EMC® PowerPath/VE®
Installation and Administration Guide
Version 5.9 and Minor Releases for VMware vSphere

P/N 302-000-236
REV 03
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CHAPTER 1

Installing PowerPath/VE with served licenses

This chapter covers the following topics:

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Installation components and workflow for served licenses

Installation components for served licenses
Refer the following to identify the required components for a PowerPath/VE environment that uses served licenses.

- **Required PowerPath/VE components:**
  - **Component:**
    - RTOOLS
    - Virtual Appliance that contains PPVE ELMS and RTOOLS packages pre-installed
  - **Software type:**
    - Windows
    - Linux
    - SLES virtual machine
  - **Host compatibility:**
    - Windows
    - Linux
    - vSphere
  - **Software location:** PowerPath/VE and RTOOLS RHEL and Windows software contained in the PowerPath/VE software distribution on EMC Online Support

- **Required VMware components:**
  - **Component:**
    - VMware vSphere CLI (vCLI)
      - **Software type:** Linux, Windows
    - VMware vCenter Update Manager (VUM)
      - VUM server
      - vSphere Client
      - VUM plugin
      - vCenter Server
      - **Software type:** Windows, all physical host, or VM
    - Auto Deploy
      - vCenter Server
      - Auto Deploy application
      - **Software type:** Windows
  - **Software location:** Software located on the VMware website

- **Required electronics served license components**
  - **Component:**
    - Electronic License Management server (ELMS)
      - **Software type:** Physical host, virtual machine
    - PPVE Electronic License Management server (PPVE ELMS)
Virtual Appliance that contains PPVE ELMS and RTOOLS packages preinstalled

- **Software type**: Linux, Windows

- **Host compatibility**:
  - Windows
  - Linux

- **Software location**: Software contained in a separate download on EMC Online Support. PPVE ELMS is a compressed file (.zip)

**Installation workflow for served licenses**
The following table lists the steps in configuring a served licensing environment for PowerPath/VE:

**Table 1** PowerPath/VE served licensing workflow

<table>
<thead>
<tr>
<th>Task</th>
<th>Action on Windows</th>
<th>Action on RHEL</th>
<th>Action on SLES Virtual Appliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Obtaining served licenses on page 9</td>
<td>Obtaining served licenses on page 9</td>
<td>Obtaining served licenses on page 9</td>
</tr>
<tr>
<td>2.</td>
<td>Save served license files. See Suggested license file locations on page 10</td>
<td>Save served license files. See Suggested license file locations on page 10</td>
<td>Save served license files. See Suggested license file locations on page 10</td>
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<tr>
<td>3.</td>
<td>Install PPVE ELMS on page 11</td>
<td>Install PPVE ELMS on page 11</td>
<td>Deploy EMC PowerPath Virtual Appliance. Refer EMC PowerPath Virtual Appliance 1.2 Installation and Configuration Guide on instructions to deploy the Virtual Appliance.</td>
</tr>
<tr>
<td></td>
<td>• Using PowerELMS script on page 16</td>
<td>• Using PowerELMS script on page 16</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Installing PowerPath/VE on page 16</td>
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<tr>
<td>5.</td>
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<tr>
<td>6.</td>
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<td>Configure served license configuration files on the rpowermt server on page 16</td>
<td>Configure served license configuration files on the rpowermt server on page 16</td>
</tr>
</tbody>
</table>

**Obtaining served licenses**

**Before you begin**

- Ensure that you know your LAC.
- Ensure that you know the IP address of the PPVE ELMS.
  
  On a Linux host, use the `ifconfig -a` command to determine the IP address.
  
  On a Windows host, use the `ipconfig` command to determine the IP address.
- Ensure that you know the host name of the PPVE ELMS.

**Procedure**:

On a Linux host, use the `hostname` or `uname -a` command to determine the host name.
On a Windows host, use the `hostname` command. Alternatively:

1. Navigate to the Windows Control Panel.
2. Under **System**, locate the computer's full computer name.

License files are not included with the PowerPath/VE software package. When you purchase PowerPath/VE, EMC sends you an email that contains the License Authorization Code (LAC). Use the LAC that contains your PowerPath/VE entitlements to obtain the served license file at the Licensing Service Center on EMC Online Support. After receiving your served license file, save the license server distribution file for your platform to an installation directory on the license server.

**Procedure**

1. Login to [http://powerlinklicensing.emc.com](http://powerlinklicensing.emc.com) using your username and password.
2. Click **Activate Licenses** and follow the on screen instructions.

**Suggested license file locations**

Use the following locations as installation directories on PPVE ELMS.

**Linux**

For Linux hosts, copy the license files to the `/etc/emc/licenses` directory.

**Windows**

For Windows hosts, copy the license files to the `c:\Program Files\emc \License Server` directory.

**Migrating to EMC PowerPath Virtual Appliance**

This section provides information on migrating PPVE ELMS to EMC PowerPath Virtual Appliance to with existing served license and with new served license file.

Refer the following EMC PowerPath Virtual Appliance 1.2 documents for detailed instructions on deploying and using the Virtual Appliance:

- [PowerPath Virtual Appliance version 1.2 Release Notes](#)
- [PowerPath Virtual Appliance version 1.2 Installation and Configuration Guide](#)
- [EMC PowerPath Virtual Appliance version 1.2 Administration Guide](#)

**Migrating physical PPVE ELMS 11.10 to PowerPath Virtual Appliance with existing served license file**

Use this procedure if you currently have the physical PPVE ELMS version 11.10 and want to migrate to the Virtual Appliance PPVE ELMS at the same IP address using the same served license file. Served licenses are tied to the IP address of the PPVE ELMS. Therefore, if you deploy the Virtual Appliance at the IP address as the PPVE ELMS that you are replacing, you can use the existing served license file.

**Procedure**

1. Stop the existing PPVE ELMS. [Stop license server on page 95](#) provides more information.
2. Save the existing served license file to a location that is accessible after stopping the PPVE ELMS in step 1.
3. Deploy the Virtual Appliance at the same IP address as the PPVE ELMS that was removed in step 1.
EMC PowerPath 1.2 Installation Configuration Guide provides more information.

4. Configure and start the PPVE ELMS. Using PowerELMS script on page 16 provides information on that procedure.

After you finish

Note

If you want to migrate the PPVE ELMS to a new IP address, you must request a new served license file. Migrating physical PPVE ELMS 11.10 to PowerPath Virtual Appliance with new served license file on page 11 provides more information.

Migrating physical PPVE ELMS 11.10 to PowerPath Virtual Appliance with new served license file

Use this procedure if you currently have the physical PPVE ELMS version 11.10 and want to migrate to the PowerPath Virtual Appliance PPVE ELMS at a different IP address from the existing PPVE ELMS using the new served license file. Served licenses are tied to the IP address of the PPVE ELMS. Therefore, if you deploy the Virtual Appliance at a different IP address as the PPVE ELMS that you are replacing, you must move (rehost) the served licenses to the new PPVE ELMS in the Virtual Appliance with the new IP address.

Procedure

1. Login to http://powerlinklicensing.emc.com using your username and password.
2. Click Move Licenses and follow the onscreen instructions.
   The activation certificate is automatically sent to the registered user for this transaction.
3. Deploy the Virtual Appliance with a different IP address as the PPVE ELMS that currently exists.
   Refer the EMC PowerPath 1.2 Installation Configuration Guide for information on deploying the EMC PowerPath Virtual Appliance.
4. Configure and start the PPVE ELMS. Using PowerELMS script on page 16 provides more information.
5. Stop the physical PPVE ELMS. Stop license server on page 95 provides more information.
6. Remove the physical PPVE ELMS. Remove PPVE ELMS on Windows on page 88 and Removing PPVE ELMS on Linux on page 89 provide more information.

Install PPVE ELMS

Before you begin

Use this procedure only if you are not deploying the virtual appliance.

PowerPath/VE for VMware vSphere license is not tied to a product version number. For PowerPath/VE, the license file indicates 5.4 license.

- Select a machine to be the PPVE ELMS. The PowerPath/VE 5.9 and Minor Releases for VMware vSphere Release Notes provides information on supported PPVE ELMS operating systems and versions.
- Have the served license file located and ready to reference during the PPVE ELMS installation. If you have a valid PowerPath/VE 5.4 and service packs license for VMware vSphere, the 5.4 version license is valid for 5.9 and 5.9 SP1.
On a Linux host, ensure that the `/etc/hosts` file has an entry like the following for the license server:

```
# Do not remove the following line, or various programs
# require network functionality will fail.
lsca2147 casco.isus.emc.com casco
```

Verify that the machines selected as rpowermt servers have access to the license server through the TCP/IP connection.

Install PPVE ELMS on Windows hosts

This section includes procedures for:

- Interactive installation
- CLI silent installation
- Upgrade

Installing PPVE ELMS on Windows using Interactive Installer

**Before you begin**

You must have administrative privileges to run the Interactive Installer.

**Procedure**

1. Navigate to [https://support.emc.com](https://support.emc.com) and log in using your username and password.
2. From the EMC Online Support home page, go to Downloads. In the Find a Product type PowerPath/VE for VMware.
3. Download the supported EMC Virtual Appliance package from EMC Online Support. The PPVE ELMS package is included in the PowerPath/VE Appliance bundle ZIP.
4. Unzip the PPVE ELMS package.
5. Unzip the PPVE ELMS for Windows package. For example, EMCPower.ELMS.Windows-11.10.v01.x86_32.zip
6. Place the PPVE ELMS executable for Windows in the `c:\` drive.
7. Double-click the PPVE ELMS executable to run it.
8. In the DestinationFolder window, choose the location for the PPVE ELMS to be installed.

   By default, PPVE ELMS is installed and configured at `c:\Program Files\emc\ELMS`.
9. In the InstallProgress window, you are prompted to input the absolute path to the license file. Type the absolute path to the served license file.

   Failure to input license file path information results in successful PPVE ELMS configuration but not successful start of the PPVE ELMS service. If you do not enter license file information, re-run the installer with the Repair option to input the license file.

**After you finish**

The InstallComplete page indicates success or failure. In case of installation failure, refer Troubleshooting PowerPath/VE Installation on page 91.
Install PPVE ELMS on Windows using CLI silent installation

This procedure applies to fresh installation only.

**Procedure**

1. Complete steps 1 to 6 of *Installing PPVE ELMS on Windows using Interactive Installer on page 12*.

2. Type the following command:

   ```bash
   <setup.exe> /s /v"/q /l*v <Path to log file> INSTALLDIR=<path to destination folder> PATHTOFILE=<path to license file>
   ```

   Where
   - `<setup.exe>` is the name of the PPVE ELMS package.
   - `<path to log file>` is the absolute customized path where the installation log file is created.
   - `INSTALLDIR=<path to destination folder>` is the location to install or update the PPVE ELMS.
   - By default, the package is installed in `c:\program files\emc\elms`.
   - `<path to license file>` is the absolute path to the license file.

3. Verify installation. From command prompt, provide the path to the folder where the license server executables are installed. Type:

   ```bash
   C:\program files\emc\elms\lmutil.exe lmstat -a -c <path to license_file_list>
   ```

   The output indicates whether the license server and vendor daemon are running, the total number of licenses available on the license server, and the number of licenses that have been allocated.

   Alternatively:
   a. Navigate to the directory where the license server executables are installed and click `lmtools.exe`.
   b. On the Server Status tab, click Perform Status Enquiry.

**After you finish**

In case of installation failure, refer *Troubleshooting PowerPath/VE Installation on page 91*.

Upgrade PPVE ELMS on Windows using Interactive Installer

**Before you begin**

You must have administrative privileges to run the Interactive Installer.

**Procedure**

1. Complete steps 1 to 6 of *Installing PPVE ELMS on Windows using Interactive Installer on page 12*.

2. In the DestinationFolder window, choose the location where the existing Flexera ELM server for PowerPath/VE is configured.

   The PPVE ELMS files will be updated to the same location.

   The InstallComplete page indicates installation success or failure.
After you finish
In case of installation failure, refer Troubleshooting PowerPath/VE Installation on page 91.

Install PPVE ELMS on Linux hosts

PPVE ELMS for Linux can be started by root and non-root users. If the service is started by a root user then, it can be stopped only by a root user. PPVE ELMS for Linux fails if a non-root user tries to stop the service started by a root user.

This section includes procedures for:
- Installation using interactive script
- Installation using non-interactive script with installation parameters
- Upgrade using interactive script
- Upgrade using non-interactive script

Installing PPVE ELMS on Linux using interactive installation script

Procedure
1. Navigate to http://www.support.emc.com and log in using your username and password.
2. From the EMC Online Support home page, go to Downloads. In the Find a Product type PowerPath/VE for VMware.
3. Download the PowerPath Virtual Appliance 1.2 P02 (New Deployment).zip from EMC Online Support. The PPVE ELMS package is included in the PowerPath/VE Appliance bundle ZIP.
4. Unzip the PPVE ELMS package.
5. Untar the PPVE ELMS package for Linux.
   For example, type: tar -xzf EMCPower.ELMS.LINUX-11.10.v01.RHEL.x86_64.tar.gz
6. Run the elms_install.sh in the ELMS_LINUX folder and follow the onscreen instructions.
7. When prompted to upgrade, press N and continue the installation.
8. Provide the license file to be used. The license server service starts after installation using the license file indicated.
   The service starts by default.
9. Verify installation. Type: /etc/emc/elms/lmutil lmstat -a -c <path to license_file>
   The output indicates whether the license server and vendor daemon are running, the total number of licenses available on this license server, and how many licenses have been allocated.

After you finish
In case of installation failure, refer Troubleshooting PowerPath/VE Installation on page 91.
Installing PPVE ELMS on Linux using non-interactive installation script

Procedure
1. Complete steps 1 to 6 of Installing PPVE ELMS on Linux using interactive installation script on page 14.
2. Provide parameters to the elms_install.sh.
   - Type: `elms_install.sh -s`
   Or
   - Type: `elms_install.sh -s -c "absolute path to the license file"`
The service starts by default.
3. Verify installation. Type: `/etc/emc/elms/lmutil lmstat -a -c <path to license_file>`
The output indicates whether the license server and vendor daemon are running, the total number of licenses available on this license server, and the number of licenses that have been allocated.

After you finish
In case of installation failure, refer Troubleshooting PowerPath/VE Installation on page 91.

Upgrading PPVE ELMS on Linux using interactive script

Use this procedure to upgrade PPVE ELMS on Linux using an interactive script.

Procedure
1. Complete steps 1 to 5 of Installing PPVE ELMS on Linux using interactive installation script on page 14.
2. Run the elms_install.sh in the ELMS_LINUX folder and follow the onscreen instructions. Provide the location of the previous Flexera ELMS software installation and absolute path to the license file when prompted.
   The service starts by default.
3. Verify installation. Type: `/etc/emc/elms/lmutil lmstat -a -c <path to license_file>`
The output indicates whether the license server and vendor daemon are running, the total number of licenses available on this license server, and how many licenses have been allocated.

After you finish
In case of installation failure, refer Troubleshooting PowerPath/VE Installation on page 91.

Upgrading PPVE ELMS on Linux using non-interactive installation script

Procedure
1. Complete steps 1 to 6 of Installing PPVE ELMS on Linux using interactive installation script on page 14.
2. Provide the location of the previous installation and the license file as parameters to the elms_install.sh. Type: `elms_install.sh -s -d "location of the old installation" -c "absolute path to the license file"`
The service starts by default.

3. Verify installation. Type: `/etc/emc/elms/lmutil lmstat -a -c <path to license_file>`

The output indicates whether the license server and vendor daemon are running, the total number of licenses available on this license server, and the number of licenses that have been allocated.

**After you finish**

In case of installation failure, refer Troubleshooting PowerPath/VE Installation on page 91.

### Using PowerELMS script

The PowerELMS script automates configuration of and starting the PPVE ELMS. This task applies to using the Linux RHEL PPVE ELMS and the Linux SLES virtual appliance. This task also applies to supporting multiple served license files on the Linux SLES virtual appliance.

**Before you begin**

Before carrying out this step, ensure that you have obtained and saved the served license file. Obtaining served licenses on page 9 and Suggested license file locations on page 10 provide more information.

**Procedure**

1. Type: `/etc/init.d/PowerELMS start -l <license search path>`

   - For single license, the license search path must contain the fully qualified path(s) to the license file.
   - For multiple license, the license search path must contain the fully qualified path(s) to the directories containing the files. Multiple search paths should be separated by colons.

   For example, if license files exist in `/licenses` and `/etc/licenses`, a search path might be `/licenses:/etc/licenses` to locate any of the license files or `/licenses/PPlicense.lic:/etc/licenses` to specify one specific license file and any others located in `/etc/licenses`.

### Installing PowerPath/VE

Install the PowerPath/VE multipathing software on the ESX hosts in your PowerPath/VE environment. Install PowerPath/VE for VMware vSphere on page 38 provides installation procedures.

### Configure served license configuration files on the rpowermt server

**Before you begin**

- Ensure that you have generated and obtained a license (.lic) file for the PPVE ELMS at the Licensing Service Center on EMC Online Support. Obtaining served licenses on page 9 provides information.
- Ensure that you have stored the license file with .lic extension in the PPVE ELMS directory.
- Ensure that the PPVE ELMS is started and running.

Use the following procedure to create a license configuration file that identifies the PPVE ELMS to the rpowermt application.

**Note**
Ensure that the rpowermt server and PPVE ELMS are synchronized within 48 hours of one another. If there is a clock skew of more than 48 hours between the rpowermt server and PPVE ELMS, rpowermt register will report license registration errors.

**Procedure**

1. On the rpowermt server, configure a license configuration (.lic) file that identifies the license server to the rpowermt application.
   a. Save the license file downloaded from Licensing Service Center on EMC Online Support as a text file with the file extension .lic. This is the license configuration file. Ensure that the following fields on both files match exactly, if you modified them on the license file downloaded from Licensing Service Center on EMC Online Support:

```
SERVER [host] INTERNET=[IP address] 27010
VENDOR EMCLM
USE_SERVER
```

   where
   - `host` is the name of the license server to be used
   - `IP address` is the IP address of the license server
   - 27010 is the TCP port number (by default, 27010).

   *Served license file errors on page 92* provides information if you receive errors.

   Save the file with the .lic extension. For example, `powerpath_vmware_served.lic`

   If you are working on a Windows host, ensure that a suffix is not automatically added to the file name; for example `.txt`.

2. Place the license server configuration file in a directory that is part of the default search path on an rpowermt server. Ensure that the license configuration file is saved with the .lic extension.

   - On a Linux host, the directories in the default search path are:
     - `/etc/emc`
     - `/etc/emc/licenses`
     - `/opt/EMCpower`
     - `/opt/EMCpower/licenses`

   - On Windows, the directories in the default search path are:
     - `%USERPROFILE%`  
     - `\MyDocuments\EMC\PowerPath\rpowermt`
     - `%ALLUSERSPROFILE%`
     - `\MyDocuments\EMC\PowerPath\rpowermt`
Setting non-default directories on page 18 provides use cases and procedures for setting non-default license server configuration file directories.

3. Run an `rpowermt` command valid for auto registration to register the vSphere hosts with the license server.

For example, run the `rpowermt display` command.

If you do not want to use automatic registration, proceed to Upgrading PowerPath/VE remote CLI (rpowermt) on page 61.

Upon entering the `rpowermt` command, you are prompted to create an `rpowermt` lockbox.

```
Enter lockbox passphrase:
```

```
Confirm passphrase:
```

```
Enter server username: root
```

```
Enter server password:
```

The passphrase must meet the following requirements:

- Be eight or more characters in length.
- Contain at least one numeric, one uppercase, one lowercase character, and one non-alphanumeric character (such as # or !).

You will need this passphrase if the lockbox is moved to a different `rpowermt` server.

The PowerPath/VE 5.9 and Minor Releases for VMware vSphere Remote CLI Guide provides information on setting the `rpowermt` lockbox.

### Setting non-default directories

Place the license server configuration file in a non-default directory and point the `PPMT_LIC_PATH` environment variable to that directory. You can keep licenses segregated into different folders or directories, for example:

- separate served and unserved license configuration files
- separate PowerPath/VE and other product licenses
- separate license server instances

You use a non-default path if you want to point to a single license file instead of a general directory.

To change directory that is part of the default search path, set the `PPMT_LIC_PATH` environment variable to point to the desired directory.

To set the environment variable `PPMT_LIC_PATH`:

**Procedure**

1. Set non-default directories on Linux by typing one of the following:

   - `# setenv PPMT_LIC_PATH <license file directory>`
   - `# export PPMT_LIC_PATH=<license file directory>`

2. Set non-default directories on Windows by typing the following:

   `C:\> set PPMT_LIC_PATH=<license file directory>`

### Make non-default directories persistent across reboots on Linux

Add the `environment` variable to the shell configuration file (for example, the `.profile` file).
Making non-default directories persistent across reboots on Windows

Procedure
1. Add the environment variable to the Environment Variables table.
2. From My Computer, select System Properties › Environment Variables.

PowerPath/VE served licenses post-installation tasks

Complete the post-installation tasks provided in PowerPath/VE post-installation and configuration tasks on page 53.
CHAPTER 2

Administering served licenses

This chapter contains the following topics:

* Migrate physical PPVE ELMS to virtual appliance PPVE ELMS ......................... 22
* Obtaining additional served licenses ................................................................. 22
* Using multiple served license files on Windows PPVE ELMS .......................... 23
* Verify license server and license status ............................................................. 23
* Set served license file path ............................................................................. 24
* Rereading served license files ......................................................................... 24
* Register served license for vSphere host ......................................................... 25
* Unregistering served license from vSphere host ............................................. 25
* Re-installing and configuring after converting license types ............................. 25
* Moving served licenses .................................................................................. 26
Migrate physical PPVE ELMS to virtual appliance PPVE ELMS

If you have the physical PPVE ELMS 11.10 version and want to migrate to the virtual appliance PPVE ELMS, the following procedures provide information:

- **Migrating physical PPVE ELMS 11.10 to PowerPath Virtual Appliance with existing served license file** on page 10 Use this procedure if you want to deploy the virtual appliance PPVE ELMS at the same IP address as the existing physical PPVE ELMS and the existing served license file.

- **Migrating physical PPVE ELMS 11.10 to PowerPath Virtual Appliance with new served license file** on page 11 Use this procedure if you want to deploy the virtual appliance PPVE ELMS at a different IP address as the existing physical PPVE ELMS and need a new served license file.

Obtaining additional served licenses

When you first obtain a served license at the Licensing Service Center on EMC Online Support, you can obtain all licenses available for that served license, or a subset of available licenses. If you initially choose to obtain a subset of available served licenses, you can obtain the remaining served licenses at a later time.

**Procedure**

1. Login to EMC Powerlink Licensing website (http://powerlinklicensing.emc.com) using your username and password.

2. Click **Activate Licenses**.

3. Follow the onscreen instructions.

   If you experience issues during the regeneration process, open a service request on EMC Online Support contact or EMC Support Center at the following numbers:

   - Inside the United States: (800) 782-4362 (SVC-4EMC)
   - In Canada: (800) 543-4782 (543-4SVC)
   - Worldwide outside the United States and Canada: +1 (508) 497-7901 option 4, and option 4 again, for assistance opening a service request.

4. Install the new served license file on the PPVE ELMS. Place the served license file in the same directory where you installed the initial served license file. PPVE supports multiple served license files. They must be stored in the same directory.

   - To support additional served license files on the Windows manual installation PPVE ELMS, follow the procedure provided in **Using multiple served license files on Windows PPVE ELMS** on page 23.

   - To support additional served license files on the RHEL manual installation PPVE ELMS or the SLES virtual appliance PPVE ELMS, follow the procedure provided in **Using PowerELMS script** on page 16.

5. Set the license path. In lmtools select **Config Services** > **Path to the license file**.

   Browse to the permanent served license file location and select, and then click **Save Service**.

6. Stop and restart the PPVE ELMS. In lmtools:

   a. Select **Start/Stop/Reread** > **Stop**

   Ensure that the **Force Server Shutdown** box is checked. The progress bar at the bottom of the pane indicates when the service is stopped.
Select: Start/Stop/Reread › Start

The progress bar at the bottom of the pane indicates when the service is started.

7. Install the PowerPath/VE multipathing software on the vSphere hosts for which you obtained the additional licenses.

Installing PowerPath/VE, on page 16 provides detailed information.

8. From the rpowermt server, run an rpowermt command valid for auto-registration to register the vSphere hosts with the license server.

Run an rpowermt command for each vSphere for which you obtained an additional served license.

Using multiple served license files on Windows PPVE ELMS

Use this procedure if you are using the manual installation of PPVE ELMS and you want to use multiple served license files.

**Before you begin**

- Ensure that you have obtained the additional served license file for Y number of licenses. Obtaining additional served licenses on page 22 provides information.

**Procedure**

1. Place the original existing served license file for X number of licenses and the newly obtained served license file for Y number of licenses in the same folder.

2. Stop the PPVE ELMS in the Start/Stop/Reread tab.

3. In the Config Services tab, manually enter the path to the directory where all the licenses are placed in the Path to license file field, and then click Save service.

4. Start the PPVE ELMS from the Start/Stop/Reread tab.

5. Verify that the PPVE ELMS shows the total number (X + Y number) of served licenses. Go to Server Status › Perform Status Enquiry.

To support multiple served license files on the SLES virtual appliance PPVE ELMS, see Using PowerELMS script on page 16.

Verify license server and license status

Use the following procedures to verify license server and license status:

- Verifying license server using lmutil utility on page 23
- Verifying license server lmtools utility for Windows only on page 24

**Verifying license server using lmutil utility**

**Procedure**

- On a Linux host, type:

  ```
  # lmutil lmstat -a -c <path to license_file_list>
  ```

- On a Windows host, type:

  ```
  lmutil.exe
  ```
The output indicates whether the license server and vendor daemon are running, the total number of licenses available on this license server, and how many licenses have been allocated.

Verifying license server lmtools utility for Windows only

Procedure
1. Navigate to the directory where the license server executables are installed and click lmtools.exe.
2. On the Server Status tab, click Perform Status Enquiry.
3. Scroll down to see the information.

Set served license file path

Use the following procedures to set served license file path:
- Set served license file path using lmutil utility on page 24
- Setting served license file path using lmtools utility on page 24

Set served license file path using lmutil utility

Use the lmutil lmpath command to:
- add a directory to the path (the -add argument)
- override the path (the -override argument)

Setting served license file path using lmtools utility

Procedure
1. Navigate to the directory where the license server executables are installed and click lmtools.exe.
2. On the Config Services tab, use the Path to the license file field to view or set the path.

Rereading served license files

Reread the served license files whenever a new or changed license file is added to the license server. Rereading the served license files enables the license manager and EMC vendor daemon to continue running while updating the internal cache of license features.

Procedure
1. Navigate to the directory where the license server executables are installed and click lmtools.exe.
2. On the Start/Stop/Reread tab, click ReRead License File.

The following message appears:
Reread Server License File Completed

- Alternatively, use the lmutil lmreread command to force the EMC vendor daemon to reread a new or changed served license file. Type: # lmutil lmreread -vendor
Register served license for vSphere host

Run an `rpowermt` command valid for auto-registration to register the vSphere hosts. Alternatively, use the `rpowermt register` command to register a served license manually on a vSphere host. The PowerPath/VE 5.9 and Minor Releases for VMware vSphere Remote CLI Guide provides more information on the `rpowermt register` command.

License count change after re-imaging the vSphere host

The license-in-use count increases by one when you re-register the vSphere host after re-imaging the vSphere host. This pertains only to served licenses. This is an expected behavior.

To correct this change in license count:

- Before re-imaging the vSphere host, unregister the PowerPath/VE served license from the vSphere host. Follow the procedure provided in Unregister served license from vSphere host on page 25
- Alternatively, take no action and wait 45 days, after which the license count decreases by one.

This pertains to issue 307490.

Unregistering served license from vSphere host

Procedure

1. Run the `rpowermt unregister` command to unregister a served license on an vSphere host.

   The PowerPath/VE 5.9 and Minor Releases for VMware vSphere Remote CLI Guide provides more information on the `rpowermt unregister` command.

2. Remove the `.lic` file from the rpowermt server.

3. (Optional) Restart the vSphere host, if desired.

   If you do not restart the vSphere host after unregistering a PowerPath/VE license, PowerPath multipathing functionality continues to be provided to any storage device previously claimed by PowerPath/VE.

   **Note**

   For served licenses, occasionally if the PPVE ELMS cannot be contacted during the unregister process, the unregister succeeds although the license available count does not get incremented. This is a known issue.

Re-installing and configuring after converting license types

Complete the following procedure to:

- convert from unserved license to served license
- convert from served license to unserved license
- convert your ELM license server configuration
Procedure

1. Work with your EMC Customer Support Representative to convert your license type.

2. For the original license for which you are converting, complete the procedure for Unregister served license from vSphere host on page 25 or Unregister unserved licenses on page 34.

3. For the new license for which you are converting, complete the procedure explained in:
   - converting to served licenses: Installation components and workflow for served licenses on page 127
   - or
   - converting to unserved licenses: Installation components and workflow for unserved licenses on page 130

Moving served licenses

Before you begin

Moving a served license file to a new host machine in a PowerPath/VE environment is called rehosting. Moving a license on page 133 provides information on the reasons and circumstances under which you might rehost.

- Install the license sever software on the host to which you will rehost the served license file.
- Note the IP address and host name of the host to which you are rehosting the served license file.

Procedure

1. Login to EMC Powerlink Licensing website using your username and password.

2. Click Move Licenses and follow the steps outlined on Licensing Service Center.

   The activation certificate is automatically sent to the registered user for this transaction.

3. Install the new served license file on the new PPVE ELMS.

   For example, place the served license file in the same directory where you installed the license server executables.

4. Start and configure the license server manager on the new PPVE ELMS

   Using PowerELMS script on page 16 provides information.

5. Edit the license server configuration file on the rpowermt servers to point to the new PPVE ELMS.

   Update the IP address of the license server and the TCP/IP port number used by the license server. Configure served license configuration files on the rpowermt server on page 16 provides more information.
CHAPTER 3

Installing PowerPath/VE with unserved licenses

This chapter covers the following topics:

- Installation components and workflow for unserved licenses .................. 28
- Installing PowerPath/VE ............................................................................ 29
- Install PowerPath remote CLI ................................................................. 29
- Finding ESX unique system ID ................................................................. 29
- Obtaining unserved licenses .................................................................. 29
- Configuring unserved license configuration files on the rpowermt server .... 30
- PowerPath/VE unserved licenses post-installation and configuration tasks .... 32
Installation components and workflow for unserved licenses

Installation components for unserved licenses
The following table identifies the required components for a PowerPath/VE environment that uses unserved licenses.

Table 2 PowerPath/VE and VMware vSphere unserved licensing components

<table>
<thead>
<tr>
<th>Required PowerPath/VE components</th>
<th>Required VMware components</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Component</strong></td>
<td><strong>Type</strong></td>
</tr>
<tr>
<td>Components</td>
<td>PowerPath/VE</td>
</tr>
<tr>
<td></td>
<td>RTOOLS</td>
</tr>
<tr>
<td></td>
<td>rpowermt server</td>
</tr>
<tr>
<td></td>
<td>Virtual appliance that contains RTOOLS packages pre-installed.</td>
</tr>
<tr>
<td>Host compatibility</td>
<td>Windows and Linux available. PowerPath/VE installs on vSphere host.</td>
</tr>
<tr>
<td>Software location</td>
<td>Software contained in the PowerPath/VE software distribution on EMC Online Support. Virtual appliance is an OVF file available as a separate download on EMC Online Support.</td>
</tr>
</tbody>
</table>

Installation workflow for unserved licenses
The following table provides a high-level workflow of the installation process for unserved licenses:

Table 3 PowerPath/VE for VMware vSphere Installation workflow—unserved licenses

<table>
<thead>
<tr>
<th>Task</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Installing PowerPath/VE on page 16</td>
</tr>
<tr>
<td>2.</td>
<td>Install PowerPath remote CLI on page 29 or Deploy EMC PowerPath Virtual Appliance. Refer EMC PowerPath Virtual Appliance 1.2 Installation and Configuration Guide on instructions to deploy the Virtual Appliance.</td>
</tr>
<tr>
<td>3.</td>
<td>Finding ESX unique system ID on page 29</td>
</tr>
<tr>
<td>4.</td>
<td>Obtaining unserved licenses on page 29</td>
</tr>
<tr>
<td>5.</td>
<td>Configuring unserved license configuration files on the rpowermt server on page 30</td>
</tr>
</tbody>
</table>
Installing PowerPath/VE

Install the PowerPath/VE multipathing software on the ESX hosts in your PowerPath/VE environment. *Install PowerPath/VE for VMware vSphere on page 38* provides installation procedures.

Install PowerPath remote CLI

Install the rpowermt CLI on the Windows and Linux hosts designated as rpowermt servers. Use this procedure only if you are not deploying the virtual appliance.

This topic describes how to install the rpowermt package on a Linux or Windows host.

Finding ESX unique system ID

PowerPath/VE uses the ESX unique system ID to identify each vSphere host in an unserved licensing environment. Before you obtain an unserved license for a vSphere host, find its ESX unique system ID.

**Procedure**

1. Use the `esxcli` command to obtain the ESX unique system ID. Type:

   ```bash
   # esxcli -s <vSphere server IP address or hostname> system uuid get
   ```

   For example:

   ```bash
   # esxcli -s lcla111 system uuid get
   ```

   Output such as the following appears:

   ```bash
   4d5e4241-6b3c-132e-44f4-00221928801a
   ```

   This is the ESX unique system ID.

2. Alternatively, use the `rpowermt check_registration` command to find the ESX unique system ID of a vSphere host for which you need to obtain an unserved license.

   The *PowerPath/VE for VMware vSphere Remote CLI Guide* provides more information on the `rpowermt check_registration` command.

Obtaining unserved licenses

**Before you begin**

Ensure that you know your License Authorization Code (LAC). When you purchase PowerPath/VE, EMC sends you an email that contains the LAC. Use the LAC to obtain PowerPath/VE licenses.

**Procedure**

1. Log in to EMC Online Support using your username and password.

2. From the EMC Online Support home page, navigate to Service Center Product Registration and Licenses, and click PowerPath.

3. Click **Activate Licenses** and follow the steps outlined on EMC Online Support Licensing Service Center.

   Online help through context-sensitive help is provided if you require assistance.
After you finish
After receiving your unserved license file, save the license file for your platform to an installation directory.

Suggested unserved license file locations
Use the following locations as installation directories for unserved license files.

Linux
For RHEL rpowermt hosts and the SLES virtual appliance VM, copy the license file in the one of following directory locations:
- /etc/emc
- /etc/emc/licenses
- /opt/EMCpower
- /opt/EMCpower/licenses

Windows
For Windows rpowermt hosts, copy the license file in the one of following directories:
- %USERPROFILE%\MyDocuments\EMC\PowerPath\rpowermt
- %ALLUSRSPROFILE%\MyDocuments\EMC\PowerPath\rpowermt

Configuring unserved license configuration files on the rpowermt server

Before you begin

Note
Ensure that the rpowermt server and the ESX host are synchronized within 48 hours of one another. If there is a clock skew of more than 48 hours between the rpowermt server and the ESX host, rpowermt register reports license registration errors.

Procedure

1. On the rpowermt server, configure a license configuration (.lic) file that identifies the ESX host to the rpowermt application. Save the license file downloaded from Licensing Service Center on EMC Online Support as a text file with the file extension .lic. This is the license configuration file.

2. Place the license configuration file in a directory that is part of the default search path on an rpowermt server.

3. Save the file with the .lic extension.
   
   For example, powerpath_vmware_unserved.lic
   
   If you are working on a Windows host, ensure that a suffix is not automatically added to the file name; for example .txt.
   
   - On a Linux host, the directories in the default search path are:
     - /etc/emc
     - /etc/emc/licenses
     - /opt/EMCpower

30 EMC PowerPath/VE Installation and Administration Guide 5.9 and Minor Releases for VMware vSphere
On Windows, the directories in the default search path are:
- `%USERPROFILE%\MyDocuments\EMC\PowerPath\rpowermt`
- `%ALLUSERSPROFILE%\MyDocuments\EMC\PowerPath\rpowermt`

Setting non-default directories on page 18 provides use cases and procedures for setting non-default license server configuration file directories.

**Note**

You can store unserved license files on multiple rpowermt servers because the license is not locked to the rpowermt server.

The license file indicates **PowerPath MP EMCLM 5.4** because the PowerPath/VE for VMware vSphere electronic license daemon, ELCLM, is not tied to a product version number. For PowerPath/VE, the license file indicates 5.4 license.

4. Run an `rpowermt` command valid for auto-registration to register the vSphere hosts.

For example, run the `rpowermt display` command.

If you do not want to use automatic registration, use the procedure provided in Manually registering the vSphere hosts on page 52.

Upon entering the `rpowermt` command for the first time, you are prompted to create an rpowermt lockbox.

Enter server username: root
Enter lockbox passphrase:
Confirm passphrase:
Enter server username: root
Enter server password:

The passphrase must meet the following requirements:
- Be eight or more characters in length.
- Contain at least one numeric, one uppercase, one lowercase character, and one non-alphanumeric character (such as # or !).

You will need this passphrase if the lockbox is moved to a different rpowermt server.

For additional information on setting the rpowermt lockbox, see the **PowerPath/VE 5.9 and Minor Releases for VMware vSphere Remote CLI Guide**

**Setting non-default directories**

Place the license server configuration file in a non-default directory and point the `PPMT_LIC_PATH` environment variable to that directory. You can keep licenses segregated into different folders or directories, for example:
- separate served and unserved license configuration files
- separate PowerPath/VE and other product licenses
- separate license server instances

You use a non-default path if you want to point to a single license file instead of a general directory.

To change directory that is part of the default search path, set the `PPMT_LIC_PATH` environment variable to point to the desired directory.
To set the environment variable `PPMT_LIC_PATH`:

**Procedure**

1. Set non-default directories on Linux by typing one of the following:
   - `# setenv PPMT_LIC_PATH <license file directory>`
   - `# export PPMT_LIC_PATH=<license file directory>`
2. Set non-default directories on Windows by typing the following:
   - `C:\> set PPMT_LIC_PATH=<license file directory>`

**Make non-default directories persistent across reboots on Linux**

Add the `environment` variable to the shell configuration file (for example, the `.profile` file).

**Making non-default directories persistent across reboots on Windows**

**Procedure**

1. Add the `environment` variable to the Environment Variables table.
2. From My Computer, select **System Properties** > **Environment Variables**.

**PowerPath/VE unserved licenses post-installation and configuration tasks**

Complete the post-installation tasks provided in **PowerPath/VE post-installation and configuration tasks on page 53**.
CHAPTER 4

Administering unserved licenses

This chapter contains the following topics:

- Unregistering unserved licenses ................................................................. 34
- Moving unserved licenses ........................................................................ 34
Unregistering unserved licenses

Procedure

1. Use the `rpowermt unregister` command to unregister an unserved license on an vSphere host. For example, from the rpowermt server, type:

```
# rpowermt unregister host=111.222.222.112
```

Do you really want to unregister the PowerPath license?
yes/[no]: yes

PowerPath license is unregistered.

2. Remove the unserved license file from each rpowermt server on which it is installed.

Unserved license files are identified by the `.lic` extension (for example, `esxhost1.lic`). On Linux, the default directory for unserved license files is `/etc/emc`. On Windows, the default directory is `C:\Documents and Settings\<username>\My Documents\EMC\PowerPath\rpowermt`.

After you finish

Re-installing and configuring after converting license types on page 25

After PowerPath/VE is removed from the vSphere host, the storage devices will be claimed by the native VMware multi-pathing facility.

Moving unserved licenses

In PowerPath/VE environment, moving an unserved license from one vSphere host to another vSphere host is called rehosting. Move a license on page 133 provides information on reasons and circumstances under which you might rehost.

Procedure

1. Unregister the unserved license from its current vSphere host before moving it to a new vSphere host.

Unregistering unserved licenses on page 34 provides more information.

2. Install the PowerPath/VE multipathing driver on the vSphere host that you are adding to your PowerPath/VE environment.

Install PowerPath/VE for VMware vSphere on page 38 provides detailed information.

3. Determine the vSphere unique system ID of the vSphere host to which you are rehosting the unserved license.

Finding ESX unique system ID on page 29 provides more information.


5. From the Powerlink home page, navigate to Support Software Downloads and Licensing > License Management, and click PowerPath.

6. Click Move Licenses and follow the steps outlined on Powerlink Licensing.

Online help through context-sensitive help is provided if you require assistance.

7. Install the unserved license files on one or more rpowermt servers in your PowerPath/VE configuration.
Configuring unserved license configuration files on the rpowermt server on page 30 provides more information.
CHAPTER 5

Installing PowerPath/VE

This chapter describes how to install PowerPath/VE for VMware vSphere. This chapter contains the following topics:

- Install PowerPath/VE for VMware vSphere ............................................................. 38
- Installing using VMware Update Manager ..............................................................39
- Installing using remote vCLI ...................................................................................42
- Install PowerPath/VE using Auto Deploy ............................................................... 44
Install PowerPath/VE for VMware vSphere

PowerPath/VE is a full package install. The PowerPath/VE for VMware vSphere Release Notes provides information on supported PowerPath/VE and VMware vSphere configurations. Both the root and non-root users can install PowerPath/VE.

Choose one of the following installation methods to install PowerPath/VE:

- Installing using VMware Update Manager on page 39 - This is the recommended installation method.
- Installing using remote vCLI on page 42
- Install PowerPath/VE using Auto Deploy on page 44

Supported PowerPath-VE installation scenarios

You can install PowerPath/VE for VMware vSphere:

- on hosts in a VMware HA cluster environment. Use cluster functions (for example, vMotion) to move active VMs to a node in the cluster on which PowerPath/VE is not being installed. By installing PowerPath/VE on one host at a time, you ensure that other cluster nodes are not impacted by the installation.
- on hosts in a live VMware DRS cluster environment without interrupting cluster service.
- in a boot-from-SAN environment. See Installing using remote vCLI on page 42.

**Note**

PowerPath/VE supports coexistence with NMP boot from SAN.

PowerPath/VE installation prerequisites

Complete the following steps before installing PowerPath/VE for VMware vSphere with any installation method:

**Procedure**

- Ensure that the base vSphere version operating system is installed on the host. Check the Environment and system requirements section of the PowerPath/VE for VMware vSphere Release Notes to verify that the vSphere version installed on the host is supported by PowerPath/VE.
- Ensure that the SPC-2 flag is enabled for Symmetrix devices.

PowerPath/VE supports Symmetrix devices with the SPC-2 flag enabled only.

Use the `esxcfg-scsidevs -l` command to determine if the SPC-2 flag is enabled on Symmetrix devices.

When the SPC-2 flag is enabled, a Symmetrix device has the following form:

```
naa.<WWN_of_the_Symmetrix_device>
```

When the SPC-2 flag is disabled, a Symmetrix device has the following form:

```
mpx.vmhba#:C#:T#:L#
```

and PowerPath/VE configures it as:

```
symm.<sid>._<dev_id>
```
Ensure that vMotion is correctly configured to allow for non-disruptive installation of PowerPath/VE.

Ensure that VMs have been migrated to another node in the cluster.

Installing using VMware Update Manager

Before you begin

- Complete the tasks in PowerPath/VE installation prerequisites on page 38.
- Ensure that vMotion is properly configured to allow for non-disruptive installation of PowerPath/VE.
- Ensure that VMs have been migrated to another node in the cluster.
- Ensure that the VUM plugin is already installed on the host where the vSphere Client is installed. The VMware Update Manager Administration Guide provides information on the VUM plugin and installation procedures.
- Ensure that your vCenter Client and vCenter Server system is configured correctly for importing offline bundles as zip files for installation. The VMware vCenter Update Manager Installation and Administration Guide provides information on vCenter Client and vCenter Server requirements.

Installation using VMware Update Manager (VUM) is the recommended installation procedure. It is a multi-step procedure that includes:

- Downloading the PowerPath/VE software distribution from EMC Online Support.
- Unzipping and saving the PowerPath/VE offline package as a zip file on a local or shared directory.
- Importing the PowerPath/VE offline package into VUM.

Procedure

1. Download the PowerPath/VE software distribution, VUM install PowerPath_VE_5.9_SP1_for_VMWARE_vSphere_Install_SW.zip, from EMC Online Support. From the Support by Product pages, locate the PowerPath/VE package using Find a Product > Downloads.
2. From the software distribution, extract the offline package EMCPower.VMWARE.5.9.SP1.b011.zip and save on a local or shared network drive.
3. In vSphere Client, select a host and go to UpdateManager Admin View > Configuration > Download Settings.
4. In the Download Settings pane, click Import Patches.
5. On the Select Patches page of the Import Patches wizard, browse to location where you saved the offline PowerPath/VE package EMCPower.VMWARE.5.9.SP1.b011.zip and select it.
6. Click Next and wait until the file upload completes successfully.
   This could take a few minutes.
   In case of upload failure, check that the structure of the zip file is correct or that the VUM network settings are correct.
7. On the Confirm Import page of the Import Patches wizard, verify the PowerPath/VE package that you imported into the VUM repository, and click Finish.
8. Create the baseline. In the Baseline Name and Type window:
   a. In the Baseline Name and Description pane, type a name that you want to give to the PowerPath/VE package in the Name field.
b. In the **Baseline Type** pane, select **Host Extension**.

c. Click **Next**.

d. In the **New Baselines Extensions** window, select the PowerPath/VE baseline from among the extensions in the repository, and verify that it appears in the **Extensions to Add** pane.

e. Click **Next**.

f. In the **New Baseline Ready to Complete** window, verify that the PowerPath/VE baseline appears in the **Extensions** pane, and click **Finish**.

9. Attach the PowerPath/VE baseline to the desired vSphere hosts.

You can attach the PowerPath/VE baseline to individually selected vSphere hosts or to multiple hosts at a time. To attach the PowerPath/VE baseline:

a. Go to **Compliance** view.

   - To attach the PowerPath/VE baseline to an individual vSphere host, highlight the desired host at the left of the **vSphere Client** pane.

   - To attach the PowerPath/VE baseline to several vSphere hosts, select, for example, a folder, cluster or datacenter at the left of the **vSphere Client** pane.

b. Click **Attach**.

c. Under **Name** in the **Attach Baseline or Group** window, click the box next to the PowerPath/VE package baseline that you created to select it.

   It should appear under **Extension Baselines**. Click **Attach**.

In the **Host Compliance** box to the top-right of the screen, the circle is if this is the first time you are attaching the baseline to the vSphere host. If you have attached baselines to the vSphere host on previous occasions and remediated them, the circle is and shows the text . This indicates that the extension is already installed.

10. Stage the baseline.

    Staging is the process of pushing the PowerPath/VE package onto individual vSphere hosts from the VUM server.

a. From the **Update Manager** tab, look at the **Attached Baselines** pane in the middle of the screen. Highlight the PowerPath/VE package baseline that you created and click **Stage**.

   Under the **Name** column in the **Baselines** box of the **Baseline Selection** windowed PowerPath/VE package baseline that you created is selected by default.

b. Do not alter the default **Name** selection.

   Under the **Host** column, all the vSphere hosts to which you attached the PowerPath/VE package baseline are selected by default.

c. If required, alter the default **Host** selection to stage the baseline to only one or some of the vSphere hosts.

d. Click **Next**.

e. In the **Patch and Extension Exclusion** window, verify the information and click **Next**.

f. Verify the information in the **Ready to Complete** window and click **Finish**.

The task bar indicates that staging is . Staging can take several minutes.

In the **Host Compliance** pane to the upper-right of the screen, the compliance circle is color-coded to show status. The colors are:
Blue
unknown

Red
complete non-compliant. This means that the stage has been successful but it has not yet been remediated.

Green
compliant. This means that both the stage and the remediation have been successful and are complete.

To see the status of each vSphere host, select it in the vSphere Client pane.

11. Remediate the PowerPath/VE baseline.

Both installing and upgrading PowerPath/VE packages using VUM are carried out through the remediation stage.

a. Highlight the vSphere host you would like to remediate.

b. Look at the Attached Baselines box in the middle of the screen. Highlight the PowerPath/VE package baseline that you created and click Remediate.

In the Baseline Groups and Types pane of the Remediate window, the Extension Baselines radio button is selected by default. In the Baselines pane the PowerPath/VE package baseline that you created is selected by default.

c. Do not alter the default Baseline Groups and Types and Extension Baselines default selections.

Under the Host column, all the vSphere hosts to which you staged the PowerPath/VE package baseline are selected by default.

d. If desired, alter the default Host selection to remediate the baseline to only one or some of the vSphere hosts.

e. Click Next.

f. Verify the information in the Patches and Extensions box and click Next.

a. In the Task Name field of the Schedule box, type a task name. For example, PowerPath/VE install

b. In the Task Description field, type a description. For example, PP/VE 5.9 install.

c. Change or maintain remediation time and failure options values in the Remediation Time and Failure Options boxes as needed to suit your environment.

g. Click Next.

h. In the Host Remediation Options window select the options required for your environment in the Maintenance mode options and ESXi 5.x patch settings fields, and click Next.

i. In the Cluster Remediation Options window, check the appropriate settings for your environment and click Next.

j. Verify the information in the Ready to Complete window and click Finish.

The task bar shows the progress of each task, including putting any vSphere hosts in any DRS clusters into maintenance mode, removal, installation, automatic reboot, and exit of maintenance mode. The entire remediation process may take several minutes. The compliance pane turns when the remediation process is complete.
Installing using remote vCLI

Before you begin

vCLI is VMware’s remote CLI tool. The VMware documentation provides vCLI package installation procedures. Complete the following steps before installing PowerPath/VE using vCLI

- Complete the tasks in PowerPath/VE installation prerequisites on page 38.
- Ensure that the vCLI package is already installed on a separate server from the vSphere host.
- Ensure that the vCLI version and vSphere versions match and are compatible. VMware documentation, available on the support section of the website, http://www.vmware.com, provides information on vCLI and vSphere version compatibility.
- If you want to install PowerPath/VE for VMware vSphere in a live VMware Distributed Resource Scheduler (DRS) cluster environment without interrupting cluster service, place the vSphere host into maintenance mode. The migration capability built into the vSphere hosts allows members of a DRS cluster to have PowerPath/VE installed without disrupting active VMs. If the vSphere hosts are part of a DRS cluster with VMotion enabled, placing the vSphere host into maintenance mode forces the active VMs to fail over to other cluster members using VMotion. PowerPath/VE installation is supported with the maintenance mode. This makes the non-disruptive installation of PowerPath/VE possible.

There are two options available for installing using remote vCLI:

- Install using remote vCLI and offline package locally available on vSphere host
- Install using remote vCLI and VIBs remotely available on http server

Installing using remote vCLI and offline package locally available on vSphere host

Procedure

1. Download the PowerPath/VE software distribution, PowerPath_VE_5.9.1_for_VMWARE_vSphere_Install_SW, from EMC Online Support. From the Support by Product pages, and locate the PowerPath/VE for VMware vSphere software using Find a Product > Downloads.

2. Make the offline package available for use on the local vSphere host:
   - Use the scp (secure copy) command to copy the PowerPath/VE .zip offline package to the vSphere host.
   - Alternatively, copy the PowerPath_VE_5.9.1_for_VMWARE_vSphere_Install_SW.zip offline package to the local vCenter datastore using vSphere client.

   Or use whatever method is convenient for you to save the PowerPath_VE_5.9.1_for_VMWARE_vSphere_Install_SW.zip offline package to your local vSphere host.

3. On the remote host running vCLI, type the following to install the PowerPath/VE package:

   ```bash
   # esxcli -s <vSphere server IP address or hostname> software vib install -d
       <absolute path to PowerPath package>
   ```

   For example:
Installing PowerPath/VE

Installing using remote vCLI and VIB packages remotely available on http server

Procedure

1. Download the PowerPath/VE software distribution, PowerPath_VE_5.9.1_for_VMWARE_vSphere_Install_SW.zip, from EMC Online Support. From the Support by Product page, locate the PowerPath/VE for VMware vSphere software using Find a Product > Downloads.

2. From the software distribution, extract the PowerPath/VE VIB packages:
   EMC_bootbank_powerpath.cim.esx_5.9.1.00.00-b011.vib, EMC_bootbank_powerpath.lib.esx_5.9.1.00.00-b011.vib, and EMC_bootbank_powerpath.plugin.esx_5.9.1.00.00-b011.vib and save the VIB packages on a remote http server.

3. On the remote host running vCLI, type the following to install the PowerPath/VE VIB packages:

   

        # esxcli -s <vSphere server IP address or hostname> software vib install 

   

   where IP address or hostname identifies the vSphere host onto which you are installing PowerPath/VE. The absolute path to PowerPath package is the directory where PowerPath/VE is installed on the remote host.

   For example:

   

        # esxcli -s lcla111 software vib install -v=http://lcla111

   

4. Bring the vSphere host into mode.

5. Restart the vSphere host onto which you are installing PowerPath/VE from the vSphere client.

6. Bring vSphere host out of mode.

If PowerPath/VE is not correctly installed, see Troubleshooting PowerPath/VE Installation on page 91 for instructions on correcting the installation.
7. Verify that PowerPath/VE is installed:
   a. Type the following query command:
      
      ```
      # esxcli -s <vSphere server IP address or hostname> software vib list
      ```
   b. Type the username and password when prompted.
      
      Output such as the following appears:
      
      | Bulletin ID     | Installed     | Summary                        |
      |-----------------|---------------|--------------------------------|
      | powerpath.cim.esx | 5.9.1.00.00-b011 | EMC PartnerSupported 2013-08-13 |
      | powerpath.lib.esx | 5.9.1.00.00-b011 | EMC PartnerSupported 2013-08-13 |
      | powerpath.plugin.esx | 5.9.1.00.00-b011 | EMC PartnerSupported 2013-08-13 |

      If PowerPath/VE is not correctly installed, see Troubleshooting PowerPath/VE Installation on page 91 for instructions on correcting the installation.

**Install PowerPath/VE using Auto Deploy**

The PowerPath/VE package for use with Auto Deploy installation is the offline package EMCPower.VMWARE.5.9.SP1.b011.zip.

**Before you begin**


1. Install the vCenter server and the Auto Deploy server on a Windows host.
2. Download and install the VMware PowerCLI package.
3. Download and save the VMware ESXi package to the vCenter Server.
4. Download the PowerPath/VE package from EMC Online Support, [http://support.emc.com](http://support.emc.com). From the Support by Product pages, search for PowerPath using Find a Product > Downloads. Save the package to the vCenter Server.
5. Configure a DHCP server that assigns an IP address to each ESX host upon startup and that points the ESX host to the FTP server from which to download gPXE.
6. Install a TFTP server. Alternatively, obtain access to a TFTP server through the DHCP server and the vCenter server system. Start the server service manually if not automatically started.

**Procedure**

1. In a vSphere Client connected to the Auto Deploy vCenter Server system, go to the Home view and under the Administration tab select Auto Deploy.
2. Save the TFTP.zip file:
   a. Click Download TFTP ZIP to download a ZIP file.
   b. Save the TFTP.ZIP file to your local machine.
   c. Copy the TFTP.ZIP file to the TFTP server.
   d. Unzip the file in the TFTP server root directory.
   e. Remove the ZIP package from the root directory.
3. Configure the DHCP server to point to the TFTP server on which the TFTP ZIP file is located:
   a. Go to Control Panel > Administration Tools > DHCP
b. Under your DHCP Server, select your server, then go to IPv4 Right-click on Server Options. Select Configure Options.

c. Under the General tab, select Boot Server Host Name and specify the IP address of the TFTP server. In case of a local machine, specify the IP address of the local host.

d. Under the General tab, select Bootfile Name and specify the following file name: undionly.kpxe.vmw-hardwired.

e. Click Apply and Close the DHCP options windows.

4. Create an image profile:

a. Open the PowerCLI command prompt and run the following commands. Confirm that all required snap-ins have been added: Type: Get-PSSnapIn

   The output displays the VMware snap-ins that are installed. If the output does not display ImageBuilder, DeployAutomation, and VimAutomationCore, use the Add command to add the snap-ins. Type:

      Add-PSSnapIn Vmware.ImageBuilder
      Add-PssnapIn Vmware.DeployAutomation
      Add-PSSnapIn Vmware.VimAutomation.Core

b. Run the Connect-VIServer <IP address of the TFTP server> cmdlet to connect to the vCenter Server system with which Auto Deploy is registered to PowerCLI.

c. Run the Add-EsxSoftwareDepot command to add the ESXi software depot that contains the ESXi image profile to the PowerCLI session.

   For example, Add-EsxSoftwareDepot C:\file_path_my_offline_depot.zip

d. Use the Get-EsxImageProfile command to bind the image profile that you would like to use.

   Assign a variable, for example, $img, and use the Get-EsxImageProfile command to display the complete list of image profiles. For example,

      $img = Get-EsxImageProfile

   Display the images by printing the variable. To print, type $img.

e. Clone the standard ESXi image to create a base image profile. Type:

      $newimg=New-EsxImageProfile -CloneProfile $img[number] -Name "[Name of profile]" - Vendor "EMC*"

f. Add the PowerPath/VE VIBs to the cloned image profile. Type:

      Add-EsxSoftwareDepot c:\vmware\powerpath\EMCPower.VMware.[Version].[b00x].zip
      Add-EsxSoftwarePackage -ImageProfile $newimg -SoftwarePackage "powerpath.lib.esx."
      Add-EsxSoftwarePackage -ImageProfile $newimg -SoftwarePackage "powerpath.cim.esx."
      Add-EsxSoftwarePackage -ImageProfile $newimg -SoftwarePackage "powerpath.plugin.esx."

5. Use the New-DeployRule command to write rules that assign an image profile to a host or multiple hosts:

Assign a variable, for example, $rule, to define a rule for hosts within a range of IP addresses assigned to an image profile:

a. Type one of the following commands:

     - $rule = New-DeployRule -Name "[rule name]" -Item $newimg - AllHosts
- $rule = New-DeployRule -Name "[rule name]" -Item $newimg -
  Pattern "ipv4=[first IP address in range]-[last IP address in
  range]" Note that pattern means range.

- $rule = New-DeployRule -Name "[rule name]" -Item $newimg, "PP-
  HostProfile" -AllHosts

b. To display the working rule set, type: Get-DeployRule

c. To add the rule to the working rule set, type the following command: Add-
  DeployRule [rule name]

6. Reboot the host and verify that the VMware vSphere ESXi and PowerPath/VE versions
   have been installed.
CHAPTER 6
Installs PowerPath/VE remote CLI (rpowermt)

This chapter contains the following topics:

- Install PowerPath/VE remote CLI (rpowermt) .......................................................... 48
Install PowerPath/VE remote CLI (rpowermt)

The PowerPath/VE remote CLI is also called rpowermt. The package is called RTOOLS.

PowerPath/VE rpowermt installation requirements

Note

These installation requirements do not apply to the virtual appliance.

The rpowermt server can be any one of the following:
- The vCLI remote server
- A Virtual Machine
- The PPVE ELMS

The PowerPath/VE 5.9 and Minor Releases for VMware vSphere Release Notes provides information on supported operating systems for the rpowermt server.

TCP port for vSphere host and rpowermt server

The TCP port between the vSphere host and rpowermt server is fixed to number 5989. This is a non-dynamic number.

For more information on VMware ports, go to VMware Knowledge Base, and search for article 1012382.

Pre-requisites for installing PowerPath/VE remote CLI

Note

These pre-requisites do not apply to the EMC PowerPath Virtual Appliance.

Before you install the rpowermt package, RTOOLS:
- Set any path environment variables for the rpowermt lockbox. The rpowermt lockbox is an RSA-enabled encrypted file used to store and protect sensitive information. rpowermt uses the lockbox to securely store remote host IP addresses and their username and password combinations. By storing this information, rpowermt does not repeatedly prompt you for the username and password for the remote host.
  
  The output from the rpowermt version command provides the location for the lockbox.
  
  To override that location, set the following environment variable: PPMT_LB_FILE
  
  To disable writing to and reading from the lockbox, set the following environment variable: PPMT_LB_DISABLE
  
  You are still prompted for username/password but these are not written to the file.
  
  See rpowermt server lockbox on page 56 for information on the lockbox.

- On Windows, ensure that you have administrative privileges before installing RTOOLS. PowerPath for Windows restricts access to the PowerPath folder for users without administrative privileges.

- On Linux, ensure that you have root privileges before installing RTOOLS. You cannot install the RTOOLS package without root privileges.
Installing PowerPath/VE remote CLI (rpowermt) on Linux

Procedure
1. Download the RTOOLS .rpm package from EMC Online Support. The RTOOLS package is part of the PowerPath/VE Appliance bundle ZIP. From the Support by Product pages, locate the PowerPath/VE for VMware vSphere software using Find a Product > Downloads.

2. Run the -i option to install the PowerPath/VE remote CLI. Type:

   ```
   rpm -ivh EMCPower.RTOOLS-<version>-<xxx>.RHEL5.x86_64.rpm
   ```

   where `<xxx>` is the build number. For example,

   ```
   rpm -ivh EMCPower.RTOOLS-5.9.0.00.00-342.RHEL5.x86_64.rpm
   ```

   The following output appears:

   ```
   Preparing... ########################################### [100%]
   1:EMCPower.RTOOLS ########################################### [100%]
   ```

Installing PowerPath/VE remote CLI (rpowermt) on Windows

Procedure
1. Download the Windows RTOOLS package .zip file from EMC Online Support. The RTOOLS package is part of the PowerPath/VE Appliance bundle ZIP. From the Support by Product pages, locate the PowerPath/VE for VMware vSphere software using Find a Product > Downloads.

2. Unzip the Windows package file.

   It contains an .exe file named

   ```
   EMCPower.RTOOLS.Windows.x86_32.<version>bxxx.exe
   ```

   where `<version>` is the PowerPath/VE version, and `bxxx` is the build number. For example,

   ```
   EMCPower.RTOOLS.Windows.x86_32.5.9.b342.zip
   ```


   The PowerPath/VE remote CLI installation Install Shield wizard appears.

   Follow the Install Shield wizard installation.

4. For all fields, click Next for the default values.

   On the installation location screen, the Install Shield wizard lists a default folder.

5. Choose from the following:
   - If you want the RTOOLS package installed in the default location, click Next.
   - If you want to install the RTOOLS package in a location other than the default location:
     a. Click Change located at the right.
     b. Browse to the desired installation location.
     c. Click Next.

6. Click Install.

   The PowerPath/VE remote CLI is installed at the location you specified.
7. Log out and log in again to the remote session to include the rpowermt directory in the default path.

For Windows the default path is, `c:\Program Files\EMC\PowerPath\rpowermt`
CHAPTER 7

Post-PowerPath/VE Installation and Configuration

This chapter describes how to install PowerPath/VE for VMware vSphere.

- Manually registering the vSphere hosts .................................................. 52
- PowerPath/VE post-installation and configuration tasks .......................... 53
- rpowermt server lockbox ........................................................................ 56
Manually registering the vSphere hosts

Use this procedure to manually register your PowerPath/VE license.

Procedure

1. From the rpowermt server, run the rpowermt register command to register an vSphere host.

   Run this command for each vSphere host in your environment. For example:

   ```
   # rpowermt register host=111.222.222.112
   ```

   The following confirmation is displayed:

   PowerPath license is registered.

   The PowerPath/VE 5.9 and Minor Releases for VMware vSphere Remote CLI Guide provides more information on the rpowermt register command.

   **Note**

   If this is the first time you are entering an rpowermt command, you are prompted to create an rpowermt lockbox. The PowerPath/VE for VMware vSphere Remote CLI Guide provides more information on setting the rpowermt lockbox.

   The following output appears:

   Enter lockbox passphrase:

   If you are not prompted to create an rpowermt lockbox, proceed to step 3.

2. Create the rpowermt lockbox:

   a. Type a passphrase for the rpowermt lockbox.

      The passphrase requires a minimum of eight characters and must contain a lowercase, uppercase, numeric, and special character.

      The following output appears:

      Confirm passphrase:

   b. Retype the rpowermt lockbox passphrase.

      The following output appears.

      Enter server username:

   c. Type the vSphere host username.

      The following output appears:

      Enter server password:

   d. Type the vSphere host password.

      All users added to the lockbox must have root privileges. The vSphere host might fail to persist any PowerPath/VE settings set by non-root users.

      Update the vSphere host's username and password entry in the lockbox to check about PowerPath/VE persistence, you can update the vSphere host's username/ password entry in the lockbox. To update the username and password entry in the lockbox, follow the procedure in Updating host username and password in the lockbox on page 56.
3. From the rpowermt server, run the `rpowermt check_registration` command to verify that the vSphere host is licensed.

   For example:

   ```
rpowermt check_registration host=111.222.222.112
   ```

   Output like the following is displayed:

   ```
rpowermt host=111.222.222.112 check_registration
PowerPath License Information:
-------------------------------
Host ID         : 522b1b2b-f22a-fdcb-1547-001e4f342f3e
Type            : served (uncounted)
State           : licensed
Registered to   : EMC
Issue Date      : 24-Jul-2013
Feature : PowerPathMP
Feature Version : 5.4
Registering Svr :  rpowermt@<rpowermt server> <ESXi server>
License Count         : 20
Overdraft Count    : 1
License server        : <licensed server>
Days until expiration : 276
License search path    : <<license path>
License file(s)    : license files
```  

   The PowerPath/VE 5.9 and Minor Releases for VMware vSphere Remote CLI Guide provides more information on the `rpowermt check_registration` command.

4. From the rpowermt server, run the `rpowermt display` command to verify that PowerPath devices are licensed and available for I/O.

   For example:

   ```
rpowermt host=111.222.222.111 display dev=0
   ```

   Output like the following is displayed:

   ```
Pseudo name=emcpower0Symmetrix ID=000192601669Logical device
ID=08DDStandard UID=naa.60000970000192601669533030384444state- alive;
policy=SymmOpt; queued-

[------------------------- Host ---------------   - Stor -   -- I/O
Path -- -- Stats --## HW Path I/O Paths Interf.
Mode State  Q-IOS
Errors--------- ------- --------- --------- ---------
alive 2 vmbha3 C0:T2:L0 FA 12fA active
    0 0 1 vmbha2 C0:T1:L0 FA 11fA
active alive 0 0 2 vmbha3 C0:T1:L0 FA 11fA
active alive 0 0 1 vmbha2 C0:T3:L0 FA 12fA
active alive 0 0
```  

   The policy for this device is set to , which is the default policy for a Symmetrix, VMAX, and VMAXe device. The I/O Path Mode is , indicating that these paths are available for I/O.

   The PowerPath/VE 5.9 and Minor Releases for VMware vSphere Remote CLI Guide provides more information on the `rpowermt display` command.

---

**PowerPath/VE post-installation and configuration tasks**

These tasks are optional.

**Pre-configuration tasks**

Complete the following tasks before proceeding to the post-installation tasks:
Procedure
- Disable Lockdown mode before carrying out any management operations related to persistent changes. In case the lockdown mode cannot be disabled, follow the instructions provided in Create CIM Ticket Authentication on page 58 to bypass rpowermt lockbox and run rpowermt commands.
- Bypass the rpowermt lockbox.
- Use CIM ticket authentication.

The PowerPath/VE 5.9 for VMware vSphere Remote CLI Guide provides information to bypass the rpowermt lockbox and use CIM ticket authentication.

Adding hosts to rpowermt lockbox

Note
Both the root and non-root user can run rpowermt commands on Windows and Linux rpowermt servers.

Procedure
1. At the command prompt, type:

```
# rpowermt setup add_host [host_file=<filename>] host=<hostname> username=<username> [password=<password>]
```

Be cautious when leaving an rpowermt server unattended after the rpowermt lockbox is enabled. After you have typed the username and password to the lockbox and rpowermt is authorized, anyone can run rpowermt commands to any vSphere host managed by a rpowermt server without any authentication. The lockbox is protected by native Operating System Access Controls. That is, any lockbox file access that you give to other users through changing Windows or Linux file permissions will in turn allow full access to the vSphere hostnames and root passwords contained in the lockbox.

Changing load-balancing policy

Before you begin
After installation, PowerPath/VE for VMware vSphere selects and sets default optimal policies as appropriate for the storage array. Change the load-balancing policy if required.

Procedure
1. Type:

```
# rpowermt host=<IP address of the vSphere server> set policy=<policy>
```

rpowermt set policy in the PowerPath/VE 5.9 and Minor Releases for VMware vSphere Remote CLI Guide provides more information.

Note
XtremIO devices of version 2.2 are managed under the xtremio class. Version 1.05 devices continue to be managed by generic storage class. VNXe devices are included in the generic device class.
Enabling path latency monitoring

Procedure

1. At the command prompt, type:

```
# rpowermt host=<IP address of the vSphere server> set
path_latency_monitor=on
# rpowermt host=<IP address of the vSphere server>
set_path_latency_threshold=<seconds>
```

rpowermt set path_latency_threshold and rpowermt set path_latency_monitor in the PowerPath/VE 5.9 and Minor Releases for VMware vSphere Remote CLI Guide provide more information.

---

**Note**

PowerPath does not configure array control devices such as CLARiiON and Invista LUNZs, Symmetrix VCMDB/ACLX devices, and third-party array control devices. These devices are still under NMP control.

---

Verifying PowerPath/VE configuration

Complete the following steps to verify if PowerPath/VE is properly configured.

**Procedure**

1. Select a storage device and examine its configuration. From the rpowermt server, type:

```
# rpowermt host=<IP address of the vSphere server> display dev=0
```

Output such as the following appears:

```
Pseudo name=emcpower0
CLARiiON ID=FCNTR073300020
Standard UID-naa.60060160e1601e006df56548a2fbd5c11
state=alive; policy=co; queued-IOs=0
Owner: default=SP B, current=SP B Array failover mode: 1
===========================================================================
-------------- Host --------------- - Stor - --- I/O Path -- -- Stats ---
### HW Path I/O Paths Interf. Mode State Q-IOs Errors
===========================================================================
1 vmhba2 C0:T1:L10 SP B7 active alive 0 0
2 vmhba1 C0:T1:L11 SP B6 active alive 0 0
2 vmhba1 C0:T0:L10 SP A6 active alive 0 1
1 vmhba2 C0:T0:L11 SP A7 active alive 0 1
```

Verify that the device has been assigned a PowerPath/VE pseudo device name, the device state, and the device policy. For CLARiiON devices, verify the default and current owner, and the array failover mode.

On a licensed vSphere host, the host information is visible by the rpowermt client and the default policy is **Symmetrix Optimized** for Symmetrix, VMAX, and VMAXe devices, **CLARiiON Optimized** for VNX and CLARION devices, and **Adaptive** for Invista, VPLEX, VNXe, supported Celerra devices, XtremIO, and supported third-party devices.

2. If the output of 1 on page 55 does not show a correct PowerPath configuration, or if you want to change the devices that PowerPath is managing, see Claim rules in PowerPath/VE environment on page 72.

3. If you disabled Lockdown mode, enable Lockdown mode after completing all operations related to policy changes.
rpowermt server lockbox

The `rpowermt lockbox` is an RSA-developed encrypted file used to store and protect sensitive information.

After entering the first `rpowermt` command, you are prompted to create an `rpowermt lockbox` command. `rpowermt` uses the lockbox to securely store remote host IP addresses and their username and password combinations. By storing this information, `rpowermt` does not repeatedly prompt you for the username and password for the remote host.

Creating lockbox

Any `rpowermt` command that includes the host argument attempts to retrieve the username and password for the specified vSphere host from the lockbox. If the lockbox does not exist, `rpowermt` creates it. It prompts you for the username and password of the vSphere host and the new passphrase for the lockbox.

The following output appears:

```
Enter lockbox passphrase:
```

Procedure

1. Type a passphrase for the rpowermt lockbox. The passphrase requires a minimum of eight characters and must contain a lowercase, uppercase, numeric, and special character.

   The following output appears:

   ```
   Confirm passphrase:
   ```

2. Retype the rpowermt lockbox passphrase.

   The following output appears:

   ```
   Enter server username:
   ```

3. Type the vSphere host username.

   The following output appears:

   ```
   Enter server password:
   ```

4. Type the vSphere host password.

   All users added to the lockbox should have root privileges. The vSphere host might fail to continue any PowerPath/VE settings set by non-root users.

   Update the username and password of vSphere host in the lockbox to check if whether PowerPath/VE settings set by non-root users are continued or not. To update the username and password, follow the procedure in Updating host username and password in the lockbox on page 56.

Updating host username and password in the lockbox

Use the `rpowermt setup_update host` command to vSphere host’s username/password entry in the lockbox.

**Usage:** `rpowermt setup_update_host [host_file=<filename>] host=<hostname> username=<username> [password=<password>]`

To update the username/password on the lockbox:
Procedure
1. Run the command:
   
   ```bash
   # rpowermt setup update_host host=<hostname>
   where <hostname> is the IP address or hostname of the ESX host.
   ```

   The following output appears.

   ```
   Enter server username:
   ```

   2. Type the vSphere host username.

   The following output appears:

   ```
   Enter server password:
   ```

   3. Type the vSphere host password.

Default lockbox location

**Linux**
On Linux, the default lockbox is: `/etc/emc/lockbox/<username>.clb`, where `<username>` is the username of the rpowermt user.

**Note**
The username is obtained by the `getpwuid_r()` library call. Some systems may not support this library call. For those systems you can disable this internal call by setting the `PPMT_DISABLE_PW_LOOKUP` environment variable. The default lockbox on these systems is `/etc/emc/lockbox/lockbox.clb`.

**Windows**
The default lockbox on Windows is:

- **Windows 2003**: `C:\Documents and Settings\<username>\My Documents \EMC\PowerPath\rpowermt\lockbox.clb`
- **Windows 2008 and Windows 2012**: `C:\Users\Administrator\Documents \EMC\PowerPath\rpowermt\lockbox.clb`.

Change lockbox name and location

Use the `PPMT_LB_FILE` environment variable to change the lockbox name and location.

**Linux**
To change the lockbox name to `/tmp/pplockbox.clb` on a Linux system, enter:

```bash
PPMT_LB_FILE=/tmp/pplockbox.clb; export PPMT_LB_FILE
```

**Windows**
To change the lockbox name to `C:\temp\pplockbox.clb` on a Windows system, enter:

```bash
set PPMT_LB_FILE=C:\temp\pplockbox.clb
```

Disabling lockbox

Use the `PPMT_LB_DISABLE` environment variable to disable writing to and reading from the lockbox.

To disable the lockbox on a Linux system, type:

```bash
export PPMT_LB_DISABLE=1
```

To disable the lockbox on a Windows system, type:

```bash
set PPMT_LB_DISABLE=1
```

Alternatively, disable through the system settings.
Procedure

1. Go to Control Panel > System > Advanced System Settings

2. Go to:
   - Environment Variables and add to user variables.
   - Environment Variables and add to system variables.

After disabling the lockbox you are still prompted for username and password. Ignore the prompt. The credentials are not written to the file.

Bypass lockbox

Use the [password=<password> | no_password] option to bypass lockbox password authentication.

The lockbox is automatically bypassed if both username=<username> and password=<password> | no password are provided as command line arguments.

Creating CIM Ticket Authentication

To use CIM Ticket Authentication to authorize a vSphere host that is managed by vCenter without the need of a root password on the vSphere host:

Procedure

1. Acquire a CIM ticket.

   VMware documentation on CIM Ticket Authentication, available at the VMware support website (http://www.vmware.com/support/developer), provides information on acquiring a CIM services ticket.

   Use the CIM ticket output in 2 on page 58.

2. On the rpowermt server, type:

   `rpowermt <command> host=<hostname> [cim_sessionid=<CIM ticket output>]`

   Output such as the following appears:

   ```
   #rpowermt version host=lcla111
   cim_sessionid=525e2427-ce2c-d4ab-d234-2c83abcd1bda
   EMC rpowermt for PowerPath (c) client Version 5.4 SP 2 (build 299)
   EMC PowerPath (c) host=lcla111.lss.emc.com Version 5.4 SP 1 (build 33)
   License search path:
   /etc/emc:/etc/emc/licenses:/opt/EMCpower:/opt/EMCpower/licenses
   Host file: /etc/emc/lockbox/lockbox.clb
   ```

   The cim_sessionid argument can be used with any rpowermt command that communicates with the vSphere host except the rpowermt setup commands.

Set rpowermt CST libraries environment variable

Set an environment variable to point the rpowermt server to the correct location if the rpowermt CST libraries have been moved. This might occur if you have more than one EMC product installed on the rpowermt server and the applications use different versions of the lockbox libraries.

Set the optional environment variable to point the PP_LB_LIB rpowermt server to directory.

On Windows, enter: `PP_LB_LIB=C:\program files\EMC\PowerPath\rpowermt`

On Linux, enter: `export PP_LB_LIB=/usr/lib`
On Linux hosts, if you receive **ERROR: Failed to open host file.**, set the correct environment variable.

Enter: `PP_LB_LIB=<location of CST libraries>`

Alternatively, remove the environment variable definition for `LD_LIBRARY_PATH`.

Enter: `unset LD_LIBRARY_PATH`

This issue pertains to 339891.
CHAPTER 8

Upgrading PowerPath/VE remote CLI (rpowermt)

This chapter contains the following topics:

- RTOOLS upgrade paths
- Upgrading PowerPath/VE remote CLI (rpowermt) on Linux
- Upgrading PowerPath-VE remote CLI (rpowermt) on Windows
RTOOLS upgrade paths

This section provides information about the available RTOOLS upgrade paths for Linux and Windows.

Use the following guidelines to upgrade the RTOOLS:

- **5.9 and 5.9 SP1 and 5.8:**
  Upgrade directly to 5.9, 5.9 SP1, or 5.8 RTOOLS package as explained in Upgrading PowerPath/VE remote CLI (rpowermt) on Linux on page 62 and Upgrading PowerPath-VE remote CLI (rpowermt) on Windows on page 63.

  **Note**

  5.8 RTOOLS package need not be removed.

- **5.7:**
  Upgrade directly to 5.9 or 5.9 SP1 RTOOLS package as explained in Upgrading PowerPath/VE remote CLI (rpowermt) on Linux on page 62 and Upgrading PowerPath-VE remote CLI (rpowermt) on Windows on page 63.

  **Note**

  5.7 RTOOLS package need not be removed.

- **5.4 SP2 HF02:**
  Remove the PowerPath/VE 5.4 SP2 HF01 RTOOLS or PowerPath 5.4 SP2 HF02 RTOOLS package.

- **5.4 SP2 HF01:**
  Remove PowerPath/VE rpowermt following instructions provided in Remove PowerPath/VE rpowermt from Linux on page 70 and Remove PowerPath/VE rpowermt from Windows on page 70.

  Alternatively, install PowerPath/VE 5.9 SP1 RTOOLS package on your host; following instructions provided in Install PowerPath/VE remote CLI (rpowermt) on Linux on page 49 and Install PowerPath/VE remote CLI (rpowermt) on Windows on page 49.

- **5.4, 5.4 SP1, and 5.4 SP1:**
  Follow the procedures in Upgrading PowerPath/VE remote CLI (rpowermt) on Linux on page 62 and Upgrading PowerPath-VE remote CLI (rpowermt) on Windows on page 63.

Upgrading PowerPath/VE remote CLI (rpowermt) on Linux

Before you begin

Before you upgrade the rpowermt package that contains the RTOOLS:

- Set any path environment variables for the rpowermt lockbox. The rpowermt lockbox is an RSA-enabled encrypted file used to store and protect sensitive information. rpowermt uses the lockbox to securely store remote host IP addresses and their username and password combinations. By storing this information, rpowermt does not repeatedly prompt you for the username and password for the remote host.

  The output from the rpowermt version command provides the location for the lockbox.

  To override that location, set the PPMT_LB_FILE environment variable.
To disable writing to and reading from the lockbox, set the `PPMT_LB_DISABLE` environment variable.

**Note**

You are prompted for username and password. Ignore it. These are not written to the file.

- On Linux, ensure that you have root privileges before installing RTOOLS. You cannot install the RTOOLS package without root privileges.

**Procedure**

1. Run the `rpowermt version` command to verify that the PowerPath/VE RTOOLS package is installed on the Linux host.

   Output such as the following appears:

   ```
   EMC rpowermt for PowerPath (c) client Version 5.x (build xxx)
   ```

2. Use the `--Uvh` option to upgrade to the PowerPath/VE 5.9 SP1 RTOOLS package.

   For example:

   ```
   # rpm -Uvh EMCPower.RTOOLS-5.9.1.00.00-011.RHEL5.x86_64.rpm
   ```

   Output such as the following appears:

   ```
   Preparing... ########################################### [100%]
   --- Installing EMCPower.RTOOLS ---
   1:EMCPower.RTOOLS ########################################### [100%]
   ```

**Upgrading PowerPath-VE remote CLI (rpowermt) on Windows**

**Before you begin**

Before you upgrade the rpowermt package that contains the RTOOLS:

- Set any path environment variables for the rpowermt lockbox. The rpowermt lockbox is an RSA-enabled encrypted file used to store and protect sensitive information. rpowermt uses the lockbox to securely store remote host IP addresses and their username and password combinations. By storing this information, rpowermt does not repeatedly prompt you for the username and password for the remote host.

   The output from the `rpowermt version` command provides the location for the lockbox.

   To override that location, set the `PPMT_LB_FILE` environment variable.

   To disable writing to and reading from the lockbox, set the `PPMT_LB_DISABLE` environment variable.

   **Note**

   You are prompted for username and password. Ignore it. These are not written to the file.

- On Windows, ensure that you are have administrative privileges before installing RTOOLS. PowerPath for Windows restricts access to the PowerPath folder for users without administrative privileges.

**Procedure**

- If PowerPath/VE 5.4, 5.4 SP1, or 5.4 SP2 RTOOLS package is installed on your host, follow the procedure in *Installing PowerPath/VE remote CLI (rpowermt) on Windows on page 49.*
If PowerPath/VE 5.4 SP2 HF01 or PowerPath 5.4 SP2 HF02 is installed on your host:

a. Remove the PowerPath/VE 5.4 SP2 HF01 or PowerPath 5.4 SP2 HF02 package.

b. Install PowerPath/VE 5.9 SP1 RTOOLS package on your host; follow Installing PowerPath/VE remote CLI (rpowermt) on Windows on page 49.
CHAPTER 9

Removing PowerPath/VE

This chapter discusses removing PowerPath/VE. Topics include:

- Removing PowerPath/VE using vCLI..........................66
Removing PowerPath/VE using vCLI

Both the root and non-root user can remove PowerPath/VE. The following procedure is also applicable for removing in a boot-from-SAN configuration.

Procedure

1. Check the package installed on the vSphere host by typing:
   
   # esxcli -s <IP address or hostname> software vib list

2. Enter the username and password as prompted.

   The following output appears:

   powerpath.cim.esx 5.9.0.00.00-<bbb> EMC PartnerSupported 2013-08-13
   powerpath.lib.esx 5.9.0.00.00-<bbb> EMC PartnerSupported 2013-08-13
   powerpath.plugin.esx 5.9.0.00.00-<bbb> EMC PartnerSupported 2013-08-13

   where <bbb> is the PowerPath/VE build number.

3. Remove the PowerPath/VE package by typing the following command:

   # esxcli -s <IP address or hostname> software vib remove -n powerpath.cim.esx -n powerpath.plugin.esx -n powerpath.lib.esx

   The removal may take a few minutes.

   Output indicating that the update has been successful and a reboot is required to be effective appears.

4. Bring the vSphere host into mode.

5. Restart the vSphere host.

6. Bring the vSphere host out of mode.
CHAPTER 10

Remove Virtual Appliance

This chapter discusses the following topics:

- Uninstalling the appliance ................................................................. 68
Uninstalling the appliance

Using your vSphere client, you can shut down and remove the appliance from your VMware inventory.

Procedure

1. Open the vSphere Client and connect to the vCenter server managing your appliance.
2. Right-click the appliance in the left pane of the Inventory > VMs and Templates window for the vSphere Client and select Power > Shut Down Guest.
3. Right-click the appliance and select Delete from Disk.
CHAPTER 11

Removing PowerPath/VE remote CLI (rpowermt)

This chapter discusses removing PowerPath/VE. Topics include:

- Remove PowerPath/VE rpowermt ................................................................. 70
- Removing PowerPath/VE rpowermt from Linux ...........................................70
- Remove PowerPath/VE rpowermt from Windows .......................................70
Remove PowerPath/VE rpowermt

This section discusses removing the rpwermt package, called RTOOLS, from the rpwermt server. This section does not apply to the EMC PowerPath Virtual Appliance.

Removing PowerPath/VE rpwermt from Linux

Procedure
1. Log in as root.
2. To display the package name, type
   
   ```
   # rpm -qa | grep EMCPower.RTOOLS
   ```
   
   The following output appears:

   ```
   EMCPower.RTOOLS-5.9.1.00.00-<b011>.RHEL5.x86_64.rpm
   ```

3. To remove the software, type
   
   ```
   # rpm -e EMCPower.RTOOLS-5.9.1.00.00-<b011>.RHEL5.x86_64.rpm
   ```

Remove PowerPath/VE rpwermt from Windows

- In Windows 2008 and Windows 2012: From the Start menu, select Control Panel > Programs and Features > EMC PowerPath Remote Tools and click Uninstall.
- In Windows 2003: From the Start menu, select Settings Control Panel > Add or Remove Programs > EMC > PowerPath Remote Tools and click Remove

Note

Because the RSA rpwermt lockbox functionality is persistent, after removing the RTOOLS package from the rpwermt server, any lockbox password that you might have set will remain on the rpwermt server.
CHAPTER 12

Managing PowerPath/VE

This chapter contains information and procedures on managing PowerPath/VE. Topics include:

- Claim rules in PowerPath/VE environment .............................................................72
- Configuration changes in PowerPath/VE .................................................................81
- Manage PowerPath/VE using rpowermt ...............................................................85
Claim rules in PowerPath/VE environment

Both PowerPath/VE and VMware NMP are supported on the same ESXi host. PowerPath/VE supports path management for EMC and many third-party arrays. NMP supports path management for the arrays that are not supported by EMC. PowerPath/VE and NMP can share the same HBAs but they cannot manage the same device simultaneously. Claim rules are used to assign storage devices either to PowerPath/VE or to NMP devices.

During PowerPath/VE installation, PowerPath/VE claims all Symmetrix, VMAX, VMAXe, VNX, CLARiiON, Invista, VPLEX, Celerra, VNXe, and supported third-party array devices by default. In the case of third-party storage system devices, the claim rules claim all third-party vendor models, including some models that may not be supported by PowerPath/VE for VMware vSphere. This is the case with claim rules 270 and 280. Change the claim rules if you do not want all these devices under PowerPath/VE control, but rather want some EMC or third-party array devices under NMP control. The PowerPath/VE for VMware vSphere Release Notes provides information on supported EMC and third-party arrays.

**Note**

Be very familiar with the VMware vStorage APIs for Multipathing framework and take careful consideration before changing claim rules.

Refer the *VMware Infrastructure Command Line Interface Installation and Reference Guide* available on VMware website for detailed information.

- Use claim rule 340 for XtremIO devices.
- Use claim rule 350 for NetApp devices (for FAS 2240).
- Use claim rule 250 for CLARiiON and VNX devices.
- Use claim rule 260 for Symmetrix, VMAX and VMAXe devices.
- Use claim rule 270 for Invista and VPLEX devices.
- Use claim rule 310 for Celerra and VNXe devices.

You do need to define claim rules if you want NMP to manage some of the CLARiiON, VNX, Symmetrix, VMAX, VMAXe, Celerra, VNXe, Invista, VPLEX, or supported third-party array devices.

Claim rules are numbered 0–65535. For NMP to claim a Symmetrix, VMAX, VMAXe, VNX, CLARiiON, Invista, VPLEX, Celerra, VNXe or third-party array device, you must add a new claim rule. The new claim rule number must be between 201 and 250. The PowerPath/VE defaults between 250 and 260. The number of rules you must add for each device depends on the number of HBAs in the vSphere host and the array type. The PowerPath/VE claim rule numbers cannot exceed 9999.

### PowerPath/VE assigned claim rules

The PowerPath/VE installation program defines claim rules that assign all PowerPath/VE-supported devices to PowerPath/VE. The following table lists the claim rules:

<table>
<thead>
<tr>
<th>Storage system</th>
<th>Claim rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>XtremIO</td>
<td>MP 340 file vendor PowerPath vendor=XtremIO model=XtremaApp</td>
</tr>
<tr>
<td>NetApp</td>
<td>MP 350 file vendor PowerPath vendor=NETAPP model=*</td>
</tr>
<tr>
<td>Storage system</td>
<td>Claim rule</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>CLARiiON, VNX</td>
<td>MP 250 file vendor PowerPath vendor=DGC model=*</td>
</tr>
<tr>
<td>Symmetrix, VMAX, VMAXe</td>
<td>MP 260 file vendor PowerPath vendor=EMC model=SYMMETRIX</td>
</tr>
<tr>
<td>Invista, VPLEX</td>
<td>MP 270 file vendor PowerPath vendor=EMC model=Invista</td>
</tr>
<tr>
<td>Hitachi HDS, USP-V, USP-VM, AMS2x00</td>
<td>MP 280 file vendor PowerPath vendor=HITACHI model=*</td>
</tr>
<tr>
<td>HP StorageWorks XP 1000, 12000, 20000, 24000, EVA 5000, EVA 8000, EVA 8100</td>
<td>MP 290 file vendor PowerPath vendor=HP model=*</td>
</tr>
<tr>
<td>Compaq EVA 5000</td>
<td>MP 300 file vendor PowerPath vendor=COMPAQ model=HSV111 (C)COMPAQ</td>
</tr>
<tr>
<td>Celerra, VNXe</td>
<td>MP 310 file vendor PowerPath vendor=EMC model=Celerra</td>
</tr>
<tr>
<td>IBM DS8x00</td>
<td>MP 320 file vendor PowerPath vendor=IBM model=2107900</td>
</tr>
<tr>
<td>IBM XIV</td>
<td>MP 330 file vendor PowerPath vendor=IBM model=2810XIV</td>
</tr>
</tbody>
</table>

**Note**

CLARiiON/VNX devices have DGC as vendor and the model is denoted by the asterisk (*). Symmetrix, VMAX, VMAXe, Invista, VPLEX, VNXe, and supported Celerra devices have EMC as vendor and the model is SYMMETRIX, Invista, and Celerra, respectively.

**Claim rules and definitions**

The claim rule definitions are:

<table>
<thead>
<tr>
<th>Claim rule</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rule</strong></td>
<td>The claim rule number that corresponds to the device being managed.</td>
</tr>
<tr>
<td><strong>Class</strong></td>
<td>The status of the claim rule.</td>
</tr>
<tr>
<td></td>
<td>The claim rule has been added persistently; runtime means that the claim</td>
</tr>
<tr>
<td></td>
<td>rule has been fully loaded into vSphere memory</td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td>The type of claim or unclaim operation to perform. In the claim rules</td>
</tr>
<tr>
<td></td>
<td>mentioned in the <a href="#">PowerPath/VE assigned claim rules</a> The types are: and</td>
</tr>
<tr>
<td></td>
<td>Other valid values are, , , and .</td>
</tr>
<tr>
<td><strong>Plugin</strong></td>
<td>The plugin that is managing the device; in the claim rules mentioned in</td>
</tr>
<tr>
<td></td>
<td><a href="#">PowerPath/VE assigned claim rules</a> The plugins are NMP and PowerPath.</td>
</tr>
<tr>
<td><strong>Matches</strong></td>
<td>The criteria that are selected to be applied the devices by the claim rule.</td>
</tr>
</tbody>
</table>
List claim rules

To list the current set of claim rules, use the VMware esxcli command at the SSH or command prompt:

```
esxcli --server <IP addr of vSphere server> storage core claimrule list
```

Following is the claim rule list as it exists after PowerPath/VE installation:

<table>
<thead>
<tr>
<th>Rule Class</th>
<th>Rule</th>
<th>Class</th>
<th>Type</th>
<th>Plugin</th>
<th>Matches</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP</td>
<td>0</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=usb</td>
</tr>
<tr>
<td>MP</td>
<td>1</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=sata</td>
</tr>
<tr>
<td>MP</td>
<td>2</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=ide</td>
</tr>
<tr>
<td>MP</td>
<td>3</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=block</td>
</tr>
<tr>
<td>MP</td>
<td>4</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=unknown</td>
</tr>
<tr>
<td>MP</td>
<td>101</td>
<td>runtime</td>
<td>vendor</td>
<td>MASK_PATH</td>
<td>vendor=DELL model=Universal Xport</td>
</tr>
<tr>
<td>MP</td>
<td>101</td>
<td>file</td>
<td>vendor</td>
<td>MASK_PATH</td>
<td>vendor=DELL model=Universal Xport</td>
</tr>
<tr>
<td>MP</td>
<td>250</td>
<td>runtime</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=DGC model=*</td>
</tr>
<tr>
<td>MP</td>
<td>250</td>
<td>file</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=DGC model=*</td>
</tr>
<tr>
<td>MP</td>
<td>260</td>
<td>runtime</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=EMC model=SYMMETRIX</td>
</tr>
<tr>
<td>MP</td>
<td>260</td>
<td>file</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=EMC model=SYMMETRIX</td>
</tr>
<tr>
<td>MP</td>
<td>270</td>
<td>runtime</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=EMC model=Invista</td>
</tr>
<tr>
<td>MP</td>
<td>270</td>
<td>file</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=EMC model=Invista</td>
</tr>
<tr>
<td>MP</td>
<td>280</td>
<td>runtime</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=HITACHI model=*</td>
</tr>
<tr>
<td>MP</td>
<td>280</td>
<td>file</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=HITACHI model=*</td>
</tr>
<tr>
<td>MP</td>
<td>290</td>
<td>runtime</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=HP model=*</td>
</tr>
<tr>
<td>MP</td>
<td>290</td>
<td>file</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=HP model=*</td>
</tr>
<tr>
<td>MP</td>
<td>300</td>
<td>runtime</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=COMPaq model=HSV111 (C)COMPaq</td>
</tr>
<tr>
<td>MP</td>
<td>300</td>
<td>file</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=COMPaq model=HSV111 (C)COMPaq</td>
</tr>
<tr>
<td>MP</td>
<td>310</td>
<td>runtime</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=EMC model=Celerra</td>
</tr>
<tr>
<td>MP</td>
<td>310</td>
<td>file</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=EMC model=Celerra</td>
</tr>
<tr>
<td>MP</td>
<td>320</td>
<td>runtime</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=IBM model=2107900</td>
</tr>
<tr>
<td>MP</td>
<td>320</td>
<td>file</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=IBM model=2107900</td>
</tr>
<tr>
<td>MP</td>
<td>330</td>
<td>runtime</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=IBM model=2810XIV</td>
</tr>
<tr>
<td>MP</td>
<td>330</td>
<td>file</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=IBM model=2810XIV</td>
</tr>
<tr>
<td>MP</td>
<td>340</td>
<td>runtime</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=XtremIO model=XtremApp</td>
</tr>
<tr>
<td>MP</td>
<td>340</td>
<td>file</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=XtremIO model=XtremApp</td>
</tr>
<tr>
<td>MP</td>
<td>350</td>
<td>runtime</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=NETAPP model=*</td>
</tr>
<tr>
<td>MP</td>
<td>350</td>
<td>file</td>
<td>vendor</td>
<td>PowerPath</td>
<td>vendor=NETAPP model=*</td>
</tr>
<tr>
<td>MP</td>
<td>65535</td>
<td>runtime</td>
<td>vendor</td>
<td>NMP</td>
<td>vendor=* model=*</td>
</tr>
</tbody>
</table>

Adding claim rules

To add claim rules:

**Procedure**

1. Identify the device for which you want to add the claim rule by running the esxcfg-mpath command:

   ```
esxcfg-mpath --server <IP addr of vSphere server> -L
   ```

   The esxcfg-mpath command manages the multipathing modules loaded on an vSphere host.

2. Add the claim rule for the device on each adapter/target combination:

   ```
esxcli --server <IP addr of vSphere server> storage core claimrule add --type="location" --rule=<number> --plugin="NMP" --adapter=vmhba<#> --channel=<channel #> --target=<target #> --lun=<lun #>
   ```

3. Verify that the claim rule has been added:

   ```
esxcli --server <IP addr of vSphere server> storage core claimrule list
   ```
The claim rules you have added should appear among the list of claim rules.

4. Load the claim rule:

```
esxcli --server <IP addr of vSphere server> storage core claimrule load
```

Loading the claim rule will ensure that the runtime class is created when you run the claimrule list.

5. Verify that the claim rule has been loaded:

```
esxcli --server <IP addr of vSphere server> storage core claimrule list
```

The claim rules you have added should appear among the list of claim rules twice: once on one line as it does after Step 3, indicating the claim rule as a file in the class column, and then directly underneath the first appearance indicating the claim rule as runtime in the class column. This indicates that the claim rules have loaded correctly.

6. Unclaim the device from PowerPath/VE control using the device number:

a. Use the `esxcfg-mpath` command to identify the device number associated with the device you want to place under NMP control:

```
esxcfg-mpath --server <IP addr of vSphere server> -L
```

Output like the following appears:

```
vmhba1:C0:T0:L57 state:active naa.6006016029a11e0048d2fa3437a4dd11 vmhba1 0 0 57
PowerPath active san fc.2000001b3210fe3d:2100001b3210fe3d
fc.50060160c1e0a2c5:5006016041e0a2c5
vmhba3:C0:T0:L57 state:active naa.6006016029a11e0048d2fa3437a4dd11 vmhba3 0 0 57
PowerPath active san fc.2000001b3210553a:2100001b3210553a
fc.50060160c1e0a2c5:5006016041e0a2c5
```

b. Unclaim the device by the device number:

```
esxcli --server <IP addr of vSphere server> storage core claiming unclaim --type=device --device=<device number>
```

7. Run the claim rule:

```
esxcli --server <IP addr of vSphere server> storage core claimrule run
```

8. Use the `esxcfg-mpath` command to verify that the device is under NMP control:

```
esxcfg-mpath --server <IP addr of vSphere server> -L
```

Example: Claim a LUN for NMP with 2 HBAs and Symmetrix array with 2 storage ports

This example describes how to claim LUN 57 for NMP on an vSphere host with two HBAs to a DMX array with two storage ports (similar to a CX array running ALUA mode) using claim rule numbers 202 and 203:

**Procedure**

1. Use the `esxcfg-mpath` command to identify the device you want to place under NMP control:

```
esxcfg-mpath --server <IP addr of vSphere server> -L
```

Output like the following appears:

```
vmhba1:C0:T0:L57 state:active naa.6006016029a11e0048d2fa3437a4dd11 vmhba1 0 0 57
PowerPath active san fc.2000001b3210fe3d:2100001b3210fe3d
fc.50060160c1e0a2c5:5006016041e0a2c5
vmhba3:C0:T0:L57 state:active naa.6006016029a11e0048d2fa3437a4dd11 vmhba3 0 0 57
PowerPath active san fc.2000001b3210553a:2100001b3210553a
fc.50060160c1e0a2c5:5006016041e0a2c5
```

2. Add the claim rule to claim the device for NMP:

```
esxcli --server <IP addr of vSphere server> storage core claimrule add --type="location" --rule=202 --plugin="NMP" --adapter=vmhba1 --channel=0 --target=0 --lun=57
```

Example: Claim a LUN for NMP with 2 HBAs and Symmetrix array with 2 storage ports
esxcli --server <IP addr of vSphere server> storage core claimrule add
--type="location" --rule=203 --plugin="NMP" --adapter=vmhba3 --channel=0
--target=0 --lun=57

3. List the claim rules to verify that the claim rules have been added:

esxcli --server <IP addr of vSphere server> storage core claimrule list

Output like the following appears:

<table>
<thead>
<tr>
<th>Rule</th>
<th>Class</th>
<th>Type</th>
<th>Plugin</th>
<th>Matches</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 0</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=usb</td>
</tr>
<tr>
<td>MP 1</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=sata</td>
</tr>
<tr>
<td>MP 2</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=ide</td>
</tr>
<tr>
<td>MP 3</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=block</td>
</tr>
<tr>
<td>MP 4</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=unknown</td>
</tr>
<tr>
<td>MP 101</td>
<td>runtime vendor</td>
<td>MASK_PATH vendor=DELL model=Universal Xport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MP 202</td>
<td>runtime vendor</td>
<td>location</td>
<td>NMP</td>
<td>adapter=vmhb1 channel=0 target=0 lun=57</td>
</tr>
<tr>
<td>MP 203</td>
<td>runtime vendor</td>
<td>location</td>
<td>NMP</td>
<td>adapter=vmhb1 channel=0 target=0 lun=57</td>
</tr>
</tbody>
</table>

4. Load the claim rule:

esxcli --server <IP addr of vSphere server> storage core claimrule load

5. List the claim rules to verify that the claim rules have been loaded:

esxcli --server <IP addr of vSphere server> storage core claimrule list

Output like the following appears:

<table>
<thead>
<tr>
<th>Rule</th>
<th>Class</th>
<th>Type</th>
<th>Plugin</th>
<th>Matches</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 0</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=usb</td>
</tr>
<tr>
<td>MP 1</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=sata</td>
</tr>
<tr>
<td>MP 2</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=ide</td>
</tr>
<tr>
<td>MP 3</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=block</td>
</tr>
<tr>
<td>MP 4</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=unknown</td>
</tr>
<tr>
<td>MP 101</td>
<td>runtime vendor</td>
<td>MASK_PATH vendor=DELL model=Universal Xport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MP 202</td>
<td>runtime vendor</td>
<td>location</td>
<td>NMP</td>
<td>adapter=vmhb1 channel=0 target=0 lun=57</td>
</tr>
<tr>
<td>MP 203</td>
<td>runtime vendor</td>
<td>location</td>
<td>NMP</td>
<td>adapter=vmhb1 channel=0 target=0 lun=57</td>
</tr>
</tbody>
</table>

The presence of a second line with the same rule number with the word runtime in the class column indicates that the claim rules have loaded correctly.

6. Unclaim the device from PowerPath/VE control using the device number that corresponds to the device:

a. Use the esxcfg-mpath command to identify the device number associated with the device:

esxcfg-mpath --server <IP addr of vSphere server> -L

Output like the following appears:

vmhba1:C0:T0:L57 state:active naa.
6006016029a11e0047d2fa3437a4dd11 vmhba1 0 0 57
PowerPath active san fc.2000001b3210553a:2100001b3210553a
fc.50060160c1e0a2c5:5006016041e0a2c5

vmhba3:C0:T0:L57 state:active naa.
6006016029a11e0047d2fa3437a4dd11 vmhba3 0 0 57
PowerPath active san fc.2000001b3210553a:2100001b3210553a
fc.50060160c1e0a2c5:5006016041e0a2c5

The device number starts with naa (in this case naa.
6006016029a11e0047d2fa3437a4dd11).
b. Unclaim the device using the device number:

```bash
esxcli --server <IP addr of vSphere server> storage core claiming unclaim --type=device --device-naa.6006016029a11e0047d2fa3437a4dd11
```

7. Run the claim rule:

```bash
esxcli --server <IP addr of vSphere server> storage core claimrule run
```

8. Use the `esxcfg-mpath` command to verify that the device is under NMP control:

```bash
esxcfg-mpath --server <IP addr of vSphere server> -L
```

Output like the following appears:

```bash
vmhba1:C0:T0:L57 state:active naa.6006016029a11e0047d2fa3437a4dd11 vmhba1 0 0 57
NMP active san fc.2000001b32105553a:2100001b3210553a
  fc.5006016040e0a2c5:5006016040e0a2c5
vmhba3:C0:T0:L57 state:active naa.6006016029a11e0047d2fa3437a4dd11 vmhba3 0 0 57
NMP active san fc.2000001b32105553a:2100001b3210553a
  fc.5006016040e0a2c5:5006016040e0a2c5
```

Note that the device is indicated as `NMP active`.

Example: Claim a LUN for NMP with 2 HBAs and CLARiiON array with 4 storage ports

This example describes how to claim LUN 55 for NMP array on a vSphere host with two HBAs to a CX with four storage ports (non-ALUA mode) using claim rule numbers 204–207:

**Procedure**

1. Use the `esxcfg-mpath` command to identify the device you want to place under NMP control:

```bash
esxcfg-mpath --server <IP addr of vSphere server> -L
```

Output like the following appears:

```bash
vmhba1:C0:T0:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11 vmhba1 0 0 55
PowerPath active san fc.2000001b3210fe3d:2100001b3210fe3d
  fc.5006016040e0a2c5:5006016040e0a2c5
vmhba1:C0:T1:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11 vmhba1 1 0 55
PowerPath active san fc.2000001b3210fe3d:2100001b3210fe3d
  fc.5006016040e0a2c5:5006016040e0a2c5
vmhba3:C0:T0:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11 vmhba3 0 0 55
PowerPath active san fc.2000001b32105553a:2100001b3210553a
  fc.5006016040e0a2c5:5006016040e0a2c5
vmhba3:C0:T1:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11 vmhba3 1 0 55
PowerPath active san fc.2000001b32105553a:2100001b3210553a
  fc.5006016040e0a2c5:5006016040e0a2c5
```

2. Add claim rules to claim the device for NMP:

```bash
esxcli --server <IP addr of vSphere server> storage core claimrule add --type="location" --rule=204 --plugin="NMP" --adapter=vmhba1 --channel=0 --target=0 --lun=55
esxcli --server <IP addr of vSphere server> storage core claimrule add --type="location" --rule=205 --plugin="NMP" --adapter=vmhba3 --channel=0 --target=1 --lun=55
esxcli --server <IP addr of vSphere server> storage core claimrule add
```
3. Verify that the claim rules have been added:

```
esxcli --server <IP addr of vSphere server> storage core claimrule list
```

Output like the following appears:

<table>
<thead>
<tr>
<th>Rule</th>
<th>Class</th>
<th>Type</th>
<th>Plugin</th>
<th>Matches</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 0</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=usb</td>
</tr>
<tr>
<td>MP 1</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=sata</td>
</tr>
<tr>
<td>MP 2</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=ide</td>
</tr>
<tr>
<td>MP 3</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=block</td>
</tr>
<tr>
<td>MP 4</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=unknown</td>
</tr>
<tr>
<td>MP 101</td>
<td>runtime</td>
<td>vendor</td>
<td>MASK_PATH</td>
<td>vendor=DELL model=Universal Xport</td>
</tr>
<tr>
<td>MP 204</td>
<td>runtime</td>
<td>location</td>
<td>NMP</td>
<td>adapter=vmhba1 channel=0</td>
</tr>
<tr>
<td>MP 205</td>
<td>runtime</td>
<td>location</td>
<td>NMP</td>
<td>adapter=vmhba1 channel=0</td>
</tr>
<tr>
<td>MP 206</td>
<td>runtime</td>
<td>location</td>
<td>NMP</td>
<td>adapter=vmhba3 channel=0</td>
</tr>
<tr>
<td>MP 207</td>
<td>runtime</td>
<td>location</td>
<td>NMP</td>
<td>adapter=vmhba3 channel=0</td>
</tr>
</tbody>
</table>

4. Load the claim rule:

```
esxcli --server <IP addr of vSphere server> storage core claimrule load
```

5. List the claim rules to verify that the claim rules have been loaded:

```
esxcli --server <IP addr of vSphere server> storage core claimrule list
```

Output like the following appears:

<table>
<thead>
<tr>
<th>Rule</th>
<th>Class</th>
<th>Type</th>
<th>Plugin</th>
<th>Matches</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 0</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=usb</td>
</tr>
<tr>
<td>MP 1</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=sata</td>
</tr>
<tr>
<td>MP 2</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=ide</td>
</tr>
<tr>
<td>MP 3</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=block</td>
</tr>
<tr>
<td>MP 4</td>
<td>runtime</td>
<td>transport</td>
<td>NMP</td>
<td>transport=unknown</td>
</tr>
<tr>
<td>MP 101</td>
<td>runtime</td>
<td>vendor</td>
<td>MASK_PATH</td>
<td>vendor=DELL model=Universal Xport</td>
</tr>
<tr>
<td>MP 204</td>
<td>runtime</td>
<td>location</td>
<td>NMP</td>
<td>adapter=vmhba1 channel=0</td>
</tr>
<tr>
<td>MP 205</td>
<td>runtime</td>
<td>location</td>
<td>NMP</td>
<td>adapter=vmhba1 channel=0</td>
</tr>
<tr>
<td>MP 206</td>
<td>runtime</td>
<td>location</td>
<td>NMP</td>
<td>adapter=vmhba3 channel=0</td>
</tr>
<tr>
<td>MP 207</td>
<td>runtime</td>
<td>location</td>
<td>NMP</td>
<td>adapter=vmhba3 channel=0</td>
</tr>
</tbody>
</table>

The presence of a second line with the same rule number with the word runtime in the class column indicates the correct loading of the claim rules.

6. Unclaim the device from PowerPath/VE control using the device number that corresponds to the device:

   a. Use the `esxcfg--mpath` command to identify the device number associated with the device:
esxcli --server <IP addr of vSphere server> storage core claim
unclaim
esxcfg-mpath --server <IP addr of vSphere server> -L

Output like the following appears:

```
vmhba1:C0:T0:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11
vmhba1 0 0 55
PowerPath active san fc.2000001b3210fe3d:2100001b3210fe3d
fc.50060160c1e0a2c5:5006016841e0a2c5

vmhba1:C0:T1:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11
vmhba1 0 1 55
PowerPath active san fc.2000001b3210fe3d:2100001b3210fe3d
fc.50060160c1e0a2c5:5006016141e0a2c5

vmhba3:C0:T0:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11
vmhba3 0 0 55
PowerPath active san fc.2000001b3210fe3d:2100001b3210fe3d
fc.50060160c1e0a2c5:5006016041e0a2c5

vmhba3:C0:T1:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11
vmhba3 0 1 55
PowerPath active san fc.2000001b3210fe3d:2100001b3210fe3d
fc.50060160c1e0a2c5:5006016941e0a2c5
```

The device number is the data that starts with naa, in this case naa. 6006016029a11e0046d2fa3437a4dd11.

7. Run the claim rule:

```
esxcli --server <IP addr of vSphere server> storage core claimrule run
```

8. Use the esxcfg-mpath command to verify that the device is under NMP control:

```
esxcfg-mpath --server <IP addr of vSphere server> -L
```

Output like the following appears:

```
vmhba1:C0:T0:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11
vmhba1 0 0 55
NMP active san fc.2000001b3210fe3d:2100001b3210fe3d
fc.50060160c1e0a2c5:5006016841e0a2c5

vmhba1:C0:T1:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11
vmhba1 0 1 55
NMP active san fc.2000001b3210fe3d:2100001b3210fe3d
fc.50060160c1e0a2c5:5006016141e0a2c5

vmhba3:C0:T0:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11
vmhba3 0 0 55
NMP active san fc.2000001b3210fe3d:2100001b3210fe3d
fc.50060160c1e0a2c5:5006016041e0a2c5

vmhba3:C0:T1:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11
vmhba3 0 1 55
NMP active san fc.2000001b3210fe3d:2100001b3210fe3d
fc.50060160c1e0a2c5:5006016941e0a2c5
```

Note

The device is indicated as NMP active.

Reclaiming devices by NMP

Use this procedure to reclaim an adapter, channel, target, and/or LUN by NMP:

Procedure

1. Type the following command:
esxcli --server <IP addr of vSphere server> storage core claimrule add --plugin=NMP --rule <rule#> --type=location [--adapter <adapter>] [--channel <channel>] [--target <target>] [--lun <lun#>]

where <rule#> is a value smaller than 250, which is the number of the first PowerPath/VE claim rule.

Use the output of esxcfg-mpath -L to determine the applicable values for the other options.

For additional information on the esxcli interface, refer VMware documentation on Command Line Interface Installation and Reference.

2. After adding the appropriate claim rule(s), run the following command:

   esxcli --server <IP addr of vSphere server> storage core claimrule load

3. Restart the host.

Renumbering claim rules

If the number of devices to be placed under NMP control and their associated paths exceeds 148, then you must modify the default PowerPath/VE claim rule using the VMware command esxcli storage core claimrule move. The move command moves a claim rule from one rule ID to another.

To renumber claim rules:

Procedure

1. List the claim rules:

   esxcli --server <IP addr of vSphere server> storage core claimrule list

2. Run the claimrule move command.

   For example, the move command in the following example shows that the PowerPath/VE claim rules are moved from 250 and 260 to 450 and 460, respectively.

   Type the following commands:

   esxcli --server <IP addr of vSphere server> storage core claimrule move -r 250 -n 450
   esxcli --server <IP addr of vSphere server> storage core claimrule move -r 260 -n 460

   esxcli --server <IP addr of vSphere server> storage core claimrule load

   esxcli --server <IP addr of vSphere server> storage core claimrule run

Output such as the following appears:

~ # esxcli storage core claimrule list

<table>
<thead>
<tr>
<th>Rule Class</th>
<th>Rule Class</th>
<th>Type</th>
<th>Plugin</th>
<th>Matches</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP</td>
<td>0</td>
<td>runtime</td>
<td>transport</td>
<td>NMP transport=usb</td>
</tr>
<tr>
<td>MP</td>
<td>1</td>
<td>runtime</td>
<td>transport</td>
<td>NMP transport=sata</td>
</tr>
<tr>
<td>MP</td>
<td>2</td>
<td>runtime</td>
<td>transport</td>
<td>NMP transport=ide</td>
</tr>
<tr>
<td>MP</td>
<td>3</td>
<td>runtime</td>
<td>transport</td>
<td>NMP transport=block</td>
</tr>
<tr>
<td>MP</td>
<td>4</td>
<td>runtime</td>
<td>transport</td>
<td>NMP transport=unknown</td>
</tr>
<tr>
<td>MP</td>
<td>101</td>
<td>runtime</td>
<td>vendor</td>
<td>MASK_PATH vendor=DELL</td>
</tr>
<tr>
<td>MP</td>
<td>101 file</td>
<td>vendor</td>
<td>MASK_PATH</td>
<td>vendor=DELL</td>
</tr>
<tr>
<td>MP</td>
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<tr>
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<td>vendor</td>
<td>PowerPath</td>
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<td>vendor</td>
<td>PowerPath</td>
<td>vendor=HP model=*</td>
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<td>vendor</td>
<td>PowerPath</td>
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<td></td>
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<td>vendor</td>
<td>PowerPath</td>
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<td>vendor</td>
<td>PowerPath</td>
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<td></td>
</tr>
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<tr>
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<td>vendor</td>
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<td>vendor=* model=*</td>
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</tbody>
</table>

The presence of a second line with the same rule number with the word runtime in the class column indicates the correct loading of the claim rules.

### Configuration changes in PowerPath/VE

Reconfigure PowerPath/VE after making configuration changes that affect host-to-storage system connectivity or logical device identification.

**Note**

If you do not reconfigure PowerPath/VE after making configuration changes, the changes are treated as unintentional, and PowerPath/VE tries to prevent them from affecting applications.

Some operations fail 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.

### Adding new paths to PowerPath/VE logical device

This procedure adds new paths to a logical device already configured with at least one path in PowerPath/VE.
This procedure can be done without interruption to running applications on vSphere hosts. After the reconfiguration is completed successfully, applications can be run on the newly added device paths.

⚠️ **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 `rpowermt host=<IP address of the vSphere server> display` command to confirm the current configuration.

2. Run `rpowermt host=<IP address of the vSphere server display dev=all` to confirm the configuration of the logical device(s) 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 for known good paths and for known bad paths.

3. Make physical path additions as required:
   a. Map the logical device to additional storage-system ports.
   b. Add new HBAs. For details, refer to your HBA vendor documentation.
   c. Attach cables.
   d. Rezone Fibre Channel switches.

4. If using SAN Manager, Volume Logix, or Access Logix, make new paths available to the host using those tools.

5. For VMware to recognize new paths so that PowerPath/VE can then recognize the new paths, carry out one of the following:
   - Run the `esxcfg-rescan` command.
     The `esxcfg-rescan` command rescans paths on an HBA to discover new storage devices.

     ```bash
     esxcfg-rescan --server <IP address of vSphere server> vmhba#
     ```

   Or
   - In the vSphere Client, go to Configuration tab Storage adapters tab, and click Rescan.

6. Inspect the new PowerPath/VE configuration:
   a. Run `rpowermt host=<IP address of the vSphere server> display dev=all`.

      The new path(s) should be displayed with a state of.

   b. Run `rpowermt host=<IP address of the vSphere server> restore` to test all paths.

   c. Scan operating system error logs to ensure no errors are logged against the new paths.
Add new logical devices to a configuration

This procedure adds new logical devices with one or more paths that will be managed by PowerPath/VE.

On vSphere 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.

Once the reconfiguration is completed successfully, new pseudo 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.

Procedure

1. Run `rpowermt host=<IP address of the vSphere server> 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 for known good paths and 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. Assign new device(s) from storage system to vSphere ESXi ports.

3. If using SAN Manager, Volume Logix, or Access Logix, make new paths available to the host using those tools.

4. For VMware to recognize a new logical device so that PowerPath/VE can then recognize a new logical device, carry out one of the following:
   
   - Run the `esxcfg-rescan` command:
     ```bash
     esxcfg-rescan --server <IP addr of vSphere server> vmhba#
     ```
     
     Or
   
   - In the vSphere Client, go to Configuration tab Storage adapters link, and click Rescan.

5. Inspect the new PowerPath/VE configuration:
   
   a. Run `rpowermt dev=all host=<IP address of the vSphere server> display`.
      
      All paths associated with the new logical devices should be displayed with a state of .
   
   b. Run `rpowermt host=<IP address of the vSphere server> 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.

6. Set PowerPath/VE-specific options for the new logical devices, such as load-balancing and failover policy.
Remove paths or logical devices from PowerPath/VE configuration

This section describes how to remove the following from a PowerPath/VE configuration:

- Entire HBAs
- Logical devices

Note

It is not possible to have mixed paths under both NMP and PowerPath/VE control. You cannot use the claim rule to add paths under NMP and then remove NMP. Because of this, you cannot remove specified paths to logical devices.

CAUTION

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

Removing HBA

You can remove the HBA in one of the following ways:

- Disconnect the HBA cable.
- Run the `esxcfg-rescan` command.

```bash
esxcfg-rescan --server <IP addr of vSphere server> vmhba#
```

- In the vSphere Client, go to Configuration tab Storage adapters link, and click Rescan to remove the dead paths from PowerPath/VE.

The I/O then fails to the other HBA after all the paths on that HBA show as

Removing logical device

Procedure

1. Stop I/O to those devices you want to remove.
2. Remove the devices from the storage group or Volume Logix.

   In the case of Symmetrix, paths to other devices assigned to the same directors go dead momentarily. In the case of CLARiiON, paths belonging to the same storage group go dead momentarily. In both cases, this is a known issue and does not impact I/O on other remaining devices. Then the paths to the removed devices show as.

3. Run `esxcfg-rescan vmhba#` to all HBAs to remove the paths.

   - Alternatively, in the vSphere Client, go to Configuration tab Storage adapters link, and click Rescan to remove the paths from NMP.

Alternate procedure to remove logical device

Procedure

1. Use the procedure in Claim rules and definitions on page 73 to put the devices that you want to remove to be under NMP control.
2. Remove the devices from the storage group or Volume Logix.
3. Run `esxcfg-rescan vmhba#` to all HBAs to remove the dead paths from NMP.

   Alternatively:
   In the vSphere Client, go to Configuration tab > Storage adapters link, and click Rescan to remove the paths from NMP.

4. Inspect the new PowerPath/VE configuration:
   a. Run `rpowermt host=<IP address of the vSphere server> display`.
      The output should show fewer total paths than before. All paths should have a state of .
   b. Run `rpowermt host=<IP address of the vSphere server> display dev=all`.
      All remaining paths associated with the affected logical devices should be displayed with a state of alive.

5. Correct any issues detected above before saving the PowerPath/VE configuration or using the new logical devices.

Configuring path latency monitoring

   Procedure
   1. Enable path latency monitor for the host.
      `rpowermt set path_latency_monitor=on host=<FQDN|IP>`.
   2. Confirm that path latency monitoring is enabled.
      `rpowermt display options host=<FQDN|IP>`
   3. Enable path latency monitoring to monitor the time interval in seconds within which I/Os should complete.
      `rpowermt set path_latency_threshold=<seconds> host=<FQDN|IP>`
   4. View information on I/O completion times.
      `rpowermt display latency host=<FQDN|IP>`

Manage PowerPath/VE using rpowermt

Use the PowerPath/VE commands to manage PowerPath/VE and paths under its control on vSphere hosts.

The PowerPath/VE for VMware vSphere Remote CLI Guide provides information on the PowerPath/VE rpowermt commands.

Workarounds for non-existent powermt commands

The following powermt commands are non-existent in PowerPath/VE for VMware vSphere. Workarounds exist to carry out their intended function.

- `powermt check`: Use the `powermt check` command to check specified paths and, if desired, remove any paths that are marked dead from the PowerPath/VE configuration.
  To remove dead paths, run the VMware native command `esxcfg-rescan vmhba#`. The rescan can be done using vSphere Client. In the vSphere Client, go to the Configuration tab > storage adapter link.
• **powermt remove**: Use the `powermt remove` command to add and remove paths and devices.

• **powermt manage**: Use the `powermt manage` command claim specific devices in an out of PowerPath/VE control. Use this in conjunction with VMware native command `esxcli storage core claimrule add` and associated procedures.

• **powermt unmanage**: Use the `powermt unmanage` command to unclaim specific devices in and out of PowerPath/VE control. Use this in conjunction with VMware native command `esxcli storage core claiming unclaim` and associated procedures.
CHAPTER 13

Remove PPVE ELMS

This chapter discusses the following topics:

- Remove PPVE ELMS on Windows ................................................................. 88
- Removing PPVE ELMS on Linux ................................................................. 89
Remove PPVE ELMS on Windows

You can remove PPVE ELMS using three methods:

- Interactive uninstallation
- Add/Remove programs
- CLI uninstallation

All license server binaries (lmgrd.exe, lmlutil.exe, lmttools.exe, and EMCLM.exe) are deleted with uninstallation of the PPVE ELMS package. All other non-license server files and binaries, including the served license file, are retained in the existing directory.

Removing PPVE ELMS using interactive uninstallation

Procedure
1. Double-click the PPVE ELMS executable for Windows to start the installer.
2. In the Program Maintenance window, select Remove.
3. Verify PPVE ELMS is removed. Go to Programs > Start; verify that PPVE ELMS is not listed among the available programs.

Removing PPVE ELMS using Add/Remove Programs

Procedure
1. From the list of installed programs, select the entry for the PPVE ELMS package.
   For example, EMC PowerPath ELMS 11.10.v01.
2. Click Uninstall.
3. Verify that the PPVE ELMS package is removed. Go to Programs > Start; verify that PPVE ELMS is not listed among the available programs.

Removing PPVE ELMS using CLI uninstallation

Procedure
1. Type the following command to remove using CLI: <setup.exe> /s /v" /q /l*v
   <path to log file> REMOVE=ALL
   Where:
   - <setup.exe> is the name of the PPVE ELMS package
   - <path to log file> is the absolute customized path to the uninstall log file
2. Verify PPVE ELMS is removed. Go to Programs > Start; verify that PPVE ELMS is not listed among the available programs.
Removing PPVE ELMS on Linux

All license server binaries are deleted with uninstallation of the PPVE ELMS package. All other non-license server files and binaries, including the served license file, are retained in the existing directory.

Procedure

1. Execute the elms_uninstall.sh script file in the directory ELMS_LINUX_11_10_v01 to stop and uninstall PPVE ELMS. Type: `./elms_uninstall.sh`

2. Verify PPVE ELMS is removed. Type: `rpm -qa | grep ELMS`

   No ELMS package should be listed.
CHAPTER 14

Troubleshooting PowerPath/VE Installation

This chapter discusses troubleshooting the PowerPath/VE installation. Topics include:

- Served license file errors ................................................................. 92
- rpowermt lockbox errors ............................................................... 93
- PowerPath/VE installation error ....................................................... 94
- Collecting logs from vCenter server or vSphere client ...................... 94
- Stop license server ........................................................................ 95
- Start license server manager .......................................................... 96
- Report a problem ........................................................................... 97
- PPVE ELMS 11.10.v01 Installer FAQ ............................................... 97
Served license file errors

If you are getting license file errors, try one of the following options:

- Resolving PPVE ELMS TCP port conflicts on page 92
- Modifying vendor daemon port number on page 93
- Modifying vendor daemon search path on page 93

Resolving PPVE ELMS TCP port conflicts

If you have two PPVE ELMS running on the same host and they are using the same default TCP port, you receive the following error message:

Warning: Failed to get a license from the server.

For both electronic license servers and vendor daemons to coexist on the same host, you must change the TCP port number from the default of 27010 to a number that does not conflict with another application on your host.

Procedure

1. Modify the TCP port number in the PowerPath/VE license file that resides on the PPVE ELMS and the PowerPath/VE license configuration file that resides on the rpowermt server. A valid number is any unused port number between 0 and 65535.

For example, the license configuration file with the default TCP port would look like this:

SERVER 172.23.168.142 INTERNET=172.23.168.142 27010
VENDOR EMCLM
USE_SERVER

The server license file downloaded from the Powerlink Licensing portal would look as follows:

SERVER 172.23.168.142
INTERNET=172.23.168.142 27050
VENDOR EMCLM
USE_SERVER

INCREMENT PowerPathMP EMCLM 5.4 permanent 20 OVERDRAFT=2 \ 
dist_info="ACTIVATED TO 4357920 LUCKY COMPUTER 1420 NE 21 ST \ BELLE'VEE WA US 98007" ISSUER=EMC ISSUED=13-Jun-2011 \ NOTICE="ACTIVATED TO SiteID: 132091443" TS_OK SIGN="00E7 F72C \ F32C 542C D66D CBF1 A46E EA00 BB5E 3BD2 4B6A CEC8 CCA4 EFB \ 0FC2"

If the TCP port number 27010 conflicts with another application, you must modify it in the license configuration file and in the server license file to another unused port number between 0 and 65535.

For example, you might modify the TCP port number to 27050, so that the license configuration file looks as follows:

SERVER 172.23.168.142 INTERNET=172.23.168.142 27050
VENDOR EMCLM
USE_SERVER

In the served license file saved on the PPVE ELMS you would also modify the TCP port number to 27050:

SERVER 172.23.168.142 INTERNET=172.23.168.142 27050
VENDOR EMCLM
USE_SERVER
INCREMENT PowerPathMP EMCLM 5.4 permanent 20 OVERDRAFT=2 \ 
dist_info="ACTIVATED TO 4357920 LUCKY COMPUTER 1420 NE 21 ST \ BELLEVE WA US 98007" ISSUER=EMC ISSUED=13-Jun-2011 \
2. Reread the license file on the PPVE ELMS.
3. Register the vSphere host using the `rpowermt` command.

Modifying vendor daemon port number

If you have changed from the default vendor daemon port, you must add the vendor daemon port to the served license file.

Procedure

1. Access the VENDOR line of the served license file.
2. Type the vendor daemon TCP port number as follows:

```
SERVER 172.23.168.142 INTERNET=172.23.168.142 27010
VENDOR EMCLM PORT=27011
USE_SERVER
INCREMENT PowerPathMP EMCLM 5.4 permanent 20 OVERDRAFT=2 \ 
dist_info="ACTIVATED TO 4357920 LUCKY COMPUTER 1420 NE 21 ST \ 
BELLEVUE WA US 98007" ISSUER=EMC ISSUED=13-Jun-2011 \ 
NOTICE="ACTIVATED TO SiteID: 132091443" TS_OK SIGN="00E7 F72C \ 
F32C 542C DD6D CBF1 A46E EA00 BB5E 3BD2 4B6A CEC8 CCA4 6EFB \ 
0FC2"
```

Modifying vendor daemon search path

If you have changed from the default vendor daemon search paths, you must add the vendor daemon search path to the served license file.

```
SERVER 172.23.168.142 INTERNET=172.23.168.142 27010
VENDOR EMCLM
USE_SERVER
INCREMENT PowerPathMP EMCLM 5.4 permanent 20 OVERDRAFT=2 \ 
dist_info="ACTIVATED TO 4357920 LUCKY COMPUTER 1420 NE 21 ST \ 
BELLEVUE WA US 98007" ISSUER=EMC ISSUED=13-Jun-2011 \ 
NOTICE="ACTIVATED TO SiteID: 132091443" TS_OK SIGN="00E7 F72C \ 
F32C 542C DD6D CBF1 A46E EA00 BB5E 3BD2 4B6A CEC8 CCA4 6EFB \ 
0FC2"
```

Procedure

1. Access the VENDOR line in the served license file.
2. Type the vendor daemon path as follows:

```
SERVER 172.23.168.142 INTERNET=172.23.168.142 27010
VENDOR EMCLM USE_SERVER
INCREMENT PowerPathMP EMCLM 5.4 permanent 20 OVERDRAFT=2 \ 
dist_info="ACTIVATED TO 4357920 LUCKY COMPUTER 1420 NE 21 ST \ 
BELLEVUE WA US 98007" ISSUER=EMC ISSUED=13-Jun-2011 \ 
NOTICE="ACTIVATED TO SiteID: 132091443" TS_OK SIGN="00E7 F72C \ 
F32C 542C DD6D CBF1 A46E EA00 BB5E 3BD2 4B6A CEC8 CCA4 6EFB \ 
0FC2"
```

The VENDOR field is protected by the signature of the license file. However, the vendor daemon path and the port are user-configurable fields. These fields can be modified without affecting the signature of the served license file. Modifying any other field invalidates the served license file.

**rpowermt lockbox errors**

The following error message appears if you use incompatible versions of the rpowermt lockbox:

Error: failed to open host file.
To correct this, remove the incompatible version of the rpowermt lockbox:

Procedure

1. Type `rpowermt host=<IP address of the vSphere server> version` to see the version of lockbox you have on your host.

   Output such as the following appears:

   ```
   <username>lsca2147.lss.abc.com -- src> rpowermt version
   EMC rpowermt for PowerPath (c) client Version 5.4 SP1(build xxx)
   License search path:
   /etc/emc:/etc/emc/licenses:/opt/EMCpower:/opt/EMCpower/licenses
   Host file: /etc/emc/lockbox/<username>.clb
   ```

   In this example, the rpowermt lockbox file is `/etc/emc/lockbox/<username>.clb`.

2. Delete rpowermt lockbox file.

3. Set up the same version of rpowermt lockbox as PowerPath/VE that you are running on your host following the procedure in `rpowermt server lockbox on page 56` section.

   **Note**
   The PowerPath/VE 5.4 and 5.4 SP1 versions of the rpowermt lockbox are not forward-compatible with the PowerPath 5.7 and late versions of the rpowermt lockbox.

   **Note**
   After PowerPath/VE 5.9 SP1 is created or converted the lockbox, the PowerPath/VE 5.4 and 5.4 SP1 versions of rpowermt will not be able to read the PowerPath 5.9 SP1 version of the rpowermt lockbox.

**PowerPath/VE installation error**

Post-PowerPath/VE installation, if you get an error message indicating, `PowerPath Not Found` on running an `rpowermt` command, ensure that the `/root` partition is not full. If the `/root` partition is full PowerPath/VE might be only partially installed.

VMware documentation provides information on checking the `/root` partition. The `PowerPath/VE for VMware vSphere Remote CLI Guide` provides more information on `rpowermt` errors.

**Collecting logs from vCenter server or vSphere client**

If you find a problem in PowerPath/VE, collect crash dump logs from vCenter Server or vSphere Client to submit to EMC Customer Support.

Procedure

1. To collect logs remotely from vSphere Center Server or vSphere client:
   - In vSphere Center Server:
     - Select File `Export System Logs`.
     - The `Export System Logs` window appears.
     - Select the vSphere host from which you want to collect the log.
   - In vSphere client:
a. Select File Export System Logs.
   The Export System Logs window appears.

2. Choose the location where you want to save the logs.
   a. Browse for the location you want.
   b. When you have selected the desired file location, click OK.
   It takes a few moments for task to complete.
   The logs include vSphere Client and Hosts.

After you finish

Post-requisites:
1. Run Grab with VMware ESX support.
   a. See EMC278043 for information on running Grab with VMware ESX support.
   b. Submit the generated tar file, along with any other supporting material, to EMC Customer Support.

Log file location

Use log files to check trace messages from various applications and to debug. Table 4 on page 95 lists the file type and names for VMware vSphere message tracing and error debugging for the PowerPath/VE versions.

Table 4 VMware vSphere error log file types and locations

<table>
<thead>
<tr>
<th>File type</th>
<th>VMware version</th>
<th>File location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation log</td>
<td>5.0</td>
<td>/var/run/log/esxupdate.log</td>
</tr>
<tr>
<td></td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td>Kernel log</td>
<td>5.0</td>
<td>/var/run/log/vmkernel.log</td>
</tr>
<tr>
<td></td>
<td>5.1</td>
<td></td>
</tr>
</tbody>
</table>

Stop license server

Gracefully shutting down the license server ensures that the correct processes are terminated.

Using lmutil utility to stop the license server

Procedure
1. Type:
   ```
   lmutil lmdown -c <license_file_list>
   ```
   where
   `<license_file_list>` is the name of the served license file used to start the license server manager.
2. When prompted, enter y to stop the server.
Using lmtools utility to stop the licence server

**Procedure**

1. Navigate to the directory where the license server executables are installed and click lmtools.exe.
2. On the **Start/Stop/Reread** tab, click **Stop Server**.
   
   The following message appears:

   License Server Shut Down

Start license server manager

Use the following procedures to start and stop the license server manager (lmgrd) on a Linux and Windows host.

Starting license server on Linux host

**Procedure**

1. Navigate to the directory where you installed the License Server Manager.
2. Run the `lmgrd` command to start the license server manager.

   ```bash
   # lmgrd -c <license_file_list> -l [+]<logfile>
   ```

   where:

   - `<license_file_list>`
     
     is one or more of the following:
     
     - the full path to a single served license file.
     - a directory where all files named `*.lic` are stored.

     If the `<license_file_list>` value contains more than one served license file or directory, they must be separated by colons.

   - `<logfile>`
     
     is the full path to the debug log file. Prepending the debug log file name with the `+` character appends logging entries to the log.

Starting license server manager on Windows hosts

**Procedure**

1. Navigate to the directory where the license server executables are installed and click lmtools.exe.
2. On the **Start/Stop/Reread** tab, click **Start Server**.

   You should see the following message:

   Server Start Successful.
Report a problem

Procedure

- If you find a problem in PowerPath/VE 5.7 for VMware vSphere, collect crash dump logs from vSphere Center Server or vSphere client (see Collecting logs from vCenter server or vSphere client on page 94) and submit the generated file with system information and dump, along with any other supporting material, to EMC Customer Support.
- If you encounter a problem with Powerlink Licensing via Powerlink, mailto://contact licensing@emc.com.

PPVE ELMS 11.10.v01 Installer FAQ

This section addresses frequently asked questions regarding the installation or upgrade from the Flexera version 11.6 or 11.8 ELM server to the PPVE ELMS 11.10v01 installer.

Q:
In case of successful installation after a fresh install, what if the server status on lmtools throws an error that license file is not valid or not found?

A (Windows hosts):
This is an expected behavior on some hosts. There will be a delay in detecting license file after installation. The issue gets fixed after a few moments or after a couple of refreshes.

Q:
Will the installation fail if the license file location is not specified?

A (Windows hosts):
No. The installation succeeds even if the license file location is not specified, but the service will not start. Select the Repair option by re-running the installer. When prompted, enter the license file path. The service then starts successfully.

A (Linux hosts):
Start the ELMS service with the license parameter after the installation. For example /etc/init.d/PowerELMS start -l <absolute path to the license file>

Q:
What if the Repair option is not seen in Add/Remove programs?

A (Windows hosts):
By design, the Repair option is available only on re-running the installer and not in Add/Remove programs.

Q:
The PPVE ELMS 11.10 files are already configured manually on the host. Should the installer be still used to re-install the files?

A (Windows hosts):
It is not required to re-install the files if they are already configured. But, doing so will not have any adverse effects.
Q: In case of upgrade, what happens if PPVE ELMS 11.10 files are installed in the default location or to a location different from that where previous Flexera 11.6 or 11.8 files are configured?

A (Windows hosts):

After successful installation, two different services will be running on the host, provided they are using different license files (or license files with different port numbers).

A (Linux hosts):

The currently running license server has to be stopped manually and the new PPVE ELMS service has to be started with the path to license file. For example, /etc/init.d/PowerELMS start -l <license search path>.

Q: Is silent upgrade (from CLI) supported?

A (Windows hosts):

No. Silent upgrade is not supported on PPVE ELMS 11.10.v01. Upgrade only through GUI (Interactive Installation).

Q: What should I do if I hit Cancel during uninstallation?

A (Windows hosts):

EMC recommends not to click Cancel during uninstallation. If done so, follow the procedure:

1. Check the status of the license server from PPVE RTOOLS. From the rpowermt server run the rpowermt check_registration command and look for the warning: Warning: License server is not responding or unreachable.

2. If the server is down or not responding, uninstall the ELMS package completely, referring to the procedure described in Removing PPVE ELMS using Add/Remove Programs on page 88.

3. Reinstall the PPVE ELMS package.

Q: What should I do if the installation succeeded but the ELMS service failed to start?

A (Linux hosts):

Start the service manually. Type /etc/init.d/PowerELMS start -l <license search path>.

Q: Where do I find the lmgrd and lmutil executables on the host after installation?

A (Linux hosts):

These file are available at /opt/emc/elms directory on the host.
APPENDIX A

Files Installed and Modified by PowerPath/VE

This appendix lists files that are created or modified by the PowerPath/VE installation.

- Files installed and modified by the PowerPath/VE installation

.................................100
Files installed and modified by the PowerPath/VE installation

The following files are installed and modified when PowerPath/VE is installed on a vSphere host:

- `/usr/libexec/jumpstart/plugins/register-emc-powerpath.json`
- `/usr/libexec/jumpstart/plugins/psa-powerpath-pre-claim-config.json`
- `/usr/lib/vmware/vmkmmod/emcp`
- `/opt/emc/powerpath/bin/powermt`
- `/opt/emc/cim/EMCProvider.conf`
- `/opt/emc/cim/db/`
- `/opt/emc/cim/log/`
- `/usr/lib/cim/libemcp_mpapi_rtl.so`
- `/usr/lib/cim/libEmcOfl4.so`
- `/usr/lib/cim/libemcp_mpapi_rtl.so`
- `/usr/lib/cim/libEmcOsls4Api.so`
- `/usr/lib/cim/libEmcOsls4sehost.so`
- `/usr/lib/cim/libsm_clsapi.so`
- `/usr/lib/cim/libsm_clsapi.so`
- `/usr/lib/cim/libstdc++.so.6.0.8`
- `/usr/lib/cim/libstdc++.so.6.0.8`
- `/opt/emc/cim/lib/license.txt`
APPENDIX B

PowerPath/VE Messages

This appendix lists messages returned by the PowerPath/VE driver, PowerPath/VE installation process, rpowermt utility, and other PowerPath/VE utilities, and provides suggested actions.

- Error log messages.............................................................................................. 102
- VM kernel errors............................................................................................... 102
- PowerPath/VE error messages.......................................................................... 103
- rpowermt error and warning messages........................................................... 110
Error log messages

Error log messages appear when you configure PowerPath/VE for common logging. The error log messages capture unexpected events that occur. Some error log messages convey information that appears on screen when a command fails. Some messages are logged to one of the following locations, depending on what you are debugging:

- VM kernel log file
- CIM log file
- vSphere update log file

The messages in this appendix are logged to the VM kernel log file.

VM kernel errors

This section discusses the operations associated with VM kernel errors and the error message sources.

Operation

Error messages written to the VM kernel log files can have to do with specific operations. The Operation column of Table 5 on page 103 lists the following main operation categories:

- Device—These messages might occur, among other reasons, if there are problems with device availability; for example, if a device could not be found or opened or if it is being quiesced.
- Module load—These messages might occur, among other reasons, if there is any problem with the license; for example, if it is expired, invalid, or cannot be located. These messages might also occur if there is insufficient memory on the system to load PowerPath/VE.
- Path claim/path unclaim—These messages might occur, among other reasons, if there is a problem with path availability for PowerPath/VE.
- rpowermt display—These messages might occur, among other reasons, as a result of user initiated commands from rpowermt.
- rpowermt register—These messages would occur if there is any problem with the license; for example, if it is expired, invalid, or cannot be located.
- SCSI command I/O on device—These messages might occur, among other reasons, due to I/O failure on devices.
- Set path state—These messages might occur, among other reasons, if there is low availability of active paths.

Message sources

Error messages written to the VM kernel log files can be generated by several commands and utilities. The message could come from the following message sources:

- PowerPath/VE driver—Usually there are driver-related error messages associated with PowerPath/VE messages. For instance, PowerPath/VE marks a path dead if the path test fails, and a path test is done as a result of an I/O failure. These failed I/Os almost always are logged by the HBA driver. These errors can be associated by time and device with PowerPath/VE errors.
- PowerPath/VE installation—These messages can appear while PowerPath/VE is being installed.
**PowerPath/VE error messages**

PowerPath/VE error messages are listed in Table 5 on page 103.

**Table 5** PowerPath/VE error messages

<table>
<thead>
<tr>
<th>Operation</th>
<th>Message type</th>
<th>Message</th>
<th>Explanation</th>
<th>Suggested action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device dump</td>
<td>Error</td>
<td>No active path to the device found.</td>
<td>No active path to the dump device was found.</td>
<td>Check the paths to storage array that has the dump device.</td>
</tr>
<tr>
<td>Device open</td>
<td>Error</td>
<td>Volume is being destroyed. Cannot open.</td>
<td>Device could not be opened.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>Device open</td>
<td>Error</td>
<td>Volume to be opened not found</td>
<td>Device could not be opened.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>Device probe</td>
<td>Error</td>
<td>Volume not found</td>
<td>SCSI device could not be found.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>Device probe</td>
<td>Information</td>
<td>Wait for volume to be unquiesced</td>
<td>Device is currently quiesced; waiting for it to be unquiesced.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>Device probe</td>
<td>Error</td>
<td>Probe of path path failed. Status: status</td>
<td>Path probe has failed.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>General (Possible error for most commands)</td>
<td>Error</td>
<td>Volume not found</td>
<td>Device could not be found.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>Get device name</td>
<td>Information</td>
<td>Device name name</td>
<td>Print device name.</td>
<td>None.</td>
</tr>
<tr>
<td>Get path names</td>
<td>Information</td>
<td>Number of Paths = number</td>
<td>Print path names to a device.</td>
<td>None.</td>
</tr>
<tr>
<td>Inquiry</td>
<td>Information</td>
<td>page 0 rc= status</td>
<td>VPD page information.</td>
<td>None.</td>
</tr>
<tr>
<td>Module load</td>
<td>Warning</td>
<td>Could not initialize log name: status</td>
<td>Initializing log handle name failed.</td>
<td>PowerPath/VE load failed. Check if</td>
</tr>
<tr>
<td>Operation</td>
<td>Message type</td>
<td>Message</td>
<td>Explanation</td>
<td>Suggested action</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>---------</td>
<td>-------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Module load</td>
<td>Warning</td>
<td>vmk_LogRegister failed: <em>status</em></td>
<td>PowerPath/VE failed to register log handle.</td>
<td>PowerPath/VE load failed. Check if enough memory is available.</td>
</tr>
<tr>
<td>Module load</td>
<td>Information</td>
<td>Char device name created</td>
<td>PowerPath/VE character device created.</td>
<td>None.</td>
</tr>
<tr>
<td>Module load</td>
<td>Error</td>
<td>Failed to create Char device name. Status: <em>status</em></td>
<td>PowerPath/VE character device could not be created.</td>
<td>PowerPath/VE load failed. Check if enough memory is available.</td>
</tr>
<tr>
<td>Module load</td>
<td>Information</td>
<td>System Id, <code>sysID</code>, Reservation Key <code>key</code></td>
<td>Print system ID and reservation key information.</td>
<td>None.</td>
</tr>
<tr>
<td>Module load</td>
<td>Information</td>
<td>License data does not match host data.</td>
<td>License information in persistent string does not match host hardware data.</td>
<td>Persisted license data is not valid on this host. Add a new PowerPath/VE License. The <em>PowerPath/VE for VMware Licensing Guide</em> provides information.</td>
</tr>
<tr>
<td>Module load</td>
<td>Information</td>
<td>Persistence of SCSI Res fail Value is 0, generating new one</td>
<td>Generating new reservation key.</td>
<td>None.</td>
</tr>
<tr>
<td>Path claim</td>
<td>Information</td>
<td>Claiming path <em>path</em>.</td>
<td>Information about the path that is going to be claimed.</td>
<td>None.</td>
</tr>
<tr>
<td>Path claim</td>
<td>Error</td>
<td>The Path has already been claimed</td>
<td>Path has already been claimed by another multipathing plugin.</td>
<td>Unclaim this path from the other multipathing plugin before trying to claim the path using PowerPath/VE. The <em>PowerPath/VE for VMware vSphere Installation and Administration</em> provides information.</td>
</tr>
<tr>
<td>Operation</td>
<td>Message type</td>
<td>Message</td>
<td>Explanation</td>
<td>Suggested action</td>
</tr>
<tr>
<td>------------</td>
<td>--------------</td>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td>Path claim</td>
<td>Error</td>
<td>MpxRecognize failed. No resources- check system maximum path limits.</td>
<td>Maximum allowed path limit has already been reached.</td>
<td>Verify that the number of devices configured on this setup is fewer than the maximum supported device/path limit.</td>
</tr>
<tr>
<td>Path claim</td>
<td>Information</td>
<td>No standard UID. Using the WWN as volume UID</td>
<td>Standard UUID for device could not be found.</td>
<td>None.</td>
</tr>
<tr>
<td>Path claim</td>
<td>Error</td>
<td>MpxRecognize failed PowerPath/VE failed to claim path.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>Path claim</td>
<td>Error</td>
<td>Could not claim the path. Status: status</td>
<td>PowerPath/VE failed to claim path.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>Path claim</td>
<td>Error</td>
<td>Could not create vol Daemon</td>
<td>PowerPath/VE failed to create a daemon or to allocate memory.</td>
<td>Check if server is out of memory.</td>
</tr>
<tr>
<td>Path claim</td>
<td>Information</td>
<td>Added new Bus ID busid for adapter adapter</td>
<td>PowerPath/VE has claimed first path to an HBA.</td>
<td>None.</td>
</tr>
<tr>
<td>Path claim</td>
<td>Information</td>
<td>PowerPath is not Licensed. Volume will be registered when a valid license is added.</td>
<td>A valid PowerPath/VE license is not available. The device settings cannot be changed.</td>
<td>Register your PowerPath/VE host. The PowerPath/VE for VMware Licensing Guide provides information.</td>
</tr>
<tr>
<td>Path claim</td>
<td>Error</td>
<td>Could not allocate SCSI device</td>
<td>Maximum number of SCSI devices, 256, has already been claimed.</td>
<td>PowerPath/VE load failed. Check if enough memory is available.</td>
</tr>
<tr>
<td>Path claim</td>
<td>Error</td>
<td>Status: status. Failed to register device. User should unclaim paths.</td>
<td>Paths to the device have been claimed but the device could not be registered. The user should unclaim</td>
<td>Check if maximum number of devices has already been claimed or if some paths to this device are claimed by other</td>
</tr>
</tbody>
</table>
Table 5 PowerPath/VE error messages (continued)

<table>
<thead>
<tr>
<th>Operation</th>
<th>Message type</th>
<th>Message</th>
<th>Explanation</th>
<th>Suggested action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Path claim/unclaim</td>
<td>Information</td>
<td>Wait for n losPending count (count) to become 0</td>
<td>Until I/O count becomes zero, PowerPath/VE will not add or remove path. There is a delay in adding or removing path.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>Path probe</td>
<td>Error</td>
<td>Path path has not been claimed</td>
<td>PowerPath/VE failed to find the path.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>Path probe</td>
<td>Information</td>
<td>Path path name is path state.</td>
<td>Print path state.</td>
<td>None.</td>
</tr>
<tr>
<td>Path probe</td>
<td>Information</td>
<td>Path path name is changing to new state from old state.</td>
<td>Path state is updated to new state from an old inconsistent state.</td>
<td>None.</td>
</tr>
<tr>
<td>Path probe</td>
<td>Information</td>
<td>Probe failed. EmsStatus : status</td>
<td>PowerPath/VE path probe has failed.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>Path unclaim</td>
<td>Information</td>
<td>Unclaiming path path.</td>
<td>Information about the path that is going to be unclaimed.</td>
<td>None.</td>
</tr>
<tr>
<td>Path unclaim</td>
<td>Error</td>
<td>The Path has not been claimed</td>
<td>Path being unclaimed has not been claimed by PowerPath/VE.</td>
<td>None. The path is already unclaimed.</td>
</tr>
<tr>
<td>Path unclaim</td>
<td>Error</td>
<td>The volume is open. Cannot unclaim last path path.</td>
<td>Cannot unclaim path because it is the last available path and is being used.</td>
<td>Stop all I/O on the device before trying to unclaim all paths to the device.</td>
</tr>
<tr>
<td>Path unclaim</td>
<td>Error</td>
<td>The volume is being registered or unregistered. Cannot unclaim last path path.</td>
<td>PowerPath/VE cannot unclaim path because this is the last available path and is being used.</td>
<td>PowerPath/VE load failed. Check if enough memory is available.</td>
</tr>
<tr>
<td>Operation</td>
<td>Message type</td>
<td>Message</td>
<td>Explanation</td>
<td>Suggested action</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------</td>
<td>----------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td>Path unclaim</td>
<td>Error</td>
<td>Could on unregister the device. Status: status</td>
<td>PowerPath/VE cannot unclaim path because this is the last available path and is being used.</td>
<td>Stop all I/O on the device before trying to unclaim all paths to the device.</td>
</tr>
<tr>
<td>Path unclaim</td>
<td>Information</td>
<td>Unclaimed path to volume device. Setting state to .</td>
<td>PowerPath/VE successfully unclaimed the path.</td>
<td>None.</td>
</tr>
<tr>
<td>Path unclaim</td>
<td>Information</td>
<td>Removing Bus ID busid for adapter adapter</td>
<td>PowerPath/VE is unclaiming last path to an HBA.</td>
<td>None.</td>
</tr>
<tr>
<td>Path unclaim</td>
<td>Information</td>
<td>Path path is dead or not an active BF path.</td>
<td>PowerPath/VE can remove path if the path is dead or is not the last active path.</td>
<td>None.</td>
</tr>
<tr>
<td>Periodic path</td>
<td>Information</td>
<td>Updating NN info for StSys device</td>
<td>Updating device NiceName periodically.</td>
<td>None.</td>
</tr>
<tr>
<td>test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rpowermt display</td>
<td>Error</td>
<td>Device(s) not found</td>
<td>There is no data for the device or there is no device specified in the rpowermt display perf</td>
<td>Specify a device in the rpowermt display perf dev=&lt;dev</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>dev=&lt;dev</td>
<td>all&gt; or rpowermt display perf bus commands.</td>
</tr>
<tr>
<td>rpowermt display</td>
<td>Error</td>
<td>Cannot communicate with host, version mismatch too great.</td>
<td>The RTOOLS version is not compatible with the PowerPath/VE version on the host.</td>
<td>Check RTOOLS version compatibility in the PowerPath/VE for VMware vSphere Release Notes and upgrade RTOOLS package, if necessary.</td>
</tr>
<tr>
<td>rpowermt display</td>
<td>Error</td>
<td>Volume is not registered</td>
<td>Device is not registered.</td>
<td>None. Wait for the device to be registered.</td>
</tr>
<tr>
<td>rpowermt display</td>
<td>Error</td>
<td>Not valid vol or Mpxdevice</td>
<td>Device is not valid.</td>
<td>None.</td>
</tr>
</tbody>
</table>

Table 5 PowerPath/VE error messages (continued)
<table>
<thead>
<tr>
<th>Operation</th>
<th>Message type</th>
<th>Message</th>
<th>Explanation</th>
<th>Suggested action</th>
</tr>
</thead>
<tbody>
<tr>
<td>rpowermt</td>
<td>Error</td>
<td>Not a valid extension device</td>
<td>Device is not valid.</td>
<td>None.</td>
</tr>
<tr>
<td>display</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rpowermt</td>
<td>Information</td>
<td>Mpx: pData data size</td>
<td>Invalid ioctl buffer size.</td>
<td>Check if kernel module version matches mpapi version.</td>
</tr>
<tr>
<td>display</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rpowermt</td>
<td>Information</td>
<td>Wait for volume to be unquiesced</td>
<td>Waiting for the device to be unquiesced before printing any information.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>display</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rpowermt</td>
<td>Error</td>
<td>PowerPath license has expired</td>
<td>New license that is being registered has already expired.</td>
<td>Check your license information. Contact Customer Support.</td>
</tr>
<tr>
<td>register</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rpowermt</td>
<td>Error</td>
<td>License feature or attribute not found</td>
<td>There is a clock skew of more than 48 hours between the rpowermt server and PPVE ELMS or the ESX host.</td>
<td>Synchronize the rpowermt server and the PPVE ELMS (for served licenses) or the ESX host (for unserved licenses) within 48 hours of each other.</td>
</tr>
<tr>
<td>register</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rpowermt</td>
<td>Error</td>
<td>No valid licenses found.</td>
<td>There is a clock skew of more than 48 hours between the rpowermt server and PPVE ELMS or the ESX host.</td>
<td>Synchronize the rpowermt server and the PPVE ELMS (for served licenses) or the ESX host (for unserved licenses) within 48 hours of each other.</td>
</tr>
<tr>
<td>register</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCSI command</td>
<td>Error</td>
<td>Failed to Create Pirp</td>
<td>PowerPath/VE failed to create I/O request.</td>
<td>Check if enough memory is present on the server.</td>
</tr>
<tr>
<td>I/O on Device</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCSI command</td>
<td>Error</td>
<td>Not a valid extension device</td>
<td>I/O has failed.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>I/O on Device</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCSI command</td>
<td>Error</td>
<td>Completed the platform I/O because of the powerpath error</td>
<td>I/O has failed.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>I/O on Device</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 5 PowerPath/VE error messages (continued)

<table>
<thead>
<tr>
<th>Operation</th>
<th>Message type</th>
<th>Message</th>
<th>Explanation</th>
<th>Suggested action</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCSI command I/O on Device</td>
<td>Error</td>
<td>Allocation of dummy &lt;ASynclDaemon/TestDaemon/SyncloDaemon&gt; entry failed. Not aborting it.</td>
<td>Task management operation has failed.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>SCSI command I/O on Device</td>
<td>Information</td>
<td>Enqueued from &lt;ASynclDaemon/TestDaemon/SyncloDaemon&gt; to Abort queue Cmd command</td>
<td>PowerPath/VE has aborted a command.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>SCSI command I/O on Device</td>
<td>Information</td>
<td>SyncloDaemonCallout IO to Abort Cmd command</td>
<td>PowerPath/VE has aborted a command.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>SCSI command I/O on Device</td>
<td>Information</td>
<td>Host Error host status Device Error dev status</td>
<td>PowerPath/VE has aborted a command.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>SCSI command I/O on Device</td>
<td>Warning</td>
<td>SCSI-2 Translation command failed after the maximum number of retries!</td>
<td>SCSI-2 translation has failed after maximum number of retries.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>SCSI command I/O on Device</td>
<td>Error</td>
<td>Unable to send cmd (cleanup PRI) to device. SCSI status status</td>
<td>PowerPath/VE is unable to determine device state.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>SCSI command I/O on Device</td>
<td>Error</td>
<td>Unable to send cmd (cleanup PRO) to device. SCSI status status</td>
<td>PowerPath/VE is unable to unregister the device.</td>
<td>Check for device connectivity and check the system log for SCSI status.</td>
</tr>
<tr>
<td>SCSI command I/O on Device</td>
<td>Error</td>
<td>SCSI-2 reservation/release failed with SCSI status status</td>
<td>SCSI-2 reservation/release has failed.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>SCSI command I/O on Device</td>
<td>Error</td>
<td>Path path: could not issue sync/async IO command: status</td>
<td>PowerPath/VE failed to issue asynchronous I/O.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
<tr>
<td>SCSI command I/O on Device</td>
<td>Error</td>
<td>Not a valid sense buffer</td>
<td>Not a valid sense buffer for I/O status.</td>
<td>None. PowerPath/VE will automatically retry the command.</td>
</tr>
</tbody>
</table>
### Table 5 PowerPath/VE error messages (continued)

<table>
<thead>
<tr>
<th>Operation</th>
<th>Message type</th>
<th>Message</th>
<th>Explanation</th>
<th>Suggested action</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCSI command I/O on Device</td>
<td>Error</td>
<td>Invalid Command Status: status</td>
<td>Invalid status.</td>
<td>None. PowerPath/VE will handle this error.</td>
</tr>
<tr>
<td>SCSI command/I/O on Device</td>
<td>Error</td>
<td>Failed to alloc Pirp</td>
<td>Insufficient memory on the system.</td>
<td>Check if enough memory is present on the server.</td>
</tr>
<tr>
<td>SCSI command I/O on Device</td>
<td>Error</td>
<td>Failed to create Platform scsicmd</td>
<td>Insufficient memory on the system.</td>
<td>Check if enough memory is present on the server.</td>
</tr>
<tr>
<td>SCSI command I/O on Device</td>
<td>Error</td>
<td>Failed to create Pirp</td>
<td>Insufficient memory on the system.</td>
<td>Check if enough memory is present on the server.</td>
</tr>
<tr>
<td>SCSI command I/O on Device</td>
<td>Error</td>
<td>Failed to Create Scsi Pirp</td>
<td>Insufficient memory on the system.</td>
<td>Check if enough memory is present on the server.</td>
</tr>
<tr>
<td>SCSI command I/O on Device</td>
<td>Error</td>
<td>Sense Info S: sc ASC:asc ASCQ:ascq</td>
<td>Non-retryable error. Some I/O failed</td>
<td>None. PowerPath/VE will handle this error.</td>
</tr>
<tr>
<td>Set path state</td>
<td>Error</td>
<td>ProbePath Failed path</td>
<td>PowerPath/VE path probe has failed.</td>
<td>Check for path availability.</td>
</tr>
<tr>
<td>Set path state</td>
<td>Error</td>
<td>Path path could not be disabled. It is the last working path to volume.</td>
<td>PowerPath/VE failed to change path state.</td>
<td>Ensure that the path that you are trying to disable is not the last active path to the volume. There must be at least one active path to the volume. Retry the operation after any existing IO has been completed.</td>
</tr>
</tbody>
</table>

### rpowermt error and warning messages

Table 6 on page 111 describes the error messages returned by the `rpowermt` command.
<table>
<thead>
<tr>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERROR: Performance Monitor is not enabled.</td>
<td>Running any perf command when the performance monitor is off.</td>
</tr>
<tr>
<td>ERROR: License autoregistration is disabled. Commands not allowed.</td>
<td>PPMT_DISABLE_LICAUTO is set to 1. Disabling autoregistration on an unlicensed host.</td>
</tr>
<tr>
<td>ERROR: Bad dev value emcpower&lt;invalid value&gt;, or not under Powerpath control.</td>
<td>An invalid device number was specified.</td>
</tr>
<tr>
<td>ERROR: Bad hba value&lt;invalid value&gt;, or not under Powerpath control.</td>
<td>An invalid HBA number was specified.</td>
</tr>
<tr>
<td>ERROR: &lt;array_type&gt; device(s) not found.</td>
<td>The rpowermt set policy command specified a policy that is valid for only one class, but no devices are configured for that class.</td>
</tr>
<tr>
<td>ERROR: Cannot communicate with host, version mismatch too great.</td>
<td>The rpowermt server from which you ran rpowermt check_registration is running a version of RTOOLS that is not compatible with the PowerPath/VE version on the host.</td>
</tr>
<tr>
<td>ERROR: &lt;class&gt; device(s) not found.</td>
<td>Both the class and dev arguments were used, but the specified values do not match a currently configured PowerPath/VE volume and device path.</td>
</tr>
<tr>
<td>ERROR: Device(s) not found.</td>
<td>A management command (for example, a set command) was issued for a vSphere host, but no devices were configured for the specified class.</td>
</tr>
<tr>
<td>ERROR: &quot;every&quot; value&lt;invalid value&gt; is not in range (1 - 86400).</td>
<td>An invalid interval was specified.</td>
</tr>
<tr>
<td>ERROR: Enable Autostandby first.</td>
<td>An attempt has been made to reinitialize the Autostandby setting while the global Autostandby setting is off.</td>
</tr>
<tr>
<td>ERROR: Failed to store host information into host file.</td>
<td>An encryption-specific error occurred. Such errors, while extremely rare, may prevent rpowermt from properly managing the lockbox.</td>
</tr>
<tr>
<td>ERROR: Failed to retrieve host information from host file.</td>
<td></td>
</tr>
<tr>
<td>ERROR: Failed to remove host information from host file.</td>
<td></td>
</tr>
<tr>
<td>ERROR: Failed to store host list into host file.</td>
<td></td>
</tr>
<tr>
<td>ERROR: Failed to retrieve host list from host file.</td>
<td></td>
</tr>
<tr>
<td>ERROR: Failed to find IP address for &lt;unresolved hostname&gt;.</td>
<td>An rpowermt command was not able to resolve the IP for the hostname supplied with the host argument.</td>
</tr>
<tr>
<td>Message</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>ERROR: Failed to access host file directory.</td>
<td>The specified lockbox location included an invalid directory.</td>
</tr>
<tr>
<td>ERROR: Host not found.</td>
<td>A specified lockbox exists, and specified host is not present. A supplied hostname or IP address cannot be reached, or there is a TCP port conflict. To troubleshoot TCP port conflicts, see Served license file errors on page 92 in Troubleshooting PowerPath/VE Installation on page 91.</td>
</tr>
<tr>
<td>ERROR: Failed to open host file.</td>
<td>• User does not have the necessary privileges/permissions to access the specified lockbox. • An rpowermt setup command specified a lockbox that does not exist. • User does not have the necessary privileges/permissions to create a lockbox at the specified location. • Another process is holding the lock. • An rpowermt setup command specified a lockbox that does not exist.</td>
</tr>
<tr>
<td>ERROR: Invalid options: &lt;invalid_value&gt;</td>
<td>An invalid argument was specified.</td>
</tr>
<tr>
<td>ERROR: Invalid passphrase during host file creation.</td>
<td>The passphrase entered for a lockbox did not meet the passphrase requirements (that is, a minimum of 8 characters and must contain a lowercase, uppercase, numeric, and special character).</td>
</tr>
<tr>
<td>ERROR: &lt;invalid_policy&gt; is not a valid policy for &lt;class&gt;.</td>
<td>The specified policy is not valid for the specified class.</td>
</tr>
<tr>
<td>ERROR: License authorization failed.</td>
<td>The rpowermt register command located the license file, but the file did not contain a key for the specified vSphere host.</td>
</tr>
<tr>
<td>ERROR: License checkout failed.</td>
<td>The rpowermt register command located the license file, but the attribute value within the license file is corrupted.</td>
</tr>
<tr>
<td>ERROR: License file does not exist or not found.</td>
<td>The rpowermt register command could not locate a license file.</td>
</tr>
<tr>
<td>ERROR: License file format error or misspelling.</td>
<td>The license file is incorrectly formatted.</td>
</tr>
<tr>
<td>ERROR: License feature or attribute not found.</td>
<td>There is a clock skew of more than 48 hours between the rpowermt server and PPVE ELMS or the ESX host.</td>
</tr>
<tr>
<td>ERROR: License key or feature not found.</td>
<td>The rpowermt register command located the license file, but the feature tag within the license file is corrupted.</td>
</tr>
<tr>
<td>ERROR: License not installed.</td>
<td>A management command (for example, a set command) was issued for a vSphere host that does not have a valid license registered for it.</td>
</tr>
<tr>
<td>ERROR: Missing option.</td>
<td>An rpowermt command (other than version) was run, but the host argument was not specified.</td>
</tr>
<tr>
<td>ERROR: No valid licenses found.</td>
<td>There is a clock skew of more than 48 hours between the rpowermt server and PPVE ELMS or the ESX host.</td>
</tr>
</tbody>
</table>
### Table 6 rpowermt error messages (continued)

<table>
<thead>
<tr>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERROR: Passphrase requires at least 8 characters and must contain a lowercase, uppercase, numeric, and special character.</td>
<td>The lockbox phrase entered is not complex enough. Enter a different passphrase with at least eight characters. The passphrase must contain an uppercase and lowercase character, a numeric character, and a special character.</td>
</tr>
<tr>
<td>ERROR: Path latency threshold value &lt;invalid value&gt; is not an integer in the range of (0 - 3600) or (0 - 3600000ms).</td>
<td>A path is in autostandy and the force option was not specified to move the path to active or standby.</td>
</tr>
<tr>
<td>ERROR: Path latency threshold value &lt;invalid_value&gt; not in range (1 - 2147483647).</td>
<td>The rpowermt set path latency threshold command specified an invalid value.</td>
</tr>
<tr>
<td>ERROR: Permission denied.</td>
<td>User does not have the necessary privileges/permissions to create a lockbox at the specified location.</td>
</tr>
<tr>
<td>ERROR: Policy must be set to StreamIO in order to set threshold.</td>
<td>The load-balancing policy on the specified device is not StreamIO.</td>
</tr>
<tr>
<td>ERROR: PowerPath Not Found</td>
<td>PowerPath is not installed on the specified host.</td>
</tr>
<tr>
<td>ERROR: Received unsupported command</td>
<td>A valid streamio_threshold value was specified, but the version of PowerPath/VE does not support this parameter.</td>
</tr>
<tr>
<td>ERROR: Requested host cannot be found in host file.</td>
<td>The lockbox specified with the rpowermt setup remove_host command does not have an entry for the specified host.</td>
</tr>
<tr>
<td>ERROR: StreamIO threshold value &lt;invalid value&gt; is not in range (64 - 2048).</td>
<td>An invalid streamio_threshold value was specified.</td>
</tr>
<tr>
<td>ERROR: Unsupported class name: &lt;invalid class&gt;. class=&lt;symm</td>
<td>clariion</td>
</tr>
<tr>
<td>ERROR: User Authentication Invalid.</td>
<td>A rpowermt command (other than help or setup) was run, but the specified lockbox did not exist. rpowermt attempted to create a lockbox, but the supplied username and/or password was invalid.</td>
</tr>
<tr>
<td>ERROR: Unsupported policy: &lt;invalid_policy&gt;</td>
<td>The rpowermt set policy command specified an invalid policy.</td>
</tr>
<tr>
<td>ERROR: &quot;width&quot; value &lt;invalid value&gt; is not in range (80 - 160).</td>
<td>An invalid width was specified.</td>
</tr>
</tbody>
</table>

Table 7 on page 113 describes the warning messages returned by the rpowermt command.

### Table 7 rpowermt warning messages

<table>
<thead>
<tr>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WARNING: Failed to reset the license server count.</td>
<td>License server is not responding or unreachable. It appears when you try to unregister served license and the license server is unreachable.</td>
</tr>
</tbody>
</table>
### Table 7 rpowermt warning messages (continued)

<table>
<thead>
<tr>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WARNING: PowerPath driver is already registered.</td>
<td>The rpowermt register command was issued for a vSphere host that already has a PowerPath/VE license registered for it.</td>
</tr>
<tr>
<td>Warning: PowerPath driver is already registered.</td>
<td>The rpowermt register command was issued for a vSphere host that already has a PowerPath/VE license registered for it.</td>
</tr>
<tr>
<td>Warning: Device(s) not found.</td>
<td>A non-management command (for example, a display command) was issued, but no devices are being managed by PowerPath/VE.</td>
</tr>
<tr>
<td>Warning: License will expire in <code>&lt;number_of_days&gt;</code> days.</td>
<td>A registered PowerPath/VE license is set to expire within the specified number of days.</td>
</tr>
<tr>
<td>Warning: License feature has expired.</td>
<td>The license file was found, but it has expired.</td>
</tr>
<tr>
<td>Warning: License not installed.</td>
<td>A non-management command (for example, a display command) was issued for a vSphere host that does not have a valid license registered for it.</td>
</tr>
<tr>
<td>Warning: <code>&lt;class&gt;</code> device(s) not found.</td>
<td>A non-management command (for example, a set command) was issued for a vSphere host, but no devices were configured for the specified class.</td>
</tr>
</tbody>
</table>
APPENDIX C

PowerPath/VE Overview

This appendix provides an overview of PowerPath/VE for VMware vSphere. Topics include:

- PowerPath/VE for VMware vSphere platform .......................................................... 116
- Technical differences ............................................................................................. 117
- Components of a PowerPath/VE configuration .................................................... 119
- PowerPath/VE features ......................................................................................... 120
- PowerPath/VE licensing ........................................................................................ 122
PowerPath/VE for VMware vSphere platform

PowerPath/VE uses redundant physical path components - host based adapters (HBAs), switches, storage processors (SPs), and cables - between a vSphere host and an external storage device to provide fault tolerance. If one or more path components fail, the vSphere host can use a viable alternate path to access an external storage device. The process of detecting a failed path and switching to another path is called path failover. Path failover helps ensure uninterrupted I/O between an vSphere host and external storage devices, allowing applications to continue to access their data.

PowerPath/VE also redistributes the I/O load across multiple paths between an vSphere host and an external storage device. This process is called load balancing. Load balancing improves a host’s ability to manage heavy I/O loads by continually balancing the load across all paths, eliminating the need for repeated static reconfigurations as workloads change.

Note

Throughout this document, wherever VMware vSphere is mentioned, vSphere refers only to VMware ESXi, unless otherwise noted.

Native LAM support for XtremIO

This section describes the native Loadable Array Module (LAM) array introduced in PowerPath/VE 5.9 SP1 for XtremIO.

PowerPath/VE 5.9 SP1 provides native LAM support for XtremIO flash array devices. With this support, XtremIO devices of version 2.2 are now managed under the xtremio class. Version 1.05 devices continue to be managed by generic storage class.

Support for NetApp array

This section describes the support for NetApp array introduced in PowerPath/VE 5.9.

PowerPath reports NetApp ID in powermt output and in user interface only if Report SCSI Name String Inquiry Descriptor setting is enabled for the initiator group through which host is connected to LUNs.

The setting is disabled by default for Windows based initiator groups, and enabled by default for all the other operating system types. Use the following NetApp commands to check the current value of the setting:

`igroup show -v igroup_name`

For example,

```
system1> igroup show -v
fcpinlx (FCP):
OS Type: linux
Member: 21:00:00:24:ff:17:d7:11 (not logged in)
Member: 10:00:00:00:d9:e6:c1:b1 (logged in on: 0a)
UUID: ab7b40ac-917c-17e0-b240-123478563412
ALUA: Yes
Report SCSI Name String Inquiry Descriptor: NO
```

Use the following command to enable report_scsi_name

`igroup set igroup_name report_scsi_name yes`
PowerPath Multipathing Plugin

The default multipathing functionality for vSphere hosts is provided by the generic Native Multipathing Plugin (NMP). The VMware vStorage APIs for Multipathing provides a framework for integrating third-party multipathing plugins (MPPs) into the vSphere platform. Third-party MPPs, like PowerPath, run in parallel with the NMP and, for specified arrays, replace the default NMP behavior by taking control of the path failover and load balancing operations. PowerPath/VE works with VMware vSphere to provide enhanced path management capabilities to vSphere hosts. Having multiple paths enables the vSphere host to access a storage device even if a specific path is unavailable. Multiple paths can also share the I/O traffic to a storage device.

Technical differences

PowerPath/VE is different from PowerPath on other supported platforms in the following ways:

- **Electronic Licensing**
  PowerPath/VE for VMware vSphere supports Electronic License Management (ELM). The `rpowermt` server stores unserved license information.
  For served licenses, PowerPath/VE for VMware vSphere uses a license server to manage license information.

  **Note**
  PowerPath/VE for VMware vSphere licenses are available only through the Licensing Service Center on EMC Online Support. The LAC (license authorization code) letter, which can be physical or electronic, contains additional information on obtaining a PowerPath/VE for VMware license.

- **Powerpath/VE Appliance**
  PowerPath/VE 5.9 and SP1 for VMware vSphere supports a virtual appliance bundle. The appliance bundle includes an OVA descriptor file with the following pre-installed for automatic installation:
  - SLES 11 SP2 OS required for use with the virtual appliance
  - PPVE ELMS package required for use with served licensing
  - The SLES RTOOLS package
  The Appliance bundle also includes the following packages for manual installation:
  - PPVE ELMS 11.10
  - The Windows and RHEL RTOOLS packages
  Served electronic license management is carried out through the `rpowermt` commands. The PowerPath/VE Appliance is located in PowerPath for VMware Software Downloads section of EMC Online Support.

- **Behavior in different licensed states**
  PowerPath/VE behaves in the following ways when operating in different licensed states:
  - **Unlicensed state**
    When PowerPath/VE is installed but not licensed, the default policies are Symmetrix Optimized, CLARiiON Optimized, or Adaptive, as appropriate for the storage array. However, until a valid PowerPath/VE for VMware vSphere license is installed, `rpowermt` server is not able to see the information for the vSphere host.
- **Licensed state**
  Upon installation of a valid PowerPath/VE for VMware vSphere license, host display and management capabilities are enabled through the rpowermt server. When the PowerPath/VE license is installed, PowerPath/VE operates with full functionality and normal PowerPath/VE behavior.

- **Expired license state**
  When an existing device functions on an expired license, PowerPath/VE functions the same as a device in a licensed state; that is, with full functionality, until the next reboot. If a new device is added to the PowerPath/VE for VMware vSphere environment where the license is expired, the device behaves the same as a device in an unlicensed state. If you install a new license, the device then operates with full PowerPath/VE functionality, as in the licensed state.

- **License requirement for CLARiiON AX-series**
  Unlike PowerPath supported on other platforms, PowerPath/VE for VMware vSphere does not provide full load-balancing and failover functionality exclusively to CLARiiON AX-series storage systems without a valid PowerPath license. The vSphere host must have a valid PowerPath/VE license, even if it is connected exclusively to CLARiiON AX-series storage arrays.

- **Installation**
  PowerPath/VE for VMware vSphere has a different installation process from PowerPath on other supported platforms. It is a multi-task installation process that includes some of the following steps, depending on whether you use served or unserved licenses:

  1. Installing a PPVE ELMS on a remote server for management of served license information OR installing the virtual appliance for automatic installation and configuration of the PPVE ELMS.
  2. Installing rpowermt on the remote rpowermt server OR installing the virtual appliance for automatic installation and configuration of the rpowermt server and RTOOLS package.
  3. Installing PowerPath/VE for VMware vSphere served licenses on the PPVE ELMS.
  4. Installing PowerPath/VE on the vSphere host.
  5. Installing PowerPath/VE for VMware vSphere unserved licenses on the rpowermt server.

- **Commands**
  Unlike other PowerPath platforms, which use a local CLI to manage their environment, PowerPath/VE uses a remote CLI, rpowermt, to configure and manage PowerPath and paths under its control on vSphere hosts in the PowerPath for VMware vSphere environment.

  Not all of the powermt commands that are supported on other PowerPath platforms have an rpowermt equivalent on PowerPath/VE. Other differences between powermt supported in other PowerPath platforms and rpowermt supported in PowerPath/VE are:

  - The host option syntax in rpowermt requires specifying the IP address or the FQDN (fully qualified domain name) of the host server. It also uses an equal sign (=) between the option and its parameter.

  For information about rpowermt for PowerPath/VE configuration and management and the supported rpowermt commands, see the PowerPath/VE 5.9 and Minor Releases for VMware vSphere Remote CLI Guide.
Components of a PowerPath/VE configuration

A PowerPath/VE configuration has the following components:

- The PowerPath/VE multipathing software, which resides on VMware vSphere host
- The Virtual Appliance for automatic installation and configuration of the remote PowerPath CLI (rpowermt) server and the PPVE ELMS for served licenses
  Or
- The remote PowerPath CLI (rpowermt) server
- The PPVE ELMS for served licenses

PowerPath/VE multipathing software

The PowerPath/VE multipathing software resides on the vSphere host.

The PowerPath/VE multipathing software resides within the vSphere kernel so that the multipathing and load-balancing functionalities are transparent to VMware and the Guest operating systems that are running on VMware. The PowerPath/VE software delivers the multipathing and load-balancing capabilities and manages license keys. The rpowermt Common Interface Model (CIM) client enables communication between the VMware vSphere host and the rpowermt server (see PPVE ELMS on page 119 for a description of the rpowermt server) for management of PowerPath/VE using the PowerPath/VE remote CLI, called rpowermt. In the case of the served licenses, the rpowermt CIM client also carries out licensing queries.

Remote PowerPath CLI (rpowermt) server

The remote PowerPath/VE, or rpowermt, host is a machine on which the PowerPath remote multipathing (rpowermt) CLI and unserved license files are installed. It is also responsible for acquiring served license files from the ELM server. You use rpowermt to manage PowerPath/VE on a vSphere host. It can be a Virtual Machine (VM) or a physical host. The PowerPath/VE for VMware vSphere Release Notes provides information on supported operating systems for the rpowermt server.

PPVE ELMS

Note

The PPVE ELMS is part of the PowerPath/VE configuration for served licenses only. If you use unserved licenses, the PPVE ELMS is not a component of your PowerPath/VE configuration.

The PPVE ELMS is a component of the PowerPath/VE for VMware vSphere configuration only if you use served licenses. It is a centralized licensing management application that keeps track of the number of licenses in use at a given time. When a host requires a particular license functionality, the license for that functionality is checked out from the license pool, which is stored in the PPVE ELMS. License keys are released back to the license pool when they are no longer being used and are available for use by another vSphere host. The check-in and check-out queries are carried out using rpowermt commands between the PPVE ELMS and the rpowermt server.
PowerPath/VE features

PowerPath/VE provides intelligent high-performance path management with path failover and load balancing optimized for Symmetrix, VMAX, VMAXe, VNX, CLARiiON, VPLEX, Invista, Celerra, and selected third-party storage systems. PowerPath/VE supports multiple paths between a vSphere host and an external storage device. Having multiple paths enables the vSphere host to access a storage device even if a specific path is unavailable. Multiple paths can also share the I/O traffic to a storage device.

PowerPath/VE is particularly beneficial in highly available environments because it can prevent operational interruptions and downtime. The PowerPath/VE path failover capability avoids host failure by maintaining uninterrupted application support on the host in the event of a path failure (as long as another path is available).

Dynamic path failover

PowerPath/VE enhances application availability by eliminating the I/O path as a point of failure. With the proper hardware configuration, PowerPath/VE can compensate for the failure of any components in the I/O path.

If a path fails, PowerPath/VE stops sending I/O to the failed path and checks for an active alternate path. If an active path is available, PowerPath/VE dynamically redirects I/O along that path. If no active paths are available, alternate, standby paths (if available) are brought into service, and I/O is routed along the alternate paths. On active-passive storage systems, all paths to the active SP are used before any paths to the passive SP. This eliminates loss of data and application downtime. Failovers are transparent and nondisruptive to applications.

This path failover and failure recovery process is transparent to applications. (Occasionally, however, there is a short delay.)

Proactive path testing and automatic path recovery

PowerPath/VE tests live and dead paths periodically. If a live path fails the test, PowerPath/VE marks it dead. Live testing allows PowerPath/VE to detect path problems quickly, avoiding delays that would otherwise result from trying to use a defective path when I/O is started on the logical device. If a failed path passes the test, it is restored automatically, and PowerPath/VE resumes sending I/O to it.

The periodic testing of live and dead paths is low priority. Periodic autorestore is low priority as well. It is not designed to restore a path immediately after it is repaired, but rather to restore the path within a reasonable time after it is repaired.

The time it takes for all paths to be restored varies greatly. In lightly loaded or small configurations, paths typically are restored within an hour after they are repaired (on average, much sooner). In heavily loaded or large configurations, it may take several hours for all paths to be restored after they are repaired, because periodic autorestore will be pre-empted by higher priority tasks. The storage system, host, and application remain available while the path is being restored.

The fastest way to restore paths is to use `rpowermt restore`. The `PowerPath/VE for VMware vSphere Remote CLI Guide` provides more information on `rpowermt set mode`. 
Dynamic multipath load balancing

PowerPath/VE distributes I/O requests to a logical device across all available paths, thus improving I/O performance and reducing management time and downtime by eliminating the need to configure paths statically across logical devices.

`rpowermt set policy` describes the policies supported by PowerPath/VE for VMware vSphere.

Storage system types

PowerPath/VE supports three types of storage systems:

**Active-active**
Symmetrix, VMAX, VMAXe, Invista, supported Celerra devices, and supported third-party array systems (see the *PowerPath/VE for VMware vSphere Release Notes* and the Interoperability Navigator, available on EMC Online Support, for supported third-party arrays).

**Active-passive**
VNX and CLARiiON systems.

**ALUA (asymmetric logical unit access)**
VNX and CLARiiON CX systems with FLARE® version 03.26 and later.

**Active-active**
In an active-active storage system, if there are multiple interfaces to a logical device, they all provide equal access to the logical device. **Active-active** means that all interfaces to a device are active simultaneously.

In an active-active system, after PowerPath/VE creates a path set, it can use any path in the set to service an I/O request. If a path fails, PowerPath/VE can redirect an I/O request from that path to any other viable path in the set. This redirection is transparent to the application, which does not receive an error.

**Active-passive**
In an active-passive storage system, if there are multiple interfaces to a logical device, one of them is designated as the primary route to the device; the device is assigned to that interface card. Typically, assigned devices are distributed equally among interface cards. I/O is not directed to paths connected to a non-assigned interface.

Normal access to a device through any interface card other than its assigned one is either impossible (for example, on VNX and CLARiiON systems) or possible but much slower than access through the assigned interface card.

In the event of a failure of an interface card or all paths to an interface card, logical devices must be moved to another interface. If an *interface card* fails, logical devices are reassigned from the broken interface to another interface. This reassignment is initiated by the other, functioning interface. If all paths from a host to an interface fail, logical devices accessed on those paths are reassigned to another interface, with which the host can still communicate. This reassignment is initiated by PowerPath/VE, which instructs the storage system to make the reassignment.

The VNX and CLARiiON term for these reassignments is *trespassing*.

Reassignment can take several seconds to complete; however, I/Os do not fail during this process. After devices are reassigned, PowerPath/VE detects the changes and seamlessly routes data through the new route.

After a reassignment, logical devices can be reassigned (trespassed back, in VNX and CLARiiON terminology) to their originally assigned interface. This occurs automatically.
if the PowerPath/VE periodic auto-restore feature is enabled. It occurs manually if 
`rpowermt restore` is run; this is the faster approach. Periodic auto-restore 
reassigns logical devices only when restoring paths from a failed state. If paths to the 
default interface are not marked dead, you must use `rpowermt restore`.

**Active-passive** means that only one interface to a device is active at a time, and any 
others are passive with respect to that device and waiting to take over if needed.

In an active-passive system, path sets are divided into two *load-balancing* groups. 
The active group contains all paths to the interface to which the target logical device 
is assigned; the other group contains all paths to the other, non-assigned interface. 
Only one load balancing group processes I/O requests at a time, and PowerPath/VE 
load balances I/O across all paths in the active group. If a path in the active load 
balancing group fails, PowerPath/VE redirects the I/O request to another path in the 
active group. If all paths in the active load balancing group fail, PowerPath/VE 
reassigns the logical device to the other interface, and then redirects the I/O request 
to a path in the newly activated group.

**ALUA**

ALUA (asymmetric logical unit access) is an array failover mode available on VNX 
systems, CLARiiON systems with FLARE version 03.26 or later. In an ALUA storage 
system, one array controller is designated as the *active/optimized* controller and the 
other array controller is designated as the *active/non-optimized* controller. As long as 
the active/optimized controller is viable, I/O is directed to this controller. Should the 
active/optimized array controller become unavailable or fail, I/O is directed to the 
active/non-optimized array controller until a trespass occurs.

**Note**

On a vSphere host, if you create a VMFS volume on a PowerPath/VE-managed device 
using CLARiiON systems with a FLARE version previous to 4.28.000.6.701 and 
subsequently remove PowerPath/VE, the VMFS volume will not be recognized until 
the ALUA mode is set to Passive Not Ready (PNR). When you want to change the 
Failover mode from PNR to ALUA through NAVI on CLARiiON systems with FLARE 
version 03.26 and later, you must reboot the host for ALUA mode to be effective.

**PowerPath/VE and NMP coexistence**

Both NMP and PowerPath/VE can be loaded on the same vSphere host and manage 
storage visible to it. NMP and PowerPath/VE cannot manage the same storage device. 
Claim rules are used to assign storage devices to either NMP or to PowerPath/VE.

When a vSphere host boots or performs a rescan, the vSphere host discovers all physical 
paths to the storage devices visible to the host.

By default, PowerPath/VE claims all PowerPath-manageable devices. You can change the 
devices claimed by changing the claim rules. *Claim rules in PowerPath/VE 
environment on page 72* provides more information.

**PowerPath/VE licensing**

A PowerPath/VE license grants you the right to use the PowerPath load-balancing and 
failover functionalities on a VMware vSphere host. A single license enables all supported 
PowerPath/VE for VMware vSphere functionality. Refer the *PowerPath/VE for VMware 
vSphere Release Notes* for the list of supported features.
Throughout this document, usage of the name *VMware vSphere* refers only to VMware ESXi, unless otherwise noted.

You can use a valid PowerPath/VE 5.4 and service packs for VMware vSphere license. You cannot use a license from a PowerPath release previous to PowerPath/VE version 5.4 or for platforms other than PowerPath/VE for VMware vSphere to license a vSphere host in a PowerPath/VE configuration.

### Supported license types

PowerPath/VE supports two license models: *served* and *unserved*. Decide the type of license model at the time of ordering PowerPath/VE software.

- The served licensing model uses the PPVE ELMS to store, distribute, and manage PowerPath/VE licenses. *Served licensing on page 126* provides more information about served licensing.

- The unserved licensing model does not use a license server. Rather, the PowerPath/VE license is stored on the remote (rpowermt) PowerPath server. An unserved license is bound to a specific vSphere host and is only valid for that vSphere host. *Unserved licensing on page 130* provides more information about unserved licensing.

- PowerPath/VE does not support storing served license configuration files and unserved licenses in the same folder on the rpowermt server. You must store served license configuration files and unserved license files in separate folders on the rpowermt server. This is related to OPT 334577.

### Permanent and expiring licenses

PowerPath/VE licenses are either permanent or expiring. *Table 8 on page 123* describes each type.

**Table 8 License types**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent</td>
<td>• A license that never expires.</td>
</tr>
<tr>
<td></td>
<td>• When you purchase a PowerPath/VE license for a vSphere host, that license is permanent.</td>
</tr>
<tr>
<td></td>
<td>• You can use PowerPath/VE on that vSphere host indefinitely.</td>
</tr>
<tr>
<td>Expiring</td>
<td>• A license that expires on a specified date.</td>
</tr>
<tr>
<td></td>
<td>• After the expiration date, the license is no longer valid. PowerPath/VE functionality is no longer available on the vSphere host.</td>
</tr>
<tr>
<td></td>
<td>• Evaluation (or trial) licenses are expiring licenses that typically are valid for 45 days.</td>
</tr>
</tbody>
</table>

**What happens when a license expires?**

If a PowerPath/VE license is due to expire within 14 days, the following warning message is displayed each time the `rpowermt` command is run:

`Warning: License will expire in <number_of_days> days`
When a license expires, PowerPath/VE multipathing functionality is not supported for the storage device claimed by PowerPath/VE. I/O to these devices, however, continues to be supported.

After a license expires, only `rpowermt check_registration` and `rpowermt version` commands can be run. All other `rpowermt` commands return the following error:

```
Warning: License not installed
```

The `rpowermt restore` command cannot be run after the license has expired. Consequently, if the periodic autorestore facility is set to Off (by default, periodic autorestore in On), paths will not be automatically restored, resulting in I/O loss in situations like CLARiiON NDU.

After PowerPath/VE is removed from the vSphere host, the storage devices are claimed by the native VMware multipathing facility.

License files

Non-virtual versions of PowerPath distribute character-based license keys on physical license cards. PowerPath/VE does not use physical license cards. Instead, PowerPath/VE uses electronic licenses available at the Licensing Service Center on EMC Online Support.

A PowerPath/VE license is distributed in a plain text file with a name that ends with the `.lic` extension. The license file contains all site-specific information required to enable licensing. `Served license file contents on page 128` describes the contents of a served license file.

`Unserved license file contents on page 133` describes the contents of an unserved license file.

Obtaining license files

License files are not included with the PowerPath/VE software package. Rather, you must obtain the license files available at the Licensing Service Center on EMC Online Support.

To do this, you log in to the EMC Online Support site, navigate to the PowerPath section of the Licensing Service Center, and then use a license authorization code provided by EMC to obtain the license file. The license files are then sent to you by email.

`Install PPVE ELMS on page 11` describes this process for served licenses.

`Install PowerPath/VE for VMware vSphere on page 38` describes this process for unserved licenses.

License authorization code

A software license authorization code (or LAC) is a unique alphanumeric value that corresponds to one or more EMC products that you have purchased.

The LAC indicates the products that you are authorized to use and provides instructions for activating licenses for these products at the Licensing Service Center on EMC Online Support. EMC sends the LAC (either as an email or as a physical letter) to the registered user on the software order after you purchase PowerPath/VE.

You use the LAC to obtain PowerPath/VE license files at the Licensing Service Center.
Licensing Service Center

The Licensing Service Center (formerly Powerlink Licensing portal) is a self-service Web portal where you obtain and manage license files for EMC products.

Access the Licensing Service Center

Before you begin

You need an EMC Online Support account to log in to the Licensing Service Center.

If you do not have an EMC Online Support account, navigate to http://support.emc.com and follow the New Member Registration steps to create your account.

Note

If you are not able to obtain an account immediately, you can access the Licensing Service Center with restricted privileges that allow you to obtain licenses only for the LAC you provide.

Procedure

1. Navigate to http://support.emc.com and log on using your username and password.
2. From the EMC Online Support home page, navigate to Support > Product Registration and Licenses.

The table below lists the transactions that you can perform at the Licensing Service Center.

Table 9 Licensing Service Center transactions

<table>
<thead>
<tr>
<th>Transaction</th>
<th>Description</th>
<th>For more information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain</td>
<td>Request a license file using your license authorization code.</td>
<td>• Obtaining served licenses on page 9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Install PowerPath/VE for VMware vSphere on page 38</td>
</tr>
<tr>
<td>Move (Rehost)</td>
<td>In a served licensing environment, move the PPVE ELMS software to a new host.</td>
<td>Moving unserved licenses on page 34</td>
</tr>
<tr>
<td></td>
<td>In an unserved licensing environment, move a PowerPath/VE license from its</td>
<td></td>
</tr>
<tr>
<td></td>
<td>current vSphere host to a new vSphere host.</td>
<td></td>
</tr>
<tr>
<td>Obtain additional</td>
<td>In a served licensing environment, obtain additional licenses for a LAC.</td>
<td>Obtaining additional served licenses on page 22</td>
</tr>
<tr>
<td>licenses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>View entitlements</td>
<td>In a served licensing environment, check how many licenses are used.</td>
<td>Verify license server and license status on page 23</td>
</tr>
</tbody>
</table>
Served licensing

In a served licensing environment, the PPVE ELMS distributes PowerPath/VE licenses to vSphere hosts. You install the license configuration file on the PPVE ELMS and it manages the licenses for all the PowerPath/VE hosts for which the license was generated.

The PPVE ELMS runs license management software and an EMC-specific vendor daemon. The PowerPath/VE served electronic licensing is built on the Flexera licensing software. The PPVE ELMS accepts license requests from an rpowermt server on behalf of a vSphere host and passes that request to the EMC vendor daemon.

PowerPath provides support for the VMware vSphere stateless model through served licensing.

The served license model provides the following advantages:

- Served licenses are more flexible than unserved licenses. Any vSphere host with PowerPath/VE installed and that can communicate with the license server can use PowerPath/VE functionality, up to the limit specified in the license file.
- Served licenses are counted; that is, there is a limitation to the number that can be active.
- Served licenses provide higher availability. If a vSphere host fails, its license can be redistributed to another vSphere host. If the PPVE ELMS fails, you can move, or rehost all served licenses to a different PPVE ELMS.
- Served licenses provide monitoring and reporting facilities. Using served licenses enables you to know how many PowerPath/VE licenses you have, what versions of PowerPath/VE you have, and on which vSphere hosts PowerPath/VE is running.

Served licensing requires that you install, configure, and manage the PPVE ELMS. If you use the Virtual Appliance, PPVE ELMS installation and configuration is automatic with the Virtual Appliance deployment.

PPVE ELMS licensing software

PowerPath/VE licensing is built on the Flexera licensing software developed by Flexera Software.

The PPVE ELMS accepts license requests from an rpowermt server on behalf of an ESX host and passes that request to the EMC vendor daemon.

License server high availability

The current version of PowerPath/VE only supports a single license server. You cannot configure redundant PPVE ELMS for a PowerPath/VE environment. Note that, once a vSphere host has registered a license, it has no dependency on the PPVE ELMS. If the PPVE ELMS is unavailable for any reason, the vSphere host can continue to use PowerPath/VE multi-pathing.

Overdraft

An overdraft allows you additional licenses in excess of the quantity of licenses you actually purchased.

This feature prevents vSphere hosts at your site from being denied service when in temporary overdraft state and when there are more requests for licenses than you have available. PowerPath provides an overdraft reserve of 10 percent. For example, if you have 100 PowerPath licenses, you can actually have 110 licensed vSphere hosts at any one time. For more information on overdraft, consult EMC Customer Support.
Components of a served licensing environment

The following figure shows a PowerPath/VE environment that uses served licenses.

**Figure 1** PowerPath/VE environment using served licenses

Key components of a served licensing environment include:

1. One or more rpowermt servers where the RTOOLS package is installed.
2. PPVE ELMS (license server). The graphic depicts the Virtual Appliance. The Virtual Appliance is a VM that contains the rpowermt server and PPVE ELMS which are automatically installed upon deployment of the Virtual Appliance. You use either the Virtual appliance with rpowermt server and PPVE ELMS installed automatically or the separate rpowermt server and PPVE ELMS.
3. VMware vSphere ESXi hosts with PowerPath/VE multipathing software installed on them and various VMs as applicable.

In the environment shown in the graphic, the PPVE ELMS, and the rpowermt server are located on different machines. They can be deployed on the same machine. The environment has a single rpowermt server. Larger deployments could have multiple rpowermt servers.

**PPVE ELMS**
The PPVE ELMS is a machine that runs the license manager software. The license server has the following components:

- lmgrd, the license server manager.
  The license server manager is a software application that runs on a Linux or Windows host. The license server manager starts and maintains the EMC vendor daemon. It accepts license requests from an rpowermt server on behalf of a vSphere host and passes that request to the EMC vendor daemon. Start license server manager on page 96 provides more information.
- **EMCLM**, the EMC vendor daemon.
  In a served licensing environment, served licenses are granted by the EMCLM vendor daemon running on the license server. The vendor daemon keeps track of how many PowerPath/VE licenses are checked out, and which vSphere hosts have them.

- **Served license file.**
  The served licenses managed by the license manager are contained in a license file that you obtain at the Powerlink Licensing portal. [Served license file contents on page 128 provides more information.](#)

- **lmutil**, the license manager management utility, which provides basic license management commands. [Administering served licenses on page 21 provides information on commonly used `lmutil` commands.](#)

- **lmtools**, the license manager GUI (Windows only) used to manage the license server manager (`lmgrd`) and EMC vendor daemon (`EMCLM`) in a served licensing environment. [Administering served licenses on page 21 provides information on commonly used `lmtools` commands.](#)

**rpowermt servers**
The `rpowermt` server is a machine on which the PowerPath remote multipathing CLI (`rpowermt`) is installed. The [PowerPath/VE for VMware vSphere Release Notes](#) provides information on supported `rpowermt` server operating systems.

The `rpowermt` server must be able to communicate with the license server and all vSphere hosts in the environment. [Loss of communication between `rpowermt` server and vSphere host on page 132 provides more information.](#)

You use the `rpowermt` server to issue `rpowermt` commands to a vSphere host. For example, you issue the command to register a PowerPath/VE license on a vSphere host from the `rpowermt` server. Refer to the [PowerPath/VE for VMware vSphere Remote CLI Guide](#) for a complete description of `rpowermt` commands.

**vSphere hosts**
Each vSphere host has the PowerPath/VE multipathing software installed on it. No licensing components are installed on a vSphere host. A vSphere host receives all licensing information from the `rpowermt` server. Therefore, the vSphere host must be able to communicate with the `rpowermt` servers through TCP/IP.

### Served license file contents
A served licensed file contains a series of keywords with a value assigned to each key word.

[Figure 2 on page 128 shows an example of a served license file:](#)

```plaintext
SERVER 172.23.168.142 INTERNET=172.23.168.142 27010
VENDOR EMCLM
USE_SERVER
INCREMENT PowerPathMP EMCLM 5.4 permanent 20 OVERDRAFT=2 \ 
dist_info="ACTIVATED TO 4357940 LUCKY COMPUTER 1420 NE 21 ST \ 
BELLEVUE WA US 98007" ISSUE=EMC ISSUED=13-Jun-2011 \ 
NOTICE="ACTIVATED TO SiteID: 132091443" TS_OK_SIGN="00E7 F72C \ 
F32C 542C DD6D CBF1 A46E EA00 BB5E 3BD2 4B6A CEC8 CCA4 6EFG \ 
0FC2"
```

The license file indicates PowerPath MP EMCLM 5.4 because the PowerPath/VE for VMware vSphere license is not tied to a product version number. For valid PowerPath/VE 5.7 product, the license file indicates 5.4 license.
Table 10 on page 129 describes the contents of a served license file.

### Table 10 Contents of a served license file

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SERVER</strong></td>
<td>Specifies the host, IP address, and TCP port number for the license server.</td>
</tr>
<tr>
<td>host:</td>
<td>In the sample license file, the value shown is 172.23.168.142. Note that you can edit the host field without affecting the signature of the license file. This field is validated against the IP address of the ELM server.</td>
</tr>
<tr>
<td>IP address:</td>
<td>Preceded by the keyword INTERNET=. The value shown in the sample license file is INTERNET=172.23.168.142. Do not modify this field; doing so will invalidate the license file. This field is protected by the signature of the license file.</td>
</tr>
<tr>
<td>port:</td>
<td>The port number defaults to 27010. A valid number is any unused port number between 0 and 64000. Note that you can edit the port number without affecting the signature of the license file.</td>
</tr>
<tr>
<td><strong>VENDOR</strong></td>
<td>Specifies the vendor, vendor daemon path, and vendor daemon TCP port number.</td>
</tr>
<tr>
<td>VENDOR:</td>
<td>Name of the vendor daemon used to serve some features in the file. Defaults to EMCLM for PowerPath/VE. Do not modify this field; doing so will invalidate the license file. The VENDOR field is protected by the signature of the license file.</td>
</tr>
<tr>
<td>vendor daemon path:</td>
<td>Optional path to the executable for this daemon. Generally, the license administrator is free to install the vendor daemon in any directory. It is recommended, however, that it be installed in a local directory on the license server. If omitted, lmgrd looks for the vendor daemon binary in:</td>
</tr>
<tr>
<td>- the current directory</td>
<td></td>
</tr>
<tr>
<td>- the path specified in lmgrd's $PATH environment variable</td>
<td></td>
</tr>
<tr>
<td>- in the directory where lmgrd is located</td>
<td></td>
</tr>
<tr>
<td>port:</td>
<td>If port is not specified, the default is chosen by the operating system at run-time. Sites with Internet firewalls need to specify the TCP port number the daemon uses. If a TCP port number is specified on the VENDOR field, there may be a delay when restarting the vendor daemon. Note that you can edit the port field without affecting the signature of the license file.</td>
</tr>
<tr>
<td><strong>INCREMENT</strong></td>
<td>Indicates:</td>
</tr>
<tr>
<td>- the product being licensed.</td>
<td></td>
</tr>
<tr>
<td>- when the license expires. If the expiration date is listed as permanent, the license never expires.</td>
<td></td>
</tr>
<tr>
<td>- number of available licenses</td>
<td></td>
</tr>
<tr>
<td>The license shown in Table 10 on page 129 has 20 instances of PowerPath/VE emclm daemon version 5.4 to run permanently.</td>
<td></td>
</tr>
<tr>
<td><strong>OVERDRAFT</strong></td>
<td>Number of overdraft (or reserve) licenses available. Overdraft on page 126 provides more information.</td>
</tr>
<tr>
<td><strong>ISSUER</strong></td>
<td>Company that issued the license. For PowerPath/VE, this is always EMC.</td>
</tr>
<tr>
<td><strong>ISSUED</strong></td>
<td>Date that the license was activated. The sample license shows that the license was activated on 13-Jun-2011.</td>
</tr>
<tr>
<td><strong>NOTICE</strong></td>
<td>Details about the site for which the license was activated.</td>
</tr>
<tr>
<td><strong>SIGN</strong></td>
<td>Digital signature that authenticates the license file.</td>
</tr>
</tbody>
</table>
PPVE ELMS provides the lmutil and lmtools utilities to manage a license server.

**Unserved licensing**

An unserved license binds PowerPath/VE to a specific vSphere host (or, more accurately, to an ESX unique system ID). An unserved license is only valid for the specific vSphere host for which it was generated. An unserved license is static; it cannot be used on another vSphere host. The only way it can be used on another vSphere host is if the license is moved, or rehosted (Moving unserved licenses on page 34 provides more information).

An unserved license is installed on the rpowermt server and is available directly to PowerPath/VE for licensing-related operations. All licensing-related communication takes place between the rpowermt server and the vSphere host. Unserved licensing, therefore, does not require the use of a license server.

Take note of the following key points about unserved licenses in a PowerPath/VE environment:

- An unserved license can only be used on the vSphere host for which it was generated (unless it is moved, or rehosted).
- You must generate an unserved license for every vSphere host on which you plan to install PowerPath/VE.
- You must install and configure the unserved license on an rpowermt server.
- Because unserved licenses are uncounted licenses, no license server is needed to manage them.
- Once configured, very minimal additional license administration is required.
- If a vSphere host fails or you want to move PowerPath/VE to a different vSphere host, you must generate a new unserved license for the new vSphere host. You cannot reuse the existing unserved license. Moving unserved licenses on page 34 describes this process.

**Components of a PowerPath/VE unserved licensing environment**

Figure 3 on page 131 shows a PowerPath/VE environment that uses unserved licenses.
Key components of an unserved license environment include:

1. One or more rpowermt servers where the RTOOLS package is installed. Figure 3 on page 131 depicts the Virtual Appliance. The Virtual Appliance is a VM that contains the rpowermt server and PPVE ELMS which are automatically installed upon deployment of the Virtual Appliance. You use either the Virtual Appliance or the separate rpowermt server.

2. VMware vSphere ESXi hosts with PowerPath/VE multi-pathing software installed on them and various VMs as applicable.

The environment shown above has a single rpowermt server. Larger deployments could have multiple rpowermt servers.

---

**Note**

unserved licenses do not use a license server. All licensing-related communication occurs directly between the rpowermt server and the vSphere hosts. If you opt for the Virtual Appliance deployment, the PPVE ELMS is automatically installed but is not used by your configuration.

---

**rpowermt server**

The rpowermt server is a machine on which the PowerPath remote multipathing CLI (rpowermt) and the unserved license files are installed. The PowerPath/VE for VMware vSphere Release Notes provides information on supported rpowermt server operating systems.

The rpowermt server must be able to communicate with all vSphere hosts in the environment. Loss of communication between rpowermt server and vSphere host on page 132 provides more information.
One or more PowerPath/VE license files are installed on the rpowermt server. A unique license file (which has the .lic extension) is required for each vSphere host that has PowerPath/VE installed on it.

Because this example environment has two vSphere hosts, the rpowermt server has two license files installed on it.

In environments with more than one rpowermt server, the unserved license files can be stored on multiple rpowermt servers or moved across rpowermt servers. Unserved license files are not restricted to a single rpowermt server.

You use the rpowermt server to issue rpowermt commands to a vSphere host. For example, you issue the command to register a PowerPath/VE license on a vSphere host from the rpowermt server. The PowerPath/VE 5.8 for VMware vSphere Remote CLI Guide provides a complete description of rpowermt commands.

vSphere hosts
Each vSphere host has the PowerPath/VE multipathing software installed on it. No licensing components are installed on the vSphere host. A vSphere host receives all licensing information from the rpowermt server.

rpowermt server and vSphere host communication
The rpowermt server and the vSphere host communicate whenever a rpowermt command is executed.

This is the only time that these two machines communicate. PowerPath/VE does not use a heartbeat between the rpowermt server and the vSphere host. A heartbeat is not necessary because, once registered, a vSphere host does not release its PowerPath/VE license. The only time that a vSphere host releases its license is when:
- the rpowermt unregister command is run.
- a license expires. What happens when a license expires? on page 123 provides more information.

Each time that an rpowermt command is executed, it determines the state of the PowerPath/VE license on the vSphere host:
- If the vSphere host has a valid PowerPath/VE license, the rpowermt command functions normally. For example, the rpowermt display dev command returns information about the storage devices claimed by PowerPath/VE.
- If an expiring PowerPath/VE license is due to expire within 14 days, the following warning message is displayed at the bottom of the command output:
  Warning: License will expire in <number_of_days> days

Loss of communication between rpowermt server and vSphere host
rpowermt cannot be executed on vSphere hosts if the rpowermt server cannot communicate with a vSphere host.

This has the following implications:
- If the vSphere host already had a valid PowerPath/VE license registered for it before communication was lost, PowerPath/VE multi-pathing functionality continues to be available on that vSphere host (using the current PowerPath settings for that vSphere host). For example, I/O continues to be load-balanced across all available paths. Any new devices added to the vSphere host are licensed and managed by PowerPath/VE (as determined by the claim rules defined for that vSphere host).
No changes to the PowerPath configuration (for example, changing the device priority for a class of storage devices) can be made until connectivity is restored and rpowermt commands can be run.

Unserved license file contents

An unserved licensed file contains a series of keywords with a value assigned to each keyword.

Do not modify an unserved license file in any way. Doing so invalidates the license.

Figure 4 on page 133 shows an example of an unserved license file:

```
INCREMENT PowerPathMP EMCLM 5.4 29-apr-2012 uncounted \
VENDOR_STRING=00000000-0000-0000-0000-0015176d1736 HOSTID=ANY \
ISSUER=EMC ISSUED=29-apr-2011 NOTICE="lCI016 fdanna LUCKY COMPUTER \
1420 NE 21 ST BELLEVUE WA US 98007 132091443" TS_OK \
SIGN="00E7 F72C F32C 542C DD6D CBF1 A46E EA00 8B5E 3BD2 4B6A \
CEC8 CCA4 6EFB 0FC2"
```

The license file indicates PowerPath MP EMCLM 5.4 because the PowerPath/VE for VMware vSphere license is not tied to a product version number. For valid PowerPath/VE product, the license file indicates 5.4 license.

Table 11 on page 133 describes the contents of a served license file.

Table 11 Contents of an unserved license file

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>INCREMENT</td>
<td>Indicates:</td>
</tr>
<tr>
<td></td>
<td>• the product being licensed.</td>
</tr>
<tr>
<td></td>
<td>• when the license expires. If the expiration date is listed as permanent, the license never expires.</td>
</tr>
<tr>
<td></td>
<td>• whether the license is unserved (uncounted)</td>
</tr>
<tr>
<td></td>
<td>The license in the figure above licenses PowerPath/VE version 5.4 to run permanently in uncounted (uncounted) mode.</td>
</tr>
<tr>
<td>VENDOR STRING</td>
<td>vSphere unique system identifier of the vSphere host for which PowerPath/VE is licensed.</td>
</tr>
<tr>
<td>ISSUER</td>
<td>Company that issued the license. For PowerPath/VE, this is always EMC.</td>
</tr>
<tr>
<td>ISSUED</td>
<td>Date that the license was activated. The sample license shows that the license was activated on April 29, 2011.</td>
</tr>
<tr>
<td>NOTICE</td>
<td>Details about the site for which the license was activated.</td>
</tr>
<tr>
<td>SIGN</td>
<td>Digital signature that authenticates the license file.</td>
</tr>
</tbody>
</table>

Move a license

Electronic licenses are tied to specific hosts. In the case of an unserved license, it is based on the vSphere host unique system ID.

In the case of a served license, it is based on the vSphere host IP address or FQDN. You cannot, therefore, use the license file generated for one vSphere host on a different
vSphere host. To move a license file to a new vSphere host (which has a different ESX unique system ID or IP address or FQDN), you must go to the Powerlink Licensing portal and activate a new unserved license file. This process is called rehosting.

Reasons for rehosting include:
- Replacing a machine that has failed.
- Upgrading to a new machine.
- Moving PowerPath/VE from one machine to another within your organization.

EMC allows you to rehost a PowerPath/VE unserved license up to three times. After that, you must contact EMC Support for assistance.

Moving served licenses on page 26 describes rehosting served licenses.
Moving unserved licenses on page 34 describes rehosting unserved licenses.