These technical notes contain information about EMC PowerPath for Solaris Interoperability with VERITAS Volume Manager (VxVM). This document is intended for customers, partners, and EMC support personnel. A basic knowledge of PowerPath, VxVM, storage system management, and the concept of pseudo and native devices is expected. Topics include:

1. Revision history
2. Introduction
3. PowerPath and VxVM co-existence
4. PowerPath installation on a Solaris host with VxVM
5. PowerPath upgrade on a Solaris host with VxVM
6. Removing PowerPath from a Solaris host with VxVM
7. Common administration procedures for PowerPath and VxVM
8. PowerPath Migration Enabler and VxVM
9. PowerPath Encryption with RSA and VxVM
10. Limitations with PowerPath and VxVM 4.1
11. Additional documentation
1. Revision history

The following table presents the revision history of this document:

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>A01</td>
<td>June 30, 2010</td>
<td>First release of PowerPath for Solaris Interoperability with VERITAS Volume Manager Technical Notes.</td>
</tr>
</tbody>
</table>
| A02      | June 15, 2012| • Addition of “1. Revision history” on page 2  
            • Modification of “3.1.1 VxVM versions ASL differences” on page 6  
            • Addition of “6.1 Pre-removal tasks” on page 22. |

2. Introduction

PowerPath is a host-based software that provides path management. By working with the storage system to intelligently manage input/output (I/O) paths, PowerPath provides priority-based management, dynamic load balancing of I/O, and automatic failover in the event of hardware failure. Its many benefits include consistent and improved service levels, optimized performance and high availability with no application disruption, and improved manageability by saving time and reducing maintenance costs. The Symantec VERITAS Volume Manager, or VxVM, also offers volume management and multipathing I/O functionalities.

These technical notes provide best practices and tips on improving performance and interoperability between PowerPath 5.3 and 5.5 and VxVM 4.1, 5.0 MPx_RPx, 5.1 and 6.0 in Solaris environments. They describe the co-existence of PowerPath and VxVM and details installation and upgrade as well as several common administrative procedures and troubleshooting scenarios and recommended actions. This document also presents best practices and use-case scenarios for VxVM with PowerPath Migration Enabler and PowerPath Encryption with RSA and explains some limitations of PowerPath with VxVM as well as other considerations to bear in mind when using Invista and third-party arrays.
The *PowerPath Family for Solaris Release Notes*, available on Powerlink, provide information on supported VxVM and Solaris OS versions for PowerPath.

## 2.1 VxVM commands

This document references the following VxVM commands:

- **vxdisk**—The *vxdisk* utility performs basic administrative operations on disks. Operations include initializing and replacing disks, as well as taking care of some book-keeping necessary for the disk model presented by the Volume Manager.

- **vxconfigd**—The Volume Manager configuration daemon, *vxconfigd*, is responsible for maintaining configurations of disks and disk groups in the VERITAS Volume Manager. *vxconfigd* takes requests from other utilities for configuration changes, and communicates those changes to the kernel and modifies configuration information stored on disk. *vxconfigd* is also responsible for initializing the Volume Manager when the system is booted.

- **vxddladm**—The *vxddladm* utility is an administrative interface to the dynamic array support facility of the Device Discovery Layer (DDL). This utility lists the types of arrays supported, adds or removes array support from DDL, and allows dynamic addition of JBOD support for disks from different vendors. It additionally lists supported JBODs and allows addition or removal of JBOD support. The *vxddladm* utility is also used to customize the set of array libraries that can participate in device discovery.

- **vxdmpadm**—The *vxdmpadm* utility is an administrative interface to the VERITAS Volume Manager Dynamic Multipathing (DMP) facility. *vxdmpadm* lists the paths under a DMP device, gets the DMP device corresponding to a path, lists all the disk controllers on the system, lists all the paths through a host disk controller, lists all the DMP nodes through a disk array, and enables or disables a host disk controller on the system.

- **vxdg**—The *vxdg* utility performs basic administrative operations on disk groups. Operations include the creation of disk groups, the addition of disks to a disk group, and disk group imports and deports.
PowerPath and VxVM co-existence

- **vxassist** — The **vxassist** utility is an interface to the VERITAS Volume Manager that finds space for and creates volumes, performs volume conversion, adds mirrors and logs to existing volumes, extends and shrinks existing volumes, migrates data from a specified set of disks, provides facilities for the online backup of existing volumes.

- **vxvol** — The **vxvol** utility performs Volume Manager operations on volumes. The first operand is a keyword that determines the specific operation to perform. The remaining operands specify configuration records to which the operation is to be applied.

3. **PowerPath and VxVM co-existence**

This section discusses the co-existence of PowerPath 5.3 and 5.5 and VxVM 5.0 MPx_RPx and later.

3.1 **Improvements in VxVM for PowerPath co-existence**

In VxVM 4.1 Symantec made a major modification to facilitate the co-existence of VxVM and PowerPath. It introduced the Third-Party Driver (TPD) Array Specific Library (ASL) for PowerPath to automatically recognize PowerPath pseudo devices in VxVM. This eliminated the need to use `powervxvm`, a command which was required to use PowerPath pseudo devices with VxVM versions prior to 4.1. Additionally, the TPD ASL enables VxVM 4.1 and later releases to use PowerPath pseudo devices by default for EMC Symmetrix and CLARiiON arrays. The third-party driver (TPD) coexistence feature of VxVM allows I/O that is controlled by third-party multipathing drivers to bypass DMP while retaining the monitoring capabilities of DMP.

The ASLs allow both PowerPath and DMP to manage the devices that are under VxVM control. The PowerPath ASLs allow PowerPath to manage the devices using pseudo device naming by default. The DMP ASLs allow DMP to manage the devices using native device naming. Starting with VxVM 5.0 MP3_RP2 `split ASL` has been introduced by Symantec. `SplitASL` refers to splitting the VxVM ASL for PowerPath with Symmetrix/CLARiiON and DMP with Symmetrix into two separate ASLs, one for DMP and another for PowerPath.
Figure 1 on page 5 and Figure 2 on page 6 depict PowerPath and VxVM co-existence.

Figure 1: PowerPath and VxVM/DMP ASL support

Figure 1 PowerPath and VxVM/DMP ASL support
VxVM supports Invista, Symmetrix, and CLARiiON arrays only with TPD ASL. There is no plan by Symantec to support third-party arrays using TPD ASLs.

**Figure 2** PowerPath and VxVM/DMP in the I/O stack

### 3.1.1 VxVM versions

#### ASL differences

<table>
<thead>
<tr>
<th>VxVM 4.1</th>
<th>VxVM 5.0 MPx_RPx and later</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default naming scheme for PowerPath with Symmetrix/CLARiiON ASL is native, not pseudo. To use pseudo device naming, user has to actively switch from tpdmode=native to tpdmode=pseudo</td>
<td>Default naming scheme for PowerPath with Symmetrix/CLARiiON ASL is pseudo. No explicit change is needed for a default operation.</td>
</tr>
<tr>
<td>DMP and PowerPath use the same ASL for Symmetrix/CLARiiON arrays.</td>
<td>Split ASL has been introduced with separate ASLs for PowerPath and DMP for Symmetrix and CLARiiON arrays.</td>
</tr>
</tbody>
</table>
3.2 Pseudo names and native names in VxVM

As shown in Figure 2 on page 6, with VxVM 4.1 or later installed in a PowerPath environment, VxVM converts any EMC Symmetrix and CLARiiON device names to operating system-based naming (OSN) pseudo names (emcpower). When the naming scheme is OSN/EBN, PowerPath, and not DMP, is responsible for multipathing operations. If the OSN is in tpdmode=pseudo, it means that DMP is using PowerPath pseudo devices to pass IO operations down to PowerPath. If the OSN is in tpdmode=native, it means that DMP is using a single PowerPath native device to pass IO operations down to PowerPath. Native names can be configured for PowerPath as well as third-party storage array devices. Best practices recommend using the default pseudo naming convention for Symmetrix and CLARiiON storage devices.

Observe the following considerations regarding pseudo and native names:

- When using VxVM 5.0 and later with DMP or PowerPath, the tpdmode can be pseudo or native.
- The tpdmode will be native with DMP.
- When using PowerPath with EMC arrays, the tpdmode can be pseudo or native.
- When using PowerPath with third-party arrays, the tpdmode can be native only.

3.3 Changing TPD mode

For disk enclosures that are controlled by TPD whose coexistence is supported by an appropriate ASL, the default behavior is to assign device names that are based on the TPD-assigned node names (pseudo). However, sometimes it may be preferable to change the pseudo device names to native device names to understand how targets are identified by the operating system. Likewise, in certain cases some predefined scripts or tools require OS-based native names to function properly.

You can use the vxdmpadm command to switch between these names and the device names that are known to the operating system (OSN scheme) or the enclosure-based names (EBN scheme). The
3.3.1 Change TPD mode from pseudo to native

To change TPD mode from pseudo to native:

Note: The default naming scheme must be set to OSN for this procedure. By default, EBN and OSN naming are persistent. Run vxddladm get namingscheme to find the naming scheme set on the system.

1. Change the default naming scheme to OSN, if applicable. Type:

```
# vxddladm get namingscheme
NAMING_SCHEME PERSISTENCE LOWERCASE USE_AVID
============================================================
OS Native Yes Yes Yes
# vxddladm set namingscheme=osn persistence=[yes|no]
```

2. If output shows:
   - namingscheme=ebn go to step 3
   - namingscheme=osn, run the command vxddladm set namingscheme=ebn persistence=[yes | no]

3. For VxVM version 5.1 and later, turn DMP native device support off: Type:

```
# vxdmpadm settune dmp_native_support=off
```

4. Run vxdmpadm listenclosure to find the name of the disk enclosures.

5. Change the pseudo names to native names. Type:

```
# vxdmpadm setattr enclosure <enclosure> tpdmode=native
```

where <enclosure> is the enclosure name of the EMC device. For example:

```
# vxdmpadm setattr enclosure EMC0 tpdmode=native
```

6. Repeat step 5 of this procedure for all of the enclosures.

7. Verify the different naming convention in the Device column by listing the device names. Type:

```
# vxdisk list
```

Output such as the following appears:
With device file name (OSN) it is difficult to identify the location of a disk by just looking at it. With EBN, the disks are sequentially named with the prefix of the storage system name eg: `pp_emc_clariion0_0`.

To discover `c#t#d#` names associated with a given enclosure-based disk name, use either of the following commands:

- `# vxdisk list <enclosure>`
- `# vxcmpadm getsubpaths dmpnodename=<enclosure>`

To change TPD mode from native to pseudo:

1. Complete step 1 and step 2 provided in ‘3.3.1 Change TPD mode from pseudo to native” on page 8.

2. Change the native names to pseudo names. Type:
   
   `# vxcmpadm setattr enclosure <enclosure> tpdmode=pseudo`

3. Verify the different naming convention in the Device column by listing the device names. Type:
   
   `# vxdisk list`

Output such as the following appears:

```
DEVICE TYPE DISCK GROUP STATUS
cdt0d10s2 auto:sliced disk1 mydg online
cdt0d11s2 auto:sliced disk2 mydg online
```

To discover `c#t#d#` names associated with a given enclosure-based disk name, use either of the following commands:

- `# vxdisk list <enclosure>`
- `# vxcmpadm getsubpaths dmpnodename=<enclosure>`
4. PowerPath installation on a Solaris host with VxVM

This section provides procedures for installing PowerPath 5.3 and 5.5 on a Solaris 9 or 10 SPARC or Solaris 10 x86(i386) host with VxVM 5.0 MPx_RPx and later already installed:

1. Select or create a directory where you can unload the PowerPath tar file. Type:
   ```bash
   mkdir /unload
   ``

2. Change directory to the unload directory. Type:
   ```bash
   cd /unload
   ```
   **Note:** Ensure the unload directory is empty.

3. Copy the PowerPath tar file to the unload directory. Type:
   ```bash
   cp /<PowerPath package> .
   ```
   For example, for
   ```bash
   cp /EMCPower.SOLARIS.5.3.0.GA.b473.tar.gz .
   ```
   and
   ```bash
   cp /EMCPower.SOLARIS10.5.5.bxxx.tar.gz .
   ```
   The *PowerPath Family for Solaris Release Notes*, available on Powerlink, provide package names for PowerPath 5.3 and 5.5 for Solaris.

4. Unzip the installation package. Type:
   ```bash
   gunzip <PowerPath Package>
   ```

5. Untar the installation package. Type:
   ```bash
   tar -xvf <PowerPath Package>
   ```

6. Install the package. Type:
   ```bash
   pkgadd -d .
   ```

A prompt similar to the following appears:

For Solaris 9 or 10 SPARC host:

The following packages are available:
1  EMCpower  EMC PowerPath
Select package(s) you wish to process (or 'all' to process all packages). (default: all) [?,??,q]:

For Solaris 10 x86(i386) host:
The following packages are available:

```
1  EMCpower  EMC PowerPath
   (i386) 5.3_b473
```

Select package(s) you wish to process (or 'all' to process all packages). (default: all) [?,??,q]:

Type 1 and press Enter.

7. You are prompted for the directory where the PowerPath program files will be installed:

   For Solaris 9 or 10 SPARC host:

   Processing package instance <EMCpower> from </unload>

   EMC PowerPath(sparc) 5.3_b473
   EMC Corporation

   Enter package base directory (default:/opt):

   For Solaris 10 x86 (i386) host:

   Processing package instance <EMCpower> from </unload>

   EMC PowerPath(i386) 5.3_b473
   EMC Corporation

   Enter package base directory (default:/opt):

   8. Press Enter to accept the default base directory (/opt), or type the path to an alternate base directory and press Enter.

   The following prompt appears:
This package contains scripts which will be executed with super-user permission during the process of installing this package.

Do you want to continue with the installation of <EMCpower> [y,n,?] 

Type y and press Enter.

9. The screen displays information about the installation ending with:

For Solaris 10 host (SPARC and x86):

* EMCpower Installation:
* Installation is successful. No reboot required.
* If you have a license key card, register now.
* License registration is NOT required to manage the CLARiiON AX series array.

Installation of <EMCpower> was successful.

For Solaris 9 SPARC host:

* EMCpower Installation:
* Installation is successful.
* If you have a license key card, register now.
* License registration is NOT required to manage the CLARiiON AX series array.

Installation of <EMCpower> was successful.

The following packages are available:
1 EMCpower EMC PowerPath (sparc) 5.3_b473

Select package(s) you wish to process (or 'all' to process all packages). (default: all) [?,??,q]:

Enter q and press Enter.

10. If you are installing PowerPath for the first time, register the software, and, if prompted to do so, reboot the host.
If you are not required to register the software or if no reboot is required, proceed to **step 11**.

11. Verify that PowerPath pseudo devices are configured by VxVM. **Type:**

```
# vxdisk list
```

Output must list the emcpower devices

<table>
<thead>
<tr>
<th>DEVICE</th>
<th>TYPE</th>
<th>DISK</th>
<th>GROUP</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c1t0d0s2</td>
<td>auto: none</td>
<td>-</td>
<td>-</td>
<td>online invalid</td>
</tr>
<tr>
<td>c1t1d0s2</td>
<td>auto: none</td>
<td>-</td>
<td>-</td>
<td>online invalid</td>
</tr>
<tr>
<td>emcpower0s2</td>
<td>auto: none</td>
<td>-</td>
<td>-</td>
<td>online invalid</td>
</tr>
<tr>
<td>emcpower5s2</td>
<td>auto: none</td>
<td>-</td>
<td>-</td>
<td>online invalid</td>
</tr>
<tr>
<td>emcpower6s2</td>
<td>auto: none</td>
<td>-</td>
<td>-</td>
<td>online invalid</td>
</tr>
<tr>
<td>emcpower7s2</td>
<td>auto: none</td>
<td>-</td>
<td>-</td>
<td>online invalid</td>
</tr>
<tr>
<td>emcpower8s2</td>
<td>auto: none</td>
<td>-</td>
<td>-</td>
<td>online invalid</td>
</tr>
</tbody>
</table>

12. If you do not see emcpower devices in the output, use one of the commands below to configure pseudo devices with VxVM (third-party array devices continue to use native names but are under PowerPath control if set to be managed):

- `# vxdisk scandisks`
- `or`
- `# vxconfigd -k`

### 4.1 Installing PowerPath with VxVM on special configurations

This section provides procedures for installing PowerPath 5.3 and 5.5 with VxVM 5.0 and later on the following special configurations:

- SAN boot disk
- VxVM encapsulated boot disk
- Sun Cluster v3.1 and later

#### 4.1.1 Install PowerPath with VxVM on a SAN boot disk configuration

1. Follow the procedure in ‘4. PowerPath installation on a Solaris host with VxVM” on page 10.
2. Copy `/etc/vfstab` as `/etc/vfstab.pre_EMCPower` and `/etc/system` as `/etc/system.pre_EMCPower` if booting from the pseudo device.
3. Edit `/etc/vfstab` to replace partition native names `c##d##s#` with its emcpower pseudo name `emcpower##`. 
4. Edit `/etc/system` to identify the rootfs and rootdev entries for the device if booting from the pseudo device. For example:

```
rootfs:ufs
rootdev:/pseudo/emcp@0:a,blk
```

4.1.2 Install PowerPath with a VxVM Encapsulated boot disk configuration

1. Follow the procedure in ‘4. PowerPath installation on a Solaris host with VxVM” on page 10.

2. Verify that the devices configured with PowerPath are under its control using the `vxdmpadm` command. Output such as the following appears:

```
lclc065.lss.emc.com:/> vxdmpadm getsubpaths dmpnodename=emcpower1s2
================================================================================
emcpower1c   ENABLED(A)   -          emcp       EMC          EMC0             -
```

3. Verify that the mounted file systems with VxVM disk groups are operating as expected.

4.1.3 Install PowerPath with Sun Cluster v3.1 and later

1. Export VxVM disk group(s) from the primary node to one of the secondary node using the `vxdg deport <diskgroup>` command.

2. Reboot the node out of the cluster using the `reboot -- -x` command.

3. Follow the procedure provided in ‘4. PowerPath installation on a Solaris host with VxVM” on page 10.

4. Reboot the node back into the cluster using the `reboot` command.

5. Import any exported VxVM disk group(s) if it is a primary node using the `vxdg import <diskgroup>` command.

6. Repeat step 2 through step 4 of this procedure for all secondary nodes.
5. PowerPath upgrade on a Solaris host with VxVM

This section provides procedures for upgrading both PowerPath and VxVM.

To upgrade from PowerPath 5.0.0 with VxVM 4.1 and later to PowerPath 5.3 with VxVM 5.0 MPx_RPx on a Solaris 9/10 SPARC or Solaris 10 Opteron host without reboot involves the following three-step procedure:

**Note:** Before upgrading to VxVM 5.0, you must manually remove any 4.x ASLs that may be installed on the system. After completing the upgrade, obtain the required updated ASLs to ensure the array is claimed correctly.

1. Upgrade from PowerPath 5.0.0 to PowerPath 5.3
2. Upgrade from VxVM 4.1 and later to VxVM 5.0 (if required)
3. Upgrade from VxVM 5.0 to VxVM 5.0 MPx_RPx.

### 5.1 Upgrading from PowerPath 5.0.0 to PowerPath 5.3

The procedure provided in this section is applicable to upgrading from PowerPath 5.0 and later to PowerPath 5.3.

1. Stop the event source daemon. Type:
   ```bash
   vxddladm stop eventsource
   ```
2. If file systems on PowerPath pseudo devices are mounted, stop I/O and unmount all file systems. Type:
   ```bash
   umount <fs_mnt_point>
   ```
3. Deport all disk groups held on PowerPath devices. Type:
   ```bash
   vxdg deport <vxdg>
   ```
4. Remove all PowerPath devices from VxVM control using script
   ```bash
   for i in `vxdisk list | grep emcpower | awk '{print $1}'`; do vxdisk rm ${i}; done
   ```
5. Remove PowerPath and verify that package is successfully removed and all emcp* modules are unloaded. No reboot is required during upgrade at this step even if the uninstall mentions it. Type:
PowerPath upgrade on a Solaris host with VxVM

pkgrm EMCpower
modinfo | grep emcp

6. If you encounter a problem during the removal of PowerPath, note the error message and take action accordingly. Possible issues are:
   - Not all IOs to devices have been stopped
   - PowerPath Migration Enabler migrations are present
   - PowerPath configuration file needed during removal could be missing.
   - DMP is using a device path.
     - If DMP is using a device path(s), disable the path(s). Type:
       vxdmpadm disable path=<pathname>

   When the issues are resolved, repeat step 5 of this procedure.

7. Ensure that no PowerPath devices are under VxVM control. Type:

   vxdisk list

8. Install PowerPath 5.3 from directory where the package is untarred and unzipped (see ‘4. PowerPath installation on a Solaris host with VxVM” on page 10). Verify that the new emcp* modules have been loaded. Type:

   pkgadd -d .
   modinfo | grep emcp

9. Reboot the system if directed by pkgadd.
   - If not directed to reboot the system, restart the event source daemon. Type:
     vxdldadm start eventsource

10. Rescan VxVM devices or restart the configuration daemon to update VxVM database using either of the following commands:
    - # vxdisk scandisks
    - or
    - # vxconfigd -k
      - If working in a VxVM 5.0 configuration, use the vxconfigd -k -x nothreads command to do a single-threaded device discovery with debugging if needed.
11. Verify that emcpower pseudo device names are used as the disk access (DA) names. Type:
   
   vxdisk list

12. Import all deported disk groups. Type:
   
   vxdg import <vxdg>

---

5.2 Installing PowerPath service pack 5.x SPx on PowerPath 5.x

1. Stop the event source daemon. Type:
   
   vxddladm stop eventsource

2. If file systems on PowerPath pseudo devices are mounted, stop I/O and unmount all file systems. Type:
   
   umount <fs_mnt_point>

3. Clear any dead devices or paths. Type:
   
   powermt check

4. Save the existing PowerPath configuration. Type:
   
   powermt save

5. Install PowerPath service pack package from the directory where the patch is untarred and unzipped. Type:
   
   patchadd .

6. Configure emcpower pseudo devices. Type:
   
   powermt config

7. Rescan VxVM devices or restart the configuration daemon to update VxVM database using one of the following commands:
   
   • # vxdisk scandisks
     or
   
   • # vxconfigd -k

   If working in a VxVM 5.0 configuration, you can use the vxconfigd -k -x nothreads command to do a single-threaded device discovery with debugging if needed.

8. Verify that emcpower pseudo device names are used as the disk access (DA) names. Type:
vxdisk list

9. Reboot the system if directed when you run the `patchadd` command.

If not directed to reboot the system, restart the event source daemon. Type:

```
vxdldadm start eventsource
```

---

### 5.3 Upgrading from VxVM with PowerPath installed

This section provides procedures for upgrading the following VxVM versions:

- Upgrading VxVM 4.1 to VxVM 5.0 with PowerPath 5.x installed
- Upgrading VxVM 5.0 to VxVM 5.0 MPx_RPx with PowerPath 5.x installed

1. If you are upgrading to VxVM 5.0:
   - Manually remove any 4.x ASLs that may be installed on the system.
   - If there are any open VxVM volumes on PowerPath emcpower devices, stop applications such as databases that access these volumes configured in the disk group and unmount any file systems configured in the volumes. Type:
     
     ```
     umount <fs_mnt_point>
     ```

     If you are upgrading to VxVM 5.0 MPx_RPx, proceed to step 2 of this procedure.

2. Stop all VxVM volumes by entering the following command for each disk group:
   
   ```
   vxvol -g <diskgroup> stopall
   ```

3. If you are upgrading:
   - VxVM 4.1 to VxVM 5.0 with PowerPath 5.x installed:
     
     Follow upgrade procedure in your VxVM installation guide to upgrade and configure VxVM software and licenses (if required). Make sure to retain the volume manager configurations from the old version during the upgrade.
- VxVM 5.0 to VxVM 5.0 MPx_RPx with PowerPath 5.x installed:
  Follow the maintenance patch upgrade procedure in your VxVM installation guide to upgrade and configure VxVM software and licenses (if required).

4. Verify that the upgrade to VxVM 5.0 is complete and check that emcpower pseudo device names are used as the disk access (DA) names. Type:
   pkginfo -l VRTSvxvm
   vxdisk list

5. If emcpower pseudo devices are not displayed in the list, rescan VxVM devices or restart the configuration daemon to update VxVM database using one of the following commands:
   - # vxdisk scandisks
   - or
   - # vxconfigd -k

You can use the `vxconfigd -k -x nothreads` command to do a single-threaded device discovery with debugging if needed.

6. Start all VxVM volumes and mount file systems that were unmounted in step 1 of this procedure. Type:
   vxvol -g <diskgroup> startall
mount <fs_mnt_point>

7. Obtain the required updated ASLs to ensure the array is claimed correctly.

### 5.4 Upgrading PowerPath on a VxVM encapsulated boot disk

This section provides procedures for upgrading from PowerPath 5.0.0 to PowerPath 5.3 on a Solaris 9 or 10 SPARC or Solaris 10 Opteron host with VxVM 5.0 MPx_RPx encapsulated boot disk:

1. If there are any open VxVM volumes on PowerPath emcpower devices, stop applications such as databases that access these volumes configured in the disk group and unmount any file systems configured in the volumes. Type:
   umount <fs_mnt_point>
2. Stop all VxVM volumes by entering the following command for each disk group:
   
   ```bash
   vxvol -g <diskgroup> stopall
   ```

3. Clear any dead devices or paths from the existing PowerPath install. Type:
   
   ```bash
   powermt check
   ```

4. Save existing PowerPath device configuration for the upgrade using command
   
   ```bash
   powermt save
   ```

5. Remove existing version of PowerPath and verify that package is successfully removed and all emcp* modules are unloaded. No reboot is required during upgrade at this step even if the uninstall mentions it.
   
   ```bash
   pkgrm EMCpower
   modinfo | grep emcp
   ```

6. If you encounter a problem during the removal of PowerPath, note the error message and take action accordingly. It may be that not all IOs to devices have been stopped, PowerPath Migration Enabler migrations are present, PowerPath configuration file needed during removal could be missing. Follow the additional steps below to remove PowerPath

   a. Check if DMP is using a device path(s) and if so disable the path(s)

      ```bash
      # vxdmpadm getsubpaths ctlr=emcp
      =============================================================================
      emcpower25c    ENABLED(A)   -          emcpower25s2 PP_EMC       pp_emc0        -
      # vxdmpadm disable path=<pathname>
      ```

   b. Check that no filesystems with emcpower devices are still mounted. If so unmount these filesystem.

   c. Deport any disk groups using the `vxdg deport <dgname>` command.

   d. Verify that the `vxdisk list` command output does not show any emcpower pseudo devices in its list. If it does use the `vxdisk rm <diskname>` command to remove the device from VxVM control.
e. Repeat step step 5 of this procedure. If necessary reboot the system. The reboot scans the removed devices and reconfigures them.

f. Import any disk groups back using the `vxdg import <dgname>` command.

7. Install PowerPath 5.3 from the directory where the package is untarred and unzipped. ‘4.1 Installing PowerPath with VxVM on special configurations’ on page 13 provides more information. Verify that the new emcp* modules have been loaded. Type:

```
pkgadd -d .
modinfo | grep emcp
```

8. Run `vxdisk scandisks` for PowerPath to take control of the devices.

The following message appears:

```
NOTICE: VxVM vxdmp V-5-0-143 dmpnode 283/0xa0 in enclosure 461238 has migrated to a Third Party Driver control.
```

9. For Symmetrix and CLARiiON devices, run `vxdisk list` to ensure that all the devices have emcpower pseudo names.

10. If you see any device that has not changed to emcpower devices or if you see any issue, reboot the host once more to reload the drivers. If no reboot is required, proceed to step 11 of this procedure.

11. Run `vxdmpadm getsubpaths dmpnodename=emcpowerxx` to verify that all devices are under PowerPath control

Output such as the following appears:

```
lclc065.lss.emc.com:/> vxdmpadm getsubpaths dmpnodename=emcpower1s2
================================================================================
emcpower1c ENABLED(A) - emcp EMC EMC0 -
```

12. Mount all the VxVM filesystems.
6. Removing PowerPath from a Solaris host with VxVM

6.1 Pre-removal tasks

Before removing PowerPath from a Solaris host with VxVM:

- Make sure no pseudo devices are in use. Unmount any mounted file systems contained on pseudo devices. Disable VxVM or Sun Volume Manage volumes on pseudo devices.

6.2 Procedure

To remove PowerPath 5.3 or 5.5 from a Solaris 9 or 10 SPARC or Solaris 10 Opteron host with VxVM 5.0 MPx_RPx follow the procedure below. It ensures that PowerPath removal is non-disruptive.

1. Complete step 1 through step 5 of the procedure ‘5.1 Upgrading from PowerPath 5.0.0 to PowerPath 5.3’ on page 15.

2. If you encounter a problem during the removal of PowerPath, note the error message and take action accordingly. It could be one of the following issues:
   - Not all IOs to devices have been stopped.
   - PowerPath Migration Enabler migrations are present.
   - PowerPath configuration file needed during removal could be missing.
   - DMP is using a device path(s). If so disable the path(s). Type:

   ```
   # vxdmpadm getsubpaths ctrlr=emcp
   ```

   Output such as the following appears:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>emcpower25c</td>
<td>ENABLED(A)</td>
<td>-</td>
<td>emcpower25s2</td>
<td>PP_EMC</td>
<td>pp_emc0</td>
<td>-</td>
</tr>
<tr>
<td>vxdmpadm</td>
<td></td>
<td>disable path=&lt;pathname&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   When any removal issues are resolved, repeat the removal step provided in step 5 on page 15.

3. On a successful removal, clean PowerPath saved configuration files. Type:
/etc/emcp_cleanup

4. Reboot the system if directed to do so.

5. Restart the event source daemon using
   vxddladm start events

6. Rescan VxVM devices or restart the configuration daemon to update VxVM database using one of the following commands:
   • # vxdisk scandisks
   or
   • # vxconfigd -k
   If working in a VxVM 5.0 configuration, you can use the vxconfigd -k -x nothreads command to do a single-threaded device discovery with debugging if needed.

7. Verify that native device names are used as the disk access (DA) names. Type:
   vxdisk list

8. Import all deported disk groups. Type:
   vxdg import <vxdg>

6.3 Removing PowerPath with VxVM on special configurations

This section provides procedures for removing PowerPath 5.3 with VxVM 5.0 MPx_RPX on the following special configurations:

- SAN boot disk
- VxVM encapsulated boot disk
- Sun Cluster v3.1 and later

6.3.1 Remove PowerPath on VxVM on a SAN boot disk configuration

Note: On SPARC platforms, complete this procedure to remove PowerPath control over a boot device. On x86 platforms, after step 1 skip to step 5, and continue the procedure.

1. Follow procedure in ‘6. Removing PowerPath from a Solaris host with VxVM’ on page 22.
2. Determine whether the hardware path from the host to the storage system has changed since the storage system boot device was configured:
   a. Examine the `/etc/vfstab.pre_EMCPower` file to identify the native name for the boot device c#t#d#. Type:
      
      ```
      cat /etc/vfstab.pre_EMCPower
      ```
   
   b. Determine the hardware path associated with this native device. Type:
      
      ```
      ls -al /dev/dsk/c#t#d#s0
      ```
      
      Non-Leadville driver: /pci@1f,4000/QLGC,qla@4/sd@0,0
      Leadville driver: /pci@1d,700000/emlx@1,1/fp@0,0/ssd@w50000972081a4d91,10:a

   c. Compare the boot path from step b of this procedure with the original boot path in the `nvramrc` attribute of the `eeprom` command.

3. If the boot path listed in step b of this procedure differs from that in the `nvramrc`, update the boot path to reflect the value listed in step b of this procedure. Type:

   ```
   Note: For Leadville(ssd) driver replace ssd in hardware path with disk.
   ```

   Non-Leadville driver
   ```
   eeprom nvramrc="devalias storagedisk
   /pci@1f,4000/QLGC,qla@4/sd@0,0"
   ```

   Leadville driver
   ```
   eeprom nvramrc="devalias storagedisk
   /pci@1d,700000/emlx@1,1/fp@0,0/
   disk@w50000972081a4d91,10:a"
   ```

4. Verify that the boot path was changed to the new value using the `eeprom` command

5. Restore the versions of `/etc/system` and `/etc/vfstab` that do not contain references to PowerPath. Type:

   ```
   cp /etc/system.pre_EMCPower /etc/system
   cp /etc/vfstab.pre_EMCPower /etc/vfstab
   ```
6.3.2 Remove PowerPath from a VxVM Encapsulated boot disk configuration

1. Follow procedure in ‘6. Removing PowerPath from a Solaris host with VxVM” on page 22.

2. Choose any native device from the `vxdisk list` command output and verify that PowerPath is no longer in control of the device using `vxdmpadm` command.
Removing PowerPath from a Solaris host with VxVM

Output such as the following appears:

```
lclc065.lss.emc.com:/> vxdmpadm getsubpaths dmpnodename= c3t50000972081A4D91d16s2
================================================================================
c3t50000972081A4D91d16s2 ENABLED(A)   -          c3         EMC          emc1             -
c3t50000972081A4D95d16s2 ENABLED(A)   -          c3         EMC          emc1             -
c4t50000972081A4D91d16s2 ENABLED(A)   -          c4         EMC          emc1             -
```

3. Verify mounted file systems with VxVM disk groups are operating as expected.

6.3.3 Removing PowerPath with Sun Cluster v3.1 and later

1. Export VxVM disk group(s) from the primary node to one of the secondary node using the `vxdg deport <diskgroup>` command.
2. Reboot the node out of the cluster using the `reboot -- -x` command.
3. Follow procedure in ‘6. Removing PowerPath from a Solaris host with VxVM” on page 22.
4. Reboot the node back into the cluster using the `reboot` command.
5. Import any exported VxVM disk group(s) if it is a primary node using the `vxdg import <diskgroup>` command.
6. Repeat step 2 through step 4 of this procedure for all secondary nodes.

Problem with PowerPath removal with Sun Cluster v3.1 and later

If you attempt to remove PowerPath in a Sun Cluster 3.1 and later with VxVM 4.1 environment and package removal fails, it could be because PowerPath pseudo devices (emcpower) are in use.

1. Type the following commands:
   ```
   # cd /dev/rdsk
   # for path in `ls emcpower*c`
   
   /usr/sbin/vxdmpadm -f disable path=${path}
done
   
   3. Remove PowerPath following the directions in ‘6. Removing PowerPath from a Solaris host with VxVM” on page 22.
   ```
6.4 Removing VxVM from a Solaris host with PowerPath

There are no extra PowerPath-specific steps for removing VxVM from a Solaris host where PowerPath is installed.

Refer to VERITAS user documentation for instructions on removing VxVM from a Solaris host.

7. Common administration procedures for PowerPath and VxVM

This section provides procedures for common configuration changes within PowerPath and VxVM.

7.1 Adding new LUNs or HBAs

To add new LUNs or HBAs:

1. Check the default naming scheme and change to OSN.
   Type:
   ```bash
   # vxddladm get namingscheme
   ```
   Output such as the following appears:
   
<table>
<thead>
<tr>
<th>NAMING_SCHEME</th>
<th>PERSISTENCE</th>
<th>LOWERCASE</th>
<th>USE_AVID</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS Native</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
   
   # vxddladm set namingscheme=osn persistence=[yes|no]

2. Stop the event source daemon.
   Type:
   ```bash
   vxddladm stop eventsource
   ```

3. Map and zone the new LUNs/HBA to the host and dynamically create the LUN mappings on the host. Use the Solaris configuration administration tool `cfgadm` to configure the HBAs.
   Type:
   ```bash
   cfgadm -vc configure <ap_id>
   ```
   where `ap_id` is the attachment point of the hardware resource.

4. Configure and create PowerPath pseudo device links.
   Type:
   ```bash
   powermt config
   ```

5. Save and load the new configuration.
   Type:
   ```bash
   powermt save
   ```
powermt load

6. Start the event source daemon. Type:
   vxddladm start eventsource

7.2 Removing LUNs or HBAs

To remove LUNs or HBAs:

1. Stop the event source daemon. Type:
   vxddladm stop eventsource

2. To remove:
   - An HBA:
     a. Disable each HBA that needs to be removed from DMP. Type:
        
        vxddmpadm disable ctrlr=<vxdmp controller name>

     b. Remove HBA from PowerPath control. Type:
       powermt remove hba=<hba#>

   - A LUN:
     a. Deport any disk group that the LUNs to be removed are part of. Type:
        
        vxdfg deport <dg name>.

     b. For each LUN that needs to be removed, type:
        vxdisk rm emcpowerxx

     c. Remove each the LUN managed by PowerPath. Type:
        powermt remove dev=<emcpower#>.

3. Remove the zones and mappings for the LUNs/HBAs from the storage array side and dynamically remove the LUN mappings on the host using Solaris configuration administration tool `cfgadm` to unconfigure the HBAs:

   `cfgadm -vc unconfigure <ap_id>`

   where `ap_id` is the attachment point of the hardware resource.
4. Reconfigure PowerPath to clean up any unreferenced device links, and then save and load the new configuration. Type:

```
powermt config
powermt save
powermt load
```

5. Start the event source daemon. Type:

```
vxddladm start eventsourc.
```

### 7.3 Cleaning duplicate device entries in VxVM

When using PowerPath and VxVM versions previous to 5.0 MP3_RP1 in certain situations, multiple device entries can be seen in `vxdisk list`. Some of the circumstances in which this issue has been seen include:

- PowerPath pseudo device links are unavailable during boot, and VxVM 4.1 depends on these links before they can be created. This usually occurs when PowerPath is removed and reinstalled without clearing the knowledge VxVM 4.1 has of these devices.

- A new LUN is mapped or zoned to a host and VxVM had prior knowledge of this device.

- VxVM 4.1 is removed and reinstalled after a LUN configuration change. VxVM maps pseudo devices based on device information saved before the uninstall and these mappings may differ from the current PowerPath mappings and configuration.

- A pseudo device instance is renamed using `emcpadm` which causes VxVM 4.1 to lose the pseudo device mapping.

In these cases, a possible solution is to reinstall VxVM 4.1 MP2 or VxVM 5.0 MP3_RP1 or later.

Additional scenarios and corrective actions are listed in the following table:
Common administration procedures for PowerPath and VxVM

<table>
<thead>
<tr>
<th>If</th>
<th>Then</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upgrading or reinstalling PowerPath in</td>
<td>If directed, reboot after the initial package removal.</td>
</tr>
<tr>
<td>a VxVM environment</td>
<td></td>
</tr>
<tr>
<td>vxddladm commands were not run</td>
<td>Reboot the system to remove duplicate device entries.</td>
</tr>
<tr>
<td>Running vxdisk list shows duplicate</td>
<td>Depending on versions of VxVM prior to 5.0 MP3_RP1, a second reboot</td>
</tr>
<tr>
<td>device entries</td>
<td>will clear the duplicates. The PowerPath pseudo device links will be</td>
</tr>
<tr>
<td></td>
<td>available during the second reboot.</td>
</tr>
<tr>
<td></td>
<td>After running emcpadm rename:</td>
</tr>
<tr>
<td></td>
<td>1. Refresh VxVM disk memory files. Type:</td>
</tr>
<tr>
<td></td>
<td>mv /etc/vx/disk.info /etc/vx/disk.info.old</td>
</tr>
<tr>
<td></td>
<td>mv /etc/vx/array.info /etc/vx/disk.array.old</td>
</tr>
<tr>
<td></td>
<td>2. Run vxconfigd -k to restart the configuration daemon.</td>
</tr>
<tr>
<td></td>
<td>The file array.info and disk.info are created anew.</td>
</tr>
<tr>
<td></td>
<td>3. Run vxdisk list to verify the correct mapping with no duplicates.</td>
</tr>
<tr>
<td>A host is rebooted with a path(s) down</td>
<td>To avoid duplicate device entries:</td>
</tr>
<tr>
<td></td>
<td>1. Run vxddladm stop eventsource .</td>
</tr>
<tr>
<td></td>
<td>2. Reestablish connection to the path(s).</td>
</tr>
<tr>
<td></td>
<td>3. Run powermt config .</td>
</tr>
<tr>
<td></td>
<td>4. Run vxddlam start eventsource.</td>
</tr>
</tbody>
</table>

7.4 Modifying VxVM disk access names after a pseudo name change

You might want to modify disk access names after pseudo name changes because the host has duplicate entries in VxVM for each pseudo device. For example, in cluster configurations in which you renumber all the emcpower devices to match on all hosts, the vxdisk list shows the old names instead of the new names.

To modify VxVM disk access after changing the pseudo name:
Note: This procedure is valid for VxVM 4.1 and VxVM 5.0 MPx_RPx with PowerPath 5.3 on Solaris 9 or 10 SPARC and Solaris 10 Opteron.

1. Remove emcpower devices you want to renumber from VxVM control. Type:
   
   vxdisk rm emcpower#s2

   For example:

   vxdisk rm emcpower9s2

2. Change the emcpower device number. Type:

   emcpadm rename -s <src_pseudo_instance> -t <tgt_pseudo_instance>

   For example:

   emcpadm rename -s emcpower9 -t emcpower10

3. Confirm that the device is still attached to the old emcpower device name. Type:

   vxdisk list

4. If duplicate device entries are seen in vxdisk list, follow the suggested corrective actions in Table on page 30
8. PowerPath Migration Enabler and VxVM

This section provides common procedures for PowerPath Migration Enabler and VxVM.

8.1 Cleaning up duplicate pseudo device entries in VxVM and Migration Enabler

After PowerPath installation with a VxVM version previous to VxVM 5.0 MP3_RP1 and Migration Enabler enabled, you may find duplicate device entries in VxVM. The procedure provided in this section removes the duplicates without a reboot.

1. Check if there are any duplicate device entries in VxVM database using

```
# vxdisk list
```

<table>
<thead>
<tr>
<th>DEVICE</th>
<th>TYPE</th>
<th>DISK</th>
<th>GROUP</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c1t0d0s2</td>
<td>auto:none</td>
<td>-</td>
<td>-</td>
<td>online invalid</td>
</tr>
<tr>
<td>emcpower0s2</td>
<td>auto:none</td>
<td>-</td>
<td>-</td>
<td>online invalid</td>
</tr>
<tr>
<td>emcpower1s2</td>
<td>auto:none</td>
<td>-</td>
<td>-</td>
<td>online</td>
</tr>
</tbody>
</table>

2. Check the default naming scheme and change to OSN. Type:

```
# vxddladm get namingscheme
# vxddladm set namingscheme=osn persistence=[yes|no]
```

3. Stop the event source daemon. Type:

```
vxddladm stop eventsource
```

4. Deport any disk groups. Type:

```
vxdg deport <diskgroup>
```

5. Remove all devices from PowerPath and if displayed note the list of devices that cannot be removed. Type:

```
powermt remove dev=all
```

Output such as the following appears

Cannot remove device that is in use:
c3t5006016A39A008B2d10s0
Cannot remove device that is in use:
c3t5006016A39A008B2d11s0
Cannot remove device that is in use:
c3t5006016A39A008B2d12s0
Cannot remove device that is in use:
c3t5006016A39A008B2d9s

6. Remove each device in the list of devices that could not be removed in step 5 of this procedure from VxVM control. Type:
   vxdisk rm emcpowerxx

   **Note:** Any devices that are part of a disk group cannot be removed so the entire disk group must be removed.

7. Repeat step 5 of this procedure and use the `powermt check force` command to verify devices have been removed.

8. Reconfigure and create PowerPath pseudo device links. Type:
   powermt config

9. Verify using the `vxdisk list` command output that duplicate device entries are removed.

10. Import any deported disk groups. Type:
    vxdg import <diskgroup>

11. Start the event source daemon. Type:
    vxddladm start eventsource

---

### 8.1.1 Cleaning duplicate device entries after a Migration Enabler migration

The procedure provided in this section removes the duplicate pseudo devices entries under the following circumstances:

- After performing migrations with pseudo devices under VxVM control using PowerPath Migration Enabler using powermig cleanup.

1. Carry out the steps outlined in ‘8.1 Cleaning up duplicate pseudo device entries in VxVM and Migration Enabler’ on page 32.

   When a migration procedure involves logical units under VxVM control, you must regenerate the VxVM persistent device naming database after the migration has been committed.

2. Regenerate the VxVM persistent device naming database. Type:
   
   ```
   rm /etc/vx/disk.info
   vxconfigd -k
   ```

3. Verify that the encrypted virtual logical units belong to the VxVM disk group. Type:
4. Re-label or format the source plain text logical units.

### 8.2 Growing a device using VxVM after a Migration Enabler migration

When migrating from a smaller device to a larger device using PowerPath Migration Enabler, the remaining space on the target device can be recaptured using the VxVM resize functionality. It is also possible to grow a device to use its maximum size with this feature.

1. Disk group is created with two 3 GB devices and a 4GB volume is created on top of it with UFS/VxFS file system. Type:

   ```
   vxdg init <dg_name> <device_name>
   vxassist -g <dg_name> make <vol_name> <size>
   mkfs -F vxfs <vol_absolute_path>
   ```

2. Using PowerPath Migration Enabler, migrate a 2 GB source to one of the 3GB target device in the disk group.

3. To recapture the remaining 1GB space on the target device, use the `vxdisk resize` command to resize the device to 3GB. Type:

   ```
   vxdisk -g <dg_name> resize
   ```

4. Use the `vxassist` command to grow the volume to the maximum size of 6GB. Type:

   ```
   vxassist -g <dg_name> maxsize
   vxassist -g <dg_name> growto <vol_name> <new_length>
   ```

5. Use the `growfs` command to grow the UFS file system on the volume. Use `fsadm` command for VxFS. Type:

   ```
   growfs -M <mnt_point> <vol_absolute_path>
   ```

6. `fsadm -F vxfs [-b newsize] [-r rawdev] <mnt_point>`
9. PowerPath Encryption with RSA and VxVM

You can use PowerPath Encryption encrypted virtual logical units to create VxVM disk groups and allocate volumes within the disk set or group. This section provides common PowerPath Encryption procedures with VxVM. All VxVM operations work with PowerPath Encryption encrypted virtual logical units, subject to the best practices described below.

Note: PowerPath Encryption with RSA is supported from PowerPath 5.2 and later.

9.1 Best practices for Encryption with RSA and VxVM

Take note of the following best practices when using PowerPath Encryption with VxVM:

✦ The logical units that belong to a VxVM disk group must either all be encrypted or all unencrypted. You cannot include both encrypted and unencrypted logical units in the same VxVM disk group.

✦ You cannot enable encryption on a logical unit that is under VxVM control.
  • Before enabling encryption on a logical unit, run the VxVM `vxdisk offline` command to remove it from VxVM control.
  • After enabling encryption, run the VxVM `vxdisk online` command to place the virtual logical unit back under VxVM control.

✦ Do not use the `powervt xcrypt -on -force` command to enable encryption on a logical unit that is already part of a VxVM disk group. Rather, follow the procedure in ‘9.3 Enabling encryption on an existing VxVM disk group” on page 38.

✦ For procedures involving encryption with migration to logical units under VxVM control, you must regenerate the VxVM persistent device naming database after the migration has been committed using the following command:

```
rm /etc/vx/disk.info
vxconfigd -k
```
9.2 Creating an encrypted VxVM disk group

This procedure describes how to create an encrypted VxVM disk group.

**Prerequisite tasks**
Complete the following prerequisite tasks:

- Use the `powermt display dev=all` command to identify the PowerPath pseudo devices that will belong to the encrypted VxVM disk group.

- If the devices to be enabled for encryption contain data that you want to save, back up that data before enabling encryption on the logical units. Enabling encryption on a device destroys any existing data on that device.

- Use the VxVM `vxdisk list` command to make sure that the target logical units are not part on an existing VxVM disk group.

- Ensure that the PowerPath pseudo devices are not being used by other applications. A PowerPath pseudo device is in use if it meets either of the following conditions:
  - The PowerPath pseudo device contains a mounted file system or is open by a volume manager such as VERITAS Volume Manager. The encryption manager detects this condition and warns you about the consequences of enabling (or disabling) encryption on this device.
  - The PowerPath pseudo device is not currently mounted or opened by an application. The device does, however, contain valid data that you may want to preserve. Also, some volume managers open a device in a manner that the encryption manager cannot detect. The encryption manager does not detect this condition and therefore does not warn you of possible data loss.

If a PowerPath pseudo device is in use, do the following before enabling encryption on that device:

- Stop any application and shut down any database using the PowerPath pseudo devices.
- Unmount any file systems mounted on the PowerPath pseudo devices.
- If the device contains data that you want to preserve, back up that data.
For Solaris hosts, EMC recommends that you perform a generic format on a PowerPath pseudo device before enabling encryption on that device.

- Run the Solaris `format` utility to format the device. From the format menu, select:
  - `type > 0` to auto-configure the device
  - `label > yes` to write the default label on the device.

After encryption has been enabled on the device, you can re-run the format command to create any custom partitions on the device if needed.

**Procedure**

To create an encrypted VxVM disk group:

1. Enable encryption on each logical unit that will be part of the VxVM disk group:
   a. Run `vxdisk offline <device>` to take the logical unit offline. For example:
      ```
      vxdisk offline emcpower52
      ```
   b. Run `powervt xcrypt -on -dev <device>` to enable encryption on the logical unit. For example:
      ```
      powervt xcrypt -on -dev emcpower52
      ```
   c. Run `vxdisk online <device>` to bring the logical unit back online. For example:
      ```
      vxdisk online emcpower52
      ```

2. Run `powervt xcrypt -info -dev all` to verify that the logical units are enabled for encryption.

3. Create the VxVM disk group using the encrypted virtual logical units created in step 1 of this procedure. Type:
   ```
   vxdisk init <pseudo device>
   vxdg init <disk group> <pseudo device>
   ```
   For example:
vxdisk init emcpower52
vxdg init encryptdg emcpower52

**Note:** All devices in the VxVM disk group must be enabled for encryption. Do not add plain text logical unit to an encrypted VxVM disk group.

4. For additional encrypted LUNs to be added to the disk group repeat step 1 through step 3 of this procedure and create volumes on the disk group as needed. The *PowerPath Encryption with RSA User Guide* provides information on how to create volumes.

### 9.3 Enabling encryption on an existing VxVM disk group

This procedure describes how to enable encryption on an existing VxVM disk group. To do this, migrate the plain text logical units in the VxVM disk group to new set of encrypted virtual logical units.

**Prerequisite tasks**

Complete the following prerequisite tasks:

- Use the VxVM `vxdisk list` command to identify the plain text logical units that currently belong to the VxVM disk group.
- Choose the target logical units for the encrypted VxVM disk group.
  - Identify a target logical unit for each plain text logical unit in the VxVM disk group. If necessary, provision storage on the PowerPath Encryption host.
  - Ensure that the target logical units are at least 65KB larger than the source logical units to accommodate PowerPath Encryption metadata.
  - Complete the steps described in prerequisite tasks provided in “9.2 Creating an encrypted VxVM disk group” on page 36 to prepare the target virtual logical units.

**Procedure**

To enable encryption on an existing VxVM disk group:

1. Carry out the Procedure in ‘9.2 Creating an encrypted VxVM disk group” on page 36 to enable encryption on each logical unit that will be part of the VxVM disk group.
2. Migrate each source plain text logical unit in the VxVM disk group to its target encrypted logical unit. Follow the procedure described in the PowerPath Encryption with RSA User Guide.

3. Use the `vxdisk list` command to verify that the encrypted virtual logical units belong to the VxVM disk group.

4. Resize each target encrypted virtual logical unit to adjust its usable space to reflect the disk’s actual physical capacity. Follow the procedure described in PowerPath Encryption with RSA User Guide.

If a file system is mounted on the encrypted virtual logical unit, grow it to use the additional space on that device. For a VxFS file system, for example, use the `fsadm` or `vxresize` command.

The PowerPath Encryption with RSA User Guide provides information on the `fsadm` and `vxresize` commands.

5. Re-label or format the source plain text logical units. The PowerPath Encryption with RSA User Guide provides information on re-labeling and reformatting source plain text logical units.

9.4 Disabling encryption on a VxVM disk group

This procedure describes how to disable encryption on an encrypted VxVM disk group. To do this, migrate the encrypted virtual logical units in the VxVM disk group to a new set of plain text logical units.

**Prerequisite tasks**

Complete the Pre-Steps outlined in ‘9.2 Creating an encrypted VxVM disk group” on page 36.

**Procedure**

To disable encryption on an encrypted VxVM disk group:

1. For each source/target pair, migrate the data on the source encrypted virtual logical unit to the target plain text logical unit. Follow the procedure provided in the PowerPath Encryption with RSA User Guide.

2. Disable encryption on the source encrypted virtual logical units. For each source encrypted virtual logical unit:
   a. Run `vxdisk offline <device>` to take the logical unit off line.
   b. Run `powervt xcrypt-off -dev <device>` to disable encryption on the virtual logical unit.
Note: If you receive an error message stating that the device is busy, the vxdisk offline command has not completed. Wait for the vxdisk offline command to complete and then re-run the powervt xcrypt -off command.

c. Run `vxdisk online <device>` to bring the logical unit back online.

3. Re-label or format the source logical units. The PowerPath Encryption with RSA User Guide provides information on re-labeling and reformatting source plain text logical units.

### 9.5 Rekeying an existing VxVM disk group

This procedure describes how to change the key for an encrypted VxVM disk group. To do this, you must migrate the encrypted virtual logical units in the VxVM disk group to new set of encrypted virtual logical units.

**Prerequisite tasks**

Complete the Pre-steps outlined in ‘9.2 Creating an encrypted VxVM disk group” on page 36.

**Procedure**

To change the key on an encrypted VxVM disk group:

1. Complete the procedure outlined in ‘9.3 Enabling encryption on an existing VxVM disk group” on page 38 to enable encryption on each logical unit that will be part of the VxVM disk group.

2. Migrate each source logical unit in the VxVM disk group to its target logical unit.

3. Complete step 2 and step 3 of ‘9.4 Disabling encryption on a VxVM disk group” on page 39 to disable encryption on the source virtual logical units.

More information can be found in the following documents:

- PowerPath Encryption with RSA User Guide
- PowerPath Migration Enabler User Guide
- powermig man page
10. Limitations with PowerPath and VxVM 4.1

This section contains limitations regarding PowerPath and VxVM 4.1 interoperability.

These limitations do not apply to VxVM 5.0 and later with PowerPath installed.

- Root device encapsulation for VxVM 4.1 is not supported on hosts running PowerPath with Solaris 10.
- With VERITAS fencing, I/O enabled on a host running PowerPath with Solaris 9 or 10, there is a performance impact when
  - Importing a disk group.
  - Running the `vxdisk list -o alldgs` command.
EMC Knowledgebase Solutions emc153120 provides more information on this problem.

To correct these issues, install VxVM 4.1 MP2.

- EFI disks on hosts running PowerPath with Solaris 9 or 10 are not supported on VxVM. The dmpnode is disabled after labeling the device as an EFI device. Currently EMC and Symantec are working jointly on a solution for this problem.

- On hosts running PowerPath with all UNIX or Linux platforms, in a VCS 5.0 cluster with a CLARiiON attach, on any of the nodes the disks are all labeled online `uuid_mismatch` and the DMP paths are flagged as disabled. The problem has been identified with CLARiiON ASL, and a joint EMC/Symantec qualification is currently in process.

10.1 Invista and third-party arrays with VxVM 4.1

There are some considerations to bear in mind when operating Invista and third-party arrays with VxVM.

- VxVM does not support PowerPath pseudo device names with Invista and third-party arrays.
- The default for Invista and third-party devices arrays is native. The VxVM `tpdmode` can be changed to native for any EMC devices in a mixed-array environment.

With respect to Invista exclusively, the following restrictions apply:
- PowerPath is supported with Invista in a JBOD mode in a VxVM 4.1 environment. This issue is due to the lack of a VxVM ASL specifically for Invista devices. The DMP confuses Invista devices with Symmetrix devices.
- Only enclosure-based naming is supported (no pseudo/emcpower names).
- The /etc/vx/libvxemc.so library file must be excluded; as a result, Symmetrix and CLARiiON cannot be directly attached to the same host.

11. Additional documentation

The following documents contain information about the topics covered in this document:
- PowerPath for Solaris Installation and Administration Guide
- PowerPath Migration Enabler User Guide
- PowerPath Encryption with RSA User Guide
- powermig man page
- Invista documentation

More information on PowerPath can be found at www.emc.com at the PowerPath page.

The EMC Powerlink website also offers the PowerPath documentation set: http://Powerlink.EMC.com. From the home page, go to Support and locate PowerPath documentation.