PowerPath and PowerPath/VE Family for Windows

Installation and Administration Guide

7.0 and minor releases

D&LL Technologies

Notes, cautions, and warnings

(i) **NOTE:** A NOTE indicates important information that helps you make better use of your product.

⚠ **CAUTION: A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.**

⚠ **WARNING: A WARNING indicates a potential for property damage, personal injury, or death.**

Contents

Figures

Tables

Installing Dell EMC PowerPath

This chapter contains the following sections:

Topics:

Before installing PowerPath

The sequence of steps to configure a storage system and install Dell EMC PowerPath or PowerPath/VE for Windows Hyper-V on a host depends on the storage system you use.

ⓘ **NOTE:** Throughout this document, all references to Dell EMC PowerPath see Dell EMC PowerPath and PowerPath/VE for Windows Hyper-V, unless otherwise noted. PowerPath/VE for Windows Hyper-V provides the same multipathing functionality as Dell EMC PowerPath for Windows in nonvirtual environments, and it supports Migration Enabler.

ⓘ **NOTE:** In Windows server 2016, the Dell EMC PowerPath 6.2 patch 01 or later installer now enforces two restarts, when MPIO is not installed before the PowerPath installation. In Windows 2016, the MPIO needs a restart for its configuration. PowerPath installation can be done only after the MPIO configuration, hence two restarts are required.

ⓘ **NOTE:** In Windows 2012 and Windows 2012 R2, Install the Windows 10 Universal CRT Update for Visual Studio 2017. The Windows 10 Universal CRT is a Windows operating system component that enables CRT functionality on the Windows operating system. This update enables Windows desktop applications that depend on the Windows 10 Universal CRT release to run on earlier Windows operating systems. You can download this update from Microsoft Support.

ⓘ **NOTE:** In Windows 2019, PowerPath upgrade requires windows update KB4487044. .

ⓘ **NOTE:** Initial installation of PowerPath on Windows 2019 prompts for two reboots. Second reboot is due to KB introduced in January 2020 for MPIO issue related to I/O queue (KB4534321). This is not a PowerPath issue. For more information, see KB4534321

ⓘ **NOTE:** PowerPath installation is subject to the acceptance of End-User LIcense Agreement (EULA) during GUI installation. By default, the customer accepts EULA during silent or unattended installation. The EULA file is available at `<Install Directory>\PowerPath\EULA` directory.

Check array configurations

Steps

● Check if the arrays attached are configured properly as per the array configuration documents.
  Check NetApp storage array report_scsi_name setting provides more information on NetApp array configuration.

Gather up-to-date information

Check the Dell EMC Online Support website for current information.

- PowerPath documentation—EMC updates PowerPath documentation when it releases new features with a service pack or when documentation errors are reported.
- Service packs and upgrades—You can download PowerPath service pack software from Dell EMC Online Support. Determine which service packs (if any) to install after PowerPath, and whether those service packs have any additional installation prerequisites.

Choose a convenient time

Installing Dell EMC PowerPath requires that you restart the host.

Plan to install or upgrade Dell EMC PowerPath at a convenient time to minimize disruption to the site.

Activate the license

PowerPath/VE for Windows Hyper-V and Dell EMC PowerPath for Windows require separate licenses. However, the licensing process for PowerPath/VE for Windows Hyper-V is the same as the licensing process for Dell EMC PowerPath for Windows.

About this task

The licensing process for both PowerPath/VE for Windows Hyper-V and for Dell EMC PowerPath for Windows is described in the *Dell EMC PowerPath Family Electronic License Ordering Process Technical Notes*, available on Dell EMC Online Support. Take note of the following regarding licenses:

Steps

- If you are upgrading from an earlier version of Dell EMC PowerPath, you do not need to re-register. Dell EMC PowerPath uses the old key.
- PowerPath Migration Enabler does not require a separate product license. The PowerPath multipathing license includes Migration Enabler functionality for all technology types (for example HostCopy and Open Replicator).
- Type the registration number exactly as it is displayed on the card or letter. To reduce common typographical errors, the License Key field accepts either uppercase or lowercase letters, and certain numbers and letters are interchangeable. Entering the alphabets O, I, S, and B is equivalent to entering the numbers 0, 1, 5, and 8.
- If a PowerMax array is purchased with an FX bundle, all the PowerPath hosts attached to the array are automatically licensed by attaching data LUNs to the host.

Prepare the host and storage system

This section describes how to prepare the host and the storage system.

- Go to Dell EMC Online Support and verify that your environment meets the requirements that are found in the *PowerPath and PowerPath/VE Family for Windows Release Notes* and the E-Lab Interoperability Navigator by running the Serviceability feature of the PowerPath Management Appliance (PPMA).
- The *PowerPath and PowerPath/VE Family for Windows Release Notes* includes the qualified Microsoft MPIO framework versions.
- The *PowerPath and PowerPath/VE Family for Windows Release Notes* includes a list of all Microsoft Hotfixes that are required to be installed, depending on your Windows Operating System, before installing Dell EMC PowerPath.
- Configure HBA drivers. Ensure that you follow the HBA driver configuration guidelines outlined in the E-Lab Interoperability Navigator and the HBA vendor documentation. The use of improper settings can cause erratic failover behavior, such as greatly increased I/O delays.
- For hosts connected to storage arrays through a Fibre Channel switch (that is, a fabric), configure the HBAs by using persistent binding for SCSI target IDs.
- Windows Server 2016 should be installed with KB4457127 or superseded KB before proceeding with PowerPath installation to avoid incompatibility issues with retpoline binaries.
  - (i) **NOTE:** For information on latest windows updates, see Microsoft website https://support.microsoft.com/en-us/help/4000825/windows-10-windows-server-2016-update-history.

- Windows Server 2019 should be installed with KB4487044 or superseded KB before proceeding with PowerPath upgrade to avoid an additional reboot.
  - (i) **NOTE:** For information on latest windows updates, see Microsoft website https://support.microsoft.com/en-us/help/4464619/windows-10-update-history.

OpenSSL configuration utility

OpenSSL is packaged separately from PowerPath Windows 7.0 package and is available for download from the Dell download site. The OpenSSL package comes with a configuration utility which takes care of configuring the supported OpenSSL binaries that are needed for PowerPath to work. The script starts the EMC PowerPath Remote Management component service.

Configure OpenSSL binaries for PowerPath

The procedure to configure OpenSSL binaries.

Steps

1. Download the OpenSSL package from the DELL EMC site and copy it to the windows system.
2. Extract the downloaded OpenSSL package.
3. Open the package and execute the `OpenSSL_config.bat` script with the option **Run as administrator**, to ensure that the administrator permissions are provided. Log file PowerPath_OpenSSL.log is generated.
   - (i) **NOTE:** OpenSSL Software Library is distributed under Apache License 2.0. Review the license terms before installing the product.

Boot from a storage array device

The following documents provide instructions for configuring a storage array device as the boot device:

- EMC Fibre Channel with Emulex Host Bus Adapters in the Windows Environment, available on the Emulex website.
- EMC Fibre Channel and iSCSI with QLogic Host Bus Adapters in the Windows Environment, available on the QLogic website.

Prepare a cluster environment

For more information on installing Dell EMC PowerPath in a new or existing cluster, go to Dell EMC PowerPath in an MSCS cluster and Dell EMC PowerPath in a Veritas Cluster Server

Install in virtual environments

The procedure to install PowerPath in virtual environments is the same as the procedure to install in physical environments. You can follow the GUI or the CLI installation procedure described in this document.

EMC supports iSCSI and Fibre Channel (FC) connections to EMC storage using the Microsoft Software iSCSI Initiator and Microsoft Hyper-V Virtual Fibre Channel, respectively, in a child partition. In this configuration PowerPath is supported in a child partition to manage multiple iSCSI or FC paths. However, pass-through disks are not supported when running PowerPath in a child partition.

Coexistence with third-party path management software

Dell EMC PowerPath can coexist with MPIO-based third-party path management software such as:

- Hitachi Dynamic Link Manager (HDLM)
- HP StorageWorks Secure Path
- HP StorageWorks AutoPath XP Virtual Array
- Microsoft MPIO (native multipathing)
- Veritas Dynamic Multipathing

Dell EMC PowerPath cannot co-manage devices with third-party path management software.

If multiple DSMs are installed to manage devices of an array, Microsoft MPIO framework currently does not ensure that a particular DSM will always manage such devices. As a result, the effects of using Dell EMC PowerPath DSM and another third-party DSM for managing the same array are undetermined. Further, when Dell EMC PowerPath coexists with other multipathing software to manage exclusive arrays, an HBA cannot be shared between the two. The Microsoft MPIO documentation provides more details.

Installation procedures

You can install using the default GUI method or through the CLI. See one of the following procedures to install PowerPath.

(i) **NOTE:** In Windows server 2016, the Dell EMC PowerPath 6.2 patch 01 or later installer now enforces two reboots when MPIO is not installed prior to PowerPath installation. In Windows 2016, the MPIO needs a reboot for it to be configured. PowerPath installation can be done only after the MPIO configuration, hence there are two reboots.

(i) **NOTE:** Initial installation of PowerPath on Windows 2019 prompts for two reboots. Second reboot is due to KB introduced in January 2020 for MPIO issue that is related to I/O queue (KB4534321). This is not a PowerPath issue. For more information, see KB4534321.

(i) **NOTE:** You must have administrative rights to install PowerPath.

(i) **NOTE:** UAC settings in the host should allow drivers and system software to be installed.

(i) **NOTE:** PowerPath should have access to make changes to the Install directory.

- Install PowerPath using the GUI (default method)
- Install Dell EMC PowerPath using the CLI

PowerPath installation creates installation logs by default in `%ProgramData%\EMC\PowerPath\logs`.

Service pack and patch installations

To install a PowerPath service pack or patch for Windows, see the following sections:

- Installing a Dell EMC PowerPath Service Pack for Windows
- Install a Dell EMC PowerPath patch for Windows

Install PowerPath using the GUI (default method)

Install PowerPath with the default interactive prompts.

Steps

1. Perform one of the following:
   - If the PowerPath executable file is saved on your local system, double-click the PowerPath executable file.
   - Click **Start** and then select **Run**.

   In the Run window, browse to or type the name of the PowerPath installation program:

   `<drive>:\<PowerPath_pkg_name>`

2. Select the language for this installation from the list and click **Next**.

   Localized version of the PowerPath installers are available in Brazilian Portuguese, Latin American Spanish, French, German, Italian, Japanese, Korean, and simplified Chinese.

3. Read and accept the End User License Agreement, and then click **Next**.
4. In the setup wizard welcome window, click **Next**.
5. In the **Custom Setup** dialog box, select the features for installation.

   By default, Multipathing, Migration Enabler, Management Component, and support for EMC storage arrays are selected. Clear unwanted default features or select extra features (such as third-party storage arrays such as NetApp) and then click **Next**.

- To select or clear features, click the arrow and select the appropriate option from the drop-down menu:

  ```
  Will be installed on local hard drive
  Entire feature will be installed on local hard drive
  Entire feature will be unavailable
  ```

- Click **Disk Usage** to view the required and available space that is needed to install selected features.
- Use the Browse option to change the destination folder.

6. Click **Next**.
7. If OpenSSL is not installed in the host with Management component selected, see OpenSSL configuration utility .
8. If the installation is PowerPath upgrade installation and if `powermt custom` file is found, the PowerPath installer provides an option to either keep or delete the existing `powermt.custom` file.

   - In order for the upgrade installation to convert and keep the existing `powermt.custom` file, select **Keep the custom configuration file**.
   - If you want to delete the existing `powermt.custom` file, select **Delete the custom configuration file**.

9. In the **Ready to Install** dialog box, click **Install**.
   a. Choose whether to save the path-specific information to the `powermt custom` file.

   (i) **NOTE:** The persist path information option in the `powermt custom` configuration file is set to ON when the box is checked. If HBA SCSI target persistent binding is not enabled, set `persist_path_info` to `off`. Without HBA persistent binding, the SCSI ID of the path persisted in the custom file may change after actions like HBA enable/disable or a server reboot. This may cause `powermt` to display misleading information. Refer to the HBA management software documentation for information about how to enable SCSI target persistent binding.

   b. If PowerPath detects that files to be updated are in use, select one of the following options:
      - Automatically close and attempt to restart applications.
      - Do not close applications (A reboot will be required.)

      If PowerPath does not detect files in use, go to Step d.

   c. Click **OK**.
   d. When the EMC Licensing Tool prompt displays, type your 24-digit registration number in the License Key field, and then click **Add**.

   (i) **NOTE:**
      - PowerPath for Windows and PowerPath/VE for Windows Hyper-V each requires a separate license. The licensing procedure is the same for each.
      - When upgrading PowerPath, the existing license key is saved and no input is required.
      - To enable additional array support, enter the license keys. Migration Enabler is enabled when you enter a valid multipathing license key.

   e. Click **OK**.
10. In the **Installation Wizard Completed** dialog box, to change the Management Component default settings, click **Launch Management Component Configuration Utility** and then click **Finish**. The Management Component is disabled by default.

    (i) **NOTE:** If you do not launch the Management Component Configuration utility during installation, you can configure the Management Component later by going to **Start** > **Programs** > **EMC** > **Configuration** and selecting **Management Component Configuration**.

If you launched the Management Component Configuration utility, review the following parameters.

- Ensure that Enable PowerPath Management Component is selected. It is selected by default.
- In the Port Number field, maintain the default and recommended port value of 9083 or change the port value to a value between 49152 and 65535 if another application is already using the default port (9083).
- In the Heartbeat Interval field, maintain the default value of 10 minutes or change the heartbeat interval value to a value between 1 and 60. The heartbeat interval is based on the number of hosts being managed.
- Click **Disable Single Path Symmetrix GateKeeper Setup Warnings** to maintain the default setting if you do not want to report Setup errors for Symmetrix gatekeeper devices that are configured with a single path. Otherwise, clear the check box if Symmetrix gatekeeper devices are multi-pathed in your data center.

> (i) **NOTE:** PowerPath supports both single-path and multi-path configured Symmetrix gatekeepers. Consult your network administrator for more information about your Symmetrix gatekeeper configuration.

- Click **Use Windows perfmon** forPowerPath PMI counters to make PowerPath performance metrics (PowerPath counters) available in the Windows Performance monitoring tools.
- To restore the default options, click **Restore Default**.

11. Click **Yes** to reboot now or **No** to reboot later.
12. (optional) If you installed Migration Enabler, and if you are not planning to use this feature, disable this service and change the Startup type to disabled.
13. When the host restarts, follow the instructions in After installing PowerPath.

Install Dell EMC PowerPath using the CLI

Install using the more advanced command-line interface. Use spaces to separate multiple properties.

Prerequisites

The customer accepts the End User License Agreement by default during silent or unattended installation.

Steps

1. Type the following command syntax to install Dell EMC PowerPath:

   `<drive>:\<PowerPath_pkg_name> <install_parameters> /v"<Property>=<Value>"`

   - For a silent or unattended installation, which does not require user input.

     Silent installations include the /s parameters.

     `<drive>:\<PowerPath_pkg_name> /s /v"/L*v <logfile> <Property>=<Value>"`

     > (i) **NOTE:** Silent or unattended installation errors are logged in `<logfile>`, the location specified in the installation command. No error message is displayed in the Windows PowerPath Administrator GUI.

   - For an interactive installation, which requires user input.

     `<drive>:\<PowerPath_pkg_name> /v"/L*v <logfile> <Property>=<Value>`

drive	The drive letter, for example, C.
PowerPath_pkg_name	The Dell EMC PowerPath package name. For example, `EMCPower.X64.signed.<version>.<build>.exe`. Where *version* is the product version. For example, Dell EMC PowerPath 6.3.
install_parameters	One or more parameters (/s, /v, or /p) that are described in CLI parameters.
logfile	Creates the logfile where the log message is sent, for example, `C:\logs\PPsetup.log`. Ensure that the specified directory exists within the specified path.
Property=Value	One or more optional properties that are described under the /v parameter in CLI parameters.

The following examples provide scenarios using the silent and interactive CLI methods:

- **Silent installation**

  Install all default Dell EMC PowerPath features (Multipathing, Migration Enabler, Management Component, and support for EMC storage arrays) using the silent method and to also set the Dell EMC PowerPath license and disable restart.

  `C:\DellEMCPower.X64.signed.<version>.<build>.exe /s /v"/L*v C:\logs\PPsetup.log`
  `LICENSENUM=0000-0000-0000-0000-0000-0000 NO_REBOOT=1"`

- **Unattended installation**

  Install all default Dell EMC PowerPath features (Multipathing, Migration Enabler, Management Component, and support for EMC storage arrays) using the unattended method and to also set the Dell EMC PowerPath license and disable restart.

  Unattended installations include the /p parameter.

```
C:\DellEMCPower.X64.signed.<version>.<build>.exe /p /v"/L*v C:\logs\PPsetup.log
LICENSENUM=0000-0000-0000-0000-0000-0000 NO_REBOOT=1"
```

- **Interactive installation**

  Install Dell EMC PowerPath using the interactive CLI method and to set the Dell EMC PowerPath license, copy, and install Dell EMC PowerPath files to `C:\Test` folder, disable restart, and install components to support Dell SC, IBM ESS, and Hitachi storage arrays.

  ```
  C:\DellEMCPower.X64.signed.<version>.<build>.exe /v"/L*v C:\Install_IBM_HDS_NETAPP.log
  LICENSENUM=0000-0000-0000-0000-0000-0000 INSTALLDIR=C:\Test NO_REBOOT=1
  ADDLOCAL=SC,IBM,HDS,NETAPP"
  ```

2. Before restarting, check the following string in logs and resolve if there are any issues.

   Windows 2016

   - ```
     Windows Server 2016 should be installed with KB4457127 or superseded KB before
     proceeding with PowerPath installation to avoid incompatibility issues with
     retpoline binaries.
     ```

     (i) **NOTE:** For information about latest windows updates, see Microsoft website, https://support.microsoft.com/en-us/help/4000825/windows-10-windows-server-2016-update-history .

3. After installing Dell EMC PowerPath, restart the host and then follow the instructions in After installing PowerPath. CLI parameters describes the parameters and options.

   (i) **NOTE:** During the first MPIO installation, Windows Server 2016 configuration requires a restart to configure MPIO installation. Install PowerPath after the MPIO configuration. Hence PowerPath on Windows Server 2016 requires two restarts in this case.

   (i) **NOTE:** Initial installation of PowerPath on Windows 2019 prompts for two reboots. Second reboot is due to KB introduced in January 2020 for MPIO issue that is related to I/O queue (KB4534321). This is not a PowerPath issue. For more information, see KB4534321.

After installing PowerPath

This section describes post-installation tasks.

Verify the configuration

Verify the PowerPath configuration after installation.

Steps

1. After the host restarts, check that PowerPath is fully configured with multiple paths to logical devices and (if appropriate) correct zones when you start.
2. Verify if the configuration is correct.

   If PowerPath sees no devices, but the devices are seen by the operating system, then verify that the devices are configured for PowerPath support.

   powermt display

   powermt display dev=all

   powermt display ports

3. Save the verified configuration.

   powermt save

Verify a patch installation

Once a patch is installed, it is listed as a subentry under the Dell EMC PowerPath entry in **Add/Remove Programs** or **Programs and Features**.

Steps

- Verify that the Dell EMC PowerPath patch appears in the list of updated programs.
  - Click **Show updates** in **Add/Remove Programs**.
  - Click **View installed updates** in **Programs and Features**.

Configure the Dell EMC PowerPath Management Pack for Microsoft Operations Manager

You can configure the Dell EMC PowerPath management daemon to remotely monitor specific Dell EMC PowerPath events.

This feature is available in a separate software package available on Dell EMC Online Support. The management daemon integrates with Microsoft Operations Manager and allows you to retrieve license and version information from remote Dell EMC PowerPath hosts. It also can generate alerts when paths or volumes remain dead for a configurable time frame. The *PowerPath Management Pack for Microsoft Operations Manager User Guide* provides more information on configuring and using the management daemon.

Adding features to an existing installation

If Dell EMC PowerPath is installed on your host and you want to install additional features, such as PowerPath Migration Enabler or components to support third-party arrays, follow one of these procedures:

Add features to an existing installation using the GUI

Add features to an existing installation using the CLI

Add features to an existing installation using the GUI

Steps

1. Using **Add/Remove Programs** or **Programs and Features** select the installed version of PowerPath and then click **Change**.
2. In the Setup wizard welcome window, click **Next**.
3. Select **Change** and click **Next**.
4. Select the feature that you want to install from the drop-down list.
   > (i) **NOTE:**
   > - A selected feature displays a hard drive icon next to it. A red X indicates that the feature is not selected.
   > - The icon next to each feature name indicates the feature's install state. Click **Help** in the **Custom Setup** dialog box for more information about the icons.

5. Select the option to install the feature on the local hard drive and click **Next**.
6. Click **Install**.
7. Click **Finish**.
8. Click **Yes** to reboot now or **No** to reboot later.
   > (i) **NOTE:** If the User Account Control (UAC) is configured in the Admin Approval mode, running the PowerPath setup program to change, repair, or to uninstall PowerPath 6.3 and later versions, using **Add/Remove Programs** or **Programs and Features** through the control panel results in multiple elevation prompts.

   > (i) **NOTE:** If you are installing Migration Enabler or Management Component then a reboot is not required. However, installing these features with any other feature requires a reboot.

Add features to an existing installation using the CLI

- Add features to an existing installation.

  <drive>:\<PowerPath_pkg_name> /s /v"/L*v <logfile> LICENSENUM=<license_key> NO_REBOOT=1 ADDLOCAL=<feature>"

  For example, to install XtremIO and Invista, type the following command on a single line.

  ```
  C:\EMCPower.X64.signed.<version>.<build>.exe /s /v"/L*v C:\logs\PPsetup.log
  LICENSENUM=0000-0000-0000-0000-0000-0000 NO_REBOOT=1 ADDLOCAL=XTREMIO,INVISTA"
  ```

Results

When the `NO_REBOOT=1` parameter is used, reboot manually after installation.

ⓘ **NOTE:**

If you are installing Migration Enabler or Management Component then a reboot is not required. However, installing these features with any other feature requires a reboot.

CLI parameters describes the parameters and options.

Installing a Dell EMC PowerPath Service Pack for Windows

To install a Dell EMC PowerPath for Windows service pack, follow the installation instructions in:

Install PowerPath using the GUI (default method)

Install Dell EMC PowerPath using the CLI

Install a Dell EMC PowerPath patch for Windows

Prerequisites

- Ensure that the Dell EMC PowerPath base package is installed. The Dell EMC PowerPath base package must be installed on the host before you can install a Dell EMC PowerPath patch for Windows. Dell EMC PowerPath patches for Windows are not full package installations and will only update a specific set of files or drivers. Installation of the patch does not change the Dell EMC PowerPath version.

- If the patch has fixes for additional Dell EMC PowerPath features (such as, Migration Enabler), then that feature must be enabled before you install the patch for the patch to be able to apply its fixes.

- A lower version patch can be applied on top of a higher version one (Multiple patches can be installed and can coexist).

About this task

Alternatively, use the command line to install the patch.

```
<Patch.exe> /s /v"/q NO_REBOOT=1 /L*v C:\logs\Install_PP_Patch.log"
```

Include `NO_REBOOT=1` so that you can manually restart at a convenient time.

Steps

1. Double click the patch executable file.
2. Click **Update** in the **Install Welcome** dialog box.
3. Click **Finish**.
4. Click **Yes** to reboot the host or **No** to reboot later.

Unsupported installation changes

This section describes unsupported installation changes.

About this task

Uninstalling an earlier version of PowerPath without rebooting, and then installing the latest version might cause system crash. To avoid this issue, reboot after installing, uninstalling, or upgrading PowerPath.

(i) **NOTE:** When the system is not rebooted after installing, uninstalling, or upgrading PowerPath, the operating system confuses the uninstallation of old drivers with the installation of new drivers, causing a system panic.

Downgrade PowerPath

If you want to run an earlier version of PowerPath, you must roll back PowerPath.

About this task

Do not try to install an earlier version of PowerPath on hosts currently running a more recent version of PowerPath.

Steps

1. Uninstall the latest version of PowerPath.
2. Restart the host.
3. Install the earlier version of PowerPath.

2

Configuring PowerPath

This chapter contains the following sections:

Topics:

Overview

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

For example:

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

(i) **NOTE:** If you do not reconfigure Dell EMC PowerPath after making configuration changes, many of these changes are treated as unintentional, and Dell EMC PowerPath tries to prevent them from affecting applications.

Many platform-specific and some Dell EMC PowerPath reconfiguration operations fail when the affected logical devices are in use (either just marked alive or with I/O in progress). This condition is noted in specific places in the procedures that follow. 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.

Whenever you make any changes to the default settings, such as changing the default load-balancing policies, then you must run the `powermt save` command to ensure that the new settings persist across restart.

Adding new paths to a Dell EMC PowerPath logical device

This procedure adds new paths to a logical device already configured (with at least one path) in Dell EMC PowerPath. This procedure can be done without interruption to running applications on Microsoft hosts.

About this task

⚠ **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.**

(i) **NOTE:** Path limit: Do not configure more than 32 paths per logical device.

Steps

1. Confirm the current configuration.

```
powermt display
```

2. Confirm the configuration of the logical devices to which new paths are added.

```
powermt display dev=all
```

3. Ensure that the number of logical devices, hardware paths, and I/O paths are as expected. The path state should be alive for known good paths and dead for known bad paths.
   If there is a problem, correct it before proceeding.

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

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

6. Scan for hardware changes in the device manager or alternately, restart.

   In some cases, the operating system may prompt for a restart after new devices are added.

7. Reconfigure Dell EMC PowerPath.

8. Inspect the new Dell EMC PowerPath configuration.
   a. Confirm the path state.

   ```
   powermt display dev=all
   ```

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

   b. Test all paths.

   ```
   powermt restore
   ```

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

9. Correct any issues that are detected.

10. Save the new configuration.

```
powermt save
```

Adding new logical devices to the Dell EMC PowerPath configuration

This procedure adds new logical devices (with one or more paths) to be managed by Dell EMC PowerPath and applies to managed storage system classes only.

About this task

Logical devices can be added without interruption of service, since no existing application can be using a logical device that is not yet available. After successful configuration, 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.**

Steps

1. Confirm the current configuration.

```
powermt display
```

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

2. Make logical device and physical path changes as required:
   a. Create new logical devices.
   b. Map logical devices to one or more storage-system ports.
   c. Add new HBAs. For details, the vendor documentation provides more details.
   d. Attach cables.
   e. Rezone Fibre Channel switches.

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

4. Scan for hardware changes in the device manager. Alternately, restart.

   In some cases, the operating system may prompt for a restart after new devices are added.
5. Reconfigure Dell EMC PowerPath.
6. After adding LUNs to a storage group and scanning the disk via the device manager/diskpart scan operation or through a restart, the `powermt display dev=all` command may return an error count of 1 for the new LUNs.
   For example, if there are 4 paths configured between the host and the array, Dell EMC PowerPath displays four errors against each LUN, one error for each path.

   Run the **`powermt restore`** command to reset the error count to 0.

   (i) **NOTE:** When a new path is added to the Windows host, the system restarts the corresponding path device to complete the software installation, resulting in a path dead message in the system log which can be ignored.
7. Inspect the new Dell EMC PowerPath configuration.
   a. Confirm the path state.

      `powermt display dev=all`

      All paths associated with the new logical devices should be displayed with a state of alive.
   b. Test all paths to the new logical device.

      `powermt restore`
   c. Scan operating system error logs to ensure that no errors are logged against the new paths and logical device.
8. Correct any issues that are detected, before saving the Dell EMC PowerPath configuration or using the new logical device.
9. Set Dell EMC PowerPath-specific options for the new logical devices, such as load-balancing and failover policy, path modes, write throttle enablement, and priority.
10. Reconfigure Dell EMC PowerPath.
11. Save the new configuration.

    `powermt save`
12. On the host where EMC ControlCenter® is installed, refresh the ControlCenter database device information.

    The ControlCenter documentation provides more information.

Removing paths to Dell EMC PowerPath logical devices

This procedure removes some (but not all) paths to logical devices configured in Dell EMC PowerPath.

About this task

⚠ **CAUTION: Do not remove the last live path to a logical device unless you plan to remove the logical device entirely, as data access is interrupted. If a Dell EMC PowerPath device is open, `powermt remove` does not remove that device or the last path to that device.**

(i) **NOTE:** Failure to follow all the steps in this procedure correctly can result in data loss and errors that affect the operating system.

Steps

1. Confirm the configuration of the logical devices from which paths will be removed.

   `powermt display dev=all`
2. Check the number of existing paths.

   The path state should be alive for known good paths and dead for known bad paths.
3. If there is a problem, correct it before proceeding.
4. Identify the physical paths to be removed or zoned out, and confirm that there are other paths to the affected logical devices.

   Otherwise, applications using those logical devices could experience I/O errors when you proceed.
5. Identify the Dell EMC PowerPath HBA number that is associated with the paths to be removed.

   `powermt display dev=all`

In complex topologies, there can be multiple paths on an HBA.

6. Set the mode to standby for all paths to be removed.

   `powermt set mode=standby`

   If an HBA is to be removed, specify the HBA (instead of the device) when running `powermt set mode`

7. Physically disconnect the paths or logically disconnect them by removing them from active zones.

   As a result, the operating system may log some error messages. However, Dell EMC PowerPath prevents these errors from affecting applications.

8. Scan for hardware changes in the device manager. Alternately, restart.

   In some cases, the operating system may prompt for a restart after new devices are added.

9. Confirm that the paths listed as dead are the ones that you intended to remove.

   `powermt restore`

10. Remove the paths.

    `powermt remove`

    Specify both the `hba` and `dev` arguments

    > ⚠️ **CAUTION: If you do not specify the `hba` argument, all paths to the specified logical device are removed.**

11. Remove HBAs as required and reboot if needed.

12. Inspect the new Dell EMC PowerPath configuration:

    a. Confirm the number of paths.

       `powermt display`

       The output should show fewer total paths than before. All paths should have a state of optimal.

    b. Confirm the path state.

       `powermt display dev=all`

       All remaining paths associated with the affected logical devices should be displayed with a state of alive.

13. Correct any issues detected before saving the Dell EMC PowerPath configuration or using the new logical devices.

14. Save the new configuration.

    `powermt save`

Removing Dell EMC PowerPath logical devices

This procedure removes logical devices (with all configured paths to those logical devices) configured in Dell EMC PowerPath. Logical devices can be removed without interruption of service only if no applications are using or configured to use the logical devices you are removing. The procedure may fail if any application is using a device that is associated with the path to be removed.

Steps

1. Inspect the current Dell EMC PowerPath configuration:

   a. Confirm the current configuration.

      `powermt display`

      Ensure that the total number of logical devices, hardware paths, and I/O paths are as expected.

      Since one or more paths may have failed, not all paths may be listed as optimal.

   b. Confirm the configuration of the logical devices that are removed.

      `powermt display dev=all`

   c. Check the number of existing paths.

      The path state should be alive for known good paths and dead for known bad paths.

2. If either of the above displays indicates a problem, correct it before proceeding.

3. Identify the logical devices to be removed.

4. Identify the physical paths that also may be removed.

5. Identify the Dell EMC PowerPath HBA number that is associated with the paths to be removed.

   `powermt display dev=all`

In complex topologies, there can be multiple paths on an HBA.

6. Reconfigure all applications that are using the logical devices to be removed, so they are no longer configured to use them.
7. Unmount file systems.
8. Remove the volume groups using the appropriate volume manager command.
9. Scan for hardware changes in the device manager. Alternately, restart.
10. If using SAN Manager™, Volume Logix, or Access Logix, remove access to the logical devices to be removed, using those tools.

    As a result of this step, the operating system may log some error messages. These are expected and are harmless.
11. Remove the paths.

    ```
    powermt remove dev=all
    ```
12. Save the new configuration.

    ```
    powermt save
    ```
13. Disconnect physical paths or zone out paths with switched fabric zone changes as required.
14. Confirm that the paths that are listed as dead are associated with the logical devices you intend to remove.

    ```
    powermt restore
    ```
15. Depending on the type of HBA installed, scan for hardware changes in the device manager. Alternately, restart.

    In some cases, the operating system may prompt for a restart after new devices are added.
16. Inspect the new Dell EMC PowerPath configuration:

    a. Confirm the number of paths.

    ```
    powermt display
    ```

    The output should show fewer total paths than before. All paths should have a summary state of optimal.

    b. Confirm the path state.

    ```
    powermt display dev=all
    ```

    All remaining paths that are associated with the affected logical devices should be displayed with a state of alive.
17. Correct any issues that are detected above, before saving the Dell EMC PowerPath configuration or using the new logical devices.
18. Save the new configuration.

    ```
    powermt save
    ```

Configuring the Microsoft iSCSI Initiator for Dell EMC PowerPath

About this task

Refer to the recommended array and hardware guidelines.

Steps

- Select **Enable multi-path while creating sessions on the target** and then click **OK**.

  The Microsoft iSCSI initiator is available by default.

Enabling and disabling the iSCSI NIC IP display feature

The iSCSI display feature is disabled by default. To see the iSCSI NIC IP for every path in `powermt display,` enable the iSCSI display feature. Enabling or disabling the iSCSI IP display feature does not affect the iSCSI functionality. This display feature has minimal support; PowerPath Host, which has multiple NIC IPs configured in the same subnet, is not supported.

Prerequisites

Perform the following procedure to ensure that a specific NIC IP is assigned to every iSCSI target. Repeat the following steps for each iSCSI target in the Targets tab of the Microsoft Software iSCSI Initiator Properties. This process ensures only one path is dead at a time instead of all paths going dead together.

1. Select a target.
2. Click **Disconnect** to disconnect the target.
3. Click **Connect** and then click **Advanced...** to go to Advanced Settings.
4. Set the Local Adapter to Microsoft iSCSI Initiator. Set the Initiator IP to the specific NIC IP from the same subnet as that of the Target IP.
5. Click **Apply** and **OK.**

About this task

To enable and disable the iSCSI display feature:

Steps

1. To enable the iSCSI display feature, set the following environmental variable:
   set EMCPMPAPI_ISCSI_DISPLAY=1
2. To disable the iSCSI display feature, unset the environmental variable (if already set) by running the following command:
   set EMCPMPAPI_ISCSI_DISPLAY=

Adding Dell EMC PowerPath PMI counters to Windows Performance Monitor

Path Management Insight (PMI) capabilities help performance monitoring by characterizing I/O patterns and diagnosing I/O problems.

About this task

The PMI counter and timers on the Performance Monitor framework is published by the V2 Performance Counter provider. The provider which is hosted by the Dell EMC PowerPath Management Service, is part of the Dell EMC PowerPath Management Component and is enabled by default. Each PMI counter and timer is present in the perfmon. Two specific Dell EMC PowerPath PMI counters are displayed as part of the Windows Performance Monitoring tools under Performance\Performance Tools\Performance Monitor. These independent counters are also listed in the **Add Counters** wizard and display the following information:

● Dell EMC PowerPath Volume PMI Data—contains all counters and timers for Volumes
● Dell EMC PowerPath Path PMI Data—contains all counters and timers for Paths

Apart from `powermt set perfmon`, there are two more commands that can be used to collect insights for enhanced performance information:

● `powermt display perf dev`
● `powermt display perf bus`

The output of these commands provide:

● Read, Write, and Total Throughput
● Read, Write and All Average Response Time
● Latency Distribution
● Retry delta
● Error delta

For more information on these commands, see the *PowerPath Family CLI and System Messages Reference Guide*.

For more information on adding counters, refer to Microsoft Performance Monitoring documentation.

Steps

● Start collecting data.
  powermt set perfmon=<on>

  Setting the `perfmon` command to On initializes the performance monitoring counter and measurements.

Upgrading PowerPath

This chapter contains the following sections:

Topics:

Before upgrading

Before upgrading PowerPath or installing a service pack:

About this task

ⓘ **NOTE:** You do not need to remove the previous version of PowerPath before upgrading to PowerPath 6.x.

Steps

1. Go to Dell EMC Online Support and do the following:
   a. Check for the most current information. EMC updates release notes periodically and posts them on Dell EMC Online Support.
   b. Download the latest version of EMC Reports, available on Dell EMC Online Support, and then check the serviceability data of PowerPath Management Appliance.
   c. Download the PowerPath software on Dell EMC Online Support at Downloads and save it to your local directory.
   Refer to E-Lab Interoperability Navigator and Release Notes of the PowerPath version to be upgraded to check for the supported arrays.
2. Save the current PowerPath configuration using one of the following methods:
   * Save the latest PowerPath configuration.

     `powermt save`

     If the custom file is being saved to a non-default location, refer to the Upgrading PowerPath custom file conversion section.

   * In the Windows PowerPath Administrator GUI, right-click the root node and then select **All Tasks** > **Save Config as**. Specify a file name and click **Save**.
     ⓘ **NOTE:** PowerPath stores configuration information in a configuration file that may be loaded at boot time. When using the Windows PowerPath Administrator GUI, the configuration file can be saved only under the default filename. After a service pack is applied, the configuration file format may have changed, resulting in the configuration file no longer being backward compatible.
3. Stop `powermt display` if it is running.
4. Close the Windows PowerPath Administrator GUI if it is open.
5. Open 'services.msc' at the command prompt and verify that the below PowerPath services are operational:
   * EMC PowerPath Service
   * EMC PowerPath Migration Service
   ⓘ **NOTE:** EMC PowerPath Remote Management component service will also be running if it was enabled in the existing PowerPath version.

6. Check 'powermt display dev=all' to verify that there are no dead paths.
   a. Fix any SAN issues that caused the dead paths.

b. If the dead paths are no longer required, remove the dead paths. The *PowerPath Family CLI and System Messages Reference Guide* provides more information on how to remove the dead paths.

7. Verify that at least 250 MB of free space is available in the installing drive.

8. Verify that there are no active migrations pending.

9. Ensure that there are no fabric or array configurations changes in progress.

10. If upgrading to claim support for a newly added array, ensure that the corresponding array feature is enabled. Refer to the Installation and upgrade procedures section for information on how to enable a feature.

11. Uninstall any PowerPath hot fixes on the host. Use **Add/Remove Programs** or **Programs and Features** to verify if hot fixes are installed.

12. Review the information in Supported upgrades.

Upgrade procedures

You can upgrade using the default GUI method or through the CLI. Refer to one of the following procedures to upgrade PowerPath.

ⓘ **NOTE:** Do not add new paths during upgrade.

ⓘ **NOTE:** You must have administrative rights to install PowerPath.

ⓘ **NOTE:** UAC settings in the host should allow drivers and system softwares to be installed.

ⓘ **NOTE:** PowerPath should have access to make changes to the Install directory.

● Upgrade PowerPath using the GUI (default method)
● Upgrade Dell EMC PowerPath using the CLI

PowerPath installation creates installation logs by default in `%ProgramData%\EMC\PowerPath\logs`.

Upgrade PowerPath using the GUI (default method)

Upgrade PowerPath with the default interactive prompts.

Steps

1. Perform one of the following:
   ● If the PowerPath executable file is saved on your local system, double-click the PowerPath executable file.
   ● Click **Start** and then select **Run**.

   In the Run window, browse to or type the name of the PowerPath installation program:

   ```
   <drive>:\<PowerPath_pkg_name>
   ```

2. Select the language for this installation from the list and click **Next**.

   Localized version of the PowerPath installers are available in Brazilian Portuguese, Latin American Spanish, French, German, Italian, Japanese, Korean, and simplified Chinese.

3. Read and accept the End User License Agreement, and then click **Next**.

4. In the setup wizard welcome window, click **Next**.

5. In the **Custom Setup** dialog box, select the features for installation.

   By default, Multipathing, Migration Enabler, Management Component, and support for EMC storage arrays are selected. Clear unwanted default features or select extra features (such as third-party storage arrays such as NetApp) and then click **Next**.

   ● To select or clear features, click the arrow and select the appropriate option from the drop-down menu:

   ```
   Will be installed on local hard drive

   Entire feature is installed on local hard drive

   Entire feature will be unavailable
   ```

   ● Click **Disk Usage** to view the required and available space needed to install selected features.

- Use the Browse option to change the destination folder.

6. Click **Next**.

7. If OpenSSL is not installed in the host with Management component selected, see *OpenSSL configuration utility*.

8. In case of PowerPath upgrade installation and if `powermt custom` file is found, the PowerPath installer provides an option to either keep or delete the existing `powermt.custom` file.

   - In order for the upgrade installation to convert and keep the existing `powermt.custom` file, select **Keep the custom configuration file**.
   - If you want to delete the existing `powermt.custom` file, select **Delete the custom configuration file**.

9. In the **Ready to Install** dialog box, click **Install**.

   a. Choose whether to save the path specific information to the `powermt custom` file.

   (i) **NOTE:** The persist path information option in the `powermt custom` configuration file is set to ON when the box is checked. If HBA SCSI target persistent binding is not enabled, set `persist_path_info` to `off`. Without HBA persistent binding, the SCSI ID of the path persisted in the custom file may change after actions like HBA enable/disable or a server reboot. This may cause `powermt` to display misleading information. Refer to the HBA management software documentation for information about how to enable SCSI target persistent binding.

   b. If PowerPath detects that files that need to be updated are currently in use, select one of the following options:
      - Automatically close and attempt to restart applications.
      - Do not close applications (A reboot will be required.)

   If PowerPath does not detect files currently in use, proceed to Step d.

   c. Click **OK**.

   d. When prompted by the EMC Licensing Tool, type your 24-digit registration number in the License Key field, and then click **Add**.

   (i) **NOTE:**
      - PowerPath for Windows and PowerPath/VE for Windows Hyper-V each require a separate license. The licensing procedure is the same for each.
      - When upgrading PowerPath, the existing license key is saved and no input is required.
      - To enable additional array support, enter the license keys. Migration Enabler is enabled when you enter a valid multipathing license key.

   e. Click **OK**.

10. In the **Installation Wizard Completed** dialog box, to change the Management Component default settings, click **Launch Management Component Configuration Utility** and then click **Finish**. The Management Component is disabled by default.

    (i) **NOTE:** If you do not launch the Management Component Configuration utility during installation, you can configure the Management Component later by going to **Start** > **Programs** > **EMC** > **Configuration** and selecting **Management Component Configuration**.

    If you launched the Management Component Configuration utility, review the following parameters.

    - Ensure that Enable PowerPath Management Component is selected. It is selected by default.
    - In the Port Number field, maintain the default and recommended port value of 9083 or change the port value to a value between 49152 and 65535 if another application is already using the default port (9083).
    - In the Heartbeat Interval field, maintain the default value of 10 minutes or change the heartbeat interval value to a value between 1 and 60. The heartbeat interval be based on the number of hosts being managed.
    - Click **Disable Single Path Symmetrix GateKeeper Setup Warnings** to maintain the default setting if you do not want Setup errors to be reported for Symmetrix gatekeeper devices that are configured with a single path. Otherwise, clear the check box if Symmetrix gatekeeper devices are multi-pathed in your data center.

      (i) **NOTE:** PowerPath supports both single-path and multi-path configured Symmetrix gatekeepers. Consult your network administrator for more information about your Symmetrix gatekeeper configuration.

      (i) **NOTE:** Windows server 2019 should be installed with KB4487044 or superseded KB before proceeding with PowerPath upgrade to avoid an additional reboot.

    - Click **Use Windows perfmon** forPowerPath PMI counters to make PowerPath performance metrics (PowerPath counters) available in the Windows Performance monitoring tools.
    - To restore the default options, click **Restore Default**.

11. Click **Yes** to reboot now or **No** to reboot later.
12. When the host restarts, follow the instructions in After upgrading PowerPath

Upgrade Dell EMC PowerPath using the CLI

Upgrade using the more advanced command-line interface. Use spaces to separate multiple properties.

Prerequisites

The customer accepts the End User License Agreement by default during silent or unattended installation.

Steps

1. Type the following command syntax to upgrade Dell EMC PowerPath:

   `<drive>:\<PowerPath_pkg_name> <install_parameters> /v"<Property>=<Value>"`

   ● For a silent or unattended upgrade, which does not require user input.

     Silent upgrade includes the `/s` parameters.

     `<drive>:\<PowerPath_pkg_name> /s /v"/L*v <logfile> <Property>=<Value>"`

     ⓘ **NOTE:** Silent or unattended upgrade errors are logged in `<logfile>`, the location specified in the upgrade command. No error message is displayed in the Windows PowerPath Administrator GUI.

   ● For an interactive upgrade, which requires user input.

     `<drive>:\<PowerPath_pkg_name> /v"/L*v <logfile> <Property>=<Value>`

drive	The drive letter, for example, C.
PowerPath_pkg_ name	The Dell EMC PowerPath package name. For example, `EMCPower.X64.signed.<version>.<build>.exe`. Where *version* is the product version. For example, Dell EMC PowerPath 6.3.
install_parameter s	One or more parameters (`/s`, `/v`, or `/p`) that are described in CLI parameters.
logfile	Creates the logfile where the log message is sent, for example, `C:\logs\PPsetup.log`. Ensure that the specified directory exists within the specified path.
Property=Value	One or more optional properties that are described under the `/v` parameter in CLI parameters.

   The following examples provide scenarios using the silent and interactive CLI methods:

   ● **Silent upgrade**

     Install all default Dell EMC PowerPath features (Multipathing, Migration Enabler, Management Component, and support for EMC storage arrays) using the silent method and to also set the Dell EMC PowerPath license and disable restart.

     `C:\EMCPower.X64.signed.<version>.<build>.exe /s /v"/L*v C:\logs\PPsetup.log LICENSENUM=0000-0000-0000-0000-0000-0000 NO_REBOOT=1"`

   ● **Unattended upgrade**

     Install all default Dell EMC PowerPath features (Multipathing, Migration Enabler, Management Component, and support for EMC storage arrays) using the unattended method and to also set the Dell EMC PowerPath license and disable restart.

     Unattended installations include the `/p` parameter.

     `C:\EMCPower.X64.signed.<version>.<build>.exe /p /v"/L*v C:\logs\PPsetup.log LICENSENUM=0000-0000-0000-0000-0000-0000 NO_REBOOT=1"`

   ● **Interactive upgrade**

     Upgrade Dell EMC PowerPath using the interactive CLI method and to set the Dell EMC PowerPath license, copy, and install Dell EMC PowerPath files to `C:\Test` folder, disable restart, and install components to support Dell SC, IBM ESS, and Hitachi storage arrays.

```
C:\EMCPower.X64.signed.<version>.<build>.exe /v"/L*v C:\Install_IBM_HDS_NETAPP.log
LICENSENUM=0000-0000-0000-0000-0000-0000 INSTALLDIR=C:\Test NO_REBOOT=1
ADDLOCAL=SC,IBM,HDS,NETAPP"
```

2. Before restarting, go through the following instructions and resolve if there are any issues.

   Windows 2016

   - ```
     Windows Server 2016 should be installed with KB4457127 or superseded KB before
     proceeding with PowerPath installation to avoid incompatibility issues with
     Retpoline binaries.
     ```

     (i) **NOTE:** For information on latest windows updates, see Microsoft website, https://support.microsoft.com/en-us/help/4000825/windows-10-windows-server-2016-update-history.

   Windows 2019

   - ```
     Windows Server 2019 should be installed with KB4487044 or superseded KB before
     proceeding with PowerPath upgrade to avoid an additional reboot.
     ```

     (i) **NOTE:** For information on latest windows updates, see Microsoft website, https://support.microsoft.com/en-us/help/4464619/windows-10-update-history .

3. After upgrading Dell EMC PowerPath, restart the host and then follow the instructions in After upgrading PowerPath.

   CLI parameters describes the parameters and options.

After upgrading PowerPath

This section describes post-upgrade tasks.

Verify the configuration

Verify the PowerPath configuration after upgrade.

Steps

1. Save the configuration.
   - After the host restarts, check that PowerPath is fully configured with multiple paths to logical devices and (if appropriate) correct zones when you start. Check that the devices from the new arrays supported by the upgraded PowerPath version are configured correctly.

     Refer to the E-Lab Interoperability Navigator and Release Notes of the upgraded PowerPath version to check for the supported arrays.

   - Verify if the configuration is correct. If PowerPath sees no devices from the newly supported arrays, but the devices are seen by the operating system, then verify that the devices are configured for PowerPath support.

     powermt display

     powermt display dev=all

     powermt display ports

     (i) **NOTE:** After PowerPath installs or upgrades, verify and save the configuration. If you upgraded with an existing custom file, internal information in the custom file may need to be updated with information from the new PowerPath version. To update the custom file, run **powermt save** when the configuration is verified as expected.
   - Save the verified configuration.

     powermt save

2. Verify that devices from arrays whose support is deprecated in the upgraded PowerPath version will not be claimed by PowerPath. If the corresponding dead devices are still present in the host, run **powermt check force** to remove those corresponding dead paths and **powermt save** to save the updated configuration information.

   Refer to Release Notes of the upgraded PowerPath version to check for arrays whose support is deprecated.

3. Verify that any new parameters added or parameter values changed in the upgraded PowerPath version are reflected correctly. `powermt display dev=all`

   Refer to Release Notes of the upgraded PowerPath version to check if any new parameters are added or if any default parameter values are changed.

Supported upgrades

Before upgrading, ensure your environment meets these requirements:
● Do not remove redundant cable connections from the array.
● Upgrading the Windows operating system provides information on upgrading Windows operating systems that have Dell EMC PowerPath installed.
● Windows Server Core 2012 and later—If Dell EMC PowerPath is installed through the GUI on the core version, the license key dialog box will not appear. Use the `emcpreg` utility to add the license key before rebooting.
● Upgrade using either the interactive GUI or the interactive CLI method.
● Upgrading Dell EMC PowerPath in a Boot from SAN environment—You can upgrade Dell EMC PowerPath in a Boot from SAN environment using the same procedure that you would use in other environments.

Upgrade Dell EMC PowerPath custom file conversion

When the `powermt.custom` file is stored in a location other than the default location, the custom file will not be converted when upgrading Dell EMC PowerPath. This may cause error messages to appear after upgrading to Dell EMC PowerPath and running `powermt load`.

Prerequisites

In order for the upgrade to convert the `powermt.custom` file, perform the following procedure before beginning the upgrade.

About this task

If you upgrade Dell EMC PowerPath without converting the `powermt.custom` file, you must recreate the settings in Dell EMC PowerPath 6.x.

Steps

1. Copy the `powermt.custom` to the default **<PowerPath_Installation_Directory>\PowerPath** directory.
2. During the upgrade, when prompted, select to keep the existing custom file.

Results

After the upgrade and restart, the settings that are saved in the `powermt.custom` file will be automatically loaded.

ⓘ **NOTE:** Without persistent binding, the SCSI ID of a LUN may change, leading to ghost paths appearing during a host restart with a saved custom file configuration. This may cause `powermt` to display misleading information. You may also see dead paths in case these paths have different SCSI IDs. In such cases, you will also see more paths per LU than what was actually configured in the SAN environment. Ghost paths can be avoided by setting the **persist_path_info** to OFF. The *PowerPath Family CLI and System Messages Reference Guide* provides more information.

Upgrading the Windows operating system

You can upgrade the Windows operating system to a major release or to its service pack.

ⓘ **NOTE:** The E-Lab Interoperability Navigator and the *PowerPath and PowerPath/VE Family for Windows Release Notes* provide information on the required service packs on different operating systems, supported versions of Dell EMC PowerPath, and any other system information that may apply to the operating system you plan to install.

Install Windows operating system service packs

You do not need to uninstall PowerPath before installing an operating system service pack.

4

Removing PowerPath

This chapter contains the following sections:

Topics:

Before removing Dell EMC PowerPath

About this task

> (i) **NOTE:** If you try to uninstall Dell EMC PowerPath when there are active migrations, the message `Migration(s) is (are) pending. Cannot uninstall.` appears and the uninstallation process aborts. Contact Customer Support if you see the message `An internal error has occurred. Migrations may be pending.`

Steps

1. Check Dell EMC Online Support for the most current information.
   EMC updates release notes periodically and posts them on Dell EMC Online Support.
2. Stop any application actively sending I/O.
   In addition, close any remaining applications and client files to avoid warning messages when rebooting after the uninstall.

Removing Dell EMC PowerPath software or components

You can remove Dell EMC PowerPath and all related components, or you can remove a specific feature, such as Migration Enabler. You can also remove specific multipathing components you may no longer need, such as components to support third-party arrays.

About this task

Steps

* You can use the Windows Add/Remove Programs or Programs and Features tools to remove Dell EMC PowerPath, or you can use the more advanced Dell EMC PowerPath command line interface.
   Use one of these methods to uninstall Dell EMC PowerPathsoftware or features:
   ○ Uninstalling Dell EMC PowerPath with Windows OS tools
   ○ Uninstalling PowerPath using the CLI

Results

> (i) **NOTE:** Reboot after removing Dell EMC PowerPath.

Uninstalling Dell EMC PowerPath with Windows OS tools

The procedures in this section describe how to uninstall Dell EMC PowerPath software or components using Windows operating system tools.

Example

- Removing Dell EMC PowerPath removes Dell EMC PowerPath multipathing and makes other Dell EMC PowerPath features unavailable for installation changes through the Windows PowerPath Administrator GUI. Future installation changes can only be made through the Dell EMC PowerPath executable file or the Dell EMC PowerPath CLI once you complete this procedure.
- Removing Dell EMC PowerPath features removes specific Dell EMC PowerPath features, such as Migration Enabler, Management Component, or components that provide support for third-party arrays.
- Dell EMC PowerPath for Windows Patch removal removes specificDell EMC PowerPath patches.

Removing Dell EMC PowerPath

Use this procedure to completely remove Dell EMC PowerPath.

Steps

1. Using **Add/Remove Programs** or **Programs and Features** uninstall the installed version of Dell EMC PowerPath.
   - If User Account Control (UAC) is turned on, click **Yes** on the elevation.
   - If you belong to the Administrative group, click **Allow** in the elevation.
   - If you are a standard user, give the administrative credentials to uninstall.
2. When prompted to remove Dell EMC PowerPath, click **Yes**.
3. When prompted to reboot the host, click **No** to reboot later.
   You can reboot after disconnecting redundant cables.
4. Complete the steps in Disconnecting redundant paths to the storage system

Removing Dell EMC PowerPath features

Use this procedure to remove specificDell EMC PowerPath features.

Prerequisites

(i) **NOTE:** You cannot uninstall PowerPath multipathing for EMC arrays using this procedure. Only the complete uninstall procedure removes default multipathing components.

Steps

1. Using **Add/Remove Programs** or **Programs and Features** select the installed version of Dell EMC PowerPath and click **Change/Remove**.
2. In the setup wizard welcome window, click **Next**.
3. Click **Change**.
4. To select a feature to uninstall, such as Migration Enabler or the Management Component, click the drop-down arrow beside the feature on the **Custom Setup** dialog box:

   (i) **NOTE:**
   - A selected feature displays a hard drive icon next to it. A red X next to it indicates features that are not selected.
   - The icon next to the feature name indicates the install state of the feature. Click **Help** in the **Custom Setup** dialog box for more information about the icons.

   a. Select **Entire feature will be unavailable**.
   b. Click **Next**.

5. In **Ready to Change Dell EMC Dell EMC PowerPath 6.X.(xxbit)**, click **Change**.

6. Click **Finish**.

7. When prompted to reboot the host, click **No** to reboot later.

   Feature removal (other than the Management Component) needs reboot.

Results

If you removed multipathing support for any storage systems, complete the steps in Disconnecting redundant paths to the storage system

Dell EMC PowerPath for Windows Patch removal

About this task

Uninstalling a base Dell EMC PowerPath package will uninstall any related patches as well. For example, uninstallation of Dell EMC PowerPath 6.3 will uninstall any corresponding Dell EMC PowerPath 6.3 patches as well.

Uninstalling a Dell EMC PowerPath for Windows patch using the GUI

Steps

1. If the Dell EMC PowerPath Administrator is running, close it.

2. Close all applications.

3. Open the Control Panel and then select **Add/Remove Programs** or **Programs and Features**.

4. Display the installed Dell EMC PowerPath patch you want to remove by clicking **Show updates** or **View installed updates**.

5. Select the specific Dell EMC PowerPath patch you want to remove, and click **Remove**.

6. Click **Yes** to remove the Dell EMC PowerPath patch.

7. Click **Yes** to restart the host.

Uninstalling PowerPath using the CLI

The command line method allows you to remove PowerPath multipathing and/or other features, such as Migration Enabler. Use this procedure for complete PowerPath removal or for feature-specific removal.

Steps

1. Remove PowerPath.
   - For a silent or unattended removal, PowerPath does not require user input.

     Silent removals include the `/s` parameters.

     `<drive>:\<PowerPath_pkg_name> /s /v"/L*v <logfile> <Property>=<Value>"`

     (i) **NOTE:** Silent or unattended removal errors are logged in `<logfile>`, the location specified in the uninstallation command. No error message appears in the Windows PowerPath Administrator GUI.
   - For an interactive removal, which requires user input.

     `<drive>:\<PowerPath_pkg_name> /v"/L*v <logfile> <Property>=<Value>"`

drive	The drive letter, for example, C.
PowerPath_pkg_name	The PowerPath package name. For example, `EMCPower.X64.signed.<version>.<build>.exe`. Where *version* is the product version. For example, PowerPath 6.3.
uninstall_parameters	One or more parameters (`/s`, `/v`, `/r`, or `/p`) that are described in CLI parameters.

logfile	Creates the log file where the log message is sent, for example, `C:\logs\PPsetup.log`. Ensure that the specified directory exists within the specified path.
Property=Value	One or more optional properties that are described under the `/v` parameter in CLI parameters.

The following examples provide scenarios using the silent and interactive CLI methods.

ⓘ **NOTE:** Use PPREMOVE=CLEAN for complete removal of PowerPath.

- **Silent removal**

  Remove all default PowerPath features (Multipathing, Migration Enabler, Management Component, and support for EMC storage arrays) using the silent removal method. It also disables reboot.

  `C:\EMCPower.X64.signed.6.x.<build>.exe /s /v"/L*v C:\logs\PPremove.log NO_REBOOT=1 PPREMOVE=CLEAN"`

- **Unattended removal**

  Removes all default PowerPath features (Multipathing, Migration Enabler, Management Component, and support for EMC storage arrays) using the unattended uninstallation method. It also disables reboot.

  Unattended installations include the `/p` parameter.

  `C:\EMCPower.X64.signed.6.x.<build>.exe /p /v"/L*v C:\logs\PPremove.log NO_REBOOT=1 PPREMOVE=CLEAN"`

- **Interactive removal**

  Removes components to support HP XP and Hitachi arrays and disables restart.

  `C:\EMCPower.X64.signed.6.x.<build>.exe /v"/L*v C:\Uninstall_HPXP_HDS.log NO_REBOOT=1 PPREMOVE=HPXP,HDS`

- Use only in case if you encounter a problem with normal PowerPath uninstallation (interactive/silent uninstallation).

  The `/r` parameter replaces PPREMOVE=ALL. By default, a bootstrapper log is created in `%ProgramData% \EMC\PowerPath\logs`. Adding the `/L*v <logfile>` parameter does not create a log file when using the PPRemoveAll utility.

  `C:\EMCPower.X64.signed.6.x.<build>.exe /r`

2. After uninstalling, complete the steps in Disconnecting redundant paths to the storage system.

   CLI parameters describes the parameters and options.

Dell EMC PowerPath uninstallation troubleshooting

The following table lists Dell EMC PowerPath uninstallation troubleshooting scenario.

About this task

Table 1. Troubleshooting scenario

Problem	Message	Suggested action
Uninstalling Dell EMC PowerPath in a Boot from SAN configuration on a host that has Windows Server 2012 or later requires two host reboots.	`PowerPath cannot disable some of its devices because a page file is located in a LUN under PowerPath control or host is configured to boot from SAN. Under these scenarios, two host reboots are required to uninstall PowerPath. Click OK to proceed, or Cancel to exit.`	1. Go to Control Panel and select **Add/ Remove Programs**. 2. Select Dell EMC PowerPath. 3. Click **Remove**. 4. Restart the host. 5. Repeat steps 1 through 3. 6. Restart the host
MPIO is ready to be uninstalled in a Boot from SAN configuration.	`PowerPath has prepared the system for uninstallation. You must restart your system`	1. Go to Control Panel and select **Add/Remove Programs**. 2. Select Dell EMC PowerPath.

Table 1. Troubleshooting scenario (continued)

Problem	Message	Suggested action
	`and continue with PowerPath uninstallation.`	3. Click **Remove**. 4. Restart the host. 5. Repeat steps 1 through 3. 6. Restart the host.

Disconnecting redundant paths to the storage system

After uninstalling Dell EMC PowerPath, disconnect redundant paths to the storage system.

About this task

⚠ CAUTION: **Data corruption is possible if multiple paths remain on a system after Dell EMC PowerPath is removed.**

Steps

1. In the Shut Down Windows dialog box, select **Shut Down** from the list and then click **OK**.
2. With the host shut down, disconnect the redundant cables from the HBAs to the storage system interface ports.

   ⓘ NOTE: SAN (fabric) configurations may have multiple logical configurations per physical connection. Ensure that no redundant zoned paths exist.

3. Restart the host.
   Dell EMC PowerPath is completely removed from the host.

Managing PowerPath

This chapter contains the following sections:

Topics:

Overview

The Dell EMC PowerPath Administrator graphical user interface for Windows Server consists of two applications:

- Dell EMC PowerPath Monitor—Continuously monitors your Dell EMC PowerPath configuration and alerts you of status changes. The Dell EMC PowerPath Monitor section provides additional information.
- Dell EMC PowerPath Administrator—Configures, monitors, and manages Dell EMC PowerPath devices. The Dell EMC PowerPath Administrator provides additional information.

Dell EMC PowerPath Monitor

Dell EMC PowerPath Monitor (on the taskbar of the Windows desktop) continuously monitors the status of the Dell EMC PowerPath configuration. Dell EMC PowerPath Monitor can be set to alert you with visual and audible cues when the status changes.

For example, if a path fails, the icon changes accordingly. Depending on the Notification settings you choose on the Options tab of the Dell EMC PowerPath **Admin (root node) Properties** dialog box (see Dell EMC PowerPath Administrator online help for Windows Server), Dell EMC PowerPath Monitor may:

- Sound an alarm.
- Restore the Dell EMC PowerPath Administrator main window.
- Flash the taskbar icon.
- Or any combination thereof.

The following table shows the taskbar icons and the status each represents.

Table 2. Dell EMC PowerPath Monitor taskbar icons

Taskbar icons	Status
	Optimal—All configured paths are operating correctly.
	Degraded—Some but not all paths have failed.
	All Failed—All configured paths have failed.

Table 2. Dell EMC PowerPath Monitor taskbar icons (continued)

Taskbar icons	Status
	Server Not Responding—Cannot communicate with Monitor service. This occurs if the Dell EMC PowerPath Administrator Suite encountered errors during initialization.
	Dell EMC PowerPath Unlicensed—Dell EMC PowerPath is unlicensed.
	Reboot Pending—Restart the system for the configuration changes made to Dell EMC PowerPath to take effect.

(i) **NOTE:** All non-optimal monitor icons appear only if you have selected the Flash Taskbar Icon on the Options tab of the Dell EMC PowerPath **Admin (root node) Properties** dialog box. The root node is the top-level view of the configuration and represents the host that Dell EMC PowerPath manages.

Launching MMC with the Dell EMC PowerPath snap-in

About this task

You can use Dell EMC PowerPath Monitor to do the following:
- Launch Microsoft Management Console (MMC) with the Dell EMC PowerPath snap-in.
- Notify you of Dell EMC PowerPath status changes if you are running it on a local host.

(i) **NOTE:** The Dell EMC PowerPath Administrator Monitor monitors the local host only. It does not remotely monitor the status of another host. The icon is only present on the Windows taskbar on the host with Dell EMC PowerPath Administrator installed. If you are running Dell EMC PowerPath for the first time on a remote host, you must start the application according to the instructions at Monitoring local or remote hosts with MMC

Steps

- Perform one of the following steps.
  - Double-click the Dell EMC PowerPath Monitor icon on the Windows taskbar to launch the default MMC console with the Dell EMC PowerPath Snap-in.
  - Right-click the Dell EMC PowerPath Monitor icon to display the following context menu options: Dell EMC PowerPath Administrator (launches Dell EMC PowerPath Administrator) or Close Monitor (closes the Dell EMC PowerPath Administrator Monitor).

  (i) **NOTE:** From PowerPath Windows 7.0 onwards, PowerPath can be managed through Dell EMC PowerPath extension for Windows Admin Center as well. For more information, see Managing PowerPath using browser-based management platform.

Dell EMC PowerPath registration tools

You can use the Dell EMC PowerPath Licensing Tool or the `emcpreg` command to register Dell EMC PowerPath and related products.

Adding a license using the Dell EMC PowerPath licensing tool

The Licensing Tool is used to register Dell EMC PowerPath and other products, from the Windows GUI.

About this task

This tool allows you to add or remove licenses. For more information, see the online help (press F1) or launch the help file, `EMCLicTool.chm`, from the Dell EMC PowerPath software CD or the `\help` directory.

Steps

- The Licensing Tool is displayed during Dell EMC PowerPath installation.

To manage licenses, you can launch the tool by selecting **Start** > **All Programs** > **Dell EMC Dell EMC PowerPath Licensing Tool**.

Adding a license using the `emcpreg` command

The `emcpreg` command facilitates scripting options and is the only way to manage licenses with the Windows Server Core. The `emcpreg` command is supported with all supported Windows platform versions.

Steps

- Add a license.

  `emcpreg -add <key>`

  Where *<key>* is the product license key.

  The *PowerPath Family CLI and System Messages Reference Guide* provides additional information.

Dell EMC PowerPath Administrator

The Dell EMC PowerPath Administrator is a graphical user interface for configuring, monitoring, and managing Dell EMC PowerPath devices. The Dell EMC PowerPath Administrator continuously monitors a multipath storage-system environment and automatically updates the configuration information that appears. You can use Dell EMC PowerPath Administrator to set up and change your device configuration and manage physical and logical path components.

The Dell EMC PowerPath Administrator displays a hierarchical representation of paths, logical devices, and HBAs.Dell EMC PowerPath Administrator displays the components of a Dell EMC PowerPath system as objects. Dell EMC PowerPath Administrator icons represent the Dell EMC PowerPath objects in your configuration. The type of icon reflects the state or status of the particular object selected. Table 6 and Table 7 display Dell EMC PowerPath Administrator icons.

Dell EMC PowerPath Administrator panes

As part of MMC, the Dell EMC PowerPath Administrator has two panes:

- The scope pane displays Dell EMC PowerPath objects in a hierarchical list that can be expanded or collapsed.
- The result pane provides a view of configuration statistics for Dell EMC PowerPath objects selected in the scope pane.

Accessing the Dell EMC PowerPath Administrator device properties

You can access most of the Dell EMC PowerPath Administrator functions through the tabs available in the device Properties dialog box.

About this task

Dell EMC PowerPath Admin (root node) properties — Use this to:

- Show root node details
- Set local or remote host options
- Set error notification options
- Set Auto-Restore
- View array management information
- Set the path latency options
- Manage the autostandby feature options
- Manage persist_path-info option
- (i) **NOTE:** The root node is the top-level view of the configuration and represents the host that Dell EMC PowerPath manages. The **Root Node Properties** dialog box contains the Details, Computer, and Options tabs. (The Computer tab is present only when you are connected to a remote host).

- Storage array properties—Show storage array details. To display this tab, select a storage array, right-click, and click **Properties**.
- Storage array port properties—Show storage array port details. To display this tab, select a storage array port, right-click, and click **Properties**.
- Adapter properties—Show adapter details and change modes on the adapter. To display this tab, select an adapter, right-click, and click **Properties**.
- Disk properties—Show disk details, change modes on the disk, and change load-balancing policies and priorities. To display this tab, select a disk, right-click, and click **Properties**.
- Path properties—Show path details and change the mode of a path. To display this tab, select a path, right-click, and select **Properties**.

(i) **NOTE:** The previous examples illustrate the most common Dell EMC PowerPath Administrator functions. The Dell EMC PowerPath Administrator online help for Windows Server provides complete information on using all theDell EMC PowerPath Administrator functions.

Steps

- Right-click the **Dell EMC PowerPathAdmin** root node and then select **Properties**.

Icons: standard, unlicensed, and unknown conditions

The following table shows icons for standard, unlicensed, unknown, and mismatched states. Standard icons represent a configuration in which Dell EMC PowerPath is optimal.

Table 3. Icons on the Dell EMC PowerPath administrator

Object	Standard Icon	Unlicensed Icon	Unknown Icon	Mismatched Icon
Root Node—Graphical representation of the host and top level view of your configuration.				N/A
Storage Array—An attached storage system that provides logical devices which are managed by Dell EMC PowerPath.				N/A
Storage Array Port—Identifies a port within a specific storage array that provides I/O paths to the logical devices.				N/A
Disk—A logical device managed by Dell EMC PowerPath. Logical devices are disk devices presented by the storage system.				N/A
Adapter—A device that provides an interface between the SCSI or Fibre Channel bus and the computer I/O bus. An adapter can have multiple paths associated with it.				N/A
Path—The logical or physical I/O path from the host to the storage system, including the HBA, cable, and interface port.				

(i) **NOTE:** The online help provides more information on icons and their meaning.

Icons: known failure conditions

When a path fails, the failure propagates through other Dell EMC PowerPath Administrator objects. These objects are displayed in a hierarchy in the scope pane and result pane. These known failure icons represent configurations that are less than optimal.

Degraded Dell EMC PowerPath objects are represented by a red slash through the standard object icon. (Because a path is either open or closed, the path icon is never shown as degraded.) Failed Dell EMC PowerPath objects are represented by a red X through the standard object icon.

The definition of degraded and failed status depends on the context shown in the following table. For example, an unlicensed version of Dell EMC PowerPath with degraded or failed paths displays icons that combine elements of both the unlicensed and degraded icons. Unless specified otherwise, all icons display in both the summary and details panes.

Table 4. Icons of known Dell EMC PowerPath failure conditions

Object	Degraded Icon	Failed Icon	Unlicensed and Degraded Icon	Unlicensed and Failed Icon
Root Node	Dell EMC PowerPathAdministrator is identifying a degradation within the managed environment.	Dell EMC PowerPath Administrator is in a failed state.	Dell EMC PowerPath is unlicensed and identifying a degradation within the managed environment.	Dell EMC PowerPath Administrator is unlicensed and in a failed state.
Storage Array	One or more (but not all) paths to the storage array have failed or are in a degraded state.	All paths to the specific array have failed. This array is not available.	Dell EMC PowerPath Administrator is unlicensed. One or more (but not all) paths to the array have failed or are in a degraded state.	Dell EMC PowerPath Administrator is unlicensed. All paths to the specific array have failed. This array is not available.
Storage Array Port	One or more (but not all) paths to the storage array port have failed or are in a degraded state.	All paths to the specific array port have failed. This array port is not available.	Dell EMC PowerPath Administrator is unlicensed. One or more (but not all) paths to the array port have failed or are in a degraded state.	Dell EMC PowerPath Administrator is unlicensed. All paths to the specific array port have failed. This array port is not available.
PowerPath Device	One or more (but not all) paths to the disk device have failed.	All paths to the specific disk device have failed. This disk is not available.	Dell EMC PowerPath Administrator is unlicensed. One or more (but not all) paths to the disk device have failed.	Dell EMC PowerPath Administrator is unlicensed. All paths to the specific disk device have failed. This disk is not available.
Adapter	One or more (but not all) adapters have either failed or degraded. Displays in the Adapters folder in the scope pane. One or more (but not all) paths have failed on the specific adapter.	All paths on this adapter have failed.	Dell EMC PowerPath Administrator is unlicensed. One or more (but not all) paths have failed on the specific adapter.	Dell EMC PowerPath Administrator is unlicensed. All paths on this adapter have failed.
Path	Not applicable	One or more of the hardware components that make up the path has failed; therefore, the entire path failed.	Not applicable	Dell EMC PowerPath Administrator is unlicensed, and one or more of the hardware components that comprise the path has failed; therefore, the entire path fails.

Undefined SP conditions

The following icons represent a rare condition on active/passive arrays, including VNX OE and CLARiiON, that produce a double link control card (LCC) failure. If you see these icons, the LCC fault light on the VNX OE or CLARiiON array should be amber. Refer to the VNX OE or CLARiiON documentation for troubleshooting information, or contact Customer Support for information on replacing an LCC.

Table 5. Icons of undefined SP Dell EMC PowerPath failure conditions

Standard Icon	Degraded Icon	Failed Icon	Unlicensed Icon	Unlicensed and Degraded Icon	Unlicensed and Failed Icon
The CLARiiON link control cards (LCC) have failed. The SP owning the disk is unknown and the disk is unavailable.	The CLARiiON link control cards (LCC) have failed. The SP owning the disk is unknown and one or more (but not all) paths to the disk device has failed. The disk is unavailable.	The CLARiiON link control cards (LCC) have failed. The SP owning the disk is unknown and all paths to the disk device has failed. The disk is unavailable.	The Dell EMC PowerPath Administrator is unlicensed and the CLARiiON link control cards (LCC) have failed. The SP owning the disk is unknown and the disk is unavailable.	The Dell EMC PowerPath Administrator is unlicensed and the CLARiiON link control cards (LCC) have failed. The SP owning the disk is unknown and one or more (but not all) paths to the disk device has failed. The disk is unavailable.	The Dell EMC PowerPath Administrator is unlicensed and the CLARiiON link control cards (LCC) have failed. The SP owning the disk is unknown and all paths to the disk device has failed. The disk is unavailable.

Monitoring local or remote hosts with MMC

With MMC and theDell EMC PowerPath Snap-in, you can monitor a local host or a remote host.

About this task

Local administration—Dell EMC PowerPath Administrator is installed on the local host by default. The installation process provides a preconfigured .msc file to launch the Microsoft Management Console (MMC). Once Dell EMC PowerPath is installed, you can use Dell EMC PowerPath to monitor the local host immediately.

Remote administration—Part 2: Adding the Dell EMC PowerPath Administrator snap-in (Remote) provides additional information on how to add theDell EMC PowerPath Snap-in to monitor a remote host with Dell EMC PowerPath installed.

Steps

- Launch MMC with the Dell EMC PowerPath Snap-in.

  Select **Start** > **All Programs** > **EMC** > **Dell EMC PowerPath** > **PowerPathAdmin**.

Example

ⓘ **NOTE:** The path starts the Dell EMC PowerPath Snap-in and the MMC console on the local host with no other action required. However, there may be scenarios in which you need to add the Dell EMC PowerPath Snap-in to a new MMC console. For example, you may want to create another instance of Dell EMC PowerPath Administrator on the local host or you may have deleted the Dell EMC PowerPath Snap-in and want to add it again. Part 2: Adding the Dell EMC PowerPath Administrator snap-in (local) provides additional information on how to add the Dell EMC PowerPath Snap-in to the MMC console to monitor a local host.

Setting a local host option

Adding the Dell EMC PowerPath snap-in to MMC and monitoring a local host is a two-part procedure.

Part 1: Opening the MMC

Steps

1. Click **Start**.
   a. In the Start Search text box, type `mmc`.
   b. In the Start Search text box, type `cmd` and then type `mmc`.
2. In the Open field, run `mmc` (32-bit OS versions) or `mmc/32` (64-bit OS versions).
   > (i) **NOTE:** 32-bit is only available after product qualification has been requested from Dell EMC Online Support.
3. Click **OK**.
   An **MMC Console** appears. The MMC title bar displays Console1. Within this pane is the Console Root. Initially this folder is empty. However, once the snap-in is added, this folder will contain the Dell EMC PowerPath Administrator (and any other added snap-ins) and is displayed as expandable icons under the Console Root folder.

Part 2: Adding the Dell EMC PowerPath Administrator snap-in (local)

Steps

1. From the MMC console, select **File** > **Add/Remove Snap-in**.
2. Select **Dell EMC PowerPath Administration** and click **Add**.
3. Select **Local Computer**.
4. Click **Finish**.
5. In the **Add/Remove Snap-in** dialog box, click **OK**.
   Dell EMC PowerPath Administrator is now added to the MMC console.

Results

You can now use Dell EMC PowerPath Administrator to configure, manage, and monitor Dell EMC PowerPath devices. Once you have changed the configuration, save the configuration. Saving a configuration provides additional information.

Setting a remote host option

Adding the Dell EMC PowerPath snap-in to MMC and monitoring a remote host is a two-part procedure.

Part 1: Opening the MMC

Steps

1. Click **Start**.
   a. In the Start Search text box, type `mmc`.
   b. In the Start Search text box, type `cmd` and then type `mmc`.
2. In the Open field, run `mmc` (32-bit OS versions) or `mmc/32` (64-bit OS versions).
   > (i) **NOTE:** 32-bit is only available after product qualification has been requested from Dell EMC Online Support.
3. Click **OK**.
   An **MMC Console** appears. The MMC title bar displays Console1. Within this pane is the Console Root. Initially this folder is empty. However, once the snap-in is added, this folder will contain the Dell EMC PowerPath Administrator (and any other added snap-ins) and is displayed as expandable icons under the Console Root folder.

Part 2: Adding the Dell EMC PowerPath Administrator snap-in (Remote)

Steps

1. From the MMC console, select **File** > **Add/Remove Snap-in**.
2. Select **Dell EMC PowerPath Administration** and click **Add**.
3. Select **Another Computer**.
4. Type the computer name or browse for the remote computer.
5. In the Browse for Computer dialog box, click **OK**.
6. Type your User Name, Domain Name, and Password.
7. Click **Finish**.

   ⓘ **NOTE:** The User Name, Domain Name, and Password fields are subsequently available for editing from the root node Properties page if you are using MMC to monitor a remote host. The section "Set Remote Host Options" in the Dell EMC PowerPath Administrator online help provides additional information.

8. In the **Add Standalone Snap-in** dialog box, click **Add to add another snap-in** or click **Close**.
9. In the **Add/Remove Snap-in** dialog box, click **OK**.
   Dell EMC PowerPath Administrator is now added to the MMC console.

Saving and loading Administrator settings

About this task

You can use Dell EMC PowerPath Administrator to configure, manage, and monitor Dell EMC PowerPath devices. The first time you run Dell EMC PowerPath Administrator, there is a default configuration. If you make changes, you can save them to a configuration file. The file records the serial numbers, mode, policy, and priority for each configured path. You can also load the last known configuration or a previously saved file.

ⓘ **NOTE:** Dell EMC PowerPath configuration files are distinct from the PowerPath management pack Microsoft Management Console (MMC) configuration files. If you close the MMC window, MMC prompts you to save the MMC settings. These settings are not the same as the Dell EMC PowerPath Administrator settings. Saving the MMC console settings does not save your Dell EMC PowerPath configuration changes. These changes will be lost unless you complete the following procedure.

Saving a configuration

Save the current Dell EMC PowerPath Administrator settings.

About this task

ⓘ **NOTE:** Saving the configuration may override an existing configuration file. Provide a unique file name and use the Save As option to avoid overriding an existing configuration file.

Steps

- Perform one of the following steps:
  - Type `powermt save [file=<pathname>]`
  - In Dell EMC PowerPath Administrator, right-click the root node and select **All Tasks** > **Save Config as**. Specify a file name and click **Save**.
- Save the configuration for reboot.

Loading a configuration

You can load the last known reboot state or a previously saved configuration file.

About this task

To load the last known reboot state, right-click the root node and select **All Tasks** > **Load Reboot Config**.

Steps

1. In the scope pane, select the Dell EMC PowerPath Admin root node.
2. To load a previously saved Dell EMC PowerPath configuration, right-click the root node and select **All Tasks** > **Load Config File**.

Saving MMC console settings

The MMC console enables you to display the Dell EMC PowerPath Snap-in data in many ways. If you change your MMC console configuration (for example, if you resize columns, change column displays, or change column sort order), you may want to save these new MMC console settings.

If you close the MMC console itself, or theDell EMC PowerPath Snap-in within the MMC console, MMC prompts you with the following message:

```
Save console settings to <filename>.msc?
```

Click **Yes** to save the latest console settings. By default, the MMC console settings are saved as `console1.msc` in the folder:

`%SystemDrive%\Programs\Administrative Tools`

You can save the console settings anytime with the Console, Save menu option in the MMC console. To save the file with a different name or to a different location, go to **MMC Console** > **Save As**.

Deploying Dell EMC PowerPath with SMS

Dell EMC PowerPath has been qualified with the Systems Management Server (SMS) software from Microsoft, which allows remote management of large groups of Windows-based systems. SMS allows you to remotely manage patches, distribute software, deploy operating systems, and perform software and hardware inventories.

Steps

1. Create a Dell EMC PowerPath package in SMS.
2. Create a program for that Dell EMC PowerPath package.
3. Assign distribution points to that package.
4. Advertise the package to target clients by defining a collection.

    See the Microsoft SMS product documentation for detailed instructions.

Windows Server traybar and UAC

The traybar monitor program communicates to the Dell EMC PowerPath service where it previously communicated directly with the kernel driver. This means that if the Dell EMC PowerPath service is disabled or fails to start, the traybar monitor will not function and an error displays.

For those tasks that require administrator privileges, you receive the elevated prompt when:

- Opening the GUI from the traybar monitor.
- Launching admin GUI from a program group.
- Starting the license tool.

When the license tool is launched from the Installation program, you do not receive an elevation prompt.

> (i) **NOTE:** The above information is valid only for built in administrator accounts and any accounts which are part of the administrator group, if UAC is turned on.

Audit and error log messages

The *PowerPath Family CLI and System Messages Reference Guide* on Dell EMC Online Support describes audit logging, including instructions for setting up logging in the environment. It also lists error messages, descriptions, and suggested corrective action.

Managing PowerPath using browser-based management platform

This chapter contains the following sections:

Topics:

Dell EMC PowerPath tools extension for Microsoft Windows Admin Center

The PowerPath tools extension for Windows Admin Center (WAC) is a graphical user interface for configuring, monitoring, and managing PowerPath devices. WAC manages server on private network without connecting to Internet. It can be installed locally or on a Windows server that acts as a gateway. It also helps to control over the server infrastructure.

PowerPath tools extension monitors a multipath storage system environment and automatically updates the configuration information. This extension can be used to set up and change the device configuration and manage the physical and logical path components.

PowerPath tools extension displays the components of a PowerPath system as objects. The PowerPath tools extension icons represent the PowerPath objects in your configuration. The type of icon reflects the state or status of the particular object selected.

Overview

This section describes the architecture of PowerPath tools extension in WAC.

WAC is an evolution of Windows server in-box management tools, it consolidates all aspects of local and remote server management. As a locally deployed, browser-based management experience.

In the figure as shown, the PowerPath tools extension is added into the ecosystem of solutions of WAC. The web server and gateway are integrated into WAC. The web server is used to communicate to internet. Extensions are published to Internet, where you can download and install the software. The gateway interacts with the Windows server through PowerShell or WMI over winRM.
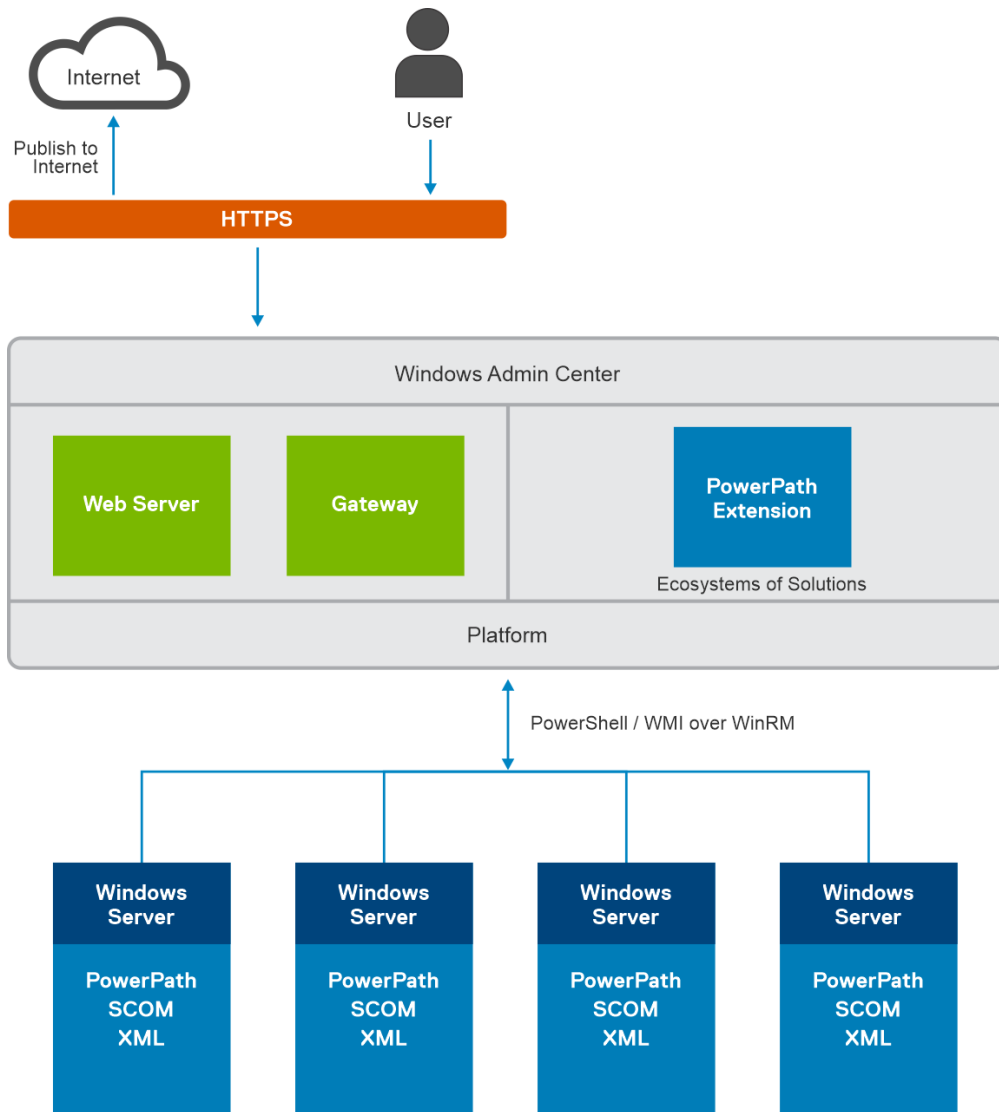
Figure 1. WAC architecture diagram

Key features

PowerPath extension displays multipathing support environment for different types of Arrays.

- Array management details: Displays array details including Storage ID, group names, vendor ID, product ID, number of ports and port names.
- Displays disk details including PowerPath created pseudo devices, disks and paths status, state, mode and IO's status. Disk view also fetches storage ID, group, logical device ID, LUN names, and failover policies for applicable arrays.
- Displays and sets PowerPath specific policies like adaptive, ClarOpt, SymmOpt, least IO's, LeastBlocks, RoundRobin, request and StreamIO for IO load-balancing.
- Displays adapter details including adapters state like Alive or Dead, Optimal or Degraded, and Active or Standby. It also includes IO's status on each adapter.
- Sets disk or path or adapters mode to Standby and Active.
- Saves the current PowerPath administrator settings.
- Displays PowerPath license status

ⓘ **NOTE:** You can modify the mode of the adpater, disk and path from Active to Standy or Standby to Active.

Additional resources

The following table provides additional resources to find more information about PowerPath extension for WAC.

Table 6. Additional resource

Document	Description	Availability
Microsoft Windows Admin Center documentation	Provides information about using Microsoft Windows Admin Center.	https://www.microsoft.com/en-us/windows-server/windows-admin-center
PowerPath Windows release notes	Provides information about new features, known issues, and workarounds.	https://www.dell.com

Support matrix

The following table lists the supported versions:

Table 7. Supported matrix

Support version for PowerPath	Supported version for Operating System	Supported browser
7.0 and later	- Windows Server 2012 (including Server Core) - Windows Server 2012 R2 (including Server Core) - Windows Server 2016 (including Server Core) - Windows Server 2019 (including Server Core)	- Google Chrome - Microsoft Edge Insider

Data security

Traffic from the browser to the WAC gateway uses https and the traffic from the gateway to managed servers uses standard PowerShell and WMI over WinRM.

WAC supports LAPS (Local Administrator Password Solution), resource-based constrained delegation, gateway access control using AD or Azure AD, and role-based access control for managing target servers.

Install Windows Admin Center

WAC can be installed on Windows 10, or Windows server 2016 or later. To manage Windows server 2012, or 2012 R2, installation of windows management framework 5.1 is required on those servers.

About this task

The following are the list of options to install WAC:
- Local Client - Install on a local Windows 10 client that has connectivity to the PowerPath installed servers.

- Gateway Server - Install on a designated gateway server and access from any client browser with connectivity to the gateway server.

- PowerPath Server - Install directly on a PowerPath installed server for managing itself or a cluster in which it is a member node.

- Failover Cluster - Deploy in a failover cluster to enable high availability of the gateway service.

ⓘ **NOTE:**

- Ensure you have good Internet connectivity.
- For more information, see Microsoft Document

Install PowerPath extension

The procedure to install PowerPath extension.

Steps

1. In the WAC page, click **Settings** in the top-right.
2. In the left pane, click **Extensions**.
   The **Available Extensions** tab lists the Dell EMC PowerPath extensions on the feed.
3. Click **Dell EMC PowerPath extension** to view the extension description, version, publisher, and other information in the **Details** pane.
4. Click **Install**.

   If the gateway must run in elevated mode to make this change, you will be presented with a UAC elevation prompt. After installation is complete, the browser automatically gets refreshed and WAC is reloaded with the Dell EMC PowerPath installed.

Install PowerPath extension through Dell support site

The procedure to install PowerPath extension from support site.

Steps

1. Download PowerPath extension from the support site.
2. Extract it to a folder that has read or write permissions. For example: C:/build.
3. Copy the package to a location on the same host.
4. The build needs to be added as a feed in WAC. The procedure to add as feed is as follows:
   a. Open WAC from the start menu.
   b. Go to **Settings** and select **Extensions** and **Feeds** and click **Add**.
   c. In the Extension feed URL or path field, copy paste the URL. For example: "C:\build\"
5. Once the URL is added, PowerPath tools extension is available under **Available Extensions** tab.

   ⓘ **NOTE:** Ensure that there is a folder named **dellemc.dellemcpowerpath**, inside the path mentioned in the feed.

6. Click **Dell EMC PowerPath extension** and click **Install**.
   After installation is complete, the browser automatically gets refreshed and WAC is reloaded with the Dell EMC PowerPath installed.

Add PowerPath server to Windows Admin Center

Add the supported PowerPath installed Windows servers. Refer to the *Support matrix* section. To add a PowerPath installed server to WAC, perform the following steps:

Prerequisites

Windows server which has PowerPath 7.0 and later installed on it.

Steps

1. Click **+ Add** under **All Connections**.
2. Choose to add a **Server Connection**.
3. Enter the name of the server and, if prompted, the credentials to use.
4. Click **Submit**.
   When you click on the added server, the server manager solution extension for the selected connection type will be loaded.

Access PowerPath extension

The procedure to access PowerPath extension.

About this task

The PowerPath extension is available under **Available Extensions** tab.

Steps

1. Select and install **Dell EMC PowerPath Integration**.
   WAC refreshes once it is installed.
2. Connect to any of the PowerPath servers in WAC.
3. The Dell EMC PowerPath Extension is displayed.
   The extension is displayed if the host that you are connected has PowerPath 7.0.0 and above installed in it. In any other case, you cannot see the tools extension for PowerPath.

   (i) **NOTE:** PowerPath tools extension installation is subject to the acceptance of End User License Agreement (EULA).

4. Click on any of the PowerPath servers that have been added.
   You can see the PowerPath as one of its tool extensions.
5. Click on Dell EMC PowerPath tool extension.
   The PowerPath UI is loaded and displayed in the right pane.

Uninstall PowerPath extension

The procedure to uninstall PowerPath extension.

Steps

1. Go to **Settings**.
2. Select **Extension** and click **Installed extensions**.
3. Select **Dell EMC PowerPath Integration** from the list.
4. Click **Uninstall** at the upper left of list.
   The Dell EMC PowerPath Integration is uninstalled.

Dell EMC PowerPath features for PowerMax array

Dell EMC PowerPath for Windows 6.3 and later, supports the following features when the host is connected to a PowerMax array running microcode 5978 and above.

Topics:

Dell EMC PowerPath Auto Host Registration

This section provides information on the Dell EMC PowerPath Auto Host Registration feature.

Overview

Dell EMC PowerPath Auto Host Registration is a feature that enables a host to be registered with PowerMax array running microcode 5978 and above. This feature 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 that are known as LUNZ devices are presented to the host, one per logical path. These devices are automatically configured in Dell EMC PowerPath. However, `powermt display` does not show these devices. Once the LUNZ devices are configured in Dell EMC 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, operating system version, and Dell EMC 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 the "*PowerPath Initiator Registration*" feature is enabled on the array, specify the PowerPath hostname when creating the Initiator Group, without specifying the initiators.

The registration commands contain information such as hostname, UUID, operating system version, and Dell EMC 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.

Mode of operation

Dell EMC PowerPath Host Registration works in the following two modes:

Automatic

Dell EMC PowerPath Host Registration is configured automatically in the following scenarios:
- On Dell EMC 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 helps in the array being aware that the host is active.
- If any of the host information such as the hostname changes, then a registration is attempted within 60 minutes.
- If the host is zoned to a new PowerMax array, then the registration is attempted within 5 minutes.

Manual

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

Settings

This section provides information about the settings that you need to configure the Dell EMC PowerPath Auto Host Registration.

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

```
[~]# powermt display options

        Show CLARiiON LUN names:        true

        Path Latency Monitor: Off
        Persist Path Information: On

        Performance Monitor: disabled
        Interval          : 1 min(s)

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

        IP Address for Host Registration: default

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

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

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

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

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

Viewing Host Registration

The Solutions Enabler software is used to check the details of the host from the array after registration. In this Dell EMC PowerPath release, virtual machine details are not sent in the registration commands and hence the array does not display any virtual machine details even if the host has Hyper-V virtual machines. If cluster software is configured in the host, the cluster software details are sent in the registration commands.

```
symcfg.exe -sid 1413 list -ppreg -host WQ212038


Symmetrix ID     : 000197801413

    Host Name:               WQ212038
    OS Version:              Windows 2016
    OS Revision:             Datacenter Build 14393
    Hardware Vendor Name:    Dell Inc.
    PowerPath Version:       6.3.0
    PowerPath Patch Level:   00.00-231
    PowerPath License Info: XXXX-XXXX-XXXX-XXXX-XXXX-XXXX
    Host Registration Time: 10/22/2018 22:07:00
    Host Connectivity type: FC
    Cluster Info:
        Cluster Name: WIN632K16
        Cluster Node Name: WQ212038
    WWNs:
        (1): 21000024FF31800F
        (2): 21000024FF31800E
    VMs:
```

Dell EMC PowerPath Device IO Statistics

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

Overview

The Dell EMC PowerPath Device IO Statistics feature provides host IO performance collection and reporting to PowerMax microcode 5978 and above. These statistics are collected per Dell EMC 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 Dell EMC PowerPath Device IO Statistics.

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

```
# powermt display options

        Show CLARiiON LUN names:      true

        Path Latency Monitor: Off

        Persist Path Information: On

        Performance Monitor: disabled

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

        IP Address for Host Registration: default

        Storage
```

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

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

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

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

Viewing Dell EMC PowerPath Device IO Statistics

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

Dell EMC PowerPath Device in Use Reporting

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

Overview

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

The device usage statistics reported to array are used by storage administrators to know LUN usage on hosts, in array capacity, and resource planning. Dell EMC PowerPath sends details such as if the device is mounted and name of the process that used the device in the preceding 24 hours to the array.

Settings

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

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

```
#powermt display options

        Show CLARiiON LUN names:      true

        Path Latency Monitor: Off

        Persist Path Information: On

        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
                        app finger printing = enabled
                        device to array performance report = enabled
                        device in use to array report = enabled
```

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

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

Viewing Dell EMC PowerPath Device in Use information

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

```
bash-4.2# ./symdev list -ppi -dev 02E2 -sid 413

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
------ ----------------   ------- ---------------- ----------------
002E2  10/23/18 03:43:27  Yes     WQ212038
bash-4.2#
```

FX Licensing

Ideally PowerPath is licensed by acquiring a license key and entering it with the **emcpreg** utility or the PowerPath licensing tool. However, if a PowerMax array is purchased with an FX bundle, all PowerPath hosts attached to it is automatically licensed by attaching data LUNs to the host.

The number of hosts that can thus be licensed is limited to 75 hosts per FX bundle. PowerPath is fully licensed not just for the PowerMax LUNs and paths, but for all LUNs and paths from other array types as well. PowerPath Migration Enabler functionality is also available through the FX bundle.

All `powermt` commands work without generating any license-related warnings. To verify that the host is licensed through FX, you can use any of the following commands:

- `[~]# ` **powermt check_registration**

  `Host is licensed through FX array.`

- `[~]# ` **emcpreg -l**

  `Host is licensed through FX array.`

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=harddisk10
Symmetrix ID=000197600545
Logical device ID=000002CC
Device WWN=60000970000197600545533030324343
state=alive; policy=SymmOpt; queued-IOs=0
==============================================================================
--------------- Host ---------------   - Stor - -- I/O Path --  -- Stats ---
###  HW Path                 I/O Paths  Interf.  Mode     State  Q-IOs Errors
==============================================================================
4 port4\path0\tgt1\lun0      c4t1d0     FA 2d:06 active    alive   1     0
4 port4\path0\tgt0\lun0      c4t0d0     FA 3d:06 asb:ofln  alive   0     1
3 port3\path0\tgt1\lun0      c3t1d0     FA 2d:06 active    alive   0     0
3 port3\path0\tgt0\lun0      c3t0d0     FA 3d:06 asb:ofln  alive   0     1
```

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:

```
Bus c3t0 to port FA 3d:06 of Symmetrix ID 000197600545 is set to asb:ofln.
Bus c4t0 to port FA 3d:06 of 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 and are logged:

- 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.

Update and display SAN Latency on the host

Procedure to update and display SAN latency on the host.

About this task

If a latency problem has been identified in the fabric, then after fixing it, there is no need to wait for PowerPath to automatically update the SAN latency sometime in the next 30 minute interval. It can be updated at any time with the following steps:

Steps

Use `powermt update san_latency` command to check and update the SAN latency values manually:

```
[root@hostname ~]# powermt update san_latency
```

Also, view the latest SAN latency values with the `powermt display bus-ports san-latency` command:

```
powermt display bus-ports san-latency
Storage class = Symmetrix
=====================================================================
-- Host Bus Adapters --- Storage System --- SAN Latency (ns)
### HW Path ID Interface Previous Current Max
=====================================================================
4 port4\path0 000197600771 FA 2d:08 157200 185200 185200
4 port4\path0 000197600771 FA 1d:08 172200 184900 184900
5 port5\path0 000197600771 FA 2d:08 417200 434600 434600
5 port5\path0 000197600771 FA 1d:08 391900 317800 415700
```

View PowerPath SAN Latency in PowerPath Management Appliance

PowerPath Management Appliance (PPMA) 3.0 or later 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 PowerPath Management Appliance 3.0, see *PowerPath Management Appliance Installation and Configuration Guide.*

HBA and Array Target Port Speed mismatch notification

This section provides information about HBA and Array Target Port Speed mismatch notification features.

ⓘ **NOTE:** This feature is applicable only with fiber channel protocol.

HBA and Array Target Port Speed mismatch notification overview

PowerMax arrays running microcode 5978.669.669 and above obtains the host HBA and array negotiated speeds and provides this information to PowerPath. On detecting difference in host HBA and array negotiated speeds, PowerPath generates an alert indicating possibility of slow drain and display it as warning.

This feature helps to identify speed mismatch by displaying speed details of host HBAs and array target ports.

ⓘ **NOTE:** In a SAN environment, when there is a mismatch of negotiation speed between host initiator HBA and the target port, there is a possibility of slow drain because of over subscription at initiator side. This leads to switch port buffer

starvation which can potentially choke ISLs that might cause other hosts that are connected in SAN to slow down resulting in slow drain.

Log Messages

When there is a mismatch of speed, following messages are logged to system event log during PowerPath service start:

```
Mismatch of negotiation speed between Host initiator and Array Target port is detected,
may cause slow drain in Fabric 10000027F8596078.
```

View PowerPath HBA and Array Target Port Speed mismatch notification in PowerPath Management Appliance

PowerPath Management Appliance version 3.1 and above logs speed mismatch notification in Host Summary tab and speed details are displayed in Bus view section.

Fabric Inclusive Failover

This section provides information about the Fabric Inclusive Failover feature.

(i) **NOTE:** This feature is applicable only with fiber channel protocol.

Fabric Inclusive Failover overview

PowerMax arrays running microcode 5978.669.669 and above provides fabric WWN details to PowerPath and this helps to identify host connectivity to different SAN fabrics.

During path failover, PowerPath considers these details in identifying best available path for I/O retry.

Dell EMC PowerPath in an MSCS cluster

This chapter contains the following sections:

Topics:

- Installing Dell EMC PowerPath and MSCS
- Integrating Dell EMC PowerPath into an existing MSCS cluster

Installing Dell EMC PowerPath and MSCS

If you are installing Dell EMC PowerPath and MSCS for the first time, install Dell EMC PowerPath first, and then install MSCS. Installing Dell EMC PowerPath first avoids disruption of cluster services at a later time. The Microsoft MSCS documentation provides complete information on planning, configuring, managing, and troubleshooting MSCS.

After installing Dell EMC PowerPath and before installing MSCS, run the `emcphostid check` to check for host conflicts. If the host IDs are not unique, run the `emcphostid set` command to set a unique host ID.

ⓘ **NOTE:** All nodes in a cluster must have the same version of PowerPath installed. Clusters with different hosts running different versions of PowerPath will not be supported.

Integrating Dell EMC PowerPath into an existing MSCS cluster

You can integrate Dell EMC PowerPath into an existing MSCS cluster, without shutting down the cluster, if there is close coordination between the nodes and the storage system.

Each node in a cluster can own a distinct set of resources. Node A is the primary node for its resources and the failover node for node B resources. Conversely, node B is the primary node for its resources and the failover node for node A resources. The Microsoft MSCS documentation provides complete information on planning, configuring, managing, and troubleshooting MSCS.

ⓘ **NOTE:** After installing Dell EMC PowerPath on the cluster, any testing involving node failover by disconnecting all cables for a LUN or otherwise disrupting the path between the active host and the array logs an event message in Windows. These event messages will indicate hardware or network failure and possible data loss. If working correctly, the cluster will failover to a node with an active path and you can ignore the messages from the original node as logged in the event log. You should check the application generating I/O to see if there are any failures. If there are none, everything is working normally.

The following procedure describes how to install Dell EMC PowerPath on a two-node cluster. You can also install Dell EMC PowerPath on clusters with more than two nodes. In these cases, the appropriate action is noted where applicable for clusters with more than two nodes.

To add Dell EMC PowerPath to an existing MSCS cluster (with MSCS running on both nodes), follow these procedures:

- Moving all resources to node A
- Installing Dell EMC PowerPath on node B
- Configuring more paths between the storage system and node B
- Moving all resources to node B
- Installing Dell EMC PowerPath on node A
- Configuring more paths between the storage system and node A
- Returning node A resources to node A
- Checking for host ID uniqueness (optional)

Moving all resources to node A

Steps

1. Start the **Windows Server Failover Cluster Manager Console**.
2. Select all groups owned by node B.
3. Move the resources to node A.
4. Pause node B to keep the node from participating in the cluster during Dell EMC PowerPath installation.

Installing Dell EMC PowerPath on node B

Steps

- Install Dell EMC PowerPath on node B.

  In a cluster with more than two nodes, install Dell EMC PowerPath on these other nodes. For example, in a four-node cluster, replace node B with nodes B, C, and D as shown in the section Moving all resources to node A.

Configuring more paths between the storage system and node B

Steps

1. If necessary, reconfigure the storage system so its logical devices appear on multiple ports.
2. If necessary, install additional HBAs on node B.
3. Connect cables for new paths between node B and the storage system.
4. Get the host ID.

   `emcphostid get`

   Make note of the returned PowerPath host ID for this node.
5. To resume node B, right-click node B and then click **Resume**.

   (i) **NOTE:** The check and the possible correction need to be performed before resuming the node.

   In a cluster with more than two nodes, configure additional paths between the storage system and these other nodes. In case this is node C, D, and later (that is, this is not the first installation node) and the host ID returned by `emcphostid get` is not unique (matches to ID of one of the previous nodes in this cluster), then manually change to any arbitrary value unique for this cluster using `emcphostid set`.

Moving all resources to node B

Steps

1. In the left pane of the **Cluster Administrator** window, select all groups.
2. Move the resources to node B.

   In a cluster with more than two nodes, move all resources to any of the remaining nodes. For example, in a four-node cluster, replace node B with any combination of nodes B, C, and D to which you want to move resources.
3. Pause node A.

Installing Dell EMC PowerPath on node A

Steps

- Install Dell EMC PowerPath on node A.

Configuring more paths between the storage system and node A

Steps

1. If necessary, configure the storage system so its logical devices appear on multiple ports.
2. If necessary, install additional HBAs on node A.
3. Connect cables for new paths between node A and the storage system.
4. Ensure the host IDs are unique on the cluster.

   `emcphostid get`

   If the returned ID is not unique (matches to ID of one of the previous nodes in this cluster) then manually change to any arbitrary value unique for this cluster using `emcphostid set`.
5. Resume node A.

   The check and the possible correction needs to be performed before resuming the node.

Returning node A resources to node A

Steps

1. Using the **Windows Server Failover Cluster Manager**, select all groups previously owned by node A.
2. Move the resources back to node A.

Checking for host ID uniqueness (optional)

Steps

- If `emcphostid get` calls, checks and possible corrections were performed before every node was resumed, then remove host IDs that are not unique.

Dell EMC PowerPath in a Veritas Cluster Server

This chapter contains the following sections:

Topics:

- Installing Dell EMC PowerPath and VCS
- Installing Dell EMC PowerPath into an existing VCS environment

Installing Dell EMC PowerPath and VCS

Follow this procedure when installing Dell EMC PowerPath and Veritas Cluster Server (VCS) for the first time. The order matters.

Steps

1. Install Dell EMC PowerPath.
2. Install Veritas Cluster Server (VCS).

Results

Installing Dell EMC PowerPath first avoids disruption to the cluster services at a later time. The Veritas Storage Foundation High Availability (SFHA) documentation provides complete information on planning, configuring, managing, and troubleshooting VCS.

> (i) **NOTE:** All nodes in a cluster must have the same version of PowerPath installed. Clusters with different hosts running different versions of PowerPath will not be supported.

Installing Dell EMC PowerPath into an existing VCS environment

Prerequisites

> ⚠ **CAUTION: Ensure that you follow these steps to manage the cluster environment. Failure to do so can result in data corruption and data loss. Refer to the Veritas Cluster Server (VCS) documentation on how to configure and manage VCS in a clustered environment.**

Steps

1. In the **Cluster Administrator** window, ensure that all resources are on the primary node in the cluster.

   When the cluster resources are on the primary node, the ClusterService in the **Status View** dialog box appears as online.

2. From the navigation pane on the left, right-click **ClusterService** and select **Disable**.

   This disables the secondary node in the VCS configuration.

3. Install Dell EMC PowerPath on the secondary node.

   Follow the procedures in Installation procedures

4. Get the host ID.

   `emcphostid get`

   Make note of the returned PowerPath host ID for this node.

> (i) **NOTE:** If this is not the first installation node and the returned host ID is not unique, change the host ID to any arbitrary value that is unique on the cluster using the `emcphostid set` command. You must perform the check and any host ID corrections before resuming the node.

5. After installation and restart of the secondary node, right-click **ClusterService** and then select **Enable** to re-enable the node in the VCS configuration.
6. Right-click **ClusterService**, select **Switch to**, and then select the secondary node to move all cluster resources over to the secondary node.
7. Display the devices are in the BasicGroup and RAW group.

   `vxdisk list`

   The proper DiskType and DiskGroup information displays.
8. Once the resources are available on the secondary node:
   a. Run **vxassist rescan**.
   b. Verify that the disks are now in the proper disk group and show MBR.

      vxdisk list

   If there are additional nodes in the cluster configuration, repeat for each node.

Displaying DiskType and DiskGroup information

The `vxdisk list` command displays DiskType as RAW instead of MBR and all disks appear to be in the default DiskGroup 'BasicGroup' after the installation of Dell EMC PowerPath.

About this task

```
C:\Documents and Settings\Administrator>vxdisk list
Name       MediaName Diskgroup  DiskStyle Size(MB) FreeSpace(MB) Status EnclosureID
P#C#T#L#
Harddisk0            BasicGroup MBR       156327   127327        Uninitialized DISKS@lhclu056
P0C0T0L0
Harddisk1   Disk1    dg1        RAW       10236    0             Imported      DGC0
P2C0T0L0
Harddisk2   Disk2    dg1        RAW       10236    0             Imported      DGC0
P2C0T1L1
Harddisk3   Disk3    dg1        RAW       10236    5118          Imported      DGC0
P2C0T0L2
Harddisk4   Disk4    dg1        RAW       10236    5118          Imported      DGC0
P2C0T1L3

C:\Documents and Settings\Administrator>vxassist rescan
Successfully rescanned

Note: Notice disk now properly show diskstyle as MBR

C:\Documents and Settings\Administrator>vxdisk list
Name       MediaName  Diskgroup  DiskStyle Size(MB) FreeSpace(MB) Status EnclosureID
P#C#T#L#
Harddisk0             BasicGroup  MBR       156327   127327 Uninitialized DISKS@lhclu056
P0C0T0L0
Harddisk1   Disk1      dg1        MBR       10236    0             Imported      DGC0
  P2C0T0L0
Harddisk2   Disk2      dg1        MBR       10236    0             Imported      DGC0
  P2C0T1L1
Harddisk3   Disk3      dg1        MBR       10236    5118          Imported      DGC0
  P2C0T0L2
Harddisk4   Disk4      dg1        MBR       10236    5118          Imported      DGC0
  P2C0T1L3
```

Steps

1. Disable the primary node in the Veritas Cluster Server (VCS) configuration and install Dell EMC PowerPath as described in Configuring PowerPath
2. After installing Dell EMC PowerPath, restart the primary node.

3. If the host IDs are not unique, set unique host IDs.

   emcphostid set
4. Re-enable the node in the VCS configuration.
5. Move all cluster resources over to the primary node.
6. Once the resources are available, run **vxassist rescan**.

WHQL Certification

This appendix contains the following section:

Topics:

• WHQL-certified driver

WHQL-certified driver

On Windows Server, the Dell EMC PowerPath driver is WHQL-certified. To view the PowerPath drive signature:

1. Select **Start > Control Panel > System**.
2. Click **Device Manager**.
3. Expand the **Storage controllers** node.
4. Right-click **EMS device bus** and then select **Properties**.
5. Click **Driver > Driver Details** to see the driver signature information.

When the driver is signed, the field contains information about the organization that signed the driver.

Files changed by PowerPath

This appendix contains the following section:

Topics:

*   Files created by PowerPath installation

Files created by PowerPath installation

The following files are added when PowerPath is installed on 64-bit hosts. If you do not install to the default locations during PowerPath installation, these file locations can change. Hence <Install directory> is denoted as a variable in the following sections.

ⓘ **NOTE:** All driver files (`.sys`, `.cat`, and `.inf`) are copied to the internal system directories by the operating system when they are installed.

<Install directory>\PowerPath

*   db_recover.exe
*   db_recover.exe.intermediate.manifest
*   difxapi.dll
*   EmcAdminProxy.dll
*   EmcAdminSvr.exe
*   EmcLicTool.exe
*   EmcLicTool_CHS.dll
*   EmcLicTool_DEU.dll
*   EmcLicTool_ESP.dll
*   EmcLicTool_FRA.dll
*   EmcLicTool_ITA.dll
*   EmcLicTool_JPN.dll
*   EmcLicTool_KOR.dll
*   EmcLicTool_PTB.dll
*   emcphostid.exe
*   EmcpLogMsgs.dll
*   EmcpMgmtComp.exe
*   EmcPowerPathAdmin.dll
*   EmcPowMon.exe
*   EmcPowPN22.dll
*   EmcPowRes.dll
*   EmcPowSrv.exe
*   EmcpPerfmonPmiPrvdr.dll
*   emcpreg.exe
*   EmcpSvcErr.dll
*   emcp_lic_rtl.dll
*   Emcp_mpapi_rtl.dll
*   emcp_serv_rtl.dll
*   Emc_PowerPath_Console.msc
*   libdb51.dll
*   libdb51.dll.intermediate.manifest
*   logcon.exe

- ManagementComp_Config.exe
- mpaa.excluded
- mpaa.lams
- powerkmd.exe
- powermig.exe
- powermt.exe
- powerpath.man
- PowMigSrvc.exe
- ppinstall.exe
- pthreadVC2.dll
- server.pem
- sockets.dll
- thinlibxml2_a.dll
- zlib.dll

\<Install directory>\EMC\PowerPath\Drivers

- emcpbase.cat
- emcpbase.inf
- emcpbase.sys
- emcpclass.cat
- emcpclass.inf
- emcpclass.sys
- EmcpCoinst30.dll
- emcpdm.cat
- emcpdm.inf
- emcpdm.sys
- emcpdsm.cat
- emcpdsm.inf
- emcpdsm.sys
- emcpgpx.cat
- emcpgpx.inf
- emcpgpx.sys
- emcpmpx.cat
- emcpmpx.inf
- emcpmpx.sys

\<Install directory>\EMC\PowerPath\EULA

- EULA.rtf

Windows\Help

- EmcLicTool.chm
- EmcLicToolCHS.chm
- EmcLicToolDEU.chm
- EmcLicToolESP.chm
- EmcLicToolFRA.chm
- EmcLicToolITA.chm
- EmcLicToolJPN.chm
- EmcLicToolKOR.chm
- EmcLicToolPTB.chm
- EmcPowerPathAdminMMC.chm

Windows\Cluster

- ppme.dll

%ALLUSERSPROFILE%\EMC\PowerPath

- bootstrapper_*.log
- msi_*.log
- ppinstall_*.log
- vcredist_<platform>_*.log

Configuration and parameters

This appendix contains the following sections:

Topics:

Check NetApp storage array report_scsi_name setting

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

Prerequisites

Steps

1. Check the current value of the setting.

   igroup show -v <initiator group name>

   For example,

   ```
   system1> igroup show -v <initiator group name>
   <Initiator group name> (FCP):
   OS Type: windows
   Member: 10:00:00:00:c9:ac:58:ec (logged in on: vtic)
   Member: 10:00:00:00:c9:ac:58:ed (logged in on: vtic, 1b)
   UUID: 4e4eb665-fff8-11e2-98b7-123478563412
   ALUA: Yes
   Report SCSI Name in Inquiry Descriptor: Yes
   ```

2. Enable `report_scsi_name`.

   igroup set <initiator group name> <report_scsi_name> yes

   For a NetApp HA pair, the following property settings must be set for an initiator group before installing Dell EMC PowerPath:

   - The `report_scsi_name` property must be enabled (set to `yes`) for both controllers of the pair.
   - The ALUA property, set using the `igroup` command must be the same for two controllers of the pair, that is, it should either be `yes` or `no` for both the controllers.

   (i) **NOTE:** Dell EMC PowerPath is supported only with ALUA mode of operation for NetApp initiator groups. For example, `igroup set <initiator group name> alua yes` or `igroup set <initiator group name> alua no`

Upgrade from Dell SCOS version 7.2.x to Dell SCOS version 7.3.x and later for Live Volumes

PowerPath 7.0 supports Dell SCOS 7.3.x.

- For existing live volumes, if *Update ALUA optimized* option is chosen for existing live volumes, remove the paths one by one and add them back to detect their new ALUA state.
- For all live volumes, in order to view the correct storage interfaces for remote array paths, enable the *Update ALUA optimized* option.
- If the server has a mix of live volumes with and without *Update ALUA optimized* option, the live volumes may show different storage interfaces. The `powermt set port_mode` may not work as expected in this case.

CLI parameters and properties

Displays the full list of all available installation and removal CLI parameters and properties. Parameters and properties can be install or removal specific as identified.

Parameters

/s   Suppresses installation and removal dialog boxes. Indicates a quiet installation and removal (no user interaction).

/v   Directs installation to pass the specified string (enclosed in quotes) to the Microsoft Installer (MSI). For example, **/v <property>=<value>**. Where *<Property>* and *<Value>* descriptions follow.

/p   Unattended installation and removal that does not require any user interaction, but will have installation progress bar shown. For example,

For example, during installation:

```
<Drive>:\<PowerPath_pkg_name> /p /v"NO_REBOOT=1"
```

For example, during removal:

```
<Drive>:\<PowerPath_pkg_name> /p /v"PPREMOVE=<feature1>, <feature2>, ..
NO_REBOOT=1"
```

/r   ⓘ **NOTE:** Contact EMC customer support before using `/r`.

Use this option only when you encounter a problem with either installation or uninstallation of Dell EMC PowerPath. This invokes the PPRemoveAll utility, which removes all Dell EMC PowerPath multipathing entries from the host. This `/r` parameter replaces `PPREMOVE=ALL`.

ⓘ **NOTE:** You do not need any of the above parameters with the `/r` parameter.

<Property> and *<Value>* descriptions

/L*v<logfile>*   Directs the Microsoft Installer to write verbose output to the file specified with this option. The target directory for the log file must exist before starting a silent installation by using the logging option (as required by the Windows installer engine). MSI logs are also available in `%ProgramData% \EMC\PowerPath\logs`.

ⓘ **NOTE:** These folders may be hidden in Windows Explorer.

ADDLOCAL=<feature>   Where *<feature>* can be any combination of the following items. Use commas to separate multiple entries, for example, **ADDLOCAL=IBM,HDS**

- If you do not pass `ADDLOCAL` values during command line installation, then Dell EMC PowerPath multipathing, Migration Enabler, Management Component, and support for EMC storage arrays is installed by default. If you pass `ADDLOCAL` values only the features you select are installed with Dell EMC PowerPath multipathing.
- In the case of an upgrade, if you do not pass `ADDLOCAL` values during command line installation, Dell EMC PowerPath installs the features based on the previous version configuration. For example, if your previous version has Migration Enabler, HPXP, and IBM features installed then Dell EMC PowerPath upgrade selects these features for installation by default.
- `ALL` = Complete installation. Installs support for all Dell EMC PowerPath features.
- `ME` = Migration Enabler (selected for installation by default)
- `HA` = Management Component (selected for installation by default)
- `IBM` = IBM ESS and XIV arrays
- `CELERRA` = Celerra and VNXe arrays (selected for installation by default)
- `HDS` = Hitachi arrays
- `HPXP` = HP XP Active-Active arrays, and HP EVA arrays with firmware VCS 4.0 or later
- `INVISTA` = Invista and VPLEX arrays (selected for installation by default)
- `XTREMIO` = XtremIO arrays firmware Version 2.2 or later (selected for installation by default)
- `NETAPP` = NetApp arrays (FAS2240)
- `SC` = Dell SC arrays

FORCE_DRIVER_ UPDATE=1	The value 1 continues to install Dell EMC PowerPath and ignores the device manager check for any pending device installation or uninstallation activities.
IGNORE_HF_WAR NING=1	The value 1 sets `IGNORE_HF_WARNING` value to ON and continues with the Dell EMC PowerPath installation even if the required Microsoft Hotfixes on the target host are missing.
INSTALLDIR=<p ath>	Where *<path>* is the location to copy and install Dell EMC PowerPath files. For example, **INSTALLDIR=C:\Test** and **INSTALLDIR=C:\Program Files\EMC** (i) **NOTE:** The default installation directory is `<RootDrive>:\ProgramFiles\EMC`.
LICENSENUM=<n umber1,<[numb er2,...]>	Where **<number1,<[number2,...]>** must be a valid license or no license will be saved. Use commas to separate multiple entries. (i) **NOTE:** Dell EMC PowerPath for Windows and PowerPath/VE for Windows Hyper-V each require a separate license. The licensing procedure is the same for each.
NO_REBOOT=1	The value 1 specifies that the host will not reboot after Dell EMC PowerPath is installed or removed. (i) **NOTE:** Use `NO_REBOOT=1` so that you can manually restart at a convenient time.
PERSIST_PATH_ INFO=1	- The value 1 sets `PERSIST_PATH_INFO` value to ON. The default is ON. - The value 0 sets `PERSIST_PATH_INFO` value to OFF.
PPREMOVE=<fea ture>	Specifies the features to uninstall. Use commas to separate multiple entries, for example: PPREMOVE=ME, INVISTA - `CLEAN` = Removes Dell EMC PowerPath and all other features, such as Migration Enabler. It also removes driver files and corresponding registry entries. - `ME` = Migration Enabler - `HA` = Management Component - `IBM` = IBM ESS and XIV arrays - `CELERRA` = Celerra and VNXe arrays - `HDS` = Hitachi arrays - `HPXP` = HP XP Active-Active arrays, and HP EVA arrays with firmware VCS 4.0 or later - `INVISTA` = Invista and VPLEX devices - `XTREMIO` = XtremIO arrays firmware Version 2.2 or later - `NETAPP` = NetApp arrays - `SC` = Dell SC arrays
PX_DELETE_CUS TOM_CONFIGURA	The Dell EMC PowerPath installer provides an option to either keep or delete the existing `powermt.custom` file through GUI or CLI methods. By default, the existing `powermt.custom` file is preserved.

TION=KEEP| **DELETE**	● KEEP keeps the existing `powermt.custom` file ● DELETE deletes the existing `powermt.custom` file For example, the CLI method provides the parameter `EMCPower.X64.signed.<version>.<build>.exe /s /` `v"PX_DELETE_CUSTOM_CONFIGURATION=DELETE NO_REBOOT=1"`
UPGRADE_MPIO= **1**	The value 1 specifies to upgrade the existing MPIO framework. Include this property if an MPIO version earlier than the one supported is installed. Dell EMC PowerPath installation stops if the host has a version of the MPIO framework earlier than the supported version.
USE_BINDING_O **RDER=1**	The value 1 fixes incorrect IP address when performing auto host registration. (i) **NOTE:** When the next auto host registration is performed, the IP address of the first adapter in the binding order list will be used.

XTREMIO_NATIV
E_ONLY=1
	The value 1 specifies to install support for XtremIO Versions 2.2 and later for Dell EMC PowerPath Version 6.x.
	
	This parameter is required in silent upgrade, when you are upgrading from Dell EMC PowerPath 5.7.1 with generic XtremIO support that is installed to Dell EMC PowerPath 6.x, which supports only XtremIO Version 2.2 and later. For example,
	
	`EMCPower.X64.signed.<version>.<build>.exe /s /v" XTREMIO_NATIVE_ONLY=1`
	`NO_REBOOT=1"`

D

Troubleshooting installation and upgrade

This appendix contains the following sections:

Topics:

- Troubleshooting Dell EMC PowerPath installation
- Repairing the Dell EMC PowerPath Installation
- Important Knowledge Base (KB) articles

Troubleshooting Dell EMC PowerPath installation

The following table lists Dell EMC PowerPath installation troubleshooting scenarios.

Table 8. Troubleshooting the installation

Problem	Error message	Suggested action
Dell EMC PowerPath drivers may be present on a host where a Dell EMC PowerPath package has been uninstalled.	`Incompatible files from a previous PowerPath version exist on the host. PowerPath recommends running PPRemoveAll with a reboot and then proceed with the PowerPath installation process. Run PPRemoveAll now?`	Perform the following: 1. Click **Yes** to run `PPRemoveAll`.[a]. Otherwise, click **No** and run the `PPRemoveAll` utility manually. 2. Restart the host. 3. Install Dell EMC PowerPath.
Upgrade of Dell EMC PowerPath may fail because Dell EMC PowerPath drivers are missing on the host.	`PowerPath detected a problem that is blocking the upgrade. Contact EMC customer support for assistance.`	Perform the following: 1. Run the `PPRemoveAll` utility to remove Dell EMC PowerPath. 2. Restart the host. 3. Install Dell EMC PowerPath. (i) **NOTE:** If the installation is still blocked, contact your Customer Support Representative.
Upgrade of a Dell EMC PowerPath driver may fail.	`The PowerPath upgrade could not complete. PowerPath recommends running PPRemoveAll with a reboot and then proceed with the PowerPath installation process. Run PPRemoveAll now?`	Perform the following: 1. Click **Yes** to run `PPRemoveAll`. Otherwise, click **No** and run the `PPRemoveAll` utility manually. 2. Restart the host. 3. Install Dell EMC PowerPath.
Installation of a Dell EMC PowerPath driver may fail.	`PowerPath encountered a problem installing drivers and will roll back the installation changes. Contact EMC Customer Support for assistance.`	Contact your Customer Support Representative.
One or more Dell EMC PowerPath drivers may require a host restart.	`One or more PowerPath drivers require a host reboot. Reboot the host and then proceed with`	Restart the host and then install Dell EMC PowerPath.

Table 8. Troubleshooting the installation (continued)

Problem	Error message	Suggested action
	the PowerPath installation process.	
	One or more PowerPath drivers require a host reboot. Reboot the host, and retry the repair.	Restart the host and then try the driver repair again.
Repair of a Dell EMC PowerPath driver fails.	The PowerPath repair operation could not complete. Contact EMC customer support for assistance.	Contact your Customer Support Representative.

a. The PPRemoveAll utility removes all PowerPath multipathing entries from the host. Use this option only when you encounter a problem with an existing installation or try a removal.

Repairing the Dell EMC PowerPath Installation

After installing Dell EMC PowerPath if any of the Dell EMC PowerPath functionality is broken, you can repair the installation to resolve those issues. The repair re-installs Dell EMC PowerPath and modifies only those components of the application that are missing or broken. It also re-installs all Dell EMC PowerPath drivers.

ⓘ **NOTE:** Repairing Dell EMC PowerPath requires that you reboot the host.

Follow one of these procedures to repair Dell EMC PowerPath:

- Repair Dell EMC PowerPath installation using the GUI
- Repair Dell EMC PowerPath installation using the CLI

Repair Dell EMC PowerPath installation using the GUI

Perform one of the following steps to repairDell EMC PowerPath installation through the GUI.

About this task

Alternatively, using **Add/Remove Programs** or **Programs and Features**, select the installed version of Dell EMC PowerPath and click **Repair**.

Steps

1. Using **Add/Remove Programs** or **Programs and Features**, select the installed version of Dell EMC PowerPath and click **Change**.
   a. In the Setup wizard welcome window, click **Next**.
   b. Select **Repair**.
   c. Click **Repair**.
   d. Click **Finish**.
2. Click **Yes** to reboot now or **No** to reboot later.
   ⓘ **NOTE:** If the User Account Control (UAC) is configured in the Admin Approval mode, running the Dell EMC PowerPath setup program to change, repair, or to uninstall Dell EMC PowerPath 7.0 using **Add/Remove Programs** or **Programs and Features** through the control panel results in multiple elevation prompts.

Repair Dell EMC PowerPath installation using the CLI

Steps

- Repair Dell EMC PowerPath.

  `<drive>:\<PowerPath_pkg_name> /s /v"/L*v <logfile> REINSTALL=ALL"`

  When `NO_REBOOT=1` is used, reboot manually after installation.

  For example,

  ```
  C:\EMCPower.X64.signed.<version>.<build>.exe /s /v"/L*v C:\logs\PPrepair.log
  REINSTALL=ALL NO_REBOOT=1"
  ```

Important Knowledge Base (KB) articles

Displays the list of Knowledge Base articles.

Table 9. Knowledge Base articles

KB number	Description	KB link
542058	PowerPath for Windows 6.4 on Windows Server 2019 hosts crash after state changed to TargetSelected and data written to the target disk.	https://www.dell.com/support/kbdoc/en-us/542058
502458	Windows PowerPath 6.1 prerequisite installation failed. Installation cannot continue.	https://support.emc.com/kb/502458
500909	How to upgrade PowerPath from 5.7.x to 6.1 in Windows Server 2012 environments	https://support.emc.com/kb/500909
500749	Running the command "powermig sync -handle X" or "powermig cleanup -handle X" returns an error "PPME error(79): Not all nodes have reached the correct state to complete this operation, please try this, or the recover command again later"	https://support.emc.com/kb/500749
499452	How to uninstall Microsoft Visual C++ redistributables installed by PowerPath	https://support.emc.com/kb/499452
495303	How to install PowerPath 6.1 using command line to avoid verification of the installed Microsoft hotfix KBs 4474419 and 4490628.	https://support.emc.com/kb/495303
488109	What is the maximum number of luns that can be presented, Maximum number of Paths per lun and Maximum size of Partition on a Microsoft Windows Operating System.	https://support.emc.com/kb/488109
486378	Disks are marked offline after upgrading to PowerPath 6.0	https://support.emc.com/kb/486378
473972	Unable to Install PowerPath. Prerequisite installation failed. Installation cannot continue.	https://support.emc.com/kb/473972
466054	Different versions of PowerPath fail to install with error "Setup encountered a problem while installing PowerPath. PowerPath installation will be rolled back. Contact EMC Customer Support for assistance."	https://support.emc.com/kb/466054
460124	PowerPath: Errors "RPC Server is unavailable" during Windows start-up and "Initialization Error" in response to powermt command	https://support.emc.com/kb/460124

Table 9. Knowledge Base articles (continued)

KB number	Description	KB link
448058	PowerPath is not able to see devices in Windows Server 2012. MPIO is also unable to see devices. How to configure Native MPIO in Microsoft Windows Server 2012.	https://support.emc.com/kb/448058
335250	Behavior of PowerPath for Windows install, uninstall, or upgrade in a Boot from SANenvironment.	https://support.emc.com/kb/335250

Index