HP StorageWorks

Hardware Providers installation guide for Windows
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1 Overview of HP StorageWorks hardware providers

This chapter describes the HP StorageWorks Hardware Providers for Windows 2003/2008 and explains how they function with Microsoft operating systems and applications.

HP hardware providers are software products that are installed on a Windows 2003/2008 server connected to an HP disk array. They enable Windows operating systems and applications to control disk array functions and copy disk array data.

Separate hardware providers support two Microsoft storage services:

- HP hardware provider for Microsoft Virtual Disk Service (VDS)
- HP hardware provider for Microsoft Volume Shadow Copy Service (VSS)

Figure 1 and subsequent topics describe the components of the HP hardware provider solution. For more information about Microsoft and HP components, see each manufacturer’s product documentation.
Windows Disk Management

Windows Disk Management consists of the Windows software and user interfaces that enable you to manage disks, volumes, and file systems. The user interface for disk management is a Computer Management tool in the Administrative Tools of the Windows Control Panel.

Management applications

Management applications operate through the Microsoft VDS and VSS services and HP hardware providers to manage application data, manage array disks and volumes, perform back ups, and restoring data.

Microsoft command line utilities

Microsoft command line utilities can manage any storage device with a VDS or VSS hardware provider.

- The DiskPart utility, which comes standard with Windows XP and Windows Server, is used to manage disks, volumes, and partitions.
- The DiskRaid utility is used to configure hardware RAID storage systems.
The Vshadow utility (for Window 2003) or DiskShadow utility (for Windows 2008) is used to create and manage volume shadow copies and snapshots.

Microsoft Virtual Disk Service

Microsoft Virtual Disk Service (VDS) enables administrators to identify, configure, and monitor logical units as if they were disks on the Windows server.

When you use Microsoft Management Console (MMC) Snap-in, Windows Disk Manager, and the Microsoft DiskPart or DiskRaid utility, your commands are sent to the array through VDS and the software or hardware providers.

VDS performs the following functions:

- Coordinates providers and clients (local and remote)
- Binds logical units
- Presents hardware logical units to software disks
- Performs common file system functions
- Monitors volume status
- Tracks fault and performance

Microsoft Volume Shadow Copy Service

Microsoft Volume Shadow Copy Service creates and maintains data shadow copies for backup and recovery, including copies across multiple volumes. Shadow copies contain static copies of related files, such as database, log, and checkpoint files. VSS coordinates with HP Business Copy software, third-party business applications, file system services, backup applications, and the storage device to ensure that all related files are copied in a consistent state.

A VSS (volume shadow) copy is also called a plex or a differential in Microsoft settings. The industry commonly refers to this type of copy as a split mirror.

Windows software providers

Microsoft software providers (called Basic Disk Provider and Dynamic Disk Provider) interface between Windows applications and devices such as disks, tape or CD drives, and disk arrays. Through software providers and VDS, Windows performs actions such as partitioning, mounting, and managing file systems on hardware devices.

HP VDS/VSS hardware providers

The HP VDS and VSS hardware providers consist of DLLs and executables that are installed on your Windows server. These components extend the capabilities of Windows and its applications to manage HP disk arrays. You can install the VDS or VSS hardware provider or both.

Using Windows applications and the HP VDS provider, you can manage array ports, discover and manage LUNs, format, partition, and mount volumes, and create and manage file systems and files. If you have multiple array models, you can manage all arrays from a single interface.

Using the HP VSS hardware provider and Microsoft VSS, you can create and manage copies on the HP array. HP Business Copy is required on the disk array and works with VSS and the HP VSS hardware provider to enable copying. Uses include: consistent backups of open files and applications, transportable copies for backup and testing, and quick recovery of lost data.
HP disk arrays

HP disk arrays provide high-capacity storage for a variety of server types, including Windows servers. HP VDS and VSS hardware providers are designed specifically to enhance the integration of HP disk arrays with the Windows OS and applications.
This chapter explains how to install and uninstall HP hardware providers for the HP EVA disk arrays.

**IMPORTANT:**

A successful installation depends on using compatible versions of the OS and all installed software. See the hardware provider release notes for version requirements.

---

**HP EVA hardware providers installation overview**

This section summarizes installation for those who want to get a quick start and do not need the details provided in later sections.

**Overview of HP EVA hardware provider preparation**

To use the HP EVA hardware providers, you must install and configure the following hardware and software as explained in their documentation.

- Windows VDS/VSS host with Windows Server 2003/2008 OS, Ethernet card and connection, and HP-tested HBA and driver software
- HP StorageWorks EVA disk array with Business Copy EVA license (for VSS) and Command View EVA management server with Ethernet connection. Use Command View EVA to add the Windows VDS/VSS host to the disk array and create disk groups for VSS copies.
- HP-tested Fibre Channel switch connecting the host to the disk array
- (Optional) Full-Featured MPIO installed on the host for multipathing
- (Optional) MSCS clustering software installed on the host

**Overview of HP EVA hardware provider installation**

Install the HP EVA HWP software by following the summary steps below.

1. If the previous version is 4.01.01 or earlier, remove the previous version of the provider using the Windows Add or Remove Programs control panel. Later versions are updated automatically and do not need to be removed first.
2. Download the provider installer from the HP VDS/VSS web page:
   
   [http://www.hp.com/support/HWPEVA](http://www.hp.com/support/HWPEVA)
   
   Be sure you select the files for your disk array and operating system. There are separate installers for VDS and VSS.
3. Extract and run the installer executable(s), and follow the InstallShield Wizard instructions to install the software. If you want to install both hardware providers, be sure to run both installers.
4. In the provider configuration utility, enter the Command View EVA management server IP address and log into Command View EVA. Connect to the disk array, and select the disk group you created for VDS/VSS operations. For VSS only, select the snapshot type you wish to use.

5. Verify the hardware providers were installed by checking that they are present in the Add or Remove Programs list of programs.

6. Install Microsoft quick fixes (KBs), if any. See the provider release notes for details.

**NOTE:**

Administrator privileges are required for all devices and software to ensure proper communication between devices and processes.

The Windows VDS/VSS host and the Command View EVA management server must be able to communicate. Ensure that any firewall is open between them.

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### Preparing to install HP EVA hardware providers

This section describes required hardware and software and explains how to configure the disk array and Windows 2003/2008 servers for use with HP hardware providers. You must complete the procedures in this section before you install the hardware providers.

**IMPORTANT:**

A successful installation depends on using compatible versions of the OS and software. See the provider release notes for version requirements.

---

### HP EVA hardware provider configuration

**Figure 2** shows the hardware and software components of an EVA hardware provider configuration. A second server is not needed for VDS and is optional for VSS. Include a second server to manage VSS copies and avoid additional demands on the primary server.

Any firewall must be open between the HP EVA hardware providers server(s) and the Command View management server. Anything that slows access to the Command View EVA management server will cause VSS timeout failures.
Hardware

- **HP StorageWorks EVA disk array**: disk array to be managed using VDS/VSS. For supported EVA models, see the HP StorageWorks EVA hardware provider release notes.

- **HP StorageWorks Command View EVA server**: A Windows server running Command View EVA. Multiple EVA disk arrays, all must be managed from one Command View management server. Other software is conditionally required on the Command View EVA server: An HP StorageWorks Business Copy EVA license is required for VSS only, and HP MPIO Full Featured Failover is required if multipathing is required.

- **VDS/VSS server** running Windows Server 2003/2008 OS and connected to the disk array via the SAN. This server manages your primary data and contains applications (such as Exchange or SQL), VDS/VSS, and HP hardware providers. If multipathing is required, HP MPIO Full Featured Failover must also be installed on the VDS/VSS server.

- **Optional server 2**: Another Windows server may be connected to the array to manage VSS copies and avoid additional demand on the VDS/VSS server. Depending on the purpose for this server, you may also need to install the HP hardware providers, your application software, and MPIO Full Featured Failover.

  The Optional Server (and HP EVA hardware provider) is used to import the shadow copy volume for operations such as consistency verification using eseutil, datamining, or /tapebackup.

- **Fibre Channel Host Bus Adapters (HBAs)** in each server that is connected to the disk array via a Fibre Channel SAN.
• **Fibre Channel switch(es) and cables** connecting host servers to the disk array.

• **Ethernet Network Interface Cards** or available network interface port in each server for connecting to Ethernet LAN.

**Notes on installing HP EVA hardware providers**

The following notes will help ensure successful operation of the hardware providers:

- Using multiple servers to manage primary data and data copies is optional. However, if you use multiple servers, they must be in the same Ethernet domain so that the DCOM communication process can communicate between servers.

- Administrator privileges are required for all devices and software. If you do not have administrator privileges, the software and hardware will not communicate properly. If authentication fails, consult the release notes for any special authentication issues and solutions.

- A firewall between the Command View EVA management server and the VDS/VSS servers must be open.

- Excessive traffic on the Ethernet LAN can affect hardware provider performance. If network traffic is a problem, you can use a private Ethernet LAN between the Command View EVA management server and the VDS/VSS server(s) and connect it to the corporate LAN through a firewall.

**HP EVA hardware provider preparation procedures**

Prepare servers and software for use with the hardware providers as described below and in the product manuals. See the overview diagram under the heading **Required components**. Your HP representative may perform some installation and preconfiguration tasks.

**Preparing the Command View EVA management server**

Preconfigure the disk array Command View EVA server as explained below. VDS only requires that you do step 1. All other steps support VSS:

1. If desired, connect the corporate Ethernet LAN to the Command View EVA management server through a firewall. Make sure the firewall is open between the Command View EVA management server and the VDS/VSS server(s).

2. If multipathing is desired, verify existing or install HP MPIO Full-Featured Failover Manager as explained in the documentation for that product.

3. Verify existing or add a license for Business Copy in Command View according to the instructions in the **HP StorageWorks Enterprise Virtual Array license key installation instructions**.

**Preparing the VDS/VSS server**

Install and configure the VDS/VSS server as follows:

1. If it is not already on the server, install the Windows 2003/2008 Enterprise Server OS on the host according to Microsoft’s installation instructions.

2. If you plan to use multipathing, install the HP MPIO Full-Featured Failover software according to the documentation for that product.

3. Install a Fibre Channel host bus adapter (HBA) card into the server according to the HBA manufacturer’s instructions.

4. Install the HBA driver and utility software onto the server according to the HBA manufacturer’s instructions. HP tested drivers are available by searching hp.com; follow the release notes for installation.
5. Connect the server to the disk array via the built-in Fibre Channel fabric switch, if present, or an external switch. Configure the switch, including zoning if required, according to the manufacturer’s instructions. For helpful information on SAN construction, search the HP website for the *HP StorageWorks SAN design reference guide*.

6. Connect the server to the corporate Ethernet LAN, through a firewall if desired. Be sure the firewall is open between the Command View EVA and VDS/VSS server(s). Use a ping command to test communication between servers. The hardware providers use ports 12372 and 2372; these ports must be available in order for the HP EVA hardware providers to function.

7. Complete configuration in this chapter and then install the required HP EVA hardware provider software on the server as explained in the following section.

**Preparing additional servers**

An additional server for managing data copies is optional, and its configuration depends on your specific application. If you plan to use additional servers, configure them according to the preceding instructions.

**Preparing the EVA disk array**

The following disk array configuration steps are required for both the VDS and VSS hardware providers. For supported Command View EVA versions, see the *HP EVA hardware providers release notes*.

1. For HP EVA hardware providers to access the Command View EVA server, you must create new user names and user groups at the operating system level on the Command View EVA server. In Windows, click **Start > Control Panel**, and select **User Accounts** from the Control Panel window.

2. Create the following two user groups:

<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP Storage Users</td>
<td>Members can look at storage but cannot make changes</td>
</tr>
<tr>
<td>HP Storage Administrators</td>
<td>Members can use Command View EVA for all storage management tasks</td>
</tr>
</tbody>
</table>

3. Still in User Accounts, create users within the new user groups. For example, you might create the following users:

<table>
<thead>
<tr>
<th>User Account</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hpuser</td>
<td>HP Storage Users</td>
</tr>
<tr>
<td>Hpadmin</td>
<td>HP Storage Administrators</td>
</tr>
</tbody>
</table>

HP EVA hardware provider users must log in as one of these users before performing VDS/VSS operations using the HP EVA hardware providers configuration utility.
4. Start Command View EVA and log into it using one of the user accounts you just created.

5. Add VDS and VSS hosts. For details about adding hosts, see the Command View EVA online help.

6. Add VDS and VSS disk groups. For details about adding disk groups, see the Command View EVA online help.

Installing hardware providers for HP EVA disk arrays

This section explains how to install and configure HP EVA hardware providers.

If you have not already prepared the server and the array as instructed in the previous section, do so before you install the HP EVA hardware providers software. The HP EVA hardware providers will not work if the array and server are not correctly configured.

**IMPORTANT:**
A successful installation depends on using compatible versions of the OS and all installed software. See the hardware provider release notes for version requirements.

The HP EVA VDS and VSS hardware providers are installed separately using two different installation executables. To install both hardware providers, be sure you run both executables. Install the VDS hardware provider first and the VSS hardware provider second. Installation of the HP EVA VDS and VSS hardware providers is very similar; therefore only VDS hardware provider installation is described.

The following instructions include Windows 2008 Server Core.

1. Before you start installation, use a `ping` command to test communication with the Command View EVA server.

2. Download and extract the HP EVA hardware providers files from the HP VDS/VSS web page: [http://www.hp.com/support/HWPEVA](http://www.hp.com/support/HWPEVA)
3. Double-click the HP EVA hardware providers installation executable: hpevavdsprv_xxx.exe or hpevavssprv_xxx.exe. The xxx in the file name represents the Windows OS version. Be sure to open the file that matches your OS.

**NOTE:**
On Windows 2008 Server Core, change to the location where you extracted the hardware provider files, and enter the name of the executable. For example, for the VDS provider, enter hpevavdsprv_x86.exe.

The InstallShield Welcome window opens.

4. Click Next. The License Agreement window opens.
   
   If this is a new installation, continue to Step 5.
   
   If a version of the hardware provider prior to 4.01.02 is still installed, a message will warn you to remove the old provider manually. Click OK to exit the installation. Open the Windows Add or Remove Programs control panel and remove the previous version. Then restart the installation. (Later versions can be updated or removed automatically using the InstallShield Wizard.)

5. Click Next to continue the installation. The Customer Information window opens.

6. Enter the information and click Next. The Choose Destination Location window opens.

7. To accept the default destination and continue, click Next. To change the installation directory or folder, enter or browse to the new location, and then click Next. The Ready to Install the Program window opens.

8. Click Install to perform the installation.
During the installation, the VDS or VSS configuration utility window opens.

a. In the utility window, enter the IP address or name of the Command View EVA server and log onto the server with your user name and password. Select the EVA storage system you plan to use with the hardware providers.

b. For the VDS hardware provider only, select the disk groups you will use.

c. For the VSS hardware provider only, select the snapshot type you will use. The snapshot types are the following:

   - **Demand Allocated Snapshot** - Space for the copy is created only as it is needed when data is copied to the copy volume.
   - **Fully Allocated Snapshot** - Space for the copy is reserved in advance and filled as data gets copied to the snapshot.
   - **Snapclone** - A complete cloned copy of the original data is created. If you choose Snapclone, you must select the disk group you created previously for VSS copies. You must also select the Redundancy Type, which is Default (same as source), vraid0 (no redundancy), vraid1 (mirroring), or vraid5 (data plus parity).

**NOTE:**

If you need to change the configuration later, you can start the configuration utility the Windows GUI or from a command window:

- **Windows GUI** — You will find the VDS and VSS configuration utilities in the Windows Start > Programs > Hewlett-Packard menu.
- **Command Window** — Run the VSS (hpevavsscfg.exe) and VDS (hpevavdscfg.exe) configuration utilities from a command window. If the default location is used during the installation, the configuration utilities are located in the following paths:
  - VSS — Program Files\Hewlett-Packard\HardwareProviders\EVA\VSS
  - VDS — Program Files\Hewlett-Packard\HardwareProviders\EVA\VDS

When installation completes, click **Finish**.

To verify the HP EVA VDS and VSS hardware providers were installed, check that they are listed in the Windows Add or Remove Programs control panel.

Consult the HP EVA hardware provider release notes for required Microsoft quick fixes (KBs) and install them on the VDS/VSS server.
Removing the HP EVA hardware providers

Before removing the VDS or VSS provider, issue a `net stop vds` or `net stop vss` command from the command line on the VDS/VSS server.

Removing HP EVA hardware providers

To remove the hardware providers:

1. In Windows, select **Start > Settings > Control Panel**.
2. Double-click **Add or Remove Programs**.
3. Select the program you want to remove (VDS or VSS).
4. Click **Change/Remove**. Windows removes the program.

**NOTE:**
You can remove the HP EVA hardware providers by starting the HP EVA hardware providers installer again.

1. Run the installer.
2. Click **Next** to open the Remove window.
3. Click **Remove**, and then click **Finish**.
4. Click **Finish**.

Removing HP EVA hardware providers using the Installer on Windows 2008 Server Core

You can remove the HP EVA hardware providers by running the installers from a command prompt.

1. In a command-line window, switch to the location of the VSS and VDS install executables.
2. Enter the name of the executable for the provider you wish to remove (**hpevavssprv_x86.exe** for VSS and **hpevavdsprv_x86.exe** for VDS).
3. Select **Remove** from the windows that appears and press **Enter**.
This chapter explains how to install and uninstall hardware providers for HP XP disk arrays.

**IMPORTANT:**
A successful installation depends on using compatible versions of the OS and all installed software. See the hardware provider release notes for version requirements.

### Preparing to install HP XP hardware providers

This section describes required hardware and software and explains how to configure the disk array and Windows 2003/2008 servers for use with HP hardware providers. You must complete the procedures in this section before you install the hardware providers.

For HP Hardware Providers software downloads, see the following web location:

http://www.hp.com/support/HWPXP

The following illustration summarizes the hardware and software in a fully configured system.

**NOTE:**
A second server is not needed for VDS and is optional for VSS. Include a second server to manage VSS copies and avoid making additional demands on the primary server.

XP Command View Advanced Edition Software is optional for managing the disk array and is not required by the VDS/VSS server(s).
Figure 3 HP XP hardware provider configuration

- **HP StorageWorks Disk Array** with Business Copy license installed by HP (connectivity to Command View EVA is optional). For supported XP models, see the HP StorageWorks XP hardware provider release notes.

- **Windows VDS/VSS Server** running Windows Server 2003/2008 Enterprise Edition. This server manages the primary data and contains applications (such as Exchange or SQL), VDS/VSS, HP hardware providers, and XP RAID Manager Library software.

- **Optional server 2**: Another Windows server may be connected to the array to manage VSS copies and avoid additional demand on the VDS/VSS server. Depending on the purpose for this server, you may also need to install the HP hardware providers, your application software, and MPIO Full Featured Failover.

  The Optional Server (and HP EVA hardware provider) is used to import the shadow copy volume for operations such as consistency verification using eseutil, datamining, or /tapebackup.

  Depending on your purpose for this server, you may need to install the HP HWP and RAID Manager Library software and your application software.

- **Fibre Channel Host Bus Adapters (HBAs)** in each server that is connected to the disk array via a Fibre Channel SAN.

  For VSS, in any individual server, use only HBAs from the same manufacturer. If any XP volumes are imported, they will be imported into ALL the XP host groups that contain a WWVN of an HBA configured in the server. If you have more than one host group with the same WWN specified, the volume shadow copy LUN could be visible to an unrelated server. This could be an issue when using a mix of HBAs from different vendors, since HBAs from different vendors may have different
driver parameters. This may cause a failure if the multipath software tries to fail over I/O from one vendor’s HBA to another vendor’s HBA. The recommended method for avoiding these problems is never to mix HBAs from different vendors in the same server.

- **Fiber cables and fabric switch** to connect the hosts to the array. (A fabric switch is optional; you can use direct connections if you prefer.)

**Notes on installing HP XP hardware provider**

The following can affect the performance of HP hardware providers.

- Server load
- Volume size (larger PVOLs take longer to copy)
- VSS hardware providers mode (Resync mode copies faster than VSS mode)

The following notes will help ensure successful operation of the hardware providers:

- Using multiple servers to manage primary data and data copies is optional. However, if you use multiple servers, they must be in the same domain to enable communication.
- Administrator privileges are required for all devices and software. If you do not have administrator privileges, the software and hardware will not communicate properly.
- A host group named SVOLand containing secondary (SVOL) LUNs must be defined for use with VSS. This host group should not have any host paths to it.
- A host group specifically named Shadow must be defined for use with VSS. This host group must not have any host paths to it.
- For VSS, primary and secondary volumes must be the same type and size. There must be at least as many secondary volumes as primary ones; some applications require more than one secondary volume for each primary volume.
- A command device LUN must be defined for each server running hardware provider. This LUN cannot be used to store data.
- Port Security must be ON.
- HP XP10000 and XP12000 disk arrays can be configured with up to 32 Storage Logical Partitions (SLPRs) numbered from 0 to 31. You have two options when configuring SLPRs:
  1. If the disk array is configured with a command device on SLPR0, HP hardware providers treat the disk array as a single system and all SLPRs are managed as a unit through the command device on SLPR0.
  2. If the disk array is configured without a command device on SLPR0 but has multiple SLPRs (such as SLPR1, SLPR2...SLPR31), HP hardware providers manage each SLPR separately through a separate command device on each SLPR. The HP hardware providers cannot cross over the SLPR boundaries. That is, the command device, P-VOLs, and SVOLs must reside on the same partition (have the same SLPR number) for the providers to work with them.
- When making shadow copies of a multi-partitioned, GPT-formatted volume, make shadow copies of only one partition at a time. For example, if the source GPT-formatted volume has 3 partitions (M: N: O:), do not create a shadow copy set containing any two of those partitions or the shadow copy set will fail during import.

Using Microsoft’s VSHADOW test tool as an example, the following command will create and import the shadow copy on the local server:

```
vshadow -p M: WORKS
vshadow -p N: WORKS
vshadow -p O: WORKS
```

Using the VSHADOW test tool, the following command will create the shadow copy set but will not be able to import it:
HP XP hardware provider preparation procedures

Prepare servers and software for use with the hardware providers as described below and in the product manuals. Your HP representative may perform some configuration tasks.

Preparing VDS/VSS servers

The VDS/VSS server contains the applications that create and store primary data. Install and configure the server as follows:

1. If it is not already on the server, install the Windows 2003/2008 OS on the host following Microsoft’s installation instructions.
2. Install a Fibre Channel host bus adapter (HBA) card into the server according to the HBA manufacturer’s instructions.
3. Install the HBA driver and software on the server according to the HBA manufacturer’s instructions. HP - tested drivers are available from the HP website.
4. Connect the server to the disk array, either via FC direct-connect or through a fabric switch and SAN topology. If you use a switch, configure it according to the manufacturer’s instructions.
5. If desired, connect the server to the corporate Ethernet LAN.

Preparing additional servers

An additional server for managing data on the SVOLs in the array is optional, and its configuration depends on your specific application. If you plan to use additional servers to manage the backup data on the array secondary volumes, install and configure them according to the instructions given previously for the VDS/VSS server.

Preparing the disk array

Prepare the XP disk array for use with the HP VDS and VSS hardware providers as described below. Steps can be performed using LUN Manager in the XP Remote Web Console or XP Command View Advanced Edition management interface.

1. (VSS only) Add a host group of any name for the primary data volumes. For VSS, also create host groups named primary host group (of any name). For VSS, also add the SVOL and SHADOW (SVOL and SHADOW names are required). Set the Host Mode to 0C or 2C. OC is the default and displays LUSE information in the LUN name. Ensure that both servers use the same mode.
2. Turn security ON for the ports connected to the VDS/VSS servers.
3. Add VDS/VSS server HBA WWNs to the primary host group, but NOT to the SVOL group. Do not add host WWNs to the SVOL or SHADOW host groups. Assigning the VDS/VSS server HBA WWN to the primary host group associates that server with the group, allowing the server access to the host group’s LUNs. Access to the SVOL host group for the VDS/VSS and optional second server is established later by the hardware provider.
4. Add a RAID Manager Command Device (CDEV) LUN of at least 36 MB. (Larger is OK but more than needed.) The CDEV must be mapped to a port that is visible to the VDS/VSS server. The...
CDEV is used to interpret commands and cannot be used for data. Command Device LUNs can be any number but are customarily assigned a number near the end of the available range. You can use a custom size volume for a Command Device, but do not use a LUSE volume.

5. For VSS, add primary and SVOL (secondary) LUNs to the primary and SVOL host groups, respectively. The primary and secondary LUNs must be the same emulation type (OPEN-3, OPEN-9, etc.) and the same size in GB. You must create at least an equal number of primary and secondary LUNs so that there are enough secondary LUNs to hold the primary LUN copies. Some application require twice as many or more secondary LUNs as primary LUNs. Windows limits LUNs to the range of 00 to 0xFE, so be sure not to use a LUN number above 0xFE.

6. For VSS only, configure the disk array Fibre Channel port connected to the VDS/VSS server(s) as follows:

<table>
<thead>
<tr>
<th>Fabric Parameter</th>
<th>Connection Parameter</th>
<th>Provides</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>FC-AL</td>
<td>NL-port (private arbitrated loop)</td>
</tr>
<tr>
<td>ON</td>
<td>FC-AL</td>
<td>NL-port (public loop) for loop connection to a switch</td>
</tr>
<tr>
<td>ON</td>
<td>POINT-TO-POINT</td>
<td>N-port (fabric port) for connection to a switch</td>
</tr>
<tr>
<td>OFF</td>
<td>POINT-TO-POINT</td>
<td>Not supported</td>
</tr>
</tbody>
</table>

Configuring LUNs

Add primary, SVOL and Shadow host groups.

Preparing the disk array for VSS

The following configuration steps are required only if you will use VSS to make volume shadow copies. If you are only using VDS and will not use VSS, you can skip these configuration steps.
1. For VSS only, configure the disk array Fibre Channel port connected to the VDS/VSS server(s) as follows:
   Settings depend on how the array is connected to the servers. See the following table for the meanings of selections.

<table>
<thead>
<tr>
<th>Fabric Parameter</th>
<th>Connection Parameter</th>
<th>Provides</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>FC-AL</td>
<td>NL-port (private arbitrated loop)</td>
</tr>
<tr>
<td>ON</td>
<td>FC-AL</td>
<td>NL-port (public loop) for loop connection to a switch</td>
</tr>
<tr>
<td>ON</td>
<td>POINT-TO-POINT</td>
<td>N-port (fabric port) for connection to a switch</td>
</tr>
<tr>
<td>OFF</td>
<td>POINT-TO-POINT</td>
<td>Not supported</td>
</tr>
</tbody>
</table>

Installing hardware providers for HP XP disk arrays

The following procedures explain how to install the RAID Manager Libraries and the HP hardware providers.

**NOTE:**
If you have not already configured the server and the array as instructed in Preparing to install HP XP hardware providers, do so now before you install the HP HWP software. HP HWP will not work if the array and server have not been correctly configured before you install HP HWP.

You will perform the following tasks during installation:

- Install RAID Manager Library (run the RM setup.exe file)
- Install the VDS hardware providers (run the VDS installation executable file)
- Install the VSS hardware providers (run the VSS installation executable file)
- Run the VDS Configuration Utility to configure arrays and command devices for VDS. Discover and move available arrays to the managed storage arrays list. Double-click managed arrays, and configure command devices. Set Hardware Provider Options.
- Run the VSS Configuration Utility to configure arrays and command devices for VSS. Discover and move available arrays to the managed storage arrays list. Double-click managed arrays, and configure command devices. Set Hardware Provider Options.

Installing the RAID Manager Library

Before you install the hardware providers, you must first install the RAID Manager Library and the XP Business Copy array firmware license. These are both required on the VDS/VSS server(s) to enable VSS copy operations on the disk array. A summary procedure for installing the RAID Manager Library is provided below. For detailed installation instructions, see the RAID Manager Library Installation Guide. A summary of installation is presented below.

1. Access the RAID Manager Library installation CD on the host.
2. Open the Windows folder, click the RMLIB folder, and then double-click the `setup.exe` file to start the RM installation executable.

   The InstallShield Welcome window appears.

3. Click **Next**. The Choose Destination Location window appears.

4. Click **Next** to select the default Destination Folder shown, or click **Browse** and select a different location for installing the software, and then click **Next**.

   The software begins installing, and a window opens to show progress.

5. Click **Next** in the progress Window when the progress meter shows that installation is done.

6. When installation is complete, the InstallShield Wizard Complete window appears.

7. Click **Finish** to exit the installer.
Installing the HP hardware providers on Windows 2003/2008

This section explains how to install and uninstall HP hardware providers for the HP XP disk arrays. The following instructions include Windows 2008 Server Core.

**IMPORTANT:**
A successful installation depends on using compatible versions of the OS and all installed software. See the hardware provider release notes for version requirements.
The following instructions include Windows 2008 Server Core.

1. Download and extract the HP XP hardware provider files from the HP website (http://www.hp.com/support/HWPXP).
2. Double click the executable file:
   hpxpvdsprv_xxx.exe
   or
   hpxpvssprv_xxx.exe

**NOTE:**
On Windows 2008 Server Core, change to the location where you extracted the hardware provider files, and enter the name of the executable. For example, for the VDS provider, enter hpxpvdsprv_x86.exe.

The InstallShield Welcome window opens.

3. Click **Next**. The License Agreement window opens.
4. Click “I accept...” to agree to the license terms, and click **Next**.
5. The Customer Information window opens. Enter your name and your company’s name.
6. Click **Next**. A window opens to remind you that RAID Manager Library must be installed. If you have not installed RAID Manager Library, click **Cancel** and install RAID Manager Library. Then return to Step 2 above and perform the provider installation again.

7. Click **Next**. The Destination Folder window opens.

8. Click **Next** to install VDS/VSS in the default location, or click **Change** to browse for a new location, and then click **Next**.

   The Ready to Install the Program window opens.

9. Click **Install** to start the installation process. A progress window opens to show installation status.

10. In the Installation Complete window, click **Next**. The InstallShield Wizard Finish window opens.

11. Click **Finish**. The InstallShield Wizard exits.

12. Click Windows **Start**, **Control Panel**, **Add/Remove Programs** to check that the hardware provider was installed as shown below. Then close **Add/Remove Programs** without making changes.

Consult the HP EVA hardware provider release notes for required Microsoft quick fixes (KBs) and install them on the VDS/VSS server.

### Configuring VDS and VSS

To complete the installation, run the configuration Utilities for the VDS and VSS hardware providers you installed. Run both utilities if you installed both providers.

**To run the configuration utility:**

Select the Windows **Start**, **Programs**, **Hewlett-Packard**, **Hardware Providers** menu, and select the Configuration Utility executable file.
NOTE:
For Windows Server Core - you can start the configuration utility the Windows GUI or from a command window:

- **Windows GUI** — You will find the VDS and VSS configuration utilities in the Windows Start > Programs > Hewlett-Packard menu.
- **Command Window** — Run the VSS (\hpxpvsscfg.exe) and VDS (\hpxpvdsconfig.exe) configuration utilities from a command window. If the default location is used during the installation, the configuration utilities are located in the following paths:
  - **VSS** — Program Files\Hewlett-Packard\HardwareProviders\XP\VSS
  - **VDS** — Program Files\Hewlett-Packard\HardwareProviders\XP\VDS

The VDS or VSS Configuration Utility opens.

Enabling auto discovery
The goal of this step is to get the arrays and command devices you want the HP VDS/VSS provider to manage into the right pane of the window.
If **Enable auto discovery** is checked and VDS/VSS command devices are already defined, the arrays and command devices automatically show up in the right pane, and disk arrays automatically show up in the left pane.

If **Enable auto discovery** is unchecked and/or command devices are unconfigured, configure command devices and then click **Discover storage arrays** to fill the left pane with a list of available arrays and command devices. Use the right arrow (>) to move the disk arrays and command devices you want to manage to the right pane. You can also use the left arrow (<) to move something from right to left. Click **Apply** to confirm changes.

1. Double-click an array in the Managed storage arrays pane. A window opens in which you can configure command devices for that array.

![Command devices window](image)

2. The left pane lists available RAID Manager command devices. Click the devices you want to manage using the hardware provider, and click the right arrow (>) to move those devices to the Managed command devices pane. Repeat this process until all devices you want to manage have been moved.
3. Click **OK** to close the Command devices window.

**Setting VDS options**

1. In the VDS Configuration Utility window, click the **Hardware Provider Options** tab to see the VDS options.
2. To specify a LUN tolerance, click the **enable LUN size tolerance level** box and enter a percentage of tolerance.

If you leave this function disabled, the VDS provider creates OPEN standard volume sizes if there is no close match to a requested volume size already available. For example, if you use DISKRAID to request the array to create a 2 GB volume and no 2 GB volumes are available, the provider creates an OPEN-3 2.29 GB volume.

When LUN size tolerance is enabled, a LUN within the specified percentage range of the requested LUN size is created. For example, if you request a 2 GB LUN and the tolerance level is 50%, a LUN sized between 2 and 3 GB is created from the available LDEVs. If no available predefined LDEV exists on the array within the tolerance level (between 2 and 3 GB in the previous example), the LUN creation request fails.

When tolerance level is set to 0, to create a LUN you must specify the exact LUN size in bytes of the unassigned LDEV.

For example:

```
DISKRAID> create lun parity size=2461040640B
```

The exact size of an OPEN-3 volume is 2461040640 bytes.

3. For VDS, browse to set the log file path. If you do not specify a log path, logs are created automatically in the hardware provider installation directory.

4. When finished setting VDS options, click **OK**.

### Setting VSS options

1. To set VSS options, open the VSS Configuration Utility as explained previously and click the **Hardware Provider Options** tab.

2. Use the **Managed storage arrays** pull-down menu to choose the array you want to configure.
3. Select the VSS modes you want to enable as explained below. Repeat for each array to be managed.

Select **VSS compliant mode** if you want the provider to delete the paired relationship between P-VOL and SVOL after the shadow copy is made.

Select **Resync mode** if you want the provider to retain the paired relationship after making a shadow copy to resynchronize the data on the P-VOL and SVOL pairs when the next shadow copy is made.

If you select Resync Mode, the provider selects the default range of Business Copy mirror unit numbers (MU# range). You can override the default MU# range by specifying a custom range in the MU# range box. (See the XP Business Copy user guide for information about mirror unit numbers.)

Selecting Resync Mode enables the option Recycle deleted shadow copies. When this option is selected and a shadow copy is deleted, the P-VOL and SVOL of the deleted shadow copy are split and the SVOL can be reused for a new shadow copy.

4. Browse to specify the VSS log file path. If you do not specify a log path, logs are created automatically in the hardware provider installation directory.

5. When finished setting VSS options, click **OK**.

### Removing the HP XP hardware providers

Before removing the VDS or VSS, issue a net stop command from the command line, as shown in these examples:

```bash
net stop vds
net stop vss
net stop hpxpvssprv
```

### Removing the HP hardware providers using Windows

1. In Windows, select **Start > Settings > Control Panel.**
2. Double-click **Add/Remove Programs.**
3. Select the program you want to remove (HP VDS or VSS HWP).
4. Click **Remove.** Windows removes the program.

### Removing the HP hardware providers using the Installer on Windows 2008 Server Core

You can remove the HP EVA hardware providers by running the installers from a command prompt (hpevavssprv_x86.exe for VSS and hpevavdsprv_x86.exe for VDS)

1. In a command-line window, switch to the location of the VSS and VDS install executables.
2. Enter the name of the executable for the provider you wish to remove.
3. Select **Remove** from the windows that appears and press **Enter.**

### Removing the HP hardware provider using the XP hardware provider installer

You can also uninstall HP hardware provider by starting the HP hardware provider installer. Click **Remove** to start removal. When removal is complete, click **Finish.**
This chapter explains how to troubleshoot the HP EVA hardware providers and also presents a list of VDS and VSS error messages and explanations.

Troubleshooting procedures

The following instructions present typical problems and solutions.

VDS/VSS HP hardware providers will not install

The HP hardware providers installation works only on the Windows versions mentioned in this guide and in the release notes supplied with the HP hardware providers. The installer will not install the software on other versions of Windows.

Also, the VSS hardware provider may fail to install if the system MSDTC service fails to start. When this occurs, the hardware provider installer indicates “Error 1722.”

Make sure that the Microsoft Distributed Transaction Coordinator service is running. If it is stopped, the VDS/VSS installation will fail.

Command View EVA authentication failure

Smart Start v7.2 may cause login failures for applications such as the HP EVA hardware providers using the Command View EVA API. This issue occurs when a server is built using the new SS v7.2 CD and then Command View EVA software is installed.

To resolve this issue, reset the HP Command View EVA API password. This password enables any application that uses the HP Command View EVA API to authenticate properly. Only a system administrator can run this utility.

To enable the HP Command View EVA API, follow these steps:

1. Execute the following utility/command to change the password:
   
   ```
c:\Program Files\Hewlett-Packard\SANworks\Element Manager for StorageWorks\HSV\Bin\elmsetup.exe -pA:administrator -f
   ```
   
   where “administrator” equals the password for the HP Command View EVA API Administrator account. You can use any password you wish in place of “administrator”.

2. In the Services window restart the HP Command View EVA service.

   Applications such as the HP EVA hardware providers that use the Command View EVA API should now be able to log into the API correctly. The new password is for the HP Command View EVA API login only. The Command View EVA GUI login remains unchanged.
VDS disk array management not working

Use a process of elimination to determine whether the problem is with one of the following components:

- Application managing the array
- VDS
- HP hardware providers
- HP disk array

Perform these tests:


2. Do the array volumes appear when you use the DiskPart utility? At the Run command line, type diskpart.exe. Type list disk to see a list of disk devices present. (Type “help” to see a list of commands.)

   If you receive this error message: “The disk management services could not complete the operation,” VDS is not enabled at startup. Click Start > Control Panels
   Select Administrative Tools > Services. Right-click Virtual Disk Service and select Properties. Click Manual under Startup type and click OK.

3. Check the release notes that came with your HP EVA hardware providers installation files to verify you are using compatible versions of software.

4. Make sure you configured the VDS or VSS configuration utility as explained in the configuration and installation sections.

5. Check VDS/VSS server and disk array configuration as explained in the configuration and installation sections.

- Check LAN connectivity between all servers and the array.
- Make sure the firewall is open between all servers and the array.
- For EVA, check the Command View server NIC bindings: the LAN that connects to the VDS/VSS server must be listed first.
- Make sure you logged into all devices and software using administrator privileges.
- Visit the Microsoft website support knowledge base and search for “VDS logging.” Turn on logging as instructed by Microsoft and use the Microsoft procedure for testing VDS and checking the log.
VSS volume copying not working

1. Is the HP VSS hardware provider running?
   For Windows 2003, at the command prompt, type:
   ```
   vssadm list providers
   ```
   You should see the HP VSS hardware provider listed.
   For Windows 2008, at the command prompt, type:
   ```
   DiskShadow
   ```
   then, from the `DiskShadow` prompt, type:
   ```
   list providers
   ```
   You should see the HP VSS hardware provider listed.

2. Verify that the Business Copy license is installed. This license is required in order to produce data copies using VSS.

3. Make sure you configured the VSS Configuration Utility as explained in the configuration and installation sections.

4. Check configuration as explained in the configuration and installation sections:
   - For EVA check the Command View EVA management server and VDS/VSS server connectivity.
   - VDS/VSS server not connected to the SAN correctly.
   - For EVA, a firewall may be interfering with connectivity between Command View and VDS/VSS servers.

5. Review the Windows application event log, Windows system event log, and VSS trace to locate errors in the snapshot process. See the Microsoft website and Windows help for information about the log and trace files.

6. Use a process of elimination to determine which components are not working. You can do this by testing components individually:
   - Test VSS and the array by using the Microsoft `vshadow` utility (or `DiskShadow` in Windows Server 2008) available in the Microsoft VSS Software Developer’s Kit to create snapshots.
     For Windows 2003, at the command line, type:
     ```
     vshadow [drive letter]
     ```
     The drive letter is the production LUN you want to copy. See the Microsoft documentation for details about using `vshadow`.
     For Windows 2008, at the command line, type:
     ```
     DiskShadow
     ```
     then type:
     ```
     Add Volume [drive letter]
     ```
     then type:
     ```
     Create
     ```
     The drive letter is the production LUN you want to copy. See the Microsoft documentation for details about using `DiskShadow`.
   - Test your backup application and VSS together by making a backup copy on a local drive, bypassing the HP EVA VSS hardware provider and the disk array.
VSS copies intermittently fail or time out

VSS allows only 30 seconds for the entire snapshot process, including only 10 seconds for actually making the copy. This narrow time window can cause any limitation in your system to hamper successful snapshots. The following issues may affect system performance:

- Firewall or LAN traffic slowing or preventing communication. Reconfigure the firewall or LAN to increase throughput.
- Viruses slowing server operation. Check for and clean off viruses.
- VDS/VSS server is too slow. Use a fast, late mode CPU with sufficient memory.
- Inadequate privileges. Administrator privileges are required in all applications and on all hardware used with the HP VSS hardware provider.
- Writer application not configured according to best practices. Consult the software manufacturer for recommended practices. For example, keeping database files small by creating more rather than larger files may speed up overall operation and database copying. Saving transaction logs to a different volume than the database may also speed up performance.
- Review the Windows application event log, Windows system event log, and VSS trace to locate errors in the snapshot process. See the Microsoft website and Windows help for information about the log and trace files.

Error messages

The following tables list error messages and their meanings.

VDS error messages

### Table 1 VDS error messages

<table>
<thead>
<tr>
<th>Message Id</th>
<th>MessageID Value (hex)</th>
<th>Message Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDS_E_NOT_SUPPORTED</td>
<td>0x80042400L</td>
<td>The operation is not supported by the object, or there is inadequate disk space.</td>
</tr>
<tr>
<td>VDS_E_INITIALIZED_FAILED</td>
<td>0x80042401L</td>
<td>The service failed to initialize.</td>
</tr>
<tr>
<td>VDS_E_INITIALIZE_NOT_CALLED</td>
<td>0x80042402L</td>
<td>The initialization method is not called.</td>
</tr>
<tr>
<td>VDS_E_ALREADY_REGISTERED</td>
<td>0x80042403L</td>
<td>The provider is already registered.</td>
</tr>
<tr>
<td>VDS_E_ANOTHER_CALL_IN_PROGRESS</td>
<td>0x80042404L</td>
<td>A concurrent second call is made on an object before the first is completed.</td>
</tr>
<tr>
<td>VDS_E_OBJECT_NOT_FOUND</td>
<td>0x80042405L</td>
<td>The object is not found.</td>
</tr>
<tr>
<td>VDS_E_INVALID_SPACE</td>
<td>0x80042406L</td>
<td>The specified space is not free or not valid.</td>
</tr>
<tr>
<td>VDS_E_PARTITION_LIMIT_REACHED</td>
<td>0x80042407L</td>
<td>Number of partitions has reached the limit on a disk.</td>
</tr>
<tr>
<td>VDS_E_PARTITION_NOT_EMPTY</td>
<td>0x80042408L</td>
<td>The extended partition is not empty.</td>
</tr>
<tr>
<td>VDS_E_OPERATION_PENDING</td>
<td>0x80042409L</td>
<td>The operation has not been completed yet.</td>
</tr>
<tr>
<td>Message Id</td>
<td>MessageID Value (hex)</td>
<td>Message Text</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-----------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>VDS_E_OPERATION_DENIED</td>
<td>0x8004240AL</td>
<td>This operation is not allowed on the current boot, system or page file volume.</td>
</tr>
<tr>
<td>VDS_E_OBJECT_DELETED</td>
<td>0x8004240BL</td>
<td>The object has been deleted.</td>
</tr>
<tr>
<td>VDS_E_CANCEL_TOO_LATE</td>
<td>0x8004240CL</td>
<td>The operation cannot be cancelled because it is too late.</td>
</tr>
<tr>
<td>VDS_E_OPERATION_CANCELED</td>
<td>0x8004240DL</td>
<td>The operation has been cancelled.</td>
</tr>
<tr>
<td>VDS_E_CANNOT_EXTEND</td>
<td>0x8004240EL</td>
<td>The volume cannot be extended because the file system does not support it.</td>
</tr>
<tr>
<td>VDS_E_NOT_ENOUGH_SPACE</td>
<td>0x8004240FL</td>
<td>There is not enough usable space for this operation.</td>
</tr>
<tr>
<td>VDS_E_NOT_ENOUGH_DRIVE</td>
<td>0x80042410L</td>
<td>Not enough drives are specified to complete this operation.</td>
</tr>
<tr>
<td>VDS_E_BAD_COOKIE</td>
<td>0x80042411L</td>
<td>The cookie is not found.</td>
</tr>
<tr>
<td>VDS_E_NO.MEDIA</td>
<td>0x80042412L</td>
<td>There is no media in the device.</td>
</tr>
<tr>
<td>VDS_E_DEVICE_IN_USE</td>
<td>0x80042413L</td>
<td>The device is in use.</td>
</tr>
<tr>
<td>VDS_E_DISK_NOT_EMPTY</td>
<td>0x80042414L</td>
<td>The disk is not empty.</td>
</tr>
<tr>
<td>VDS_E_INVALID_OPERATION</td>
<td>0x80042415L</td>
<td>Invalid operation.</td>
</tr>
<tr>
<td>VDS_E_PATH_NOT_FOUND</td>
<td>0x80042416L</td>
<td>The path is not found.</td>
</tr>
<tr>
<td>VDS_E_DISK_NOT_INITIALIZED</td>
<td>0x80042417L</td>
<td>The disk is not initialized.</td>
</tr>
<tr>
<td>VDS_E_NOT_AN_UNALLOCATED_DISK</td>
<td>0x80042418L</td>
<td>The disk is not unallocated.</td>
</tr>
<tr>
<td>VDS_E_UNRECOVERABLE_ERROR</td>
<td>0x80042419L</td>
<td>Unrecoverable error happened. The service must shut down.</td>
</tr>
<tr>
<td>VDS_S_DISK_PARTIALLY_CLEANED</td>
<td>0x0004241AL</td>
<td>The disk is not fully cleaned due to I/O error.</td>
</tr>
<tr>
<td>VDS_E_DMADMIN_SERVICE_CONNECTION_FAILED</td>
<td>0x8004241BL</td>
<td>The provider failed to connect to the Logical Disk Management Administrative service.</td>
</tr>
<tr>
<td>VDS_E_PROVIDER_INITIALIZATION_FAILED</td>
<td>0x8004241CL</td>
<td>The provider failed to initialize.</td>
</tr>
<tr>
<td>VDS_E_OBJECT_EXISTS</td>
<td>0x8004241DL</td>
<td>The object already exists.</td>
</tr>
<tr>
<td>VDS_E_NO_DISKS_FOUND</td>
<td>0x8004241EL</td>
<td>No disks were found on the target machine.</td>
</tr>
<tr>
<td>VDS_E_PROVIDER_CACHE_CORRUPT</td>
<td>0x8004241FL</td>
<td>The provider’s cache has become corrupt.</td>
</tr>
<tr>
<td>VDS_E_DMADMIN_METHOD_CALL_FAILED</td>
<td>0x80042420L</td>
<td>A method call to the Logical Disk Management Administrative service failed.</td>
</tr>
<tr>
<td>VDS_S_PROVIDER_ERROR_LOADING_CACHE</td>
<td>0x00042421L</td>
<td>The provider encountered errors while loading the cache. See the NT Event Log for more information.</td>
</tr>
<tr>
<td>Message Id</td>
<td>MessageID Value (hex)</td>
<td>Message Text</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-----------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>VDS_E_PROVIDER_VOL_DEVICE_NAME_NOT_FOUND</td>
<td>0x80042422L</td>
<td>The device form of the volume pathname could not be retrieved.</td>
</tr>
<tr>
<td>VDS_E_PROVIDER_VOL_OPEN</td>
<td>0x80042423L</td>
<td>Failed to open the volume device.</td>
</tr>
<tr>
<td>VDS_E_DMADMIN_CORRUPT_NOTIFICATION</td>
<td>0x80042424L</td>
<td>A corrupt notification was sent from the Logical Disk Manager Administrative service.</td>
</tr>
<tr>
<td>VDS_E_INCOMPATIBLE_FILE_SYSTEM</td>
<td>0x80042425L</td>
<td>The file system is incompatible.</td>
</tr>
<tr>
<td>VDS_E_INCOMPATIBLE_MEDIA</td>
<td>0x80042426L</td>
<td>The media is incompatible.</td>
</tr>
<tr>
<td>VDS_E_ACCESS_DENIED</td>
<td>0x80042427L</td>
<td>Access is denied.</td>
</tr>
<tr>
<td>VDS_E_MEDIA_WRITE_PROTECTED</td>
<td>0x80042428L</td>
<td>The media is write protected.</td>
</tr>
<tr>
<td>HRESULT VDS_E_BAD_LABEL</td>
<td>0x80042429L</td>
<td>The label is illegal.</td>
</tr>
<tr>
<td>VDS_E_CANT_QUICK_FORMAT</td>
<td>0x8004242AL</td>
<td>Cannot quick format the volume.</td>
</tr>
<tr>
<td>VDS_E_IO_ERROR</td>
<td>0x8004242BL</td>
<td>IO error occurred during format.</td>
</tr>
<tr>
<td>VDS_E_VOLUME_TOO_SMALL</td>
<td>0x8004242CL</td>
<td>The volume size is too small.</td>
</tr>
<tr>
<td>VDS_E_VOLUME_TOO_BIG</td>
<td>0x8004242DL</td>
<td>The volume size is too big.</td>
</tr>
<tr>
<td>VDS_E_CLUSTER_SIZE_TOO_SMALL</td>
<td>0x8004242EL</td>
<td>The cluster size is too small.</td>
</tr>
<tr>
<td>VDS_E_CLUSTER_SIZE_TOO_BIG</td>
<td>0x8004242FL</td>
<td>The cluster size is too big.</td>
</tr>
<tr>
<td>VDS_E_CLUSTER_COUNT_BEYOND_32BITS</td>
<td>0x80042430L</td>
<td>The number of clusters is too big for 32 bit integer.</td>
</tr>
<tr>
<td>VDS_E_OBJECT_STATUS_</td>
<td>0x80042431L</td>
<td>The object is in failed status.</td>
</tr>
<tr>
<td>VDS_E_VOLUME_INCOMPLETE</td>
<td>0x80042432L</td>
<td>All extents for the volume could not be found.</td>
</tr>
<tr>
<td>VDS_E_EXTENT_SIZE_LESS_THAN_MIN</td>
<td>0x80042433L</td>
<td>The size of the extent is less than the minimum.</td>
</tr>
<tr>
<td>VDS_S_UPDATE_BOOTFILE_FAILED</td>
<td>0x00042434L</td>
<td>Failed to update the boot.ini file or NVRAM.</td>
</tr>
<tr>
<td>VDS_S_BOOT_PARTITION_NUMBER_CHANGE</td>
<td>0x00042436L</td>
<td>The boot partition’s partition number will change as a result of the migration operation.</td>
</tr>
<tr>
<td>VDS_E_BOOT_PARTITION_NUMBER_CHANGE</td>
<td>0x80042436L</td>
<td>The migration operation failed. The boot partition’s partition number will change as a result of the migration operation.</td>
</tr>
<tr>
<td>VDS_E_NO_FREE_SPACE</td>
<td>0x80042437L</td>
<td>The migration operation failed. The selected disk does not have enough free space to complete the operation.</td>
</tr>
<tr>
<td>VDS_E_ACTIVE_PARTITION</td>
<td>0x80042438L</td>
<td>The migration operation failed. An active partition was detected on the selected disk, and it is not the active partition used to boot the currently running OS.</td>
</tr>
<tr>
<td>Message Id</td>
<td>MessageID Value (hex)</td>
<td>Message Text</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-----------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>VDS_E_PARTITION_OF_UNKNOWN_TYPE</td>
<td>0x80042439L</td>
<td>The migration operation failed. Cannot read partition information.</td>
</tr>
<tr>
<td>VDS_E_LEGACY_VOLUME_FORMAT</td>
<td>0x8004243AL</td>
<td>The migration operation failed. A partition with an unknown type was detected on the selected disk.</td>
</tr>
<tr>
<td>VDS_E_NON_CONTIGUOUS_DATA_PARTITIONS</td>
<td>0x8004243BL</td>
<td>The migration operation failed. The selected GPT formatted disk contains a non-basic-data partition, which is both preceded, and followed, by a basic data partition(s).</td>
</tr>
<tr>
<td>VDS_E_MIGRATE_OPEN_VOLUME</td>
<td>0x8004243CL</td>
<td>The migration operation failed. A volume on the selected disk could not be opened.</td>
</tr>
<tr>
<td>VDS_E_VOLUME_NOT_ONLINE</td>
<td>0x8004243DL</td>
<td>Operation failed. The volume is not online.</td>
</tr>
<tr>
<td>VDS_E_VOLUME_NOT_HEALTHY</td>
<td>0x8004243EL</td>
<td>Operation failed. The volume is not healthy.</td>
</tr>
<tr>
<td>VDS_E_VOLUME_SPANS_DISKS</td>
<td>0x8004243FL</td>
<td>Operation failed. The volume spans multiple disks.</td>
</tr>
<tr>
<td>VDS_E.Requires_CONTIGUOUS_DISK_SPACE</td>
<td>0x80042440L</td>
<td>Operation failed. The volume consists of multiple extents.</td>
</tr>
<tr>
<td>VDS_E_BAD_PROVIDER_DATA</td>
<td>0x80042441L</td>
<td>A provider returned bad data.</td>
</tr>
<tr>
<td>VDS_E_PROVIDER_FAILURE</td>
<td>0x80042442L</td>
<td>A provider failed to complete an operation.</td>
</tr>
<tr>
<td>VDS_S_VOLUME_COMPRESS_FAILED</td>
<td>0x00042443L</td>
<td>Failed to compress the volume.</td>
</tr>
<tr>
<td>VDS_E_PACK_OFFLINE</td>
<td>0x80042444L</td>
<td>The operation failed. The pack is not online.</td>
</tr>
<tr>
<td>VDS_E_VOLUME_NOT_A_MIRROR</td>
<td>0x80042445L</td>
<td>Break or remove plex operation failed. The volume is not a mirror.</td>
</tr>
<tr>
<td>VDS_E_NO_EXTENTS_FOR_VOLUME</td>
<td>0x80042446L</td>
<td>No extents were found for the volume.</td>
</tr>
<tr>
<td>VDS_E_DISK_NOT_LOADED_TO_CACHE</td>
<td>0x80042447L</td>
<td>The migrated disk failed to load to the cache.</td>
</tr>
<tr>
<td>VDS_E_INTERNAL_ERROR</td>
<td>0x80042448L</td>
<td>Check the event log for errors.</td>
</tr>
<tr>
<td>VDS_S_ACCESS_PATH_NOT_DELETED</td>
<td>0x000042449L</td>
<td>The access paths on the volume may not be deleted.</td>
</tr>
<tr>
<td>VDS_E_PROVIDER_TYPE_NOT_SUPPORTED</td>
<td>0x8004244AL</td>
<td>The method call is not supported for the specified provider type.</td>
</tr>
<tr>
<td>VDS_E_DISK_NOT_ONLINE</td>
<td>0x8004244BL</td>
<td>The repair operation failed. The disk is already in use by the volume.</td>
</tr>
<tr>
<td>VDS_S_IN_PROGRESS</td>
<td>0x0004244DL</td>
<td>The asynchronous operation is in progress.</td>
</tr>
<tr>
<td>VDS_E_ASYNC_OBJECT_FAILURE</td>
<td>0x8004244EL</td>
<td>Failure initializing the asynchronous object.</td>
</tr>
<tr>
<td>VDS_E_VOLUME_NOT_MOUNTED</td>
<td>0x8004244FL</td>
<td>The volume is not mounted.</td>
</tr>
<tr>
<td>VDS_E_PACK_NOT_FOUND</td>
<td>0x80042450L</td>
<td>The pack was not found.</td>
</tr>
<tr>
<td>Message Id</td>
<td>MessageID Value (hex)</td>
<td>Message Text</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-----------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>VDS_E_IMPORT_SET_INCOMPLETE</td>
<td>0x80042451L</td>
<td>Import failed. Attempt to import a subset of the disks in the foreign pack.</td>
</tr>
<tr>
<td>VDS_E_DISK_NOT_IMPORTED</td>
<td>0x80042452L</td>
<td>A disk in the import's source pack was not imported.</td>
</tr>
<tr>
<td>VDS_E_OBJECT_OUT_OF_SYNC</td>
<td>0x80042453L</td>
<td>The system’s information about the object may not be up to date.</td>
</tr>
<tr>
<td>VDS_E_MISSING_</td>
<td>0x80042454L</td>
<td>Operation failed. The disk is missing.</td>
</tr>
<tr>
<td>VDS_E_DISK_PNP_REG_CORRUPT</td>
<td>0x80042455L</td>
<td>The provider’s list of Pnp registered disks has become corrupt.</td>
</tr>
<tr>
<td>VDS_E_LBN_REMAP_ENABLED_FLAG</td>
<td>0x80042456L</td>
<td>The provider does not support the LBN REMAP ENABLED volume flag.</td>
</tr>
<tr>
<td>VDS_E_NO_DRIVELETTER_FLAG</td>
<td>0x80042457L</td>
<td>The provider does not support the NO DRIVELETTER volume flag.</td>
</tr>
<tr>
<td>VDS_E_REVERT_ON_CLOSE</td>
<td>0x80042458L</td>
<td>REVERT ON CLOSE should only be set if the HIDDEN or READ ONLY volume flag is set.</td>
</tr>
<tr>
<td>VDS_E_REVERT_ON_CLOSE_SET</td>
<td>0x80042459L</td>
<td>A REVERT ON CLOSE volume flag is already set for this volume.</td>
</tr>
<tr>
<td>VDS_E_REVERT_ON_CLOSE_MISMATCH</td>
<td>0x80042459L</td>
<td>When clearing volume flags that have been set using revert on close, the same combination of HIDDEN and/or READ ONLY flags must be passed to both the SetFlags and ClearFlags calls.</td>
</tr>
<tr>
<td>VDS_E_IA64_BOOT_MIRRORED_TO_MBR</td>
<td>0x8004245AL</td>
<td>Not Used! You have mirrored your boot volume on a GPT disk, to an MBR disk. You will not be able to boot your machine from the secondary plex.</td>
</tr>
<tr>
<td>VDS_S_IA64_BOOT_MIRRORED_TO_MBR</td>
<td>0x0004245AL</td>
<td>You have mirrored your boot volume on a GPT disk, to an MBR disk. You will not be able to boot your machine from the secondary plex.</td>
</tr>
<tr>
<td>VDS_S_UNABLE_TO_GET_GPT_ATTRIBUTES</td>
<td>0x0004245BL</td>
<td>Unable to retrieve the GPT attributes for this volume, (hidden, read only and no drive letter).</td>
</tr>
<tr>
<td>VDS_E_VOLUME_TEMPORARILY_DISMOUNTED</td>
<td>0x8004245CL</td>
<td>The volume is temporarily dismounted.</td>
</tr>
<tr>
<td>VDS_E_VOLUME_PERMANENTLY_DISMOUNTED</td>
<td>0x8004245DL</td>
<td>The volume is permanently dismounted.</td>
</tr>
<tr>
<td>VDS_E_VOLUME_HAS_PATH</td>
<td>0x8004245EL</td>
<td>The volume still has access path to it.</td>
</tr>
<tr>
<td>VDS_E_TIMEOUT</td>
<td>0x8004245FL</td>
<td>The operation timed out.</td>
</tr>
</tbody>
</table>
The operation could not be completed. To repair a volume, both the volume and plex must be online, and must not be healthy or rebuilding.

The operation timed out in the Logical Disk Manager Administrative service. Retry the operation.

The operation failed. Cannot retain plex that has not regenerated.

Create pack operation failed. An online pack already exists.

<table>
<thead>
<tr>
<th>Message Id</th>
<th>MessageID Value (hex)</th>
<th>Message Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDS_E_REPAIR_VOLUMESTATE</td>
<td>0x80042460L</td>
<td>The operation could not be completed. To repair a volume, both the volume and plex must be online, and must not be healthy or rebuilding.</td>
</tr>
<tr>
<td>VDS_E_LDM_TIMEOUT</td>
<td>0x80042461L</td>
<td>The operation timed out in the Logical Disk Manager Administrative service. Retry the operation.</td>
</tr>
<tr>
<td>VDS_E_PLEX_NOT_REGENERATED</td>
<td>0x80042462L</td>
<td>The operation failed. Cannot retain plex that has not regenerated.</td>
</tr>
<tr>
<td>VDS_E_RETRY</td>
<td>0x80042463L</td>
<td>The operation failed. Retry the operation.</td>
</tr>
<tr>
<td>VDS_E_ONLINE_PACK_EXISTS</td>
<td>0x80042464L</td>
<td>Create pack operation failed. An online pack already exists.</td>
</tr>
</tbody>
</table>

### VSS error messages

#### Table 2 VSS error messages

<table>
<thead>
<tr>
<th>Error</th>
<th>Meaning</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSS_E_BAD_STATE</td>
<td>0x80042301L</td>
<td>A function call was invalid because of the state of either the backup extensions or the coordinator. For example calling AddToSnapshot set prior to calling StartSnapshotSet.</td>
</tr>
<tr>
<td>VSS_E_PROVIDER_ALREADY_REGISTERED</td>
<td>0x80042303L</td>
<td>Calling RegisterProvider.</td>
</tr>
<tr>
<td>VSS_E_PROVIDER_NOT_REGISTERED</td>
<td>0x80042304L</td>
<td>Calling UnregisterProvider.</td>
</tr>
<tr>
<td>VSS_E_PROVIDER_VETO</td>
<td>0x80042306L</td>
<td>Calling DoSnapshotSet.</td>
</tr>
<tr>
<td>VSS_E_PROVIDER_IN_USE</td>
<td>0x80042307L</td>
<td>Calling UnregisterProvider, StartSnapshotSet.</td>
</tr>
<tr>
<td>VSS_E_OBJECT_NOT_FOUND</td>
<td>0x80042308L</td>
<td>Calling DeleteSnapshots, Query.</td>
</tr>
<tr>
<td>VSS_S_ASYNC_PENDING</td>
<td>0x00042309L</td>
<td>Calling IVssAsync:: QueryStatus.</td>
</tr>
<tr>
<td>VSS_S_ASYNC_FINISHED</td>
<td>0x0004230AL</td>
<td>Calling IVssAsync:: QueryStatus.</td>
</tr>
<tr>
<td>VSS_S_ASYNC_CANCELLED</td>
<td>0x0004230BL</td>
<td>Calling IVssAsync:: QueryStatus.</td>
</tr>
<tr>
<td>VSS_E_VOLUME_NOT_SUPPORTED</td>
<td>0x8004230CL</td>
<td>Calling AddToSnapshotSet.</td>
</tr>
<tr>
<td>VSS_E_OBJECT_ALREADY_EXISTS</td>
<td>0x8004230DL</td>
<td>Calling ExposeCurrentState.</td>
</tr>
<tr>
<td>VSS_E_VOLUME_NOT_SUPPORTED_BY_PROVIDER</td>
<td>0x8004230EL</td>
<td>Calling AddToSnapshotSet.</td>
</tr>
<tr>
<td>VSS_E_UNEXPECTED_PROVIDER_ERROR</td>
<td>0x8004230FL</td>
<td>Calling several methods supported by the providers.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Error</th>
<th>Meaning</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSS_E_CORRUPT_XML_DOCUMENT</td>
<td>0x80042310L</td>
<td>XML document unexpectedly does not match schema.</td>
</tr>
<tr>
<td>VSS_E_INVALID_XML_DOCUMENT</td>
<td>0x80042311L</td>
<td>An XML document passed an argument that is not valid, i.e., is either not correctly formed XML or does not match the schema.</td>
</tr>
<tr>
<td>VSS_E_MAXIMUM_NUMBER_OF_VOLUMES_REACHED</td>
<td>0x80042312L</td>
<td>Cannot add any more volumes since the system passed the maximum limit.</td>
</tr>
<tr>
<td>VSS_E_FLUSH_WRITES_TIMEOUT</td>
<td>0x80042313L</td>
<td>VSS couldn’t flush I/O writes anymore.</td>
</tr>
<tr>
<td>VSS_E_HOLD_WRITES_TIMEOUT</td>
<td>0x80042314L</td>
<td>VSS couldn’t hold I/O writes anymore.</td>
</tr>
<tr>
<td>VSS_E_UNEXPECTED_WRITER_ERROR</td>
<td>0x80042315L</td>
<td>VSS encountered problems while sending events to writers.</td>
</tr>
<tr>
<td>VSS_E_SNAPSHOT_SET_IN_PROGRESS</td>
<td>0x80042316L</td>
<td>StartSnapshotSet was called when another snapshot set in the process of being created.</td>
</tr>
<tr>
<td>VSS_E_MAXIMUM_NUMBER_OF_SNAPSHOTS_REACHED</td>
<td>0x80042317L</td>
<td>AddToSnapshotSet was called on a volume that has already reached its maximum number.</td>
</tr>
<tr>
<td>VSS_E_WRITER_INFRASTRUCTURE</td>
<td>0x80042318L</td>
<td>The Writer infrastructure is not operating properly. Check that the Event Service and the Volume Snapshot Service are started and check for errors associated with these services in the error log.</td>
</tr>
<tr>
<td>VSS_E_WRITER_NOT_RESPONDING</td>
<td>0x80042319L</td>
<td>A writer did not respond to a GetWriterStatus call. This means that the process containing the writer died or is hung.</td>
</tr>
<tr>
<td>VSS_E_WRITER_ALREADY_SUBSCRIBED</td>
<td>0x8004231AL</td>
<td>A writer has already successfully called the Subscribe function. It cannot call subscribe multiple times.</td>
</tr>
<tr>
<td>VSS_E_UNSUPPORTED_CONTEXT</td>
<td>0x8004231BL</td>
<td>Attempt to use an unsupported context.</td>
</tr>
<tr>
<td>VSS_E_VOLUME_IN_USE</td>
<td>0x8004231DL</td>
<td>Calling ChangeDiffAreaMaximumSize</td>
</tr>
<tr>
<td>VSS_E_MAXIMUM_DIFFAREA_ASSOCIATIONS_REACHED</td>
<td>0x8004231EL</td>
<td>Calling AddDiffArea.</td>
</tr>
<tr>
<td>VSS_E_INSUFFICIENT_STORAGE</td>
<td>0x8004231FL</td>
<td>Calling EndPrepareSnapshots, ChangeDiffAreaMaximumSize</td>
</tr>
<tr>
<td>VSS_E_NO_SNAPSHOTS_IMPORTED</td>
<td>0x80042320L</td>
<td>Calling ImportSnapshots, no volumes were successfully imported.</td>
</tr>
<tr>
<td>VSS_S_SOME_SNAPSHOTS_NOT_IMPORTED</td>
<td>0x00042320L</td>
<td>Calling ImportSnapshots, some volumes were not successfully imported.</td>
</tr>
<tr>
<td>VSS_E_WRITERERROR_INCONSISTENTSNAPSHOT</td>
<td>0x800423F0L</td>
<td>Indicates that the snapshot contains only a subset of the volumes needed to correctly backup an application component.</td>
</tr>
<tr>
<td>Error</td>
<td>Meaning</td>
<td>Corrective Action</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>----------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>VSS_E_WRITERERROR_OUTOFRESOURCES</td>
<td>0x800423F1L</td>
<td>Indicates that the writer failed due to an out of memory, out of handles, or other resource allocation failure.</td>
</tr>
<tr>
<td>VSS_E_WRITERERROR_TIMEOUT</td>
<td>0x800423F2L</td>
<td>Indicates that the writer failed due to a timeout between freeze and thaw.</td>
</tr>
<tr>
<td>VSS_E_WRITERERROR_RETRYABLE</td>
<td>0x800423F3L</td>
<td>Indicates that the writer failed due to an error that might not occur if another snapshot is created.</td>
</tr>
<tr>
<td>VSS_E_WRITERERROR_NONRETRYABLE</td>
<td>0x800423F4L</td>
<td>Indicates that the writer failed due to an error that most likely would occur if another snapshot were created.</td>
</tr>
<tr>
<td>VSS_E_WRITERERROR_RECOVERY_FAILED</td>
<td>0x800423F5L</td>
<td>Indicates that auto recovery of the snapshot volume failed.</td>
</tr>
</tbody>
</table>
5 Reference

Related documentation

The following documents provide related information:

- HP StorageWorks EVA Hardware Providers for Windows 2003 release notes
- HP StorageWorks EVA Hardware Providers for Windows 2008 and Windows 2008 Server Core release notes
- HP StorageWorks EVA Hardware Providers administrator guide for Windows

You can find these documents from the Manuals page of the HP Business Support Center website:

http://www.hp.com/support/manuals

In the search box, enter EVA Hardware Provider or XP Hardware Provider.

HP technical support

For worldwide technical support information, see the HP support website:

http://www.hp.com/support

Before contacting HP, collect the following information:

- Product model names and numbers
- Technical support registration number (if applicable)
- Product serial numbers
- Error messages
- Operating system type and revision level
- Detailed questions

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HP websites

For additional information, see the following HP websites:

- http://www.hp.com
- http://www.hp.com/go/storage
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This glossary defines acronyms and terms used in this guide or related to this product and is not a comprehensive glossary of computer terms.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>API</td>
<td>Application Programming Interface, an interface that allows a software application to connect to and work with another software application.</td>
</tr>
<tr>
<td>clone</td>
<td>A full copy of a volume, usable by an application.</td>
</tr>
<tr>
<td>Command View EVA</td>
<td>HP StorageWorks Command View, a browser-based interface that allows management of an HP disk array.</td>
</tr>
<tr>
<td>differential copy</td>
<td>A copy of a database consisting only of the differences in the database since the last full copy.</td>
</tr>
<tr>
<td>disk array</td>
<td>A RAID. A collection of disk drives within a cabinet or multiple cabinets and including a controller and software allowing drives to be ganged together in various configurations to create virtual drives (LUNs).</td>
</tr>
<tr>
<td>EVA</td>
<td>HP StorageWorks Enterprise Virtual Array.</td>
</tr>
<tr>
<td>FC</td>
<td>Fibre Channel, a fiber optic interconnection standard commonly used for storage area networks.</td>
</tr>
<tr>
<td>GUI</td>
<td>Graphical User Interface.</td>
</tr>
<tr>
<td>HBA</td>
<td>Host bus adapter. The FC interface card that installs in a host to connect the host to a fabric SAN.</td>
</tr>
<tr>
<td>HWP</td>
<td>Hardware Provider. Software that executes on the host, a bus adapter, and the disk array to enable managing of array LUNs and ports through the Windows OS and applications.</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network.</td>
</tr>
<tr>
<td>LUN</td>
<td>Logical Unit Number. A physically addressable storage unit as surfaced by a hardware RAID subsystem. A virtual disk, consisting of multiple portions of physical disks addressed as a single unit.</td>
</tr>
<tr>
<td>mirror</td>
<td>See also clone.</td>
</tr>
<tr>
<td>plex</td>
<td>A Microsoft term denoting a full copy of data that has been split off from the original and is no longer being updated. See also split mirror.</td>
</tr>
<tr>
<td>PVOL</td>
<td>Primary volume. Typically the volume where application data is stored.</td>
</tr>
<tr>
<td>RAID</td>
<td>Redundant array of independent disks.</td>
</tr>
<tr>
<td>SVOL</td>
<td>Secondary volume. The volume that receives backup copies of data.</td>
</tr>
<tr>
<td><strong>SAN fabric</strong></td>
<td>The Fibre Channel hardware and cabling that connects servers to storage devices in a Storage Area Network (SAN) is referred to as a “fabric.” A fabric switch provides automatically-switched connectivity between servers and storage in the fabric.</td>
</tr>
<tr>
<td><strong>SNMP</strong></td>
<td>Simple Network Management Protocol.</td>
</tr>
<tr>
<td><strong>shadow copy</strong></td>
<td>A Microsoft term describing a point-in-time copy of an original volume. The original volume continues to change as the process continues, but the shadow copy of the volume remains constant.</td>
</tr>
<tr>
<td><strong>snapclone</strong></td>
<td>An HP EVA disk array term denoting a full copy of a volume that becomes immediately usable by an application. Created much faster than ordinary clones by taking a snapshot and updating to a full copy in the background.</td>
</tr>
<tr>
<td><strong>snapshot</strong></td>
<td>A generic term meaning a static point-in-time copy of a volume, typically used for backup.</td>
</tr>
<tr>
<td><strong>split mirror</strong></td>
<td>A full copy of data that has been split off from the original and is no longer being updated.</td>
</tr>
<tr>
<td><strong>subsystem</strong></td>
<td>See disk array, RAID.</td>
</tr>
<tr>
<td><strong>volume</strong></td>
<td>Generic term for a number of physical disks or portions of disks logically bound together as a virtual disk containing contiguous logical blocks. Volume can also be software shorthand for a mapped volume (Windows drive letter or mount point).</td>
</tr>
<tr>
<td><strong>VDS</strong></td>
<td>Microsoft Virtual Disk Service, the Windows service that manages storage through the HWPs.</td>
</tr>
<tr>
<td><strong>volume shadow copy</strong></td>
<td>See shadow copy.</td>
</tr>
<tr>
<td><strong>VSC</strong></td>
<td>Volume Size Configuration, a feature of HP disk arrays that allows creation of logical volumes custom-sized according to user requirements.</td>
</tr>
<tr>
<td><strong>VSS</strong></td>
<td>Microsoft Volume Shadow Copy Service, the Windows service that creates data copies. Works through an HP provider to make copies of disk array volumes.</td>
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