

PowerPath/VE for VMware vSphere

Version 6.6 and minor releases

Installation and Administration Guide

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PREFACE

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

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

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

Purpose

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

Audience

Readers of this guide are expected to be familiar with:

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

Related documentation

The following Dell EMC publications provide additional information:

- *PowerPath VE for VMware vSphere Release Notes*
- *PowerPath Family CLI and System Messages Reference Guide*
- *PowerPath Family Product Guide*
- *PowerPath Management Appliance Installation and Configuration Guide*

Table 1 Revision history

Revision	Date	Description
03	February 2020	Updated the <code>rpowermt display options</code> in the PowerPath Device in Use Reporting section.
02	January 2020	Updated the following sections: <ul style="list-style-type: none">• Flaky Path Reporting to PowerMax Overview• SAN latency reporting overview
01	September 2019	First release of the product

Special notice conventions used in this document

Dell EMC uses the following conventions for special notices:

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

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

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 **NOTICE** Addresses practices not related to personal injury.

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

Typographical conventions

Dell EMC uses the following type style conventions in this document:

Bold	Used for names of interface elements, such as names of windows, dialog boxes, buttons, fields, tab names, key names, and menu paths (what the user specifically selects or clicks)
<i>Italic</i>	Used for full titles of publications referenced in text
Monospace	Used for: <ul style="list-style-type: none"> • System code • System output, such as an error message or script • Pathnames, filenames, prompts, and syntax • Commands and options
<i>Monospace italic</i>	Used for variables.
Monospace bold	Used for user input.
[]	Square brackets enclose optional values.
	Vertical bar indicates alternate selections - the bar means “or”.
{ }	Braces enclose content that the user must specify, such as x or y or z.
...	Ellipses indicate nonessential information that is omitted from the example.

Where to get help

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

Product information

For documentation, release notes, software updates, or information about Dell EMC products, go to [Dell EMC Online Support](#) .

Technical support

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

CHAPTER 1

Using PowerPath/VE in a served license environment

This chapter describes how to use PowerPath/VE in a served license environment.

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- [Migrating from physical ELMS to PowerPath Management Appliance](#)..... 12
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Installation components and workflow for served licenses

This section describes the components that are required served licenses and provides the workflow.

Installation components for served licenses

In addition to installing PowerPath/VE on a VMware vSphere host, you need the following components.

PowerPath/VE components

You can install one of the following two PowerPath/VE component options for served licenses:

- Dell EMC PowerPath Management Appliance. The appliance is a SUSE Linux (SLES) virtual machine that includes RTOOLS and PowerPath/VE Electronic License Manager System (ELMS) pre-installed.
- PowerPath remote multipathing (rpowermt) CLI package, called RTOOLS, for management on a physical host or VM

VMware components

You can install one of the following three VMware component options:

- VMware vSphere CLI (vCLI) software.
- VMware vSphere Update Manager (VUM) software. VUM includes the VUM server, VMware vSphere Client, and VMware vCenter Server.
- VMware Auto Deploy. Auto Deploy includes the vCenter Server and Auto Deploy application.

The VMware documentation provides the host requirements for VMware vCLI and VUM. Download the VMware software from the VMware website.

Electronic served license components

You can install one of the following three Electronic License Manager System (ELMS) component options:

- Dell EMC PowerPath Management Appliance. The appliance is a SLES virtual machine that includes RTOOLS and PowerPath/VE ELMS pre-installed.
- PowerPath/VE ELMS on a physical host or virtual machine.

Installation workflow for served licenses

The following procedure lists the steps in configuring a served licensing environment for PowerPath/VE.

Before you begin

Ensure that you know your License Authorization Code (LAC) in order to obtain the served licenses. If you are not using the Dell EMC PowerPath Management Appliance, ensure that you know the host name and IP address of the PowerPath/VE Electronic License Manager System (ELMS).

Procedure

1. Obtain served licenses and then activate the licenses at the Licensing Service Center on DellEMC Online Support. When you purchase PowerPath/VE, Dell EMC sends you an email that contains the LAC. Use the LAC to obtain PowerPath/VE licenses.

- a. From DellEMC Online Support, navigate to **Service Center Product Registration and Licenses** and then click **PowerPath**.
 - b. Click **Activate Licenses** and then follow the outline in the DellEMC Online Support Licensing Service Center.
2. After you receive the license file, save the files to the following directory on the license server:
- On Linux hosts, copy the license files to:
 - /etc/emc
 - /etc/emc/licenses
 - /opt/EMCpower
 - /opt/EMCpower/licenses
 - On Windows hosts, the default directory for license placement is:
 - %USERPROFILE%\Documents\EMC\PowerPath\rpowermt
 - %ALLUSERSPROFILE%\EMC\PowerPath\rpowermt

In cases if the directory is not present, create one and then copy the license file.

3. Deploy the Dell EMC PowerPath Management Appliance. The Dell EMC PowerPath Management Appliance includes the PowerPath/VE Electronic License Manager System (ELMS) and the rpowermt CLI package (RTOOLS) pre-installed.

The *PowerPath Management Appliance Installation and Configuration Guide* provides more information.

Alternatively, you can install the PowerPath/VE ELMS and the remote multipathing (rpowermt) CLI package individually instead of using the Dell EMC PowerPath Management Appliance. To install the ELMS and rpowermt CLI package, perform the following steps:

- a. Install the PowerPath/VE Electronic License Manager System (ELMS).

[Installing the PowerPath/VE ELMS](#) provides more information.

- b. On Linux hosts, use the PowerELMS script to configure and start the ELMS and the virtual appliance.

```
/etc/init.d/PowerELMS start -l license_search_path
```

 **Note:** For RHEL 7.x and above use `systemctl start PowerELMS` to start the ELMS service.

For single license, the license search path must contain the fully qualified paths to the license file. For multiple licenses, the license search path must contain the fully qualified paths 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.

On Windows hosts, during ELMS installation it prompts for the location of the license file. Once provided, the PowerPath/VE ELMS is configured and started automatically.

- c. Install the remote multipathing (rpowermt) CLI package on the Linux and Windows hosts designated as rpowermt servers. Install the rpowermt server only if you are not deploying the virtual appliance.

[Install the PowerPath/VE remote CLI \(rpowermt\)](#) provides more information.

4. Install the PowerPath/VE for VMware vSphere software on the vSphere hosts in your PowerPath/VE environment.
[Installing PowerPath/VE for VMware vSphere](#) provides more information.
5. Configure the served license configuration files on the rpowermt server.

Migrating from physical ELMS to PowerPath Management Appliance

This section provides information on migrating PowerPath/VE Electronic License Manager System (ELMS) to PowerPath Management Appliance with existing served license and with new served license file.

The PowerPath Management Appliance documentation provides detailed instructions on deploying and using the Virtual Appliance.

Migrate physical PowerPath/VE ELMS to Dell EMC PowerPath Management Appliance with existing served license file

Use this procedure if you currently have the physical PowerPath/VE Electronic License Manager System (ELMS) and want to migrate to the PowerPath/VE ELMS at the same IP address using the same served license file.

About this task

Served licenses are tied to the IP address of the PowerPath/VE ELMS. Therefore, if you deploy the appliance at the IP address as the PowerPath/VE ELMS that you are replacing, you can use the existing served license file.

If you want to migrate the PowerPath/VE ELMS to a new IP address, you must request a new served license file.

Procedure

1. Stop the existing PowerPath/VE Electronic License Manager System (ELMS).
 - On Linux hosts, type `lmdown -c license_file_list` and then press `y` to stop the server. Where `license_file_list` is the name of the served license file used to start the license server manager. The Macrovision FLEXnet documentation provides more information.

```
# ./lmutil lmdown -c /etc/emc/licenses/license.lic
lmutil - Copyright (c) 1989-2014 Flexera Software LLC. All Rights Reserved.

Port@Host          Vendors
1) 27010@dur-ppa-242-158 EMCLM

Are you sure (y/n)? y
1 FlexNet License Server shut down
```
 - On Windows hosts, in the **Start/Stop/Reread** tab, click **Stop Server**. Output similar to the following appears: License Server Shut Down.
2. Save the existing served license file to a location that is accessible after stopping the PowerPath/VE ELMS.
3. Deploy the Dell EMC PowerPath Management Appliance at the same IP address as the PowerPath/VE ELMS that was removed in step 1.

The *PowerPath Management Appliance Installation and Configuration Guide* provides more information.

Migrate physical PowerPath/VE ELMS to PowerPath Management Appliance with new served license file

Use this procedure if you currently have the physical PowerPath/VE Electronic License Manager System (ELMS) and want to migrate to the PowerPath Management Appliance at a different IP address from the existing PowerPath/VE ELMS using the new served license file.

About this task

Served licenses are tied to the IP address of the PowerPath/VE ELMS. Therefore, if you deploy the PowerPath Management Appliance at a different IP address as the PowerPath/VE ELMS that you are replacing, you must move (*rehost*) the served licenses to the new PowerPath/VE ELMS in the PowerPath Management Appliance with the new IP address.

Procedure

1. Log into the DellEMC Online Support licensing website and then click **Move Licenses**.

Follow the steps outlined in the Licensing Service Center. The activation certificate is automatically sent to the registered user for this transaction.

2. Deploy the PowerPath Management Appliance with a different IP address as the PowerPath/VE ELMS that currently exists.

The *PowerPath Management Appliance Installation and Configuration Guide* provides more information.

3. Remove the physical PowerPath/VE ELMS.

Configure served license configuration files on the rpowermt server

Use the following procedure to create a license configuration file that identifies the PowerPath/VE Electronic License Manager System (ELMS) to the rpowermt application.

Before you begin

- Ensure that you have generated and obtained a license (.lic) file for the PowerPath/VE ELMS at the Licensing Service Center on DellEMC Online Support.
- Ensure that you have stored the license file with .lic extension in the PowerPath/VE ELMS directory.
- Ensure that the PowerPath/VE ELMS is started and running.
- Ensure that the rpowermt server and PowerPath/VE 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 PowerPath/VE ELMS, the `rpowermt register` command 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.

Save the license file downloaded from Licensing Service Center on DellEMC Online Support as a text file with the file extension .lic. 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.

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 DellEMC 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).
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 Linux `rpowermt` servers, copy the license file to one of the following directories:
 - `/etc/emc`
 - `/etc/emc/licenses`
 - `/opt/EMCpower`
 - `/opt/EMCpower/licenses`
 - On Windows `rpowermt` servers, copy the license file to one of the following directories:
 - `%USERPROFILE%\Documents\EMC\PowerPath\rpowermt`
 - `%ALLUSERSPROFILE%\EMC\PowerPath\rpowermt`
 3. Run an `rpowermt` command valid for auto-registration to register the vSphere hosts, such as `rpowermt display`. If you do not want to use automatic registration, then use the manual registration procedure.

After entering the `rpowermt` command, you are prompted to create an `rpowermt` lockbox. You will need this passphrase if the lockbox is moved to a different `rpowermt` server. The *PowerPath Family CLI and System Messages Reference Guide* provides information on setting the `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 !).

Set non-default directories using the `PPMT_LIC_PATH` environment variable

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

Procedure

1. Place the license server configuration file in a non-default 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
2. To change directory that is part of the default search path, set the PPMT_LIC_PATH environment variable to point to the desired directory.
 - On Linux hosts, type one of the following commands:

```
# setenv PPMT_LIC_PATH=license_file_directory
# export PPMT_LIC_PATH=license_file_directory
```

- On Windows hosts, type the following command:

```
C:\> set PPMT_LIC_PATH=license_file_directory
```

After you finish

Optionally [make the non-default directories persistent across reboot](#).

Make non-default directories persistent across reboot

After you set non-default directories using the PPMT_LIC_PATH environment variable, make the change persistent across reboot.

Procedure

- On Linux hosts, add the PPMT_LIC_PATH environment variable to the shell configuration file. For example, the .profile file.
- On Windows hosts, perform the following steps:
 - a. From My Computer, select **System Properties > Environment Variables**.
 - b. Add the PPMT_LIC_PATH environment variable to the Environment Variable table.

Obtain additional served licenses

When you first obtain a served license at the Licensing Service Center on DellEMC Online Support, you can obtain all licenses available for that served license, or a subset of available licenses.

About this task

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. From DellEMC Online Support, navigate to Service Center Product Registration and Licenses and then click **PowerPath**.
2. Click **Activate Licenses** and then follow the outline in the DellEMC Online Support Licensing Service Center.

If you experience issues during the regeneration process, open a service request on DellEMC Online Support or EMC Support Center.

3. Install the new served license file on the PowerPath/VE Electronic License Manager System (ELMS). Place the served license file in the same directory where you installed the initial served license file. PowerPath/VE supports multiple served license files. They must be stored in the same directory.

4. Set the license path.
 - a. In **lmtools**, select **Config Services > Path to the license file**.
 - b. Browse to the permanent served license file location and select.
 - c. Click **Save Service**.
5. Stop and restart the PowerPath/VE ELMS.
 - a. In **lmtools**, select **Start/Stop/Reread > Stop**

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

The progress bar at the bottom of the pane indicates when the service is started
6. Install the PowerPath/VE multipathing software on the vSphere hosts for which you obtained the additional licenses.
7. From the `rpowersmt` server, run an `rpowersmt` command valid for auto-registration to register the vSphere hosts with the license server.

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

Use multiple served license files on Windows PowerPath/VE ELMS

Use this procedure if you are using the manual installation of PowerPath/VE Electronic License Manager System (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.

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. In the **Start/Stop/Reread** tab, click **Stop Server**.

Output similar to the following appears: `License Server Shut Down`
3. In **Config Services**, manually type the path to the directory where all the licenses are placed in **Path to license file** and then click **Save service**.
4. In the **Start/Stop/Reread** tab, click **Start Server**.

Output similar to the following appears: `Server Start Successful`
5. In the **Start/Stop/Reread** tab, click **ReRead License File**.

Output similar to the following appears: `Reread Server License File Completed`
6. Verify that the PowerPath/VE ELMS shows the total number (X + Y number) of served licenses. Navigate to **Server Status > Perform Status Enquiry**.

Verify license server and license status

About this task

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

Verify the license server using the `lmutil` utility

Use the `lmutil` utility to verify the license server.

Procedure

- On Linux hosts, type the following command:

```
lmutil lmstat -a -c path_to_license_file_list
```

- On Windows hosts, type the following command:

```
lmutil.exe lmstat -a -c path_to_license_file_list
```

Results

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.

Verify the license server using the `lmtools` utility

Use the `lmtools` utility to verify the license server. This applies to Windows only.

Procedure

- Navigate to the directory where the license server executables are installed and then click `lmtools.exe`.
- In the **Server Status** tab, click **Perform Status Enquiry**.

Results

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.

Set served license file path

About this task

Use the following procedures to set served license file path.

Set the served license file path using the `lmtools` utility

Use the `lmtools` utility to set the served license file path. This applies to Windows only.

Procedure

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

Reread the served license files

Reread the served license files whenever a new or changed license file is added to the license server.

About this task

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 then click `lmtools.exe`.
2. In the **Start/Stop/Reread** tab, click **ReRead License File**.

Output similar to the following appears: `Reread Server License File Completed`

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.

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.
- Alternatively, take no action and wait 45 days, after which the license count decreases by one.

Unregister the served license from the vSphere host

Complete the following procedure to unregister the served from the vSphere host.

Procedure

1. Run the `rpowermt unregister` command to unregister a served license on an vSphere host.
2. Remove the `.lic` file from the `rpowermt` server.
3. (Optional) Restart the vSphere host. 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.

For served licenses, occasionally if the PowerPath/VE Electronic License Manager System (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.

Convert from an unserved license to a served license

Complete the following procedure to convert from an unserved license to a served license.

Procedure

1. Download and deploy the PowerPath Management Appliance.
The *PowerPath Management Appliance Installation and Configuration Guide* provides more information.
2. Request a PowerPath/VE unserved-served license file conversion by performing the following steps:
 - a. Navigate to DellEMC Online Support and then create a service request.
 - b. Select **Technical Problem/Question**.
 - c. In the body of the message add PowerPath/VE unserved-served conversion request.
3. Install the new served license file in the PowerPath Management Appliance.
4. Remove an unserved license from a PowerPath/VE host.

```
rpowermt unregister host=hostname
```


You cannot remove an unserved license from a PowerPath/VE host through the PowerPath Management Appliance web console. Removing the existing licenses will not affect PowerPath/VE multipathing capability.
5. Verify that the license appliance is automatically deploying licenses to PowerPath/VE hosts. This will take approximately 10-15 minutes to redeploy all of the licenses.

Alternatively, you can run `rpowermt register` to register a served license on a vSphere host.

Move served licenses to a new host machine

Moving a served license file to a new host machine in a PowerPath/VE environment is called *rehosting*.

Before you begin

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. Log into the DellEMC Online Support licensing website and then click **Move Licenses**.
Follow the steps outlined in the Licensing Service Center. The activation certificate is automatically sent to the registered user for this transaction.
2. Install the new served license file on the new PowerPath/VE Electronic License Manager System (ELMS).

For example, place the served license file in the same directory where you installed the license server executables.
3. Start and configure the license server manager on the new PowerPath/VE ELMS.
4. Edit the license server configuration file on the rpowermt servers to point to the new PowerPath/VE ELMS.

Update the IP address of the license server and the TCP/IP port number used by the license server.

CHAPTER 2

Using PowerPath/VE in an unserved license environment

This chapter describes how to use PowerPath/VE in an unserved license environment.

- [Installation components and workflow for unserved licenses](#).....22
- [Configure unserved license configuration files on the rpowermt server](#).....23
- [Make non-default directories persistent across reboot](#)..... 24
- [Unregister unserved licenses](#).....24
- [Move unserved licenses from one vSphere host to another vSphere host](#).....25

Installation components and workflow for unserved licenses

This section describes the components that are required for unserved licenses and provides the workflow.

Installation components for unserved licenses

In addition to installing PowerPath/VE on a VMware vSphere host, you need the following components.

PowerPath/VE components

You can install one of the following two PowerPath/VE component options for unserved licenses:

- PowerPath remote multipathing (rpowermt) CLI package, called RTOOLS, for management on a physical host or VM.
- PowerPath Management Appliance. The Virtual Appliance is a SLES virtual machine that includes RTOOLS pre-installed.

VMware components

You can install one of the following two VMware component options:

- VMware vSphere CLI (vCLI) software.
- VMware vSphere Update Manager (VUM) software. VUM includes the VUM server, VMware vSphere Client, and VMware vCenter Server.

The VMware documentation provides the host requirements for VMware vCLI and VUM. Download the VMware software from the VMware website.

Installation workflow for unserved licenses

The following procedure lists the steps in configuring an unserved licensing environment for PowerPath/VE.

Before you begin

Ensure that you know the vSphere unique system ID and License Authorization Code (LAC) in order to obtain the unserved licenses.

Procedure

1. Install the PowerPath/VE for VMware vSphere software on the vSphere hosts in your PowerPath/VE environment.
[Installing PowerPath/VE for VMware vSphere](#) provides more information.
2. Install the remote multipathing (rpowermt) CLI package, also called RTOOLS, on the Linux and Windows hosts designated as rpowermt servers.
Install the rpowermt server only if you are not deploying the virtual appliance. [Install the PowerPath/VE remote CLI \(rpowermt\)](#) provides more information.
3. Obtain the vSphere unique system ID for each vSphere host using the `esxcli` command.

`esxcli system uuid get` provides the following output
4d5e4241-6b3c-132e-44f4-00221928801a. This is the vSphere unique system ID.

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

4. Obtain unserved licenses and then activate the licenses at the Licensing Service Center on DellEMC Online Support. When you purchase PowerPath/VE, EMC sends you an email that contains the LAC. Use the LAC to obtain PowerPath/VE licenses.
 - a. From DellEMC Online Support, navigate to **Service Center > Product Registration & Licenses**.
 - b. Click **PowerPath**.
 - c. Click **Activate Licenses** and then follow the outline in the DellEMC Online Support Licensing Service Center.
5. After you receive the license file, save the files.

Do not save the unserved licenses in the Electronic License Manager System (ELMS) folder.

- On Linux hosts, copy the license files to one of the following directories.
 - /etc/emc
 - /etc/emc/licenses
 - /opt/EMCpower
 - /opt/EMCpower/licenses

 **Note:** /opt/EMCpower/licenses is not available as a default folder. You must manually create this folder.
 - On Windows hosts, copy the license files to one of the following directories.
 - %USERPROFILE%\Documents\EMC\PowerPath\rpowermt
 - %ALLUSERSPROFILE%\EMC\PowerPath\rpowermt
6. Configure the unserved license configuration files on the rpowermt server.

Configure unserved license configuration files on the rpowermt server

Before you begin

Ensure that the rpowermt server and the vSphere 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 vSphere host, `rpowermt register` reports license registration errors.

Procedure

1. On the rpowermt server, configure a license configuration (.lic) file that identifies the vSphere host to the rpowermt application. Save the license file downloaded from Licensing Service Center on DellEMC 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
- /opt/EMCpower/licenses
- On Windows, the directories in the default search path are:
 - %USERPROFILE%\Documents\EMC\PowerPath\rpowermt
 - %ALLUSERSPROFILE%\EMC\PowerPath\rpowermt

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

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

For example, run the `rpowermt display` command.

 **Note:** If you do not want to use automatic registration, you can manually register the vSphere hosts.

Upon entering the `rpowermt` command for the first time, you are prompted to create an rpowermt lockbox. You will need this passphrase if the lockbox is moved to a different rpowermt server.

```
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 !).

Make non-default directories persistent across reboot

After you set non-default directories using the `PPMT_LIC_PATH` environment variable, make the change persistent across reboot.

Procedure

- On Linux hosts, add the `PPMT_LIC_PATH` environment variable to the shell configuration file. For example, the `.profile` file.
- On Windows hosts, perform the following steps:
 - a. From My Computer, select **System Properties > Environment Variables**.
 - b. Add the `PPMT_LIC_PATH` environment variable to the Environment Variable table.

Unregister unserved licenses

Complete the following procedures to unregister unserved licenses.

Procedure

1. Unregister an unserved license on an vSphere host.

```
rpowermt unregister host=hostname
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 directories for unserved license files include:
 - /etc/emc
 - /etc/emc/licenses
 - /opt/EMCpower
 - /opt/EMCpower/licenses
 - On Windows, the default directory is %ALLUSERSPROFILE%\EMC\PowerPath\rpowermt.

Results

After PowerPath/VE is removed from the vSphere host, the storage devices are claimed by the native VMware multipathing facility.

After you finish

Perform one of the following operations: Reinstall and then configure after converting license types.

- Remove PowerPath/VE from the vSphere host, the storage devices are claimed by the native VMware multipathing facility. Reinstall and then configure after converting license types.
- Restart the vSphere host. 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.

Move unserved licenses from one vSphere host to another vSphere host

In a PowerPath/VE environment, moving an unserved license from one vSphere host to another vSphere host is called *rehosting*.

Procedure

1. Unregister the unserved license from its current vSphere host before moving it to a new vSphere host.
2. Install the PowerPath/VE multipathing driver on the vSphere host that you are adding to your PowerPath/VE environment.
3. Determine the vSphere unique system ID of the vSphere host to which you are rehosting the unserved license.
4. Log into the DellEMC Online Support licensing website and then click **Move Licenses**.
Follow the steps outlined in the Licensing Service Center. The activation certificate is automatically sent to the registered user for this transaction.
5. Place the unserved license files on one or more rpowermt servers in your PowerPath/VE configuration.

CHAPTER 3

Using PowerPath/VE in an FX license environment

This chapter describes how to use PowerPath/VE in an FX license environment.

- [Installation components for FX license](#)..... 28
- [Register FX license for vSphere](#)..... 28
- [Unregister FX license](#)..... 28

Installation components for FX license

In addition to installing PowerPath/VE on a VMware vSphere host, you need the following components.

PowerPath/VE components

- PowerPath remote multipathing (rpowermt) CLI package, called RTOOLS, for management on a physical host or VM.
- PowerPath Management Appliance. The Virtual Appliance is a SLES virtual machine that includes RTOOLS pre-installed.

VMware components

You can install one of the following two VMware component options:

- VMware vSphere CLI (vCLI) software.
- VMware vSphere Update Manager (VUM) software. VUM includes the VUM server, VMware vSphere Client, and VMware vCenter Server.

The VMware documentation provides the host requirements for VMware vCLI and VUM. Download the VMware software from the VMware website.

Register FX license for vSphere

About this task

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

If PowerPath is already registered with Served or Unserved license, it continues with Served or Unserved license, even if FX is available.

If Served or Unserved PowerPath license expires or unregisters, PowerPath detects FX license automatically.

Unregister FX license

About this task

Hosts with FX license cannot be unregistered unless all data devices from VMAX3 or PowerMax with FX software package gets removed.

CHAPTER 4

Using PowerPath/VE in a subscription license environment

This section provides information about the Subscription License feature.

- [Subscription License Overview](#).....30

Subscription License Overview

Using the subscription license feature you can try PowerPath before buying Permanent Key.

The subscription model has the following subscription types:

- 1 year
- 2 years

The subscription model contains Start date, End date, and Grace period. These fields decide the validity of the PowerPath/VE software and based on the current date, it issues warning on respective rpowermt commands are being used.

View subscription key

You can view the subscription key as follows:

About this task

```
SERVER XXXXXX INTERNET=XXXX 27010
VENDOR EMCLM
USE_SERVER
INCREMENT PowerPathMP EMCLM 5.4 31-Jul-2019 5 \
  VENDOR_STRING="PRODUCT_LINE=PowerPath/VE;FEATURE_NAME=PowerPath/VE \
  For ESXi Multipathing Host \
  License; UOM_CODE=ZC; UOM_NAME=Individual CPU \
  Core; TYPE=SUBSCRIPTION;START_DATE=14-Mar-2019;END_DATE=17-
  Jul-2019;GRACE_PERIOD=31-Jul-2019;SWID=ELMPPV1218N0FP;PLC=PPVE" \
  dist_info="ACTIVATED TO XXXX" \
  ISSUER=EMC ISSUED=14-Mar-2019 \
  NOTICE="ACTIVATED TO License Site Number: XXXX" \
  SN=3725527 SIGN="xxxx xxxx xxxx xxxx 1A6B CF87 2100 2FEB \
  E060 6111 1B79 xxxx xxxx xxxx"
```

View regular served license

You can view the regular served license as follows:

About this task

```
SERVER xxxx INTERNET=xxxx 27010
VENDOR EMCLM
USE_SERVER
INCREMENT PowerPathMP EMCLM 5.4 20-Mar-2018 5 \
  VENDOR_STRING="PRODUCT_LINE=PowerPath;FEATURE_NAME=PowerPath/VE \
  For ESXi Multipathing Host \
  License;UOM_CODE=IA;UOM_NAME=Instance per \
  Server;SWID=PPQA1118;PLC=PP;" OVERDRAFT=1 dist_info="ACTIVATED \
  TO xxxx" ISSUER=EMC ISSUED=17-Jan-2018 NOTICE="ACTIVATED TO \
  License Site Number: xxxx" SN=2343572 SIGN="xxxx xxxx xxxx \
  xxxx xxxx xxxx xxxx"
```

CHAPTER 5

PowerPath features for PowerMax array

PowerPath/VE for VMware vSphere supports the following features when the host is connected to a PowerMax array running microcode 5978 and above.

- [PowerPath Host Registration](#)..... 32
- [FX Licensing](#)..... 34
- [PowerPath Device IO Statistics](#)..... 34
- [PowerPath Device in Use Reporting](#)..... 35
- [Proactive Port Offline Autostandby](#) 36
- [Flaky Path Reporting to PowerMax](#)..... 37
- [SAN latency reporting](#)..... 37

PowerPath Host Registration

This section provides information on the PowerPath Host Registration feature.

Overview

PowerPath Host Registration is a feature that enables a host to be registered with PowerMax array running microcode 5978 and above.

This makes it easier to configure storage for a new host from an array.

Initial Registration and Storage Configuration

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

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

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

After the Initiator Group is created (automatically or manually), then other entities such as, the Storage Group, Port Group, and Masking view can be created to configure data LUNs for the host.

Modes of operation

PowerPath Host Registration works in the following two modes:

Automatic

PowerPath Host Registration is configured automatically in the following scenarios:

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

Manual

The `rpowermt update host_registration host=<ip/Host name>` command can be run at any time to send registration to all connected PowerMax arrays. This is useful in scenarios where the hostname is changed and the array needs to be updated immediately.

Settings

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

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

```
[~]# rpowermt display options host=<x.x.x.x>

    Show CLARiiON LUN names:      true

    Path Latency Monitor: Off

    Performance Monitor: enabled
    Interval                   : 1 min(s)

    Autostandby:  IOs per Failure (iopf): enabled
                  iopf aging period   : 7 d
                  iopf limit          : 5000000

    Storage
    System Class  Attributes
    -----
    Symmetrix     periodic autorestore = on
                  reactive autorestore = on

                  proximity based autostandby = on
                  proximity based autostandby threshold = default
                  auto host registration = enabled
                  device to array performance report = enabled
                  device in use to array report = enabled
```

This setting can be changed with the following `rpowermt set` command:

```
rpowermt set auto_host_registration={on|off} class=<class> host=<ip/hostname>
```

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

Viewing Host Registration

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

```
symcfg.exe -sid 413 list -ppreg -host ncpp240029
```

```
Symmetrix ID      : 000197801413

Host Name:        ncpp240029
OS Version:      ESXi 6.7.0
OS Revision:     Releasebuild-8169922
Hardware Vendor Name:
PowerPath Version: 6.4.0
PowerPath Patch Level: 0.0-103
PowerPath License Info: FX
Host Registration Time: 09/30/2018 06:55:26
Host Connectivity type: FC
Cluster Info:
  Cluster Name:
  Cluster Node Name:
WWNs:
(1): 10000090FAF0B43B
(2): 10000090FAF0B43C
VMs:
(1)
  VM Name       : PPMA_Instance
  OS Vendor Info:
(2)
  VM Name       : WinDBSRv
```

```
OS Vendor Info:
```

FX Licensing

This section provides information on the FX licensing feature.

Overview

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

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

Viewing FX licensing information

You can view the FX licensing information as follows:

```
# rpowermt check_registration host=<x.x.x.x>

PowerPath License Information:
-----

Host ID           : 5b4fcfc6-8da3-3e92-78d3-d094664b61b0
Type              : FX
State             : licensed

Days until expiration : (non-expiring)
```

PowerPath Device IO Statistics

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

Overview

The PowerPath Device IO Statistics feature provides host IO performance collection and reporting to PowerMax microcode 5978 and above. These statistics are collected per PowerPath managed PowerMax device and reported to array at one minute intervals.

Settings

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

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

```
[~]# rpowermt display options host=<x.x.x.x>

                                Show CLARiiON LUN names:      true

Path Latency Monitor: Off

Performance Monitor: enabled
Interval              : 1 min(s)

Autostandby:  IOs per Failure (iopf): enabled
               iopf aging period   : 7 d
               iopf limit          : 5000000
```

```

Storage
System Class  Attributes
-----
Symmetrix    periodic autorestore = on
              reactive autorestore = on

              proximity based autostandby = on
              proximity based autostandby threshold = default
              auto host registration = enabled
              device to array performance report = enabled
              device in use to array report = enabled

```

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

```
#rpowermt set device_perf_to_array_report={on|off} [class=<class>|all] host=<ip/hostname>
```

Viewing PowerPath Device IO Statistics

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

PowerPath Device in Use Reporting

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

Overview

PowerPath Device in Use Reporting feature provides a way to report by PowerPath to PowerMax running microcode version 5978 and above on PowerPath managed devices.

The device usage statistics reported to array are used by storage administrators to know LUN usage on per host basis, use for array capacity, and resource planning. Once every 24 hours, for each PowerMax device, PowerPath sends details such as if the device is mounted and name of the VM that used the device in the preceding 24 hours to the array.

Settings

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

PowerPath Device in Use feature is enabled by default for PowerMax. This can be seen with the `rpowermt display options` command.

```
#rpowermt display options host=<x.x.x.x>

Show CLARiiON LUN names:      true

Path Latency Monitor: Off

Performance Monitor: disabled

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

Storage
System Class  Attributes
-----
Symmetrix    periodic autorestore = on

```

```

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

```

This setting can be changed with the following `rpowermt set` command:

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

Viewing PowerPath Device in Use information

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

```

symdev list -ppi -dev 235F

Symmetrix ID      : 000197801413

      P O W E R P A T H   D E V I C E   S T A T U S
Device Last I/O Time      Mounted Hostname      Process name
-----
0235F 10/04/18 03:04:21   Yes ncpp244053         WINSQLDB_VM

```

Proactive Port Offline Autostandby

This section provides information about the PowerPath Proactive Port Offline Autostandby feature.

Proactive Port Offline Autostandby Overview

There is a new autostandby mode that is supported for devices from PowerMax running microcode 5978.444.444 and above.

This mode is known as *autostandby offline* (`asb:ofln`). PowerPath proactively sets this mode when it detects that a port maintenance operation is going to be conducted on a PowerMax Front-end adapter.

Before a planned maintenance activity, the array administrator runs a script for the specified front-end adapter. It triggers PowerPath to set paths to that adapter as *autostandby offline* (`asb:ofln`) and the paths are not used for IOs. Hence, when the administrator carries out the maintenance activity after a few minutes and the paths go dead, there are no unnecessary IO latencies as these paths are not picked for IOs. After the maintenance activity is completed and when the paths become alive, they are automatically set to active mode and then used for IOs.

The autostandby offline paths are listed like the following in `powermt` display output:

```

Pseudo name=emcpowere
Symmetrix ID=000197600545
Logical device ID=00000664
Device WWN=60000970000197600545533030363634
state=alive; policy=SymmOpt; queued-IOs=0
=====
----- Host ----- - Stor - -- I/O Path -- -- Stats ---
### HW Path          I/O Paths   Interf.  Mode   State   Q-IOs Errors
=====
      8 bfa          sdqw       FA 3d:05 active  alive   0     1
      9 bfa          sdqv       FA 3d:05 active  alive   0     1
      9 bfa          sdmq       FA 2d:05 asb:ofln alive   0     2
      8 bfa          sdmo       FA 2d:05 asb:ofln alive   0     2

```

Log Messages

When PowerPath detects that a maintenance is going to be carried out on array ports and sets the paths as *autostandby offline*, messages such as the following are logged to the system log:

```
Aug 28 07:57:17 lnq244072 kernel: Info:Mpx:Path Bus 9 Tgt 37 Lun 4 to
Symmetrix ID 000197600545 is set to asb:ofln.
Aug 28 07:57:17 lnq244072 kernel: Info:Mpx:Path Bus 9 Tgt 37 Lun 0 to
Symmetrix ID 000197600545 is set to asb:ofln.
Aug 28 07:57:17 lnq244072 kernel: Info:Mpx:Path Bus 9 Tgt 37 Lun 8 to
Symmetrix ID 000197600545 is set to asb:ofln.
Aug 28 07:57:17 lnq244072 kernel: Info:Mpx:Path Bus 9 Tgt 37 Lun 3 to
Symmetrix ID 000197600545 is set to asb:ofln.
```

Flaky Path Reporting to PowerMax

This section provides information about PowerPath Flaky Path Reporting to PowerMax feature.

Flaky Path Reporting to PowerMax Overview

PowerPath already can identify paths with intermittent IO failures (also known as flaky paths) and mark them as *autostandby io-per-failure* (*asb:iopf*) automatically.

When paths are marked as *autostandby*, they are not used for IOs and hence performance issues can be avoided until the issues with those paths are fixed.

For devices from PowerMax running microcode 5978.444.444 and above, PowerPath also reports flaky path information to the array. This process helps array administrators to identify potential problems on the array if multiple hosts report flaky paths from the same port.

SAN latency reporting

This section provides information about SAN latency Reporting feature.

SAN latency reporting overview

PowerPath now reports SAN latency values for paths to PowerMax arrays running microcode 5978.444.444 and above.

As the vendor-specific commands used to calculate these values are not queued on the array port, their response is not dependent on how loaded the array is and hence accurately reflects the actual latency between the host initiator and array ports. SAN administrators can analyze these values to determine issues in the network that may be causing higher latencies and fix them.

Following latency values are determined automatically every 30 minutes for each host initiator to array target pair:

- Previous Latency – Latency value reported from the previous iteration.
- Current Latency – Most recently reported Latency value.
- Max Latency – Max latency reported in the last 24 hours. This value gets reset every 24 hours.

View PowerPath SAN Latency in Dell EMC PowerPath Management Appliance

Dell EMC PowerPath Management Appliance (PPMA) 2.6 or above displays SAN latency values in Bus View tab under PowerPath Monitor view section.

About this task

The appliance gets latency details periodically by polling hosts. These details can be refreshed manually by repolling the hosts.

 **Note:** For more details about Dell EMC PowerPath Management Appliance 2.6, see *PowerPath Management Appliance Installation and Configuration Guide*.

CHAPTER 6

Installing the PowerPath/VE components

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

- [Installing PowerPath/VE for VMware vSphere](#).....40
- [Installing the PowerPath/VE ELMS](#).....46
- [Install PowerPath/VE remote CLI \(rpowermt\)](#)..... 49

Installing 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.

Install PowerPath/VE using one of the following methods:

- Install using VMware Update Manager - This is the recommended installation method
- Install using VMware vSphere CLI (vCLI)
- Install using VMware vSphere Auto Deploy

Supported PowerPath/VE installation scenarios

You can install PowerPath/VE:

- 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 install using the remote vCLI.

 **Note:** PowerPath/VE supports coexistence with NMP Boot from SAN.

PowerPath/VE installation prerequisites

Complete the following steps before installing PowerPath/VE with any installation method.

- 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 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.

Install/upgrade PowerPath/VE using VMware vSphere Update Manager

Complete the following procedure to install or upgrade using the VMware vSphere Update Manager:

Before you begin

- Ensure that VMware vSphere vMotion is correctly configured to enable for non-disruptive installation of PowerPath/VE.
- Ensure that VMs have been migrated to another node in the cluster.
- Ensure that the vCenter Server system is configured correctly for importing offline bundles as zip files for installation. The VMware vCenter Update Manager documentation provides information about vCenter Server requirements.

About this task

Installation using VMware vSphere Update Manager (VUM) is the recommended installation procedure.

Procedure

1. Download the PowerPath/VE software distribution from DellEMC Online Support.
2. Extract the offline package (DellEMCPower.VMWARE.<version>.<build>.zip) and then save on a local or shared network drive.
3. In the vCenter Server, from home page select **Update Manager**.
4. In **Update Manager**, select **UPDATES** tab on upper right and select **Upload From File**.
Select **Browse** and provide the location of PowerPath/VE package and it imports the package.
5. In **Update Manager**, select **Baselines** and click **New** drop-down menu and select **Baseline**.
 - a. Enter the name of base line in **From create base line** window.
 - b. Enter the required information in **Description**.
 - c. Select **Extention** and click **Next** from content.
 - d. Select the required package and click **Next** from **Select Extensions** page.
 - e. Review your settings and click **Finish** in **Summary** page .
6. Attach the PowerPath/VE baseline to the wanted vSphere hosts.

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

- a. Go to **Hosts and Clusters**
 - b. Select the host and click the **UPDATES** tab at upper right.
 - c. Select **Host Updates** and click **Attach** from **Attached Baselines**.
 - d. Select the base line that is created in [step](#) and click **Attach** in **Attach** page.
7. Stage the baseline.

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

- a. Go to **Hosts and Clusters**
 - b. Select the host and click the **UPDATES** tab at upper right.
 - c. Select **Host Updates** and select the base line that is attached in previous step and click **STAGE**.
 - d. In **Stage patches window**, select the host for staging and click **STAGE** and wait until the stage complete.
It takes several minutes to finish. Observe the tasks tab for status.
8. Remediate the PowerPath/VE baseline.
 - a. After completing the staging, click **REMEDiate** from the **Attached Baselines** window.
 - b. In **Remediate** page, select the Remediation settings and select the required settings based on your environment.
 - c. Select **Scheduling Options** if you plan to remediate later.
 - d. After all the settings are updated, click **REMEDiate** and wait until the remediation complete.

It takes several minutes to finish. Observe the tasks tab for status.

Installing PowerPath/VE for VMware vSphere using remote vCLI

Use this procedure to install PowerPath/VE using the remote vCLI.

Before you begin

- Ensure that the VMware vSphere CLI (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. The VMware documentation provides information on vCLI and vSphere version compatibility.
- If you want to install PowerPath/VE 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.

Procedure

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

Install PowerPath/VE using remote vCLI and offline package locally available on vSphere host

Complete the following procedure to install using the remote vCLI and offline package.

Procedure

1. Download the PowerPath/VE software distribution from DellEMC Online Support.
2. Make the offline package available for use on the local vSphere host by one performing of the following options.
 - Use the `scp` (secure copy) command to copy the PowerPath/VE ZIP offline package to the vSphere host.
 - Copy the PowerPath/VE install ZIP offline package to the local vSphere datastore using vSphere client.
 - Alternatively, use another method is convenient for you to save the PowerPath/VE install ZIP offline package to your local vSphere host.
3. On the remote host running vCLI, install the PowerPath/VE package.

```
esxcli -s vSphere_server_IP_address_or_hostname software vib install -d  
absolute_path_to_PowerPath_package
```

For example,

```
# esxcli -s lclal11 software vib install -d /  
EMCPower.VMWARE.<version>.<build>.zip
```

4. Bring the vSphere host into Maintenance mode.
5. Restart the vSphere host onto which you are installing PowerPath/VE from the vSphere client.
6. Bring the vSphere host out of Maintenance mode.

7. Use the `esxcli` command to verify that PowerPath/VE is installed or to check the package that is installed.

```
# esxcli -s vSphere_server_IP_address_or_hostname software vib list

-----Bulletin ID-----Installed-----
Summary-----
powerpath.cim.esx      <version>-<build> PartnerSupported <installed
date>
powerpath.lib.esx      <version>-<build> PartnerSupported <installed
date>
powerpath.plugin.esx   <version>-<build> PartnerSupported <installed
date>
```

Install PowerPath/VE using remote vCLI and VIB packages remotely available on http server

Complete the following procedure to install using the remote vCLI and VIB packages.

Procedure

1. Download the PowerPath/VE software distribution from DellEMC Online Support.
2. Extract the PowerPath/VE VIB packages and then save the VIB packages to a remote http server.
3. On the remote host running vCLI, install the PowerPath/VE VIB packages.

```
esxcli -s vSphere_server_IP_address_or_hostname software vib install -
v=http://path_on_http_server
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.
```

```
esxcli -s lclal11 software vib install -v=http://lclal11
/DellEMC_bootbank_powerpath.cim.esx_<version>-<build>.vib
-v=http://lclal11/
DellEMC_bootbank_powerpath.lib.esx_<version>-<build>.vib
-v=http://lclal11/
DellEMC_bootbank_powerpath.plugin.esx_<version>-<build>.vib
```

4. Bring the vSphere host into Maintenance mode.
5. Restart the vSphere host onto which you are installing PowerPath/VE from the vSphere client.
6. Bring the vSphere host out of Maintenance mode.
7. Use the `esxcli` command to verify that PowerPath/VE is installed or to check the package that is installed.

```
# esxcli -s vSphere_server_IP_address_or_hostname software vib list

-----Bulletin ID-----Installed-----
Summary-----
powerpath.cim.esx      <version>-<build> PartnerSupported <installed
date>
powerpath.lib.esx      <version>-<build> PartnerSupported <installed
date>
powerpath.plugin.esx   <version>-<build> PartnerSupported <installed
date>
```

Install PowerPath/VE using VMware vSphere Auto Deploy

Complete the following procedure to install using VMware vSphere Auto Deploy.

Before you begin

The VMware vSphere Auto Deploy documentation provides more information on installing Auto Deploy.

1. Install the vCenter server and the Auto Deploy server.
2. Download and install the VMware PowerCLI package.
3. Download and save the VMware vSphere package to the vCenter Server.
4. Download the PowerPath/VE package from DellEMC Online Support. Save the package to the vCenter Server.
5. Configure a DHCP server that assigns an IP address to each vSphere host upon startup and that points the vSphere 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. Navigate to **Control Panel > Administration Tools > DHCP**.
 - b. Under your DHCP Server, select your server and then go to **IPv4**. Right-click on **Server Options**. Select **Configure Options**.
 - c. In 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. In the **General** tab, select **Bootfile Name** and specify the following file name:
`undionly.kpxe.vmw-hardwired.`
 - e. Click **Apply** and then close the DHCP options windows.
4. Create an image profile.
 - a. Open the PowerCLI command prompt and type `Get-PSSnapIn` to confirm that all required snap-ins have been added.

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.

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

- b. Connect to the vCenter Server system with which Auto Deploy is registered to PowerCLI.

```
Connect-VIServer IP_address_of_the_vCenter_server
```

- c. Add the vSphere software depot that contains the vSphere image profile to the PowerCLI session.

```
Add-EsxSoftwareDepot C:\file_path_my_offline_depot.zip
```

- d. 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. Display the images by printing the variable.

```
$img = Get-EsxImageProfile
```

- e. Clone the standard vSphere image to create a base image profile.

```
$newimg=New-EsxImageProfile -CloneProfile $img[number] -Name
"[name_of_profile]" - Vendor "EMC"
```

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

```
Add-EsxSoftwareDepot c:\vmware\powerpath\EMCPower.VMWare.[Version].
[build].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. 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]"
$rule = New-DeployRule -Name "[rule_name]" -Item $newimg, "PP-
HostProfile" -AllHosts
```

Optionally, type the following commands to display the working rule set and to add the rule to the working rule set.

```
Get-DeployRule
Add-DeployRule [rule_name]
```

6. Reboot the host and verify that the VMware vSphere and PowerPath/VE versions have been installed.

Installing the PowerPath/VE ELMS

If you are not using the PowerPath Management Appliance use these procedures to install the PowerPath/VE Electronic License Manager System (ELMS).

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

Before you install the ELMS:

- Select a machine to be the PowerPath/VE ELMS. The *PowerPath/VE for VMware vSphere Release Notes* provides information on supported PowerPath/VE ELMS operating systems and versions.
- Have the served license file located and ready to reference during the PowerPath/VE 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 later.
- 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 TCP/IP connection.

Installing PowerPath/VE ELMS on Linux hosts

PowerPath/VE Electronic License Manager System (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. PowerPath/VE ELMS for Linux fails if a non-root user tries to stop the service started by a root user.

Install PowerPath/VE ELMS using one of the following methods:

- Install using interactive script
- Install using non-interactive script with installation parameters

Install PowerPath/VE ELMS on Linux using the interactive installation script

Use this procedure for new installations of the PowerPath/VE Electronic License Manager System (ELMS) on Linux hosts using the interactive installation script.

Procedure

1. Download the new deployment .zip from DellEMC Online Support.
2. Unzip the PowerPath/VE ELMS package.

3. Untar the PowerPath/VE ELMS package for Linux.

```
tar -xzf DelleMCPower.ELMS.LINUX-11.14.v01.RHEL.x86_64.tgz
```

4. Run the `elms_install.sh` in the `ELMS_LINUX` folder and follow the onscreen instructions.

Perform one of the following steps based on the ELMS version installed (earlier than 11.10 or 11.10 and later). Using the wrong command might result in an error.

- Upgrade from non-rpm based ELMS versions earlier than 11.10.

```
elms_install.sh -s -d
                  location_of_the_old_installation -l
                  absolute_path_to_the_license_file
```

- Upgrade between rpm based ELMS 11.10.x or later.

```
elms_install.sh -s -l
                  absolute_path_to_the_license_file
```

5. When prompted to upgrade, press `n` and continue the installation.
6. Provide the license file to be used. The license server service starts after installation using the license file indicated. The service starts by default.
7. Configure and start the PowerPath/VE Electronic License Manager System (ELMS).

```
/etc/init.d/PowerELMS start -l absolute_path_to_license_file
```

Note: For RHEL 7.x and above use `systemctl start PowerELMS` to start the ELMS service.

Where `path_to_license_file` is the path to the folder where the license file is available. The Macrovision FLEXnet documentation provides more information.

```
install-dir/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 the license server, and the number of licenses that have been allocated.

Install PowerPath/VE ELMS on Linux using the non-interactive installation script

Use this procedure for new installations of the PowerPath/VE Electronic License Manager System (ELMS) on Linux hosts using the non-interactive installation script.

Procedure

1. Download the new deployment .zip from DellEMC Online Support.
2. Unzip the PowerPath/VE ELMS package.
3. Untar the PowerPath/VE ELMS package for Linux.

```
tar -xzf DelleMCPower.ELMS.LINUX-11.14.v01.RHEL.x86_64.tgz
```

4. Provide parameters to the `elms_install.sh`. Perform one of the following steps:

- Type `elms_install.sh -s`
- Type `elms_install.sh -s -c absolute_path_to_the_license_file`

The service starts by default.

- Configure and start the PowerPath/VE Electronic License Manager System (ELMS).

```
/etc/init.d/PowerELMS start -l absolute_path_to_license_file
```

Note: For RHEL 7.x and above use `systemctl start PowerELMS` to start the ELMS service.

Where *path_to_license_file* is the path to the folder where the license file is available. The Macrovision FLEXnet documentation provides more information.

```
install-dir/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 the license server, and the number of licenses that have been allocated.

Install PowerPath/VE ELMS on Windows hosts

Install PowerPath/VE ELMS using one of the following methods:

- Install using the interactive installer
- Install using the CLI silent installation

Install PowerPath/VE ELMS on Windows using the Interactive Installer

Use this procedure for new installations of the PowerPath/VE Electronic License Manager System (ELMS) on Windows hosts using the interactive installer. You must have administrative privileges to run the Interactive Installer.

Procedure

- Download the new deployment .zip from DellEMC Online Support.
- Unzip the PowerPath/VE ELMS package.
- Unzip the PowerPath/VE ELMS package for Microsoft Windows.

```
unzip DellEMCPower.ELMS.Windows-11.14.v01.x86_64.zip
```

- Place the PowerPath/VE ELMS executable for Windows in the `c:\` drive.
- Double-click the PowerPath/VE ELMS executable to run it.
- In the **DestinationFolder** window, choose the location for the PowerPath/VE ELMS to be installed.

By default, PowerPath/VE ELMS is installed and configured at `C:\Program Files (x86)\emc\ELMS`.

- In **InstallProgress**, you are prompted to input the absolute path to the license file. Type the absolute path to the served license file.

Failure to input the license file path prevents the ELMS installation from proceeding any further.

Results

The **InstallComplete** window indicates installation success or failure. In case of installation failure, refer to [Troubleshooting PowerPath/VE installation](#).

Install PowerPath/VE ELMS on Windows using CLI silent installation

Use this procedure for new installations of the PowerPath/VE Electronic License Manager System (ELMS) on Windows hosts using the command line interface (CLI).

Procedure

1. Download the new deployment .zip from DellEMC Online Support.
2. Unzip the PowerPath/VE ELMS package.
3. Unzip the PowerPath/VE ELMS package for Microsoft Windows.

```
unzip DelleMCPower.ELMS.Windows-11.14.v01.x86_64.zip
```

4. Place the PowerPath/VE ELMS executable for Windows in the c:\ drive.
5. Type `<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 PowerPath/VE ELMS package.
 - *path_to_log_file* is the absolute customized path where the installation log file is created.
 - *path_to_destination_folder* is the location to install or update the PowerPath/VE ELMS. By default, the package is installed in C:\Program Files (x86)\emc\ELMS
 - *path_to_license_file* is the absolute path to the license file.
6. Perform one of the following steps:
 - Configure and start the PowerPath/VE Electronic License Manager System (ELMS).
 - Navigate to the directory where the license server executables are installed and then click `lmttools.exe`. On the **Server Status** tab, click **Perform Status Enquiry**.

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.

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

When you do not use the PowerPath Management Appliance then review the following `rpowermt` server requirements.

The `rpowermt` server can be any one of the following:

- The vCLI remote server
- A Virtual Machine
- The PowerPath/VE Electronic License Manager System (ELMS)

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

When you do not use the PowerPath Management Appliance then review the following PowerPath/VE remote CLI requirements.

Before you install the `rpowermt` package, RTOOLS:

- Set any path environment variables for the `rpowermt` lockbox, such as `PPMT_LB_FILE` or `PPMT_LB_DISABLE`. 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 *PowerPath Family CLI and System Messages Reference Guide* provides more information on the environment variables.

- On Linux, ensure that you have root privileges before installing RTOOLS. You cannot install the RTOOLS package without root privileges.
- 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.
- RTOOLS should not share a license folder with the Electronic License Manager System (ELMS).

Install or upgrade the PowerPath/VE remote CLI (rpowermt) on Linux

When you do not use the Virtual Appliance, install the remote CLI.

Before you begin

- 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.

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

- Ensure that you have root privileges before installing RTOOLS. You cannot install the RTOOLS package without root privileges.

Procedure

1. Download the RTOOLS package .zip file from DellEMC Online Support.
2. Unzip the PowerPath/VE RTOOLS package.
3. Install the PowerPath/VE RTOOLS package.

```
# rpm -ivh DellEMCPower.RTOOLS-<version>-  
<build>.<architecture>.x86_64.rpm  
Preparing... ##### [100%]
```

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

Where *version* is the PowerPath version (such as, version 6.4) and *build* is the software build number (such as, build 105). Where *architecture* is RHEL7.x or below.

Install or upgrade the PowerPath/VE remote CLI (rpowermt) on Windows

When you do not use the appliance, install the remote CLI.

Before you begin

- 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.

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

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

Procedure

1. Download the RTOOLS package .zip file from DellEMC Online Support.
2. Unzip the PowerPath/VE RTOOLS package.
3. Double-click on the .exe file.

The PowerPath/VE remote CLI installation install wizard appears.

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

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

5. Perform one of the following steps:
 - 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**.
 - 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 then 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 (x86)\EMC\PowerPath\rpowermt`

CHAPTER 7

Post-PowerPath/VE Installation and Configuration

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

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- [PowerPath/VE post-installation and configuration tasks](#)..... 55
- [Verify the PowerPath/VE configuration](#)..... 55
- [rpowermt server lockbox](#)..... 56

Manually register the vSphere hosts

Use this procedure to manually register the vSphere host with your PowerPath/VE license.

Procedure

1. From the rpowermt server, register the vSphere host.

Run this command for each vSphere host in your environment.

```
# rpowermt register host=111.222.222.112
PowerPath license is registered.
```

If this is the first time you are entering an `rpowermt` command, you are prompted to create an `rpowermt` lockbox. 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.

- a. Type and then confirm the `rpowermt` lockbox passphrase.
- b. Type the vSphere host username.
- c. Type the vSphere host password.

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 or password entry in the lockbox.

2. From the `rpowermt` server, verify that the vSphere host is licensed.

```
# rpowermt check_registration host=10.249.216.17

PowerPath License Information:
-----

Host ID           : 54c9ae6e-3838-7686-430f-001e4f175670
Type              : served (counted)
State             : licensed
Registered To    :
Issue Date       : 2-Sep-2014
Feature          : PowerPathMP
Feature Version  : 5.4
Registering Svr  : rpowermt@vmq216038->10.249.216.17
License Server   : VMQ216038

Days until expiration : 163

License search path: /etc/emc:/etc/emc/licenses:/opt/EMCpower:/opt/
EMCpower/licenses

License file(s): /etc/emc/*.lic
                 /etc/emc/licenses/vmq216038.lic
                 /opt/EMCpower
                 /opt/EMCpower/licenses
```

3. Verify that PowerPath/VE devices are licensed and available for I/O.

```
# rpowermt host=10.31.13.224 display
Symmetrix logical device count=19
VNX logical device count=97
=====
--- Host Bus Adapters ---  ---- I/O Paths ----  ----- Stats -----
### HW Path                Summary Total  Dead  IO/Sec Q-IOs Errors
```

```
=====
 1 vmhba1          optimal    140    0    -    0    0
 2 vmhba2          optimal    140    0    -    0    0
=====
```

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

PowerPath/VE post-installation and configuration tasks

After you install, complete the following tasks.

Pre-configuration tasks (optional)

Ensure that you have carried out one of the following before proceeding to the post-installation tasks:

- Disable Lockdown mode before carrying out any management operations related to persistent changes.
- Bypass the rpowermt lockbox.
- Use CIM ticket authentication.

The *PowerPath Family CLI and System Messages Reference Guide* provides information on Bypass the rpowermt lockbox and Use CIM ticket authentication.

Post-installation tasks

- Add hosts to rpowermt lockbox by running the `rpowermt setup add_host` command. 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.
- Change the load-balancing policy by running the `rpowermt set policy` command. After installation, PowerPath/VE selects and sets default optimal policies as appropriate for the storage array. Change the load-balancing policy if required.
- Enable path latency monitoring by running the `rpowermt set path_latency_monitor` command.

Verify the 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.

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

```
# rpowermt display host=10.249.216.11 dev=132
Pseudo name=emcpower132
Symmetrix ID=000196800207
Logical device ID=006D
```

```

Device WWN=60000970000196800207533030303644
Standard UID=naa.60000970000196800207533030303644
type=Conventional; state=alive; policy=SymmOpt; queued-IOs=0
=====
----- Host ----- - Stor - -- I/O Path -- -- Stats ---
### HW Path      I/O Paths  Interf.  Mode   State  Q-IOs  Errors
=====
    1 vmhba3      C0:T14:L28 FA  1e:06  active  alive    0    0
    1 vmhba3      C0:T15:L16 FA  3e:06  active  alive    0    0
    2 vmhba2      C0:T18:L28 FA  1e:06  active  alive    0    0
    2 vmhba2      C0:T19:L16 FA  3e:06  active  alive    0    0

```

If the output 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 68.

2. 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.

Create the rpowermt 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.

Procedure

1. Type a passphrase for the `rpowermt lockbox`.

The passphrase must:

- 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 !).

2. Retype the `rpowermt lockbox` passphrase.
3. Type the vSphere host username.
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.

After you finish

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.

Update the host username and password in the lockbox

Update the vSphere host username and password entry in the lockbox.

Procedure

1. Run the `rpowermt setup update_host` command.
2. Type the vSphere host username.
3. 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.

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 Server 2003:** `C:\Documents and Settings\\My Documents\EMC\PowerPath\rpowermt\lockbox.clb`.
- **Windows Server 2008 and Windows Server 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

Change the lockbox name to `/tmp/pplockbox.clb`

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

Windows

Change the lockbox name to `C:\temp\pplockbox.clb`

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

Disable the lockbox using the environment variable

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

Procedure

- On Linux hosts, type the following command.


```
export PPMT_LB_DISABLE=1
```
- On Windows hosts, perform one of the following steps.
 - Type the following command: `set PPMT_LB_DISABLE=1`
 - Disable the lockbox through the system settings.
 1. Navigate to **Control Panel > System > Advanced System Settings**
 2. Go to **Environment Variables** and then add the environment variable to either User variables or System variables.

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

Bypass the lockbox

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

Procedure

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

Create 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.
2. On the `rpowermt` server, type an `rpowermt` command to add the CIM session ID.

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

```
#rpowermt version host=lclal11
cim_sessionid=525e2427-ce2c-d4ab-d234-2c83abcd1bda
EMC_rpowermt for PowerPath (c) client Version 6.3 (build 105)
EMC PowerPath (c) host=10.224.240.32 Version 6.3 (build 105)
License search path: /etc/emc:/etc/emc/licenses:/opt/EMCpower:/opt/
EMCpower/licenses
Host file: /etc/emc/lockbox/root.clb
[root@dur-ppa-242-162 ~]#
```

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.

About this task

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.

Procedure

- On Linux hosts, type the following command.

```
export PP_LB_LIB=/usr/lib
```

If you receive `Failed to open host file`, set the correct environment variable by typing `PP_LB_LIB=location_of_CST_libraries`. Alternatively, remove the environment variable definition by typing `unset LD_LIBRARY_PATH`. This issue pertains to 339891.

- On Windows hosts, type the following command.

```
PP_LB_LIB=C:\Program Files (x86)\EMC\PowerPath\rpowermt
```


CHAPTER 8

Upgrading the PowerPath/VE components

This chapter describes how to upgrade the PowerPath/VE for VMware vSphere components.

- [Upgrade PowerPath/VE for VMware vSphere](#) 62
- [Upgrade the PowerPath/VE ELMS on Linux using the interactive installation script](#) 62
- [Upgrade the PowerPath/VE ELMS on Linux using the non-interactive installation script](#) 63
- [Upgrade the PowerPath/VE ELMS on Windows using Interactive Installer](#) 64
- [Install or upgrade the PowerPath/VE remote CLI \(rpowermt\) on Linux](#)..... 64
- [Install or upgrade the PowerPath/VE remote CLI \(rpowermt\) on Windows](#)..... 65

Upgrade PowerPath/VE for VMware vSphere

Use this procedure to upgrade PowerPath/VE.

Before you begin

VMware vSphere ESXi 6.0 or later must be installed. If you are using an earlier version of vSphere, upgrade the operating system and then perform the following procedure.

Procedure

1. Upgrade PowerPath/VE as described in [Installing PowerPath/VE for VMware vSphere](#).
2. Restart the host.

Upgrade the PowerPath/VE ELMS on Linux using the interactive installation script

Use this procedure for upgrades of the PowerPath/VE Electronic License Manager System (ELMS) on Linux hosts using the interactive installation script.

Procedure

1. Download the upgrade .zip from DellEMC Online Support.
2. Unzip the PowerPath/VE ELMS package.
3. Untar the PowerPath/VE ELMS package for Linux.

```
tar -xzf DellEMCPower.ELMS.LINUX-11.14.v01.RHEL.x86_64.tgz
```

4. Run the `elms_install.sh` in the `ELMS_LINUX` folder and follow the onscreen instructions.

Perform one of the following steps based on the ELMS version installed (earlier than 11.10 or 11.10 and later). Using the wrong command might result in an error.

- Upgrade from non-rpm based ELMS versions earlier than 11.10.

```
elms_install.sh -s -d
                    location_of_the_old_installation -l
                    absolute_path_to_the_license_file
```

- Upgrade between rpm based ELMS 11.10.x or later.

```
elms_install.sh -s -l
                    absolute_path_to_the_license_file
```

5. Configure and start the PowerPath/VE Electronic License Manager System (ELMS).

```
/etc/init.d/PowerELMS start -l absolute_path_to_license_file
```

Note: For RHEL 7.x and above use `systemctl start PowerELMS` to start the ELMS service.

Where `path_to_license_file` is the path to the folder where the license file is available. The Macrovision FLEXnet documentation provides more information.

```
install-dir/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 the license server, and the number of licenses that have been allocated.

Upgrade the PowerPath/VE ELMS on Linux using the non-interactive installation script

Use this procedure for upgrades of the PowerPath/VE Electronic License Manager System (ELMS) on Linux hosts using the non-interactive installation script.

Procedure

1. Download the upgrade .zip from DellEMC Online Support.
2. Unzip the PowerPath/VE ELMS package.
3. Untar the PowerPath/VE ELMS package for Linux.

```
tar -xzf DellEMCPower.ELMS.LINUX-11.14.v01.RHEL.x86_64.tgz
```

4. Run the `elms_install.sh` in the `ELMS_LINUX` folder and follow the onscreen instructions.

Perform one of the following steps based on the ELMS version installed (earlier than 11.10 or 11.10 and later). Using the wrong command might result in an error.

- Upgrade from non-rpm based ELMS versions earlier than 11.10.

```
elms_install.sh -s -d
                    location_of_the_old_installation -l
                    absolute_path_to_the_license_file
```

- Upgrade between rpm based ELMS 11.10.x or later.

```
elms_install.sh -s -l
                    absolute_path_to_the_license_file
```

5. Configure and start the PowerPath/VE Electronic License Manager System (ELMS).

```
/etc/init.d/PowerELMS start -l absolute_path_to_license_file
```

Note: For RHEL 7.x and above use `systemctl start PowerELMS` to start the ELMS service.

Where *path_to_license_file* is the path to the folder where the license file is available. The Macrovision FLEXnet documentation provides more information.

```
install-dir/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 the license server, and the number of licenses that have been allocated.

Upgrade the PowerPath/VE ELMS on Windows using Interactive Installer

Use this procedure for upgrades of the PowerPath/VE Electronic License Manager System (ELMS) on Windows hosts using the interactive installer. You must have administrative privileges to run the Interactive Installer.

Procedure

1. Download the upgrade .zip from DellEMC Online Support.
2. Unzip the PowerPath/VE ELMS package.
3. Unzip the PowerPath/VE ELMS package for Microsoft Windows.

```
unzip DellEMCPower.ELMS.Windows-11.14.v01.x86_64.zip
```

4. Place the PowerPath/VE ELMS executable for Windows in the `c:\` drive.
5. Double-click the PowerPath/VE ELMS executable to run it.
6. In the **DestinationFolder** window, choose the location for the PowerPath/VE ELMS to be installed.

By default, PowerPath/VE ELMS is installed and configured at `C:\Program Files (x86)\emc\ELMS`.

Results

The **InstallComplete** window indicates installation success or failure.

Install or upgrade the PowerPath/VE remote CLI (rpowermt) on Linux

When you do not use the Virtual Appliance, install the remote CLI.

Before you begin

- 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.

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

- Ensure that you have root privileges before installing RTOOLS. You cannot install the RTOOLS package without root privileges.

Procedure

1. Download the RTOOLS package .zip file from DellEMC Online Support.
2. Unzip the PowerPath/VE RTOOLS package.

3. Install the PowerPath/VE RTOOLS package.

```
# rpm -ivh DellEMCPower.RTOOLS-<version>-
<build>.<architecture>.x86_64.rpm
Preparing... ##### [100%]
--- Installing DellEMCPower.RTOOLS ---
1:DellEMCPower.RTOOLS ##### [100%]
```

Where *version* is the PowerPath version (such as, version 6.4) and *build* is the software build number (such as, build 105). Where *architecture* is RHEL7.x or below.

Install or upgrade the PowerPath/VE remote CLI (rpowermt) on Windows

When you do not use the appliance, install the remote CLI.

Before you begin

- 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.

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

- 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

1. Download the RTOOLS package .zip file from DellEMC Online Support.
2. Unzip the PowerPath/VE RTOOLS package.
3. Double-click on the .exe file.

The PowerPath/VE remote CLI installation install wizard appears.

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

On the installation location screen, the install wizard lists a default folder.
5. Perform one of the following steps:
 - 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**.
 - 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 then 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 (x86)\EMC\PowerPath
\rpowermt**

CHAPTER 9

Managing PowerPath/VE

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

- [Claim rules in PowerPath/VE environment](#)..... 68
- [Configuration changes in PowerPath/VE](#)..... 77
- [Manage PowerPath/VE using the rpowermt commands](#)..... 80

Claim rules in PowerPath/VE environment

PowerPath/VE and VMware NMP can co-exist on the same vSphere host. PowerPath/VE and NMP both supports path management for EMC and many third-party arrays. NMP also supports path management for the arrays that PowerPath/VE does not support. 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, Unity, VNX/VNXe, CLARiiON, Invista, VPLEX, Celerra, XtremIO, Dell Compellent, 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 PowerPath/VE may not support. This is the case with HITACHI and HP array vendors. 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.

Note: Be very familiar with the VMware vStorage APIs for Multipathing framework and take careful consideration before changing claim rules. Refer the VMware command line interface documentation available on VMware website for detailed information.

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

Claim rules are numbered 0–65535. For NMP to claim a Symmetrix VMAX, Unity, VNX/VNXe, CLARiiON, Invista, VPLEX, Celerra, XtremIO, Dell Compellent, or third-party array device, you must add claim rule. The new claim rule number must be between 201 and 250. The PowerPath/VE defaults between 250 and 360. 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.

Table 2 Claim rules

Storage system	Claim rule
Unity, VNX, CLARiiON	MP 250 file vendor PowerPath vendor=DGC model=*
Symmetrix VMAX	MP 260 file vendor PowerPath vendor=EMC model=SYMMETRIX
VPLEX, Invista	MP 270 file vendor PowerPath vendor=EMC model=Invista
Hitachi HDS, USP-V, USP-VM, AMS2x00	MP 280 file vendor PowerPath vendor=HITACHI model=*
HP StorageWorks XP 1000, 12000, 20000, 24000, EVA 5000, EVA 8000, EVA 8100	MP 290 file vendor PowerPath vendor=HP model=*
Compaq EVA 5000	MP 300 file vendor PowerPath vendor=COMPAQ model=HSV111 (C)COMPAQ
VNXe, Celerra	MP 310 file vendor PowerPath vendor=EMC model=Celerra
IBM DS8x00	MP 320 file vendor PowerPath vendor=IBM model=2107900

Table 2 Claim rules (continued)

Storage system	Claim rule
IBM XIV	MP 330 file vendor PowerPath vendor=IBM model=2810XIV
XtremIO	MP 340 file vendor PowerPath vendor=XtremIO model=XtremApp
NetApp	MP 350 file vendor PowerPath vendor=NETAPP model=*
Dell Compellent	MP 360 file vendor PowerPath vendor=COMPELNT model=Compellent Vol
VMAX LUNZ	MP 370 file vendor PowerPath vendor=EMC model=VMAXLUNZ

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

List the claim rules

Use the VMware `esxcli` command at the SSH or command prompt to list the current set of claim rules.

The following output is the claim rule list as it exists after PowerPath/VE installation.

```

~ # esxcli storage core claimrule list
Rule Class Rule Class Type Plugin Matches
-----
MP 0 runtime transport NMP transport=usb
MP 1 runtime transport NMP transport=sata
MP 2 runtime transport NMP transport=ide
MP 3 runtime transport NMP transport=block
MP 4 runtime transport NMP transport=unknown
MP 101 runtime vendor MASK_PATH vendor=DELL model=Universal Xport
MP 101 file vendor MASK_PATH vendor=DELL model=Universal Xport
MP 250 runtime vendor PowerPath vendor=DGC model=*
MP 250 file vendor PowerPath vendor=DGC model=*
MP 260 runtime vendor PowerPath vendor=EMC model=SYMMETRIX
MP 260 file vendor PowerPath vendor=EMC model=SYMMETRIX
MP 270 runtime vendor PowerPath vendor=EMC model=Invista
MP 270 file vendor PowerPath vendor=EMC model=Invista
MP 280 runtime vendor PowerPath vendor=HITACHI model=*
MP 280 file vendor PowerPath vendor=HITACHI model=*
MP 290 runtime vendor PowerPath vendor=HP model=*
MP 290 file vendor PowerPath vendor=HP model=*
MP 300 runtime vendor PowerPath vendor=COMPAQ model=HSV111
(C) COMPAQ
MP 300 file vendor PowerPath vendor=COMPAQ model=HSV111
(C) COMPAQ
MP 310 runtime vendor PowerPath vendor=EMC model=Celerra
MP 310 file vendor PowerPath vendor=EMC model=Celerra
MP 320 runtime vendor PowerPath vendor=IBM model=2107900
MP 320 file vendor PowerPath vendor=IBM model=2107900
MP 330 runtime vendor PowerPath vendor=IBM model=2810XIV
MP 330 file vendor PowerPath vendor=IBM model=2810XIV
MP 340 runtime vendor PowerPath vendor=XtremIO model=XtremApp
MP 340 file vendor PowerPath vendor=XtremIO model=XtremApp
MP 350 runtime vendor PowerPath vendor=NETAPP model=*
MP 350 file vendor PowerPath vendor=NETAPP model=*
MP 360 runtime vendor PowerPath vendor=COMPELNT model=Compellent

```

```
Vol  false  false  0
MP      360  file    vendor    PowerPath  vendor=COMPELNT model=Compellent
Vol  false  false  0
MP      65535 runtime vendor    NMP        vendor=* model=*
MP      370  runtime vendor    PowerPath  vendor=EMC model=VMAXLUNZ false
false  0
MP      370  file    vendor    PowerPath  vendor=EMC model=VMAXLUNZ false
false  0
~ #
```

where:

- Rule is the claim rule number that corresponds to the device being managed.
- Class is the status of the claim rule. The claim rule has been added persistently. *Runtime* means that the claim rule has been fully loaded into vSphere memory.
- Type is the type of claim or unclaim operation to perform. Valid values include: transport, vendor.
- Plugin is the plugin that is managing the device. Valid values include: NMP, PowerPath.
- Matches is the criteria that are selected to be applied the devices by the claim rule.

Add a claim rule

Complete the following procedure to add a claim rule. The VMware documentation provides more information.

Procedure

1. Identify the device for which you want to add the claim rule.

```
esxcli-mpath --server IP_addr_of_vSphere_server -L
```

The `esxcli-mpath` command manages the multipathing modules loaded on a 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 appears 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 ensures 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 appears 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. Identify the device number associated with the device you want to place under NMP control.

```
esxcfg-mpath --server IP_addr_of_vSphere_server -L
```

- 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. 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 a 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. Identify the device you want to place under NMP control.

```
# esxcfg-mpath --server IP_addr_of_vSphere_server -L
vmhba1:C0:T0:L57 state:active naa.6006016029a11e0048d2fa3437a4dd11
vmhba1 0 0 57
PowerPath active san fc.2000001b3210fe3d:2100001b3210fe3d
fc.50060160c1e0a2c5:5006016841e0a2c5

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 devices 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
# 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
Rule Class Type Plugin Matches
MP 0 runtime transport NMP transport=usb
MP 1 runtime transport NMP transport=sata
MP 2 runtime transport NMP transport=ide
MP 3 runtime transport NMP transport=block
MP 4 runtime transport NMP transport=unknown
MP 101 runtime vendor MASK_PATH vendor=DELL model=Universal Xport
MP 202 file location NMP adapter=vmhba1 channel=0 target=0
```

```
lun=57
MP 203 file      location  NMP          adapter=vmhba3 channel=0 target=0
lun=57
```

4. Load the claim rule.

```
esxcli --server IP_address_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
Rule  Class  Type      Plugin  Matches
MP 0   runtime transport NMP      transport=usb
MP 1   runtime transport NMP      transport=sata
MP 2   runtime transport NMP      transport=ide
MP 3   runtime transport NMP      transport=block
MP 4   runtime transport NMP      transport=unknown
MP 101 runtime vendor   MASK_PATH vendor=DELL model=Universal Xport
MP 202 runtime location NMP      adapter=vmhba1 channel=0 target=0
lun=57
MP 202 file      location NMP      adapter=vmhba1 channel=0 target=0
lun=57
MP 203 runtime location NMP      adapter=vmhba3 channel=0 target=0
lun=57
MP 203 file      location NMP      adapter=vmhba3 channel=0 target=0
lun=57
```

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. Identify the device number associated with the device.

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

```
esxcli --server IP_addr_of_vSphere_server storage core claiming unclaim
--type=device --device=naa.6006016029a11e0047d2fa3437a4dd11
```

7. Run the claim rule.

```
esxcli --server IP_addr_of_vSphere_server storage core claimrule run
```

8. Verify that the device is under NMP control.

```
# esxcfg-mpath --server IP_addr_of_vSphere_server -L
vmhba1:C0:T0:L57 state:active naa.6006016029a11e0047d2fa3437a4dd11
vmhba1 0 0 57 NMP active san fc.2000001b3210553a:2100001b3210553a
fc.50060160c1e0a2c5:5006016041e0a2c5
```

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

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. Identify the device you want to place under NMP control.

```
# esxcfg-mpath --server IP_addr_of_vSphere_server -L
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.2000001b3210553a:2100001b3210553a
fc.50060160c1e0a2c5:5006016041e0a2c5

vmhba3:C0:T1:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11
vmhba3 0 1 55
PowerPath active san fc.2000001b3210553a:2100001b3210553a
fc.50060160c1e0a2c5:5006016941e0a2c5
```

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

```
# 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
--type="location" --rule=206 --plugin="NMP" --adapter=vmhba1 --
channel=0 --target=0 --lun=55
# esxcli --server IP_addr_of_vSphere_server storage core claimrule add
--type="location" --rule=207 --plugin="NMP" --adapter=vmhba3 --
channel=0 --target=1 --lun=55
```

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
Rule Class Type Plugin Matches
MP 0 runtime transport NMP transport=usb
MP 1 runtime transport NMP transport=sata
MP 2 runtime transport NMP transport=ide
MP 3 runtime transport NMP transport=block
MP 4 runtime transport NMP transport=unknown
MP 101 runtime vendor MASK_PATH vendor=DELL model=Universal Xport
MP 204 file location NMP adapter=vmhba1 channel=0 target=0
lun=55
```

```
MP 205 file location NMP adapter=vmhba1 channel=0 target=1
lun=55
MP 206 file location NMP adapter=vmhba3 channel=0 target=0
lun=55
MP 207 file location NMP adapter=vmhba3 channel=0 target=1
lun=55
```

4. Load the claim rule.

```
esxcli --server IP_address_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
Rule Class Type Plugin Matches
MP 0 runtime transport NMP transport=usb
MP 1 runtime transport NMP transport=sata
MP 2 runtime transport NMP transport=ide
MP 3 runtime transport NMP transport=block
MP 4 runtime transport NMP transport=unknown
MP 101 runtime vendor MASK_PATH vendor=DELL model=Universal Xport
MP 204 runtime location NMP adapter=vmhba1 channel=0 target=0
lun=55
MP 204 file location NMP adapter=vmhba1 channel=0 target=0
lun=55
MP 205 runtime location NMP adapter=vmhba1 channel=0 target=1
lun=55
MP 205 file location NMP adapter=vmhba1 channel=0 target=1
lun=55
MP 206 runtime location NMP adapter=vmhba3 channel=0 target=0
lun=55
MP 206 file location NMP adapter=vmhba3 channel=0 target=0
lun=55
MP 207 runtime location NMP adapter=vmhba3 channel=0 target=1
lun=55
MP 207 file location NMP adapter=vmhba3 channel=0 target=1
lun=55
```

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. Identify the device number associated with the device.

```
# esxcli --server IP_addr_of_vSphere_server storage core claiming
unclaim esxcfg-mpath --server IP_addr_of_vSphere_server -L
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.2000001b3210553a:2100001b3210553a
fc.50060160c1e0a2c5:5006016041e0a2c5

vmhba3:C0:T1:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11
vmhba3 0 1 55
PowerPath active san fc.2000001b3210553a:2100001b3210553a
fc.50060160c1e0a2c5:5006016941e0a2c5
```

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

- b. Unclaim the device using the device number.

```
esxcli --server IP_addr_of_vSphere_server storage core claiming unclaim
--type=device --device=naa.6006016029a11e0047d2fa3437a4dd11
```

7. Run the claim rule.

```
esxcli --server IP_addr_of_vSphere_server storage core claimrule run
```

8. Verify that the device is under NMP control.

```
# esxcfg-mpath --server IP_addr_of_vSphere_server -L
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.2000001b3210553a:2100001b3210553a
fc.50060160c1e0a2c5:5006016041e0a2c5

vmhba3:C0:T1:L55 state:active naa.6006016029a11e0046d2fa3437a4dd11
vmhba3 0 1 55
NMP active san fc.2000001b3210553a:2100001b3210553a
fc.50060160c1e0a2c5:5006016941e0a2c5
```

The device is indicated as `NMP active`.

Reclaim devices by NMP

Complete the following procedure to reclaim devices by NMP. The VMware documentation provides more information.

Procedure

1. Reclaim an adapter, channel, target, and LUN by NMP.

```
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.

2. Load the claim rule.

```
esxcli --server IP_address_of_vSphere_server storage core claimrule load
```

3. Restart the host.

Renumber 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 `esxcli storage core claimrule move` command.

Procedure

1. List the claim rules.

```
esxcli --server IP_addr_of_vSphere_server storage core claimrule list
```

2. Move the claim rule from one rule ID to another.

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

```
# 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
```

3. Load the claim rule.

```
esxcli --server IP_address_of_vSphere_server storage core claimrule load
```

4. Run the claim rule.

```
esxcli --server IP_addr_of_vSphere_server storage core claimrule run
```

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
Rule Class Rule Class Type Plugin Matches
-----
MP 0 runtime transport NMP transport=usb
MP 1 runtime transport NMP transport=sata
MP 2 runtime transport NMP transport=ide
MP 3 runtime transport NMP transport=block
MP 4 runtime transport NMP transport=unknown
MP 101 runtime vendor MASK_PATH vendor=DELL model=Universal
Xport
MP 101 file vendor MASK_PATH vendor=DELL model=Universal
Xport
MP 250 runtime vendor PowerPath vendor=DGC model=*
MP 250 file vendor PowerPath vendor=DGC model=*
MP 260 runtime vendor PowerPath vendor=EMC model=SYMMETRIX
MP 260 file vendor PowerPath vendor=EMC model=SYMMETRIX
MP 270 runtime vendor PowerPath vendor=EMC model=Invista
MP 270 file vendor PowerPath vendor=EMC model=Invista
MP 280 runtime vendor PowerPath vendor=HITACHI model=*
MP 280 file vendor PowerPath vendor=HITACHI model=*
MP 290 runtime vendor PowerPath vendor=HP model=*
MP 290 file vendor PowerPath vendor=HP model=*
MP 300 runtime vendor PowerPath vendor=COMPAQ model=HSV111
(C) COMPAQ
MP 300 file vendor PowerPath vendor=COMPAQ model=HSV111
(C) COMPAQ
MP 310 runtime vendor PowerPath vendor=EMC model=Celerra
MP 310 file vendor PowerPath vendor=EMC model=Celerra
MP 320 runtime vendor PowerPath vendor=IBM model=2107900
MP 320 file vendor PowerPath vendor=IBM model=2107900
MP 330 runtime vendor PowerPath vendor=IBM model=2810XIV
MP 330 file vendor PowerPath vendor=IBM model=2810XIV
MP 340 runtime vendor PowerPath vendor=XtremIO model=XtremApp
```

```

MP 340 file vendor PowerPath vendor=XtremIO model=XtremApp
MP 350 runtime vendor PowerPath vendor=NETAPP model=*
MP 350 file vendor PowerPath vendor=NETAPP model=*
MP 65535 runtime vendor NMP vendor=* model=*
~ #

```

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.

Add new paths to PowerPath/VE logical device

Add new paths to a logical device already configured with at least one path in PowerPath/VE.

About this task

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

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. Confirm the current configuration.


```
rpowermt host=IP_addr_of_vSphere_server display
```
2. Confirm the configuration of the logical device(s) to which new paths will be added.


```
rpowermt host=IP_addr_of_vSphere_server display dev=all
```

Ensure that the number of logical devices, hardware paths, and I/O paths are as expected. The path state should be alive for known good paths and dead for known bad paths.
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, perform one of the following steps.

- Rescan paths on an HBA to discover new storage devices.

```
esxcfg-rescan --server IP_addr_of_vSphere_server vmhba#
```

- In the vSphere Client, navigate to **Configuration > Storage adapters** and then click **Rescan**.
6. Inspect the new PowerPath/VE configuration.
 - a. Confirm that the new paths display with a state of alive.


```
rpowermt host=IP_addr_of_vSphere_server display dev=all
```
 - b. Test all paths.


```
rpowermt host=IP_addr_of_vSphere_server restore
```
 - c. Scan operating system error logs to ensure no errors are logged against the new paths.

Add new logical devices to a configuration

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

About this task

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. Confirm the current configuration.


```
rpowermt host=IP_addr_of_vSphere_server display
```
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 new paths so that PowerPath/VE can then recognize the new paths, perform one of the following steps.
 - Rescan paths on an HBA to discover new storage devices.

```
esxcfg-rescan --server IP_addr_of_vSphere_server vmhba#
```

- In the vSphere Client, navigate to **Configuration > Storage adapters** and then click **Rescan**.
5. Inspect the new PowerPath/VE configuration.
 - a. Confirm that the new paths display with a state of alive.


```
rpowermt host=IP_addr_of_vSphere_server display dev=all
```
 - b. Test all paths.

```
rpowermt host=IP_addr_of_vSphere_server restore
```

- c. Scan operating system error logs to ensure no errors are logged against the new paths.
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

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.

Remove the HBA

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

Procedure

- Run the `esxcfg-rescan` command.

```
esxcfg-rescan --server IP_addr_of_vSphere_server
vmhba#
```

- In the vSphere Client, navigate to **Configuration > Storage adapters**, and then click **Rescan** to remove the dead paths from PowerPath/VE.

Results

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

Remove the logical device

Remove the logical device in case of array maintenance or after migration to a new array.

Procedure

- PowerPath does not have specific steps to remove the logical device. Follow the procedure documented in VMware Knowledge Base article [2004605](#) to remove logical devices.

Alternate procedure to remove logical device

Procedure

1. Use the procedure in [Claim rules and definitions](#) 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. Perform one of the following steps:
 - Run `esxcfg-rescan vmhba#` to all HBAs to remove the dead paths from NMP.
 - In the vSphere Client, navigate to **Configuration > Storage adapters** and then click **Rescan** to remove the dead paths from NMP.

4. Inspect the new PowerPath/VE configuration:
 - a. Run `rpowermt host=IP_addr_of_the_vSphere_server display`
 The output should show fewer total paths than before. All paths should have a state of optimal.
 - b. Run `rpowermt host=IP_addr_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.

Configure 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 the rpowermt commands

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

The *PowerPath Family CLI and System Messages Reference 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`

To remove dead paths, run the VMware `esxcfg-rescan vmhba# native` command. The rescan can be done using vSphere Client. In the vSphere Client, navigate to **Configuration > Storage adapter** .

`powermt manage`

Use VMware `esxcli storage core claimrule add native` command and associated procedures.

`powermt unmanage`

Use VMware `esxcli storage core claiming unclaim native` command and associated procedures.

CHAPTER 10

Removing the PowerPath/VE components

This chapter discusses removing the PowerPath/VE for VMware vSphere components.

- [Remove the PowerPath/VE package using vCLI](#) 82
- [Remove the PowerPath/VE ELMS on Linux](#) 82
- [Remove the PowerPath/VE ELMS on Windows](#) 83
- [Remove PowerPath/VE rpowermt](#) 84

Remove the PowerPath/VE package 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. Confirm the packages that are installed on the vSphere host.

```
# esxcli -s IP_address_or_hostname software vib list
powerpath.cim.esx      6.x.x.xx.xx-<build>  EMC  PartnerSupported  <date>
powerpath.lib.esx     6.x.x.xx.xx-<build>  EMC  PartnerSupported  <date>
powerpath.plugin.esx  6.x.x.xx.xx-<build>  EMC  PartnerSupported  <date>
```

2. Remove the PowerPath/VE package. The removal may take a few minutes.

```
esxcli -s IP_address_or_hostname software vib remove -n powerpath.cim.esx
-n powerpath.plugin.esx -n powerpath.lib.esx
```

For example,

```
The update completed successfully, but the system needs to be rebooted
for the changes to be effective.
Reboot Required: true
VIBs Installed:

VIBs Removed: DelleMC_bootbank_powerpath.cim.esx_6.x.x.xx.xx-<build>,
DelleMC_bootbank_powerpath.lib.esx_6.x.x.xx.xx-<build>,
DelleMC_bootbank_powerpath.plugin.esx_6.x.x.xx.xx-<build>
VIBs Skipped:
```

3. Bring the vSphere host into Maintenance mode.
4. Restart the vSphere host.
5. Bring the vSphere host out of Maintenance mode.

Remove the PowerPath/VE ELMS on Linux

All license server binaries are deleted with uninstallation of the PowerPath/VE Electronic License Manager System (ELMS) package.

About this task

All other non-license server files and binaries, including the served license file, are retained in the existing directory.

Procedure

1. Run the `elms_uninstall.sh` script file in the `ELMS_LINUX` directory to stop and uninstall the PowerPath/VE ELMS.

```
./elms_uninstall.sh
```

2. Verify that PowerPath/VE ELMS is removed.

```
rpm -qa | grep ELMS
```

Results

The PowerPath/VE ELMS is not listed among the available programs.

Remove the PowerPath/VE ELMS on Windows

You can remove the PowerPath/VE Electronic License Manager System (ELMS) using one of the following three methods.

- Interactive uninstallation
- Add/Remove programs
- CLI uninstallation

All license server binaries (Imgrd.exe, Imutil.exe, Imtools.exe, and EMCLM.exe) are deleted with uninstallation of the PowerPath/VE ELMS package. All other non-license server files and binaries, including the served license file, are retained in the existing directory.

Remove the PowerPath/VE ELMS using interactive uninstallation

Complete the following procedure to remove the Electronic License Manager System (ELMS).

Procedure

1. Double-click the PowerPath/VE ELMS executable for Windows to start the installer.
2. In **Program Maintenance**, select **Remove**.
3. Verify that PowerPath/VE ELMS is removed by navigating to **Programs > Start**.

The PowerPath/VE ELMS is not listed among the available programs.

Remove the PowerPath/VE ELMS using Add/Remove Programs

Complete the following procedure to remove the Electronic License Manager System (ELMS).

Procedure

1. From the list of installed programs, select the entry for the PowerPath/VE ELMS package.
For example, PowerPath ELMS 11.12.v01.
2. Click **Uninstall**.
3. Verify that PowerPath/VE ELMS is removed by navigating to **Programs > Start**.

The PowerPath/VE ELMS is not listed among the available programs.

Remove the PowerPath/VE ELMS using CLI uninstallation

Complete the following procedure to remove the Electronic License Manager System (ELMS).

Procedure

1. Remove the ELMS using the CLI.

```
setup.exe /s /v" /q /l*v path_to_log_file REMOVE=ALL
```

Where *setup.exe* is the name of the PowerPath/VE ELMS package and *path_to_log_file* is the absolute customized path to the uninstall log file.

2. Verify that PowerPath/VE ELMS is removed by navigating to **Programs > Start**.

The PowerPath/VE ELMS is not listed among the available programs.

Remove PowerPath/VE rpowermt

This section discusses removing the rpowermt package, called RTOOLS, from the rpowermt server. This section does not apply to the Dell EMC PowerPath Management Appliance.

Remove PowerPath/VE rpowermt from Linux

Complete the following procedure to remove rpowermt.

Before you begin

Log in as root.

Procedure

1. Display the package name.

```
# rpm -qa | grep EMCPower.RTOOLS  
DellEMCPower.RTOOLS-<version>-<build>.<architecture>.x86_64.rpm
```

2. Remove the PowerPath/VE rpowermt software.

```
# rpm -e DellEMCPower.RTOOLS-<version>-<build>.<architecture>.x86_64.rpm
```

Remove PowerPath/VE rpowermt from Windows

Complete the following procedure to remove rpowermt.

Procedure

1. Navigate to **Programs and Features > EMC PowerPath Remote Tools**.
2. Click **Uninstall**.

Results

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

CHAPTER 11

Troubleshooting PowerPath/VE Installation

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

- [Resolve PowerPath/VE ELMS TCP port conflicts](#).....86
- [Modify the vendor daemon port number](#).....87
- [Modify the vendor daemon search path](#)..... 87
- [Remove incompatible versions of the rpowermt lockbox](#)..... 87
- [Collect logs from vCenter server or vSphere client after an issue](#)..... 88
- [Shutdown or stop the license server](#)..... 88
- [Start the license server](#)..... 89
- [PowerPath/VE ELMS Installer FAQ](#) 89

Resolve PowerPath/VE ELMS TCP port conflicts

If you have two PowerPath/VE Electronic License Manager System (ELMS) running on the same host and they are using the same default TCP port, you receive the `Warning: Failed to get a license from the server. error message.`

About this task

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 PowerPath/VE ELMS and the PowerPath/VE license configuration file that resides on the powermt 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 Licensing Service Center 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 \
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"
```

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 a 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 PowerPath/VE 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 \
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"
```

2. Reread the license file on the PowerPath/VE ELMS.
3. Register the vSphere host using the `rpowermt register` command.

Modify the 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.

```
VENDOR EMCLM PORT=port
```

Modify the 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.

About this task

Any fields that you modify in the license file must also be modified in the `rpowermt` license configuration file. Copy the contents of the license file into the `.lic` file to be used as the `rpowermt` license configuration file.

Procedure

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

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.

Remove incompatible versions of the rpowermt lockbox

If you use incompatible versions of the `rpowermt` lockbox the `failed to open host file` error message displays.

About this task

`rpowermt` version 6.1 and below lock are not forward compatible with the latest version. RTOOLS forward compatibility starts from PowerPath RTOOLS version 6.2 onwards. However, some of the features and commands that will be introduced in the future version of PowerPath/VE will not be supported with older version of RTOOLS.

Procedure

1. Verify the version that you have on the host.

```
# rpowermt version
DellEMC rpowermt for PowerPath (c) client Version 6.4(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 the rpowermt lockbox file.
3. Set up the same version of rpowermt lockbox as PowerPath/VE that you are running on your host.

Collect logs from vCenter server or vSphere client after an issue

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 select **File > Export System Logs**.
For vSphere Center Server, select the vSphere host from which you want to collect the log.
2. Choose the location where you want to save the logs. 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

Run Grab with VMware vSphere support.

- See [emc278043](#) for information on running Grab with VMware vSphere support.
- Submit the generated tar file, along with any other supporting material, to your Customer Support Representative.

Log file location

Use log files to check trace messages from various applications and to debug.

The logs can be found in the following locations:

- The installation log is located in `/var/run/log/esxupdate.log`
- The kernel log is located in `/var/run/log/vmkernel.log`

Shutdown or stop the license server

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

Use the `lmdown` utility or on the **Start/Stop/Reread** tab, click **Stop Server**.

Start the license server

Use the following procedures to start the license server manager.

Start the license server manager using the `lmgrd` utility

Use the `lmgrd` utility to start the license server manager.

Procedure

1. Navigate to the directory where you installed the License Server Manager.
2. Start the license server manager.

```
lmgrd -c license_file_list -l [+]debug_log_path
```

where:

- `license_file_list` is the full path to a single served license file or 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.
- `debug_log_path` is the full path to the debug log file. Prepending the debug log file name with the + character appends logging entries to the log.

The Macrovision FLEXnet documentation provides more information.

Start the license server manager using the `lmttools` utility

Use the `lmttools` utility to start the license server manager.

Procedure

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

Output similar to the following appears: `Server Start Successful`

PowerPath/VE ELMS Installer FAQ

This section addresses frequently asked questions regarding the installation or upgrade to the PowerPath/VE Electronic License Manager System (ELMS) installer.

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

This is an expected behavior on some Windows 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.

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

On Linux hosts, start the ELMS service with the license parameter after the installation.

```
# /etc/init.d/PowerELMS start -l absolute_path_to_the_license_file
```

 **Note:** For RHEL 7.x and above use `systemctl start PowerELMS` to start the ELMS service.

On Windows hosts, 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, type the license file path. The service then starts successfully.

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

By design on Windows, the `Repair` option is available only on re-running the installer and not in `Add/Remove programs`.

The PowerPath/VE ELMS files are already configured manually on the host. Should the installer be still used to re-install the files?

On 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.

In case of upgrade, what happens if PowerPath/VE ELMS files are installed in the default location or to a location different from that where previous Flexera 11.x files are configured?

On Linux hosts, the currently running license server has to be stopped manually and the new PowerPath/VE ELMS service has to be started with the path to license file.

```
# /etc/init.d/PowerELMS start -l license_search_path
```

Note: For RHEL 7.x and above use `systemctl start PowerELMS` to start the ELMS service.

On 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).

Is silent upgrade (from CLI) supported?

On Windows hosts, silent upgrade is not supported on PowerPath/VE ELMS. Upgrade only through GUI (Interactive Installation).

What should I do if I hit Cancel during uninstallation?

Do not click **Cancel** during uninstallation. If you do, perform the following steps:

1. Check the status of the license server from PowerPath/VE 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.
3. Reinstall the PowerPath/VE ELMS package.

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

On Linux hosts, start the service manually.

```
# /etc/init.d/PowerELMS start -l license_search_path
```

Note: For RHEL 7.x and above use `systemctl start PowerELMS` to start the ELMS service.

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

On Linux hosts, these files 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](#)..... 92

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.

- /etc/init.d/PowerPathCIMConfig.sh
- /opt/emc/cim/db/
- /opt/emc/cim/EMCProvider.conf
- /opt/emc/cim/lib/libstdc++.so.6.0.8
- /opt/emc/cim/lib/libstdc++.so
- /opt/emc/cim/lib/license.txt
- /opt/emc/cim/log/
- /opt/emc/powerpath/bin/powermt
- /opt/emc/powerpath/EULA.txt
- /usr/lib/cim/libemcp_mpapi_rtl.so
- /usr/lib/cim/libemcp_serv_rtl.so
- /usr/lib/cim/libEmcOf14.so
- /usr/lib/cim/libEmcOs1s4Api.so
- /usr/lib/cim/libEmcOs1s4sehost.so
- /usr/lib/cim/libsyminqapi.so
- /usr/lib/cim/libsm_clsapi.so
- /usr/lib/cim/libEmcOs1s4CMPI.so
- /usr/lib/cim/libsm_sms.so
- /usr/lib/cim/libEmcOs1s4Apisehost.so
- /usr/libexec/jumpstart/plugins/register-emc-powerpath.json
- /usr/lib/vmware/vmkmod/emcp

APPENDIX B

PowerPath/VE Overview

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

- [PowerPath/VE for VMware vSphere platform](#)..... 94
- [Technical differences between PowerPath/VE and PowerPath](#)..... 95
- [PowerPath/VE for VMware vSphere licensing](#)..... 96

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 reconfiguration as workloads change.

NetApp Report SCSI Name String Inquiry Descriptor setting

PowerPath reports NetApp ID in the `rpowermt` output and in the 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.

- Check the current value of the setting using the following NetApp command.

```
igroup show -v igroup_name
```

For example,

```
system1> igroup show -v
fcplnx (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
```

- Enable `report_scsi_name` using the following NetApp command.

```
igroup set igroup_name report_scsi_name yes
```

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 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 between PowerPath/VE and PowerPath

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

- PowerPath/VE supports Electronic License Manager System (ELMS). The `rpowermt` server stores unserved license information. For served licenses, PowerPath/VE uses a license server to manage license information.

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

- PowerPath/VE supports a virtual appliance bundle. The appliance bundle includes an OVA descriptor file with the following pre-installed for automatic installation:
 - SLES 12 SP1 OS required for use with the virtual appliance
 - PowerPath/VE Electronic License Manager System (ELMS) package required for use with served licensing
 - The SLES RTOOLS package

The Appliance bundle also includes the following packages for manual installation: PowerPath/VE ELMS and the Windows and Red Hat Enterprise Linux (RHEL) RTOOLS packages

Served electronic license management is carried out through the `rpowermt` commands.

- 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 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 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 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 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 has a different installation process from PowerPath on other supported platforms. It is a multi-task installation process that includes additional steps depending on whether you use served or unserved licenses.

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/VE 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.

PowerPath/VE for VMware vSphere licensing

A PowerPath/VE license grants you the right to use the PowerPath load-balancing and failover functionalities on a vSphere host. A single license enables all supported PowerPath/VE for VMware vSphere functionality.

You cannot use a license from a PowerPath platform other than PowerPath/VE 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 You license model at the time of ordering PowerPath/VE software.

- The served licensing model uses the PowerPath/VE Electronic License Manager System (ELMS) to store, distribute, and manage PowerPath/VE licenses.
- The unserved licensing model does not use a license server. Rather, the PowerPath/VE license is stored on the remote (`rpowermt`) PowerPath/VE server. An unserved license is bound to a specific vSphere host and is only valid for that vSphere host.
- 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.

Permanent

A license that never expires. When you purchase a PowerPath/VE license for a vSphere host, that license is permanent. You can use PowerPath/VE on that vSphere host indefinitely.

Expiring

A license that expires on a specified date. After the expiration date, the license is no longer valid. PowerPath/VE functionality is no longer available on the vSphere host. Evaluation (or trial) licenses are expiring licenses that typically are valid for 45 days.

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:

```
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:

```
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 is 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 DellEMC Online Support.

A PowerPath/VE license is distributed in a plaintext file with a name that ends with the `.lic` extension. The license file contains all site-specific information required to enable licensing.

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 DellEMC Online Support.

To do this, log into DellEMC Online Support, 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.

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 DellEMC 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

If you do not have an DellEMC Online Support account, follow the New member registration steps to create your account.

Before you begin

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

- From DellEMC Online Support, navigate to **Support > Product Registration and Licenses**.

The following lists the transactions that you can perform at the Licensing Service Center.

Obtain

Request a license file using your license authorization code.

Move (Rehost)

In a served licensing environment, move the PowerPath/VE Electronic License Manager System (ELMS) software to a new host. In an unserved licensing environment, move a PowerPath/VE license from its current vSphere host to a new vSphere host.

Obtain additional licenses

In a served licensing environment, obtain additional licenses for a LAC.

View entitlements

In a served licensing environment, check how many licenses are used.

Served licensing

In a served licensing environment, the PowerPath/VE Electronic License Manager System (ELMS) distributes PowerPath/VE licenses to vSphere hosts. You install the license configuration file on the PowerPath/VE ELMS and it manages the licenses for all the PowerPath/VE hosts for which the license was generated.

The PowerPath/VE 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 PowerPath/VE ELMS accepts license requests from an rpowermt server on behalf of a vSphere host and passes that request to the EMC vendor daemon. PowerPath/VE provides support for the 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 provides higher availability. If a vSphere host fails, its license can be redistributed to another vSphere host. If the PowerPath/VE ELMS fails, you can move, or rehost all served licenses to a different PowerPath/VE 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 PowerPath/VE ELMS. If you use the PowerPath Management Appliance, PowerPath/VE ELMS installation and configuration is automatic with the PowerPath Management Appliance deployment.

PowerPath/VE ELMS licensing software

PowerPath/VE licensing is built on the Flexera licensing software developed by Flexera Software.

The PowerPath/VE Electronic License Manager System (ELMS) accepts license requests from an rpowermt server on behalf of a vSphere 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 PowerPath/VE Electronic License Manager System (ELMS) for a PowerPath/VE environment.

Note that, once a vSphere host has registered a license, it has no dependency on the PowerPath/VE ELMS. If the PowerPath/VE ELMS is unavailable for any reason, the vSphere host can continue to use PowerPath/VE multipathing.

Overdraft

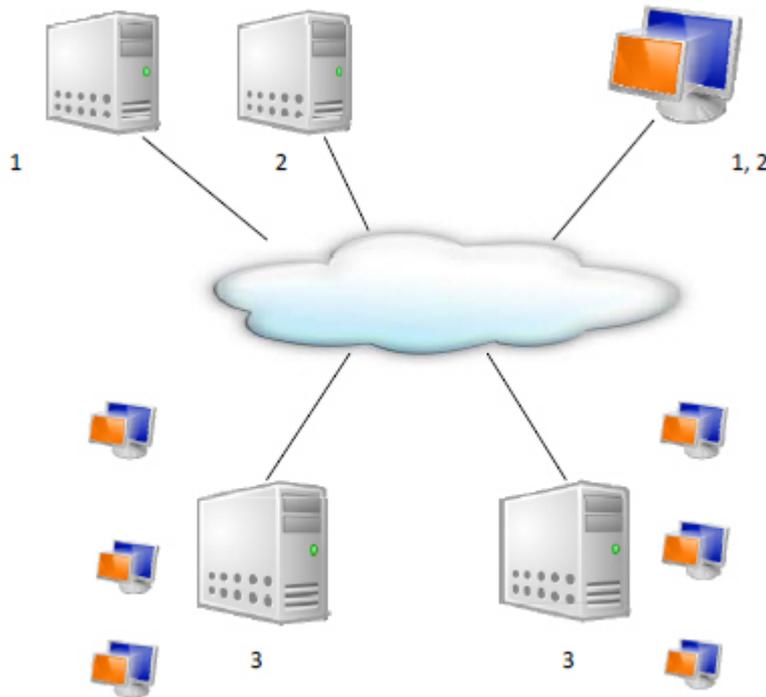
An overdraft allows you additional licenses in excess of the quantity of licenses you actually purchased.

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 your Customer Support Representative.

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. PowerPath/VE Electronic License Manager System (ELMS).
The graphic depicts the PowerPath Management Appliance. The virtual appliance is a VM that contains the rpowermt server and PowerPath/VE ELMS which are automatically installed upon deployment of the virtual appliance. You use either the virtual appliance with rpowermt server and PowerPath/VE ELMS installed automatically or the separate rpowermt server and PowerPath/VE ELMS.
3. VMware vSphere hosts with PowerPath/VE multipathing software installed on them and various VMs as applicable.

In the environment shown in the graphic, the PowerPath/VE 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.

PowerPath/VE Electronic License Manager System (ELMS)

The PowerPath/VE ELMS is a machine that runs the license manager software. The license server has the following components:

- Imgrd, 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.

- 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 Licensing Service Center.
- lmutil, the license manager management utility, which provides basic license management commands.
- lmttools, the license manager GUI (Windows only) used to manage the license server manager (lmgrd) and EMC vendor daemon (EMCLM) in a served licensing environment.

rpowermt servers

The rpowermt server is a machine on which the PowerPath/VE remote multipathing CLI (rpowermt) is installed. The rpowermt server must be able to communicate with the license server and all vSphere hosts in the environment. 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.

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.

The license file indicates PowerPath MP EMCLM 5.4 because the PowerPath/VE license is not tied to a product version number. For valid PowerPath/VE product, the license file indicates 5.4 license.

PowerPath/VE ELMS provides the lmutil and lmttools utilities to manage a license server.

Example 1 Served license file

```
SERVER <server> INTERNET=<ip_addr> 27010
VENDOR EMCLM
USE SERVER
INCREMENT PowerPathMP EMCLM 5.4 10-mar-2015 5 OVERDRAFT=1
ISSUER=EMC \
        ISSUED=10-Feb-2015 TS_OK SIGN="00B6 4332 27AC 042A A2C2
613F \
        8507 7600 3DF0 03F1 245C 919D 09BA 1393 0550"
```

SERVER

Specifies the host, IP address, and TCP port number for the license server.

- host: you can edit the host field without affecting the signature of the license file. This field is validated against the IP address of the Electronic License Manager System (ELMS).
- IP address: Preceded by the keyword INTERNET=. Do not modify this field; doing so will invalidate the license file. This field is protected by the signature of the license file.

- port: 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.

VENDOR

Specifies the vendor, vendor daemon path, and vendor daemon TCP port number. The default is 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.

- vendor daemon path: 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, Imgrd looks for the vendor daemon binary in:
 - the current directory
 - the path specified in *Imgrd's \$PATH* environment variable
 - in the directory where Imgrd is located

If vendor_daemon_path is blank, then any options or TCP port number specifications require the PORT= string. Note that you can edit the vendor daemon path field without affecting the signature of the license file.

- port: 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

INCREMENT

Indicates:

- the product being licensed.
- when the license expires. If the expiration date is listed as permanent, the license never expires.
- number of available licenses.

OVERDRAFT

Number of overdraft (or reserve) licenses available.

ISSUER

Company that issued the license. For PowerPath/VE, this is always EMC.

ISSUED

Date that the license was activated.

NOTICE

Details about the site for which the license was activated.

SIGN

Digital signature that authenticates the license file.

Unserviced licensing

An unserved license binds PowerPath/VE to a specific vSphere host (or, more accurately, to a vSphere 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.

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.

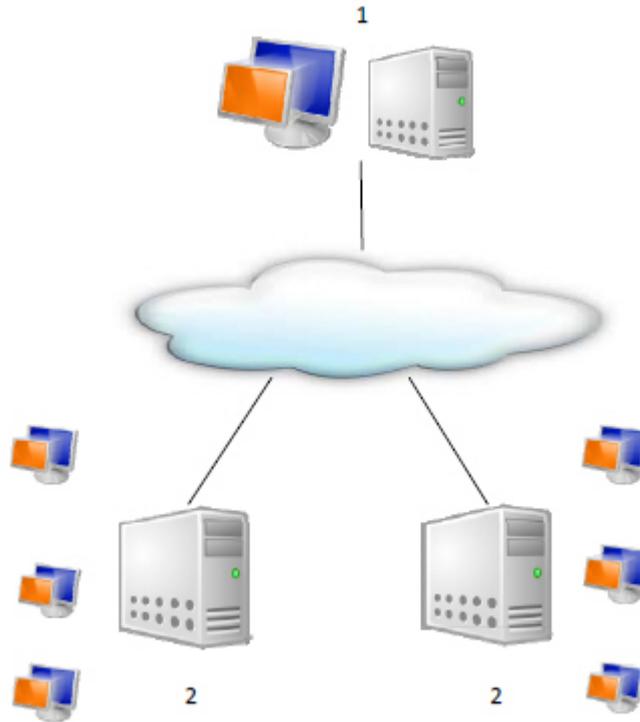
Take note of the following key points about unserved licenses in a PowerPath/VE environment:

- 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.

Components of an unserved licensing environment

The following figure shows a PowerPath/VE environment that uses unserved licenses.

Figure 2 PowerPath/VE environment using unserved licenses



Key components of an unserved license environment include:

1. One or more rpowermt servers where the RTOOLS package is installed.
2. VMware vSphere hosts with PowerPath/VE multipathing 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 PowerPath Management Appliance deployment, the PowerPath/VE Electronic License Manager System (ELMS) is automatically installed but is not used by your configuration.

rpowermt server

The rpowermt server is a machine on which the PowerPath/VE remote multipathing CLI (rpowermt) and the unserved license files are installed.

The rpowermt server must be able to communicate with all vSphere hosts in the environment. 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.

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.

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.

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, Output similar to the following appears: License will expire in *number_of_days* days

Loss of communication between rpowermt server and vSphere host

The `rpowermt` commands 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 multipathing 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.

Unserviced license file contents

An unserviced licensed file contains a series of keywords with a value assigned to each keyword.

Do not modify an unserviced license file in any way. Doing so invalidates the license.

The license file indicates PowerPath MP EMCLM 5.4 because the PowerPath/VE license is not tied to a product version number. For valid PowerPath/VE product, the license file indicates 5.4 license.

Example 2 Unserviced license file

Example 2 Unserved license file (continued)

```
INCREMENT PowerPathMP EMCLM 5.4 29-apr-2012 uncounted \
VENDOR_STRING=0000000-0000-0000-0000-0015176D1736 HOSTID=ANY \
ISSUER=EMC ISSUED=29-apr-2011 NOTICE="lcli016 fdanna LUCKY COMPUTER
\
1420 NE 21 ST BELLEVUE WA US 98007 132091443" TS_OK \
SIGN="00E7 F72C F32c 542c DD6D CBF1 A46E Ea00 BB5E 3BD2 4B6A \
CEC8 CCA4 6EFB 0FC2"
```

INCREMENT

Indicates:

- the product being licensed.
- when the license expires. If the expiration date is listed as permanent, the license never expires.
- number of available licenses.

VENDOR STRING

vSphere unique system identifier of the vSphere host for which PowerPath/VE is licensed.

ISSUER

Company that issued the license. For PowerPath/VE, this is always EMC.

ISSUED

Date that the license was activated.

NOTICE

Details about the site for which the license was activated.

SIGN

Digital signature that authenticates the license file.

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 vSphere unique system ID or IP address or FQDN), you must go to the Licensing Service Center 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 your Customer Support Representative for assistance.

APPENDIX C

Dynamic Linking of OpenSSL libraries

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

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

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- [Changes](#) 108
- [Expected behavior](#) 108

Overview

OpenSSL libraries are used by Remote Management Tools(RTOOLS). When PPMA or RTOOLS server connects to a ESXi host, the socket calls are secured by the OpenSSL library.

In earlier versions of PowerPath/VE, OpenSSL libraries were bundled within RTOOLS package and PowerPath/VE RTOOLS would use the bundled library and not depend on the host installed OpenSSL version.

From PowerPath/VE 6.4 version, OpenSSL libraries are not bundled with RTOOLS package. It is necessary that a compatible version of OpenSSL library is installed on the host in order for the RTOOLS feature to work properly.

Changes

There may be instances when OpenSSL library is not installed or an incompatible version is installed.

In such cases, RTOOLS installation fails and following error message is displayed:

```
RTOOLS will work only when a supported version of  
OpenSSL library is installed. Please install a supported version of  
OpenSSL library and try again.
```

Expected behavior

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

With OpenSSL 1.0.x

There is no change in behavior from previous versions of PowerPath/VE if a compatible version of OpenSSL is available on a host.

With no OpenSSL library or incompatible version

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

Installation fails with following error message:

```
RTOOLS will work only when a supported version of OpenSSL library is installed.  
Please install a supported version of OpenSSL library and try  
again.
```

 **Note:** PowerPath/VE RTOOLS is compatible with 1.0.x version of OpenSSL.