Veritas Storage Foundation for Windows
Administrator's Guide

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Overview

This chapter includes the following topics:

■ About Symantec Storage Foundation for Windows products
■ General features
■ Optional advanced features
■ Software components
■ Advantages of dynamic volumes
■ SFW’s software RAID

About Symantec Storage Foundation for Windows products

Symantec Storage Foundation for Windows is available in the following forms:

■ Symantec Storage Foundation for Windows (SFW)
■ Symantec Storage Foundation for Windows Basic (SFW Basic)
  "Basic" indicates a limited version of SFW.
■ Symantec Storage Foundation and High Availability Solutions for Windows (SFW HA)
  "HA" indicates SFW with High Availability.

SFW and SFW Basic have the same functions except SFW Basic is limited in the number of dynamic volumes that it can support. No other options are available in SFW Basic.

SFW and SFW HA have the same functions except for the feature of clustering support. SFW HA adds Symantec Cluster Server (VCS) support. SFW retains the cluster option for Failover Cluster feature for Windows.
The information in this guide applies to SFW, SFW Basic, and SFW HA. Clustering support is covered in the last few chapters of the manual. The rest of the manual focuses on the features common to both products. Additional information about clustering with VCS can be found in other guides in the Symantec Storage Foundation for Windows document set.

**Note:** To avoid having to repeat the products’ names throughout this manual, the name “Symantec Storage Foundation for Windows” and the acronym “SFW” are used to refer to SFW, SFW Basic, and SFW HA when discussing features that are common to the products. When there is a feature that is available in only one of the products, the distinction is clearly identified for the reader.

### General features

Symantec Storage Foundation for Windows provides a comprehensive solution to storage management in an integrated graphical view. SFW lets you configure and manage local and remote storage attached to your system while your system remains online.

With Symantec Storage Foundation for Windows, you can do the following:

- Manage domain-wide storage from a single console.
- Create and configure software RAID while systems remain online and available.
- Optimize storage system performance via online capacity monitoring and storage load balancing.

### SFW’s configuration solutions

Many storage configuration tasks require taking the system offline and restarting the server, which interrupts system and data availability. Symantec Storage Foundation for Windows provides a major improvement for system administrators and their users by allowing online configuration of dynamic volumes without requiring a system reboot. SFW allows you to perform a wide variety of storage administration tasks while your systems remain online and your data remains available.

SFW’s configuration solutions offer the following:

- Provides the ability to configure and manage different volume layouts: concatenated, striped, mirrored, mirrored striped, and RAID-5 volumes. Supports up to 32-way mirrors on a mirrored volume.
Provides automatic detection of failed disks and the ability to repair fault-tolerant volumes on those disks without interrupting applications using the volumes.

Provides a storage migration path with the ability to upgrade existing partitions to the new "dynamic" volumes (volumes based on Symantec Storage Foundation for Windows technology).

Supports online extending of all volume types.

Supports a cluster environment that runs under Microsoft Cluster Service software.

Supports mounting a volume without requiring the use of a drive letter.

Supports moving of storage between computers with the Import and Deport Dynamic Disk Group functions.

Provides command line support for administrators who prefer this method over a graphical user interface (GUI).

For a Server Core installation of Windows Server, only the SFW command line interface (CLI) is available.

**Optimized system performance**

Performance degradation occurs when a program or device uses too much disk I/O. By monitoring a system’s I/O, you can find the problem areas and eliminate areas of high activity ("hot spots"), thus ensuring smooth operation. SFW’s performance monitoring utility allows you to continuously monitor and tune system performance, monitor I/O statistics, perform hot spot detection, and make adjustments.

Symantec Storage Foundation for Windows can help improve overall disk and system performance in several ways, some of which are as follows:

- I/O statistics are used to identify high-traffic areas, known as "hot spots." You can use the Move Subdisk command to resolve these hot spots online.

- Data is assigned to physical drives to evenly balance the I/O load among the disk drives. This is known as storage load balancing.

- Event logging of errors and important information is provided.

**Optional advanced features**

This section describes the program’s licensable options.

The options are as follows:
Options available in both SFW and SFW HA
- Veritas FlashSnap option
- Symantec Dynamic Multi-Pathing for Windows option
- Symantec Storage Foundation Volume Replicator option

Option available in SFW only
- Veritas cluster option for Failover Cluster

Option available in SFW HA only
- Veritas Global Cluster Option

**FlashSnap option**

FlashSnap is a multi-step process that allows you to create independently addressable snapshot volumes that are copies or mirrors of the volumes on your server. These snapshot volumes can be used as quick recovery images for recovering applications, such as Microsoft SQL Server. They also can be used for backup or application testing. One of the main advantages of using FlashSnap is that the snapshot volumes can be easily moved to another server. Thus, backup or other processing can be performed on another server without affecting the performance of applications on the applications server.

Even when FlashSnap is performed on the same server, its very efficient mirror breakoff and join process is fast and takes less CPU availability than other mirror breakoff procedures that use ordinary mirroring.

SFW supports the capability of creating simultaneous and multiple split-mirror snapshots. These snapshots can be done either through the Veritas Enterprise Administrator (VEA) GUI or through the `vxsnap` command line interface (CLI) command.

**Note:** FlashSnap is available only with the Enterprise edition. See the “Licensing” section in the *Symantec Storage Foundation and High Availability Solutions Installation and Upgrade Guide* for details.

FlashSnap contains several components: FastResync, Snapshot commands, and Disk Group Split and Join.

See “FlashSnap components” on page 333.

If you install FlashSnap, you also have access to the Fast File Resync feature that allows you to resynchronize one or more files in a snapshoted volume back to the original volume.

See “Fast File Resync” on page 380.
Symantec Dynamic Multi-Pathing for Windows option

The Symantec Dynamic Multi-Pathing for Windows (DMPW) option adds fault tolerance to disk storage by making use of multiple paths between a computer and individual disks in an attached disk storage system. Disk transfers that would have failed because of a path failure are automatically rerouted to an alternate path. With Symantec Dynamic Multi-Pathing for Windows, the VEA GUI allows you to configure, manage, and obtain status information about these multiple paths. Symantec Dynamic Multi-Pathing for Windows also improves performance by allowing load balancing among the paths.

See “DMPW overview” on page 425.

Symantec Storage Foundation Volume Replicator option

Symantec Storage Foundation for Windows enables dynamic volumes to work with Symantec Storage Foundation Volume Replicator (Volume Replicator). Volume Replicator is a data replication tool designed to contribute to an effective disaster recovery plan by maintaining a consistent copy of application data at a remote site. In the event that the data center is down, the application data is immediately available at the remote site, and the application can be restarted at the remote site.

See “Overview” on page 523.

Microsoft failover cluster option

Symantec Storage Foundation for Windows supports all Windows-supported nodes of a Microsoft failover cluster.

See “Overview” on page 491.

VCS Global Cluster option

The Symantec Cluster Server Global Cluster option allows for the management of multiple clusters and their applications from a single console. The Global Cluster option is also a disaster recovery tool that facilitates replication support after a site failure. It ensures that applications are failed over as well as data.

Software components

Symantec Storage Foundation for Windows includes the following components:
Advantages of dynamic volumes

One of the main advantages of dynamic volumes is that they can span across multiple disks. You can get better use of your available disk space by combining areas of unallocated space in volumes that go across multiple disks. Multi-disk volumes also improve disk performance by letting more than one disk drive read and write data. Finally, multi-disk volumes let you use RAID technology to make volumes fault tolerant.

When you upgrade a disk so that it can contain dynamic volumes, Symantec Storage Foundation for Windows writes a small database onto the upgraded disk that contains volume management information about the disk and all other dynamic disks in its disk group. This database gives a dynamic disk additional advantages, which are as follows:

- Users can create dynamic volumes without restarting the system.
- Volumes can be accessed continuously, even across disk reconfiguration events.
- All dynamic volumes with an NTFS file system can be extended online. You can select where to extend the volume, or Symantec Storage Foundation for Windows assigns space optimally on the disks available within the volume’s dynamic disk group.
- Disk configuration information is contained on the disk, not in the registry. The disk configuration information is also replicated across all dynamic disks in the disk group so that the failure of one disk does not obstruct access to data on other disks.
Dynamic disks provide volume migration, which is the ability to move a disk or disks containing a volume or volumes from one system to another system without loss of data.

Dynamic disks allow you to move portions of volumes (subdisks) between disks on a single computer system to optimize performance.

**SFW’s software RAID**

To make the best use of SFW’s dynamic volumes, you need an understanding of the RAID levels available with the program and what uses are appropriate for each RAID level.

This section covers the following topics:

- What is RAID?
- SFW and Virtual Disk Service (VDS)
- Choosing RAID levels
- Hardware and software RAID

**What is RAID?**

RAID (Redundant Array of Independent Disks) is a collection of specifications that describe a system for ensuring the reliability and stability of data stored on large disk subsystems.

RAID provides the following general benefits:

- Increased storage system reliability
- Improved I/O performance
- Fault tolerance

**SFW and Virtual Disk Service (VDS)**

Virtual Disk Service (VDS) provides a standard way to manage multi-vendor storage devices through a common storage interface. VDS focuses on the management of logical volumes through both software and hardware RAID. VDS supports the Disk Management user interface and two scriptable command line interfaces, DISKPART and DISKRAID.

DISKPART implements software RAID procedures. It deals with the creation, extension, and deletion of logical volumes or partitions on both basic disks and dynamic disks. DISKPART is the command line version of Disk Management.
DISKRAID implements hardware RAID procedures. It is used with vendor-specific hardware arrays to configure virtual disks (logical disks that span two or more independent physical disks).

In order for the common storage interface to work, participating hardware and software vendors must prepare their providers for the VDS software. Each hardware or software provider translates VDS standard APIs into instructions specific to the related storage device or software RAID procedures.

Storage administrators can use the scriptable command line utilities to create scripts to automate storage procedures across multi-vendor devices. The administrator creates the scripts using standard commands from the CLI, and therefore does not have to spend extra time to learn the specific management utilities that come with each hardware device or software RAID program. Once the script is set up, it can automate time-consuming procedures that had been done manually, such as adding storage to the network.

For Windows Server operating systems, the native disk and volume manager is Microsoft Disk Management. On a Windows Server OS, SFW does not take the place of Microsoft Disk Management. SFW provides all the functionality as if it were installed on a Windows Server OS with the added benefit that Microsoft Disk Management is still available. Uninstalling SFW does not affect Microsoft Disk Management.

On a Windows Server operating system, SFW can be accessed with the Microsoft Disk Management GUI.

**Note:** On Windows Server operating systems, Microsoft Disk Management does not support objects created by SFW, such as dynamic disks or dynamic volumes.

At this time, the advanced functionality of Symantec Storage Foundation for Windows is not available through the Microsoft CLI VDS interfaces.

### Choosing RAID levels

The following illustrations show how RAID levels (RAID-0, RAID-1, RAID-5, and RAID 0+1) provide various levels of redundancy and performance, compared with a simple volume on a single disk. From these, you can decide what choices are applicable to your particular situation.

#### Concatenated

Figure 1-1 shows a concatenated volume layout.
Concatenated volume layout offers the following:

- Concatenates $n$ disks as one large virtual disk with a capacity of $n$ disks.
- Data fills up the first disk before it is written to the second disk.
- Not fault tolerant. When a disk fails, the large virtual disk fails.
- No performance gain.

**RAID level 0 (Striping)**

Figure 1-2 shows a RAID-O volume layout.

RAID-0 volume layout offers the following:

- Groups $n$ disks as one large virtual disk with a capacity of $n$ disks.
- Data is stored to the disks alternately.
- Not fault tolerant. When a disk fails, the large virtual disk fails.
- Better read and write performance than both simple volumes and all other RAID levels.
**RAID level 1 (Mirroring)**

Figure 1-3 shows RAID level 1 (mirroring).

**Figure 1-3** Mirrored volume

RAID level 1 (mirroring) volume layout offers the following:
- Groups two or more disks as one virtual disk with the capacity of a single disk.
- Data is replicated on each disk, providing data redundancy.
- When a disk fails, the virtual disk still works. The data is read from the surviving disk(s).
- Better read performance, but slightly slower write performance.
- Because data is duplicated on two or more disks, RAID-1 is more "expensive" in terms of disk space.

**RAID level 5 (Striping with distributed parity)**

Figure 1-4 shows RAID level 5 (striping with distributed parity).

**Figure 1-4** RAID-5 volume layout

RAID-5 (striping with distributed parity) volume layout offers the following:
- Groups $n$ disks as one large virtual disk with a capacity of $(n-1)$ disks.
Redundant information (parity) is alternately stored on all disks.

- When a disk fails, the virtual disk still works. The data is reconstructed from the surviving disks and the parity alternately stored on the disks. You need to replace the failed disk to restore fault tolerance.
- Better read performance, but slower write performance.

**RAID level 0+1 (Mirrored striped volumes)**

Figure 1-5 shows RAID level 0+1 (mirrored striped volumes).

![Figure 1-5](image)

RAID level 0+1 (mirrored striped volumes) volume layout offers the following:

- Stripes the data across two disks and mirrors it.
- When a disk fails, the data is read from the surviving mirror.
- Better read performance and write performance than RAID level 1 alone.
- Provides both redundancy (with mirroring) and performance (with striping).

**Hardware and software RAID**

RAID functions can be implemented with either hardware RAID (a specific RAID controller) or software RAID (software without the specific hardware).

Software RAID can be configured on top of the hardware RAID volumes and provide a powerful variety of features.
Overview

SFW’s software RAID
Setup and configuration overview

This section presents the procedures for doing the initial setup and configuration of the Symantec Storage Foundation for Windows software once the program is installed on the server. It also describes how to work with disk groups that were created with earlier versions of the software, Symantec Storage Foundation Volume Replicator for Windows.
Note: It is recommended that after installing valid SFW/SFW HA licenses on the system and before restarting vxsvc service, manually revert or change the service recovery option to **Restart the Service** from **Take No Action.**

Symantec Storage Foundation for Windows lets you optimize your storage through the use of dynamic disk groups and dynamic volumes.

The main configuration tasks that you need to do are as follows:

- Create one or more disk groups
- Create dynamic volumes for each disk group
- Set up a dynamic boot and/or system volume (optional)
- Configure options
- Set preferences

## Function overview

Before you can configure Symantec Storage Foundation for Windows, you need an understanding of the main concepts in the program.

This section gives an overview of the following concepts:

- Basic and dynamic disks
- Basic and dynamic volumes
- Disk groups
- Dynamic volume components

### Basic and dynamic disks

Physical disks under SFW’s control are either basic or dynamic. When you install Symantec Storage Foundation for Windows initially on a new system, all disks on a computer system are defined as basic disks. You can upgrade them to dynamic disks by making the disks part of a dynamic disk group.

Basic and Dynamic disk details are as follows:

| Basic Disks | Basic disks adhere to the partition-oriented scheme of Windows NT, Windows 95/98, and MS-DOS. Basic disks can also contain RAID volumes that were created in NT Disk Administrator. In addition, CD-ROMs and other removable media are considered basic disks. |
Dynamic Disks

Dynamic disks can contain dynamic volumes created with Symantec Storage Foundation for Windows. The five dynamic volume types are concatenated (includes simple and spanned volumes), mirrored, striped, RAID-5, and mirrored striped (RAID 0+1). On a dynamic disk, space is organized through dynamic volumes rather than partitions.

Because a dynamic disk does not have the partitioning scheme used by Windows NT, Windows 95/98, and MS-DOS, you cannot access dynamic disks through those operating systems.

Basic and dynamic volumes

A volume is a logical entity that is made up of a portion or portions of one or more physical disks. A volume can be formatted with a file system and can be accessed by a drive letter or a mount path. Like disks, volumes can be basic or dynamic. Volumes are defined as basic or dynamic, depending on whether they reside on a basic or dynamic disk.

Basic and Dynamic volume details are as follows:

Basic Volumes

Basic volumes can be primary or extended partitions, simple logical drives that reside on extended partitions, or RAID volumes that were originally created in Windows NT Disk Administrator.

Dynamic Volumes

Dynamic volumes are volumes created on dynamic disks by using Symantec Storage Foundation for Windows. You can create any number of dynamic volumes in unallocated space on one or more disks.

The volumes are created online without the need for restarting (except a boot or system volume). Each volume can have a FAT, FAT32, or NTFS file system.

SFW's volumes are internally organized according to established RAID levels.

See “SFW's software RAID” on page 29.

You can do online extending of all dynamic volume types, and you can add up to 32 mirrors to any volume type, except RAID-5.

The dynamic volumes created by SFW are accessed by the Windows Server operating systems in the same way that physical partitions are accessed. The volumes are identified by a drive letter or mount point.

Although you cannot create new NT Disk Administrator-type volumes on a basic disk, you can upgrade them to dynamic. Then these volumes will have the full capabilities of other SFW dynamic volumes.
About dynamic volumes in SFW Basic

As in Symantec Storage Foundation, dynamic volumes can be created in Symantec Storage Foundation Basic. However, SFW Basic is limited to a maximum of four dynamic volumes. Upgrading SFW Basic to SFW lets you create any number of dynamic volumes.

Disk groups

All basic and dynamic volumes should be in a disk group. There is only one disk group for basic disks, known as the Basic disk group (or BasicGroup in the VEA GUI). There can be one or more dynamic disk groups. A dynamic disk group contains dynamic disks managed by SFW.

When you move disks between computers, you use the Import and Deport Dynamic Disk Group commands. The disk group for clusters is called a cluster disk group.

See “Disk groups overview” on page 171.

See “Create a cluster dynamic disk group” on page 496.

On Windows Server operating systems, there are two different types of dynamic disk groups, the Microsoft Disk Management Disk Group and the SFW dynamic disk group. The Microsoft Disk Management Disk Group is a disk group that can be created by Microsoft Disk Management. In the VEA GUI, this type of disk group is distinguished with an icon containing the character "M". In addition to the SFW disk groups, SFW can also create and manage the Microsoft Disk Management Disk Group.

Dynamic volume components

The components or virtual storage objects involved in a dynamic volume include its disk group, the dynamic disks it is associated with, and its plexes, columns, and subdisks. The terms “dynamic disk” and “dynamic disk group” have been defined in the preceding sections.

The definitions for plexes, columns, and subdisks are given below:

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plexes</td>
<td>A plex refers to an instance of the volume. Mirrored volumes have two or more plexes. All other volumes have one plex.</td>
</tr>
<tr>
<td>Columns</td>
<td>A column refers to an area on the disk where all or a portion of the volume resides. Striped, RAID-5, and mirrored striped (RAID 0+1) volumes contain multiple columns. Other volume types contain one column.</td>
</tr>
</tbody>
</table>
Subdisks identify the disk location and size of each contiguous disk area in the volume. Subdisks are the basic units in which Symantec Storage Foundation for Windows allocates disk space in a volume. An SFW disk can be divided into one or more subdisks. Each subdisk represents a specific portion of a volume on a dynamic disk.

An SFW disk may contain multiple subdisks, but subdisks cannot overlap or share the same portions of disk space. Any SFW disk space that is not part of a subdisk is considered to be unallocated space, which can be used to create new volumes or to extend existing volumes.

You can move subdisks to improve disk performance.

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support operations on subdisks.

Access Symantec Storage Foundation for Windows

To access Symantec Storage Foundation for Windows, you must have installed the program on the servers to be managed and on any client computer that is used to manage the program remotely.

For complete installation instructions, see the Installation Guide.

SFW is accessed through the Veritas Enterprise Administrator (VEA) GUI interface. The VEA GUI is used for multiple Symantec programs.

If SFW has been installed correctly, then the VEA GUI can be accessed through either the Start menu or the Computer Management window of the server or the client computer you are using. Once you access the VEA GUI, you then need to connect to one or more servers that you want SFW to manage.

Note: Using an older client version of SFW (for example, SFW 6.0) to connect through VEA GUI on the newer or latest server version of SFW (for example, SFW 6.1) is not supported.

This section describes how to use these two methods to access VEA and to connect to a server.
To access and perform operations within Symantec Storage Foundation for Windows, you must have administrator rights on the computer you want to connect to. Not having administrator rights only lets you view information in Symantec Storage Foundation for Windows. If User Access Control (UAC) is enabled, run the program or commands in the “Run as administrator” mode even if the logged-on user belongs to the local administrators group. Alternatively, log on as an Administrator (default administrator account) to perform the tasks.

If User Access Control (UAC) is enabled on Windows Server operating systems, then you cannot log on to VEA GUI with an account that is not a member of the Administrators group, such as a guest user. This happens because such user does not have the "Write" permission for the "Veritas" folder in the installation directory (typically, C:\Program Files\Veritas). As a workaround, an OS administrator user can set "Write" permission for the guest user using the Security tab of the "Veritas" folder's properties.

See “Understanding the conditions for remote connection” on page 43.

This section covers the following topics:
- Accessing VEA from the Windows Start menu
- Accessing VEA through the Windows computer management window
- Disabling write caches and HBA caches
- Disconnecting from a server
- Understanding the conditions for remote connection

### Accessing VEA from the Windows Start menu

Use the following to access Veritas Enterprise Administrator (VEA) from the Windows Start menu and connect to a server.

**To access VEA from the Windows Start menu and connect to a server**

1. Launch VEA from Start > Programs > Symantec > Symantec Storage Foundation > Veritas Enterprise Administrator or, on Windows 2012 operating systems, from the Apps menu in the Start screen.

   The Select Profile window appears.

2. Select a profile and click OK to continue.

   The Veritas Enterprise Administrator window appears.
3. Click **Connect to a Host or Domain** to connect. The Connect window appears.

4. Select a Host from the drop-down menu, click **Browse** to find a Host, or enter the Host name of the computer and click **Connect**.

![Connect Window](image)

You may also choose to connect using a different user account after selecting a Host. In this case, you will be prompted for another user name and password to connect with.

**Note:** On the VEA GUI, in the Connect panel, if a period (.) is used instead of "localhost" as the **Host Name**, then the login credentials are not saved even if the **Save Password** option is selected while logging in.

### Accessing VEA through the Windows computer management window

Use the following to access VEA through the computer management window and connect to a server.

**To access VEA through the computer management window and connect to a server**

1. Right-click the **My Computer** icon and select **Manage** from the context menu that appears.

   The Computer Management window comes up.

   The window’s display can represent a local computer or a remote computer as follows:

   - If the window is representing the local computer, "(Local)" appears after the Computer Management node in the tree view.
   - If a remote computer is being represented, the name of the remote computer appears after the Computer Management node.
The default setting is for the window to display the local computer as the top node.

2 To connect to a different computer, right-click the top node of the Computer Management tree view and select **Connect to another computer** from the context menu. In the Select Computer window that appears, click **Local** or **Another computer**.

For another computer, enter or browse for the name of the appropriate computer. Click **OK** to connect. You may be asked to enter a user name and password.

3 In the Computer Management tree view, expand the Storage node and the Volume Management node that appears under it.

If the server is running SFW or a version of Volume Manager for Windows, **Veritas Enterprise Administrator** appears under the Volume Management node.

4 Double-click **Veritas Enterprise Administrator**.

The Veritas Enterprise Administrator GUI comes up with the Select Profile window displayed.

5 Select a profile and click **OK** to continue.

The Veritas Enterprise Administrator console appears.

### Disabling write caches and HBA caches

The following describes how to disable write caches and HBA caches.

#### Write caches

Write caches for disks and disk arrays improves disk performance, but the cached data may be lost in an unplanned disk shutdown. In general, Symantec recommends that write caches be disabled to avoid any possible data loss. However, write caches may be enabled for disks and disk arrays that have an emergency backup power source for their caches.

Refer to your hardware documentation for additional information about disabling the write cache. Also refer to Microsoft Knowledge Base Article #811392 (http://support.microsoft.com/default.aspx/kb/811392) for additional information to configure the write cache.

If you choose to have the write cache enabled, the warning message about write cache enabled disks is displayed during startup. This message can be turned off by clearing the checkbox for Show write cache enabled information in the Storage Foundation General tab of the Preferences GUI.
More information about turning off the message is available. See “The disk view” on page 86.

It may be possible to disable the write cache for a disk by using the Windows Computer Management GUI as shown in the following steps.

To disable the write cache:
1. Select Device Manager in the left pane of Windows Computer Management.
2. Expand Disk Drives in the right pane to display the disks.
3. Right-click the appropriate disk and select Properties from the context menu.
4. Click the Disk Properties tab and clear the checkbox for Write cache enabled.
5. Click OK to save and close your setting.

HBA caches

Some storage devices, such as RAID controllers, may have HBA caches. If these storage devices are used in a cluster environment, such as Microsoft Failover Clustering or VCS, the data in the cache of a failed system has the potential of corrupting the data in the cluster. Symantec recommends that the HBA caches be disabled for these devices. Refer to your hardware documentation for information about disabling HBA caches.

Disconnecting from a server

Use the following to disconnect from a server.

To disconnect from a server
1. Right-click the server icon you want to disconnect from, and select Disconnect from the computer context menu. Alternatively, you can select Disconnect from the File menu or click the Disconnect tool on the toolbar, the second tool from the left (the small computer with a red checkmark).
2. A confirmation dialog appears; click OK to end the connection.

The computer icon disappears from the tree view.

If the connection is lost for any other reason, a message appears that indicates the connection has been terminated. SFW removes the icon for that computer from the tree view. You need to click OK to close the message box.

Understanding the conditions for remote connection

This section describes the conditions for connecting to a remote computer.
You can connect to a remote computer if it is established that your user name and password match those of an account with any of the following:

- Local Administrator rights of the remote server
- Domain Administrator rights of the domain of the remote server and you have logged on from that domain or a trusted domain
- Domain Administrator rights of a trusted domain to the remote server’s domain and you have logged on from that domain or the remote server’s domain

When you initiate the command to connect to a remote computer, Symantec Storage Foundation for Windows checks to see whether you have already met one of the three conditions above when you logged on initially to the local client computer. If you have, then you will be connected directly to the remote computer without being asked to supply a user name and password.

You will not be connected automatically if you have logged onto the local computer with an account that does not have administrator privileges on the remote machine you want to connect to. However, with the Connect command in the VEA GUI, you are always given the opportunity to enter a user name and password. Click the More button in the Connection dialog box to expand the dialog box and display the Authentication section. If you then enter a user name and password for an administrator account on the remote machine, you will be connected to the remote computer.

Note: The first time you enter a user name and password, you can click the Remember password checkbox, so that you do not have to enter the password every time.

Review the Veritas Enterprise Administrator GUI

Once you have connected to one or more servers, you can use the VEA GUI to view and manage the connected servers. This section gives a brief overview of the VEA GUI so that you may understand how to use the GUI to accomplish the tasks needed to set up and configure the Symantec Storage Foundation for Windows program on the server.

If you look in the right pane of the VEA GUI window, you should see an icon representing the server or servers that you are connected to. There are additional icons for all of the storage components associated with the server. By viewing these icons, you can see at a glance how the different storage components on the server are organized and whether they are functioning normally.

The VEA GUI is shown below.
The key points about the VEA GUI are as follows:

- The tree view in the left pane provides an efficient overall view of the storage. In the VEA GUI, the different components of the storage being managed by Symantec Storage Foundation for Windows are represented as icons. The top level of the tree is the management console icon. Under it are the servers being managed by SFW. Under each server are the storage components associated with it—CD-ROMs, disk groups, disks, and volumes. By clicking on the + or - sign in front of an icon, you can display or hide subordinate icons under that icon. The Control Panel icon for each server gives access to further settings that can be applied to the storage objects. The Logs icon brings up an Event Log and a Task Log relating to the storage objects.

- If there is a problem with one of the storage components, a small error symbol is superimposed on the icon. A yellow caution symbol indicates there is a potential problem. A red circle with an x on it indicates that a serious storage failure has occurred, such as a disk failure. See “SFW error symbols” on page 264.

- Selecting a storage object in the tree view brings up further information relating to that object in the right pane of the GUI window. For example, if you expand the Disks icon in the tree view and click a particular disk, the right-pane view displays the volumes on that disk. That right-pane view for the disks has two other tabs, Disk Regions and Disk View. Disk Regions shows you subdisks (that is, parts of volumes that reside on the disk) and free space.
The Disk View represents the same disk regions in a diagram and provides additional information. The tabs in the right pane change, depending on what storage object is selected in the tree view.

- Right-clicking a storage object in the tree view or right-pane view brings up a context-sensitive menu with the commands that are appropriate to that storage object. For example, two tasks that are necessary in setting up storage under Symantec Storage Foundation for Windows are to create disk groups and volumes. You can right-click the Disk Group icon or a disk icon and a menu will come up that includes the command New Dynamic Disk Group. Likewise, once a dynamic disk group is created, you can click the Disk Group icon or an icon of a disk that is included in a dynamic disk group and a menu comes up that includes the command New Volume.

- You can also select commands from the menu bar and the toolbar. Again, the commands on each menu can vary, depending on what storage object you have selected.

- The lower pane of the VEA GUI is used to display recent alerts relating to the storage objects, or it can also show the progress of storage tasks, such as formatting of a volume. To toggle back and forth between the two purposes, click the Console or Tasks tab at the lower left corner of the pane.

More information about using the VEA GUI to manage your storage is available. See “VEA Overview” on page 71.

If you are installing on a new system with new disks or you have added new disks to the system, such disks show up in the tree view with the words "No Signature" after them. Right-click each disk and select Write Signature from the context menu. See “Add a disk signature to a disk” on page 120.

**Configure basic disks (Optional)**

The Symantec Storage Foundation for Windows program defines disks as being either basic or dynamic. Basic disks are disks other than the ones that have been defined through SFW as dynamic. In most cases, it is not necessary to configure basic disks for your initial setup and configuration of SFW.

This section provides information about basic disks and describes the situations where you might want to use the commands provided within SFW to configure basic disks.
About basic disks

Basic disks are disks that have the standard partitioning scheme used by Windows NT, Windows 95/98, and MS-DOS. When you install Symantec Storage Foundation for Windows on a new system, all physical disks on your system are defined as basic, even though they may not all have partitions on them. If the Windows operating system is installed, you will have your system and boot partition already set up as a basic disk partition. This partition is created as a part of the Windows install process. Once Symantec Storage Foundation for Windows is running, you do not need to create any more basic disk partitions. You can then set up dynamic disk groups and volumes with your remaining storage to make them into dynamic disks. It is not necessary to place partitions on a new disk for it to be made into a dynamic disk through Symantec Storage Foundation for Windows.

Upgrading basic disks to dynamic

All basic disks can be upgraded to dynamic disks through Symantec Storage Foundation for Windows. To upgrade a basic disk to a dynamic disk, you need to create a dynamic disk group and include the disk in the group.

See “Create dynamic disk groups” on page 47.

The basic disk does not have to include a partition on it; but if it does, a primary partition becomes a simple dynamic volume and any logical drives within an extended partition also become simple volumes. The extended partition will no longer exist.

The process of upgrading a basic partition to a dynamic volume is called "encapsulation," because it encapsulates the partition information within the dynamic volume structure.

You can also upgrade your system and boot partition to a dynamic disk and then mirror it.

See “Set up a dynamic boot and system volume (Optional)” on page 62.

Create dynamic disk groups

When you create a dynamic disk group and add disks to it, those disks become dynamic—that is, they can now have Symantec Storage Foundation for Windows dynamic volumes created on them. Thus, a basic disk is said to be "upgraded to a dynamic disk" through its addition to a dynamic disk group. You can change multiple basic disks to dynamic at one time when you use either the New Dynamic Disk Group command or the Add Disk to Dynamic Disk Group command.
In this setup and configuration chapter, only the command for creating a dynamic disk group is included.

Information on adding a disk to a disk group is available.

See “Add a disk to a dynamic disk group” on page 121.

This section covers the following:
- Considerations when changing a basic disk to dynamic
- [Unresolved xref]
- Making storage available after system startup

Considerations when changing a basic disk to dynamic

There are some considerations to make when you change a basic disk to dynamic. Consider the following:

- Once you change a basic disk to a dynamic disk, the volumes on the disk cannot be accessed by MS-DOS, Windows 95/98, or Windows NT.

- After you upgrade a basic disk to a dynamic disk and create dynamic volumes on it, you cannot change the dynamic volumes back to partitions or basic volumes. You can revert a dynamic disk to basic, but you must delete all dynamic volumes on the disk and then use the Remove Disk from Dynamic Disk Group command.

- On Windows Server operating systems, you can upgrade a basic disk to a dynamic disk that can be contained in a Microsoft Disk Management Disk Group or in an SFW dynamic disk group as follows:
  - If you upgrade a basic disk to a dynamic disk in a Microsoft Disk Management Disk Group, you can add it to an existing Microsoft Disk Management Disk Group or use it to create the Microsoft Disk Management Disk Group. You are not able to have more than one Microsoft Disk Management Disk Group.
  
  - If you upgrade a basic disk to a dynamic disk in an SFW dynamic disk group, you can add it to an existing SFW dynamic disk group or use it to create an SFW dynamic disk group. You can have multiple SFW dynamic disk groups.

- To create a bootable dynamic disk that can be mirrored, you must upgrade a basic disk that contains the system partition to a dynamic disk. See “Set up a dynamic boot and system volume (Optional)” on page 62.

- When a basic disk with existing partitions is converted to a dynamic disk, all handles to the disk must be closed before the conversion. This means that all
applications using the disk must be stopped before starting the conversion operation.

Steps for creating a dynamic disk group

Use the following to create a dynamic disk group.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support cluster disk groups.

**To create a new dynamic disk group**

1. Right-click the Disk Groups folder or right-click a disk.
2. Select **New Dynamic Disk Group** from the context menu that comes up.

   The New Dynamic Disk Group Wizard screen appears.

   The wizard can also be reached by clicking the **New Dynamic Disk Group** button on the Storage Foundation Assistant.
3 Click **Next** to continue.

A screen comes up for naming the disk group and for selecting its disks and type.
4 Enter a name for the dynamic disk group, and indicate which disks you want to include in the group. Also consider whether you want the disks to be part of a regular disk group or one of the optional disk group types, which are defined in the table below. If you click none of the optional disk group type checkboxes, you will create a regular dynamic disk group.

Make sure only the disks you want to include are listed in the right pane of the window (Selected disks), and click Next.

Check the Disk names prefix checkbox and enter a disk name prefix to give the disks in the disk group a specific identifier. The identifier precedes a system-generated numeric ID that SFW uses to distinguish the disks in the disk group. For example, entering TestGroup as the prefix for a disk group that contains three disks creates TestGroup1, TestGroup2, and TestGroup3 as internal names for the disks in the disk group.

A dynamic disk group name is limited to 18 ASCII characters. It cannot contain spaces or forward or backward slashes. Also, a period cannot be the first character in the name.

<table>
<thead>
<tr>
<th>Disk Group Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster Dynamic Disk Group</td>
<td>Creates a cluster dynamic disk group that can be used with VCS or Microsoft Failover Clustering.</td>
</tr>
<tr>
<td>Private Dynamic Disk Group Protection</td>
<td>The feature of private dynamic disk group protection makes it possible to partition shared storage with a regular dynamic disk group.</td>
</tr>
<tr>
<td>Windows Disk Management Compatible Dynamic Disk Group</td>
<td>For Windows Server operating systems, this creates a Windows Disk Management disk group. This is the type of disk group that is created by Microsoft Disk Management.</td>
</tr>
</tbody>
</table>

Windows Disk Management Disk Group
5 The next screen confirms the disks you have selected. Choose Next to continue if you are satisfied with the disk selection. If you are not satisfied, you can click the Back button to go back to the previous screen to modify your disk choices.

For each disk, information is provided on whether it contains volumes and whether it will be updated. If it is not going to be updated, you will want to modify the selection.

Normally, you would add all the disks you want in the group at this point. You can always add more disks later with the Add Disk to Dynamic Disk Group command.

6 Click Finish in the final screen.

The next step in the process is to create dynamic volumes.

Making storage available after system startup

Generally, dynamic (non-cluster) disk groups are available during system startup. However, some types of storage are not available until the service that controls the storage has been started. SFW provides the Veritas DG Delayed Import Service (VxDgDl) to accommodate this type of storage. VxDgDI and the vxdg latestart command allow SFW to access the storage when it becomes available.

See “vxdg” on page 550.

Create dynamic volumes

This section on creating dynamic volumes has some useful background information, as well as the detailed steps for carrying out the procedure.

This section covers the following:

- Background information
- [Unresolved xref]
- Dynamic volume types

Background information

The following is background information to create dynamic volumes.

Dynamic volume layouts or types

There are five dynamic volume layouts or types—concatenated (simple or spanned), mirrored, striped, RAID-5, and mirrored striped (RAID 0+1).
See “Dynamic volume types” on page 59.

**Volume size in the new volume wizard**

It is important to understand that the total volume size you indicate for the volume in the New Volume wizard is the usable size for storing the data. Depending on the layout type, the volume can take more space on the disk. The size shown in the wizard for simple, striped, and spanned volumes is the actual volume size on the disk. A RAID-5 volume requires additional space for parity information, and a mirrored volume is a multiple of the space taken by the original plex of the volume.

The wizard provides a Max Size button to determine the size of the volume. Again, this is the usable size of the volume rather than the actual size taken by the volume on the disk.

**Preselecting disks**

You can preselect one or more disks before invoking the New Volume command. For example, you can click a specific disk in the tree view or select several disks in the right pane and then invoke the command from the context menu. If you have a disk or several disks selected, the program assumes that only the selected disks will be used for the volume and the manual selection radio button will be indicated in the New Volume wizard. If you find that you want to use more disks than those originally selected, you can adjust the disk selection from within the wizard.

**Thin Provisioned disks**

Volumes can be created with disks that are enabled to support thin provisioning and storage reclamation. Using thin provisioned disks for a volume allows for efficient allocation of storage for the volume. A disk that supports thin provisioning is represented with a disk icon that includes a red colored sector. A disk that supports thin provisioning and storage reclamation is represented with a disk icon that includes a green colored sector with an asterisk (*).

---

**Note:** The operation to reclaim storage from thin provisioned disks is not supported for RAID-5, DCO, or Volume Replicator DCM volumes.

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**Note:** The operation to reclaim storage is supported only for NTFS volumes.
About dynamic volumes in SFW Basic

As in SFW, dynamic volumes can be created in SFW Basic. However, SFW Basic is limited to a maximum of four dynamic volumes. Upgrading SFW Basic to SFW lets you create any number of dynamic volumes.

Steps for creating a dynamic volume

Use the following to create a dynamic volume.

To create a new volume

1. Right-click a dynamic disk in the tree view, the right pane, or the Disk View tab, and select New Volume from the context menu that comes up.
   You can also select the command from the Actions menu or click the New Volume tool on the toolbar.

2. The New Volume wizard appears.
   Click Next to continue.
   The Assign Disks for Volume screen appears.

3. Make your selections in the Assign Disks for Volume screen as follows:
   - A default dynamic disk group will appear in the Group name box. If you want to create the volume in a different dynamic disk group, select it from the pull-down list.
   - Specify the Site Preferences as Siteless, Site Confined, or Site Separated by enabling the required radio button against each of the respective options.
See “Administering volumes for site-based allocation” on page 464.

- Automatically selecting disks is the default setting. To manually select the disks, click the **Manually select disks** radio button. The disks that you select should be in the right pane when you click **Next**.
  
  If you had one or more disks selected when you invoked the **New Volume** command, the disk selection method will be set to manual.
  
  You may view disks that are only enabled for thin provisioning, by checking the checkbox for Thin Provisioned Disks. Using this checkbox lets you manually select only thin provisioned disks to create the volume.

- You may also check **Disable Track Alignment** to disable track alignment for the volume.
  
  Disabling Track Alignment means that the volume does not store blocks of data in alignment with the boundaries of the physical track of the disk.
  
  More information about Track Alignment is available.
  
  See “Track alignment” on page 117.

Click **Next** to continue. The screen for selecting volume attributes appears.

4 Select the attributes listed below for the volume, and click **Next** to continue.

![New Volume Wizard](image)

If you find the volume layout that you want is grayed out, it is most likely because not enough disks have been selected. Choose the Back button and return to the previous screen to select more disks as follows:
The volume name is the internal Symantec Storage Foundation for Windows-specific name that is used in some SFW commands. Enter a name in the Volume name text box.

A volume name is limited to 18 ASCII characters. It cannot contain spaces or forward or backward slashes. Also, a period cannot be the first character in the name.

If you enter a volume name, SFW will automatically assign the file system volume label the same name. If you later change the file system volume label through the FileSystem command, the Symantec Storage Foundation for Windows volume name and the file system volume label will be different. However, it will make little difference because the GUI identifies the volume by the file system label name except for the one entry that is listed as "Volume Name." If you use the command line interface to create a volume, the file system name is not automatically set to the name of the volume.

Select one of the following volume layout types:

- Concatenated
- Striped
- RAID-5
- Mirrored
- Mirrored Striped (RAID 0+1): Choose the Striped and the Mirrored checkbox

A detailed description of the volume layout types is available. See “Dynamic volume types” on page 59.

If you are creating striped or RAID-5 volumes, the Columns and Stripe unit size must be specified. The stripe unit size is expressed as a number of sectors. Default values are provided.

In addition, you may specify to have the stripe across disks done by Port, Target, Enclosure, or Channel.

For a concatenated or striped volume, you may also specify a mirror volume with the following optional attributes:

- Number of mirrors
- Enable logging
- Mirror across disks by Port, Target, Enclosure, or Channel

Note that the operation to create a new dynamic volume fails if the appropriate resources are not available to support the selected attributes to mirror across disks.
■ Provide a size for the volume. You can use the pull-down list to the right of the Size entry box to select Sectors, KB, MB, GB, or TB for indicating the volume size.

If you click the Max Size button, a size appears in the Size box that represents the maximum possible volume size for that layout in the dynamic disk group. For a given dynamic disk group, the maximum volume size will depend on the type of layout selected.

Click Next to continue.

5 In the Add Drive Letter and Path screen, select one of the three choices described below, and click Next.

The options are as follows:

■ Accept the drive letter assignment indicated or assign a drive letter by using the pull-down list.

■ Do not assign a drive letter. You may prefer to do this task later.

■ Mount as an empty NTFS folder by clicking the option and then typing in a folder name or browsing to select the folder name. Symantec Storage Foundation for Windows will create a new folder for you if you click the New Folder button in the Browse for Drive Path dialog box.

6 In the Create File System screen that appears next, indicate your choices for the file system selections that are described below, and click Next.
The options are as follows:

- Make sure that the **Format this volume** checkbox is checked if you want to format the volume using NTFS, FAT, or FAT32. You can uncheck the box if you want to format later.

- Make sure the file system type that you want is highlighted if you want to format the volume now.

- If desired, change the allocation size.

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**Note**: To set the appropriate allocation size for an application on your system, refer to the documentation for the application or Microsoft documentation concerning the application.

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- If desired, type a file system label. If you do not enter a label, no default label will be provided. You can enter a label for the file system later.

- Decide if you want to perform a quick format. If the **Perform a quick format** box is not checked, the volume will be formatted with normal formatting.

- If desired, check the **Enable file and folder compression** checkbox. This option is available only if the volume is being formatted with NTFS.

---

**Note**: If you plan to use this volume to install SQL Server, do not select the **Enable file and folder compression** checkbox. The SQL Server installation cannot copy files on a compressed or encrypted folder.
If you want to format the volume, create a file system label, or change any of the volume settings, right-click the volume and select File System and the subcommand New File System from the volume context menu. You will be able to make your choices from a screen that has the same selections as the one above.

7 Check your selections in the final screen. When you are satisfied with your choices, click Finish.

By clicking the Back button, you can go back and make changes before you click Finish.

If you chose to format the volume, Symantec Storage Foundation for Windows will begin the formatting process. Click the Tasks tab in the bottom left corner of the lower pane to see a text entry indicating the status and progress of the formatting process.

By default, the dynamic volume is created as a read/write volume. To make the dynamic volume a read only volume, right-click the volume and check Read only in the Properties for the volume.

Dynamic volume types

This section provides a detailed description of the types of dynamic volumes that are available in Symantec Storage Foundation for Windows.
**Note:** In the Symantec Storage Foundation for Windows New Volume command, simple and spanned volume types are both referred to as concatenated and considered one type.

This section covers the following:

- Concatenated (Simple and spanned) volumes
- Striped volumes
- Mirrored volumes
- RAID-5 volumes
- Mirrored striped volumes (RAID 0+1)

**Concatenated (Simple and spanned) volumes**

The concatenated volume type includes both simple and spanned dynamic volumes.

**Simple volume**

A dynamic simple volume consists of a single contiguous region (or subdisk) on a single physical disk. Dynamic simple volumes can be extended or mirrored. When you extend a simple volume to a noncontiguous region within the same disk or onto additional disks, it becomes a spanned volume.

**Spanned volume**

A dynamic spanned volume consists of two or more subdisks (single contiguous regions) on one or more disks. With a spanned dynamic volume, you can combine sections of unallocated space from multiple dynamic disks into one large volume. The areas of unallocated space used to create spanned volumes can be different sizes. Spanned volumes are organized sequentially—that is, Symantec Storage Foundation for Windows sequentially allocates space on each disk until that disk is full and then continues with the next disk until the volume size is reached. Up to 256 disks can be included in a spanned volume.

Existing spanned volumes can be extended by the amount of unallocated space on all the disks in the dynamic disk group. However, after a spanned volume is extended, no portion of it can be deleted without deleting the entire spanned volume.

The advantage of a spanned volume is that it lets you create a large volume consisting of smaller pieces of disk space from several disks, thereby making more efficient use of the disk space than would be possible if you had to limit the volume to a single disk. The disadvantage of a spanned volume is that it is not fault tolerant. If one of the disks containing a spanned volume fails, the entire volume fails. However, a spanned volume can be mirrored.
Striped volumes

Striped volumes are created by combining areas of free space on two or more disks into one logical volume. Data is divided into blocks and spread in a fixed order among all the disks in the volume. With a striped volume, data is written to multiple disks, similar to spanned volumes. However, striping writes files across all disks so that data is added to all disks at the same rate. Up to 256 disks can be used in a striped volume.

Striped volumes offer the best performance of all the disk management strategies. However, as with spanned volumes, striped volumes do not provide fault tolerance. If a disk in a striped volume fails, the data in the entire volume is lost. However, a striped volume can be mirrored to provide data redundancy. In addition, Symantec Storage Foundation for Windows lets you extend a striped volume, either with or without a mirror.

Mirrored volumes

A mirrored volume is a fault-tolerant volume that duplicates your data on two or more physical disks. A mirror provides redundancy by simultaneously writing the same data onto two or more separate mirrors (or plexes) that reside on different disks. If one of the disks fails, data continues to be written to and read from the unaffected disk or disks.

Mirrored volumes protect the data on the disk from media failure. Mirroring reduces the chance of an unrecoverable error by providing duplicate sets of data, but it also multiplies the number of disks required for data storage and the input/output (I/O) operations when writing to the disk. However, some performance gains are achieved for reading data because of I/O load balancing of requests between the plexes. A mirrored volume is about the same as a RAID-5 volume in read operations but faster in write operations.

You can create a mirrored volume with the Create Volume wizard, or you can add a mirror to an existing volume with the Add Mirror wizard. To create a mirrored volume on two or more disks, each mirror or plex of the original volume requires space that is at least the same size as the original volume. When you create a mirror, the same drive letter is used for all plexes of the volume. If you have sufficient disks available, you can create multiple mirrors for extra redundancy (up to the limit of 32 mirrors). Then, you can break off a mirror to use for backup, data analysis, or testing without losing redundancy.

Note: Adding a mirror to a volume involves a certain amount of time for mirror resynchronization. The SmartMove feature can help reduce mirror resynchronization time.
See “SmartMove” on page 112.

Breaking off a plex of the mirrored volume does not delete the information, but it does mean that the plex that is broken off will no longer mirror information from the other plex or plexes in the mirrored volume. The broken-off plex will be assigned a different drive letter than that of the original mirrored volume. It is no longer part of the mirrored volume, but it retains its other volume layout characteristics. For example, if you had a mirrored striped volume, the broken-off plex would become a striped volume.

In the case of an unrecoverable error on a plex within a mirrored volume, you need to remove the plex that is damaged with the Remove Mirror command. You then can use the Add Mirror command to create a new plex on another disk to take the place of the damaged plex.

When you want to use the space in a mirrored volume for other purposes, you can remove a plex and return the space it used to unallocated space.

Symantec Storage Foundation for Windows lets you add a mirror to any kind of dynamic volume, except RAID-5. You can extend any mirrored volume.

**RAID-5 volumes**

A RAID-5 volume is a fault-tolerant volume with data and parity striped alternately across three or more physical disks. If one of the physical disks fails, data that was on the failed disk is recreated from the remaining data and parity on the other disks. RAID-5 volumes are a good solution for data redundancy in a computer environment in which most activity consists of reading data.

You need a minimum of three disks for a RAID-5 volume. Symantec Storage Foundation for Windows can accommodate up to 256 disks in a RAID-5 volume. You can extend a RAID-5 volume, but it cannot be mirrored.

**Mirrored striped volumes (RAID 0+1)**

RAID 0+1 volumes are mirrors of striped volumes. For example, a two-disk striped volume can be mirrored to two additional disks. This RAID type provides the advantages of both speed (from striping) and fault tolerance (from mirroring). You can add more mirrors to a mirrored striped volume, and you can extend this type of volume onto additional dynamic disks within the dynamic disk group.

**Set up a dynamic boot and system volume (Optional)**

You may want to make the Windows boot and system partition into a dynamic volume and mirror that volume. Then, if the disk containing the boot and system
volume fails, you can start the computer from the disk containing the mirrors of
the volume.

To make a boot and system partition dynamic, you include the disk that contains
the basic active boot and system partition in a dynamic disk group. When you do
that, the boot and system partition is automatically upgraded to a dynamic simple
volume that is active—that is, the system will boot from that volume.

For an optimal setup, it is recommended that you have a separate disk for the
dynamic system and boot volume and mirror it with one or two disks. Thus, you
will have a boot dynamic disk group with two or three disks. You then need to
have an additional disk or disks for the data. The data disks would be in another
dynamic disk group.

In Windows documentation, the boot volume is the partition that contains the
operating system and the system volume is the partition that the computer starts
from. The boot and system volumes can be in the same partition or different
partitions for MBR style partitions. For GPT style partitions, the boot and system
volumes must be in different partitions.

This following procedure is written for an MBR style partition with the boot and
system volumes in the same partition. If the boot and system volumes are in
different partitions, then these steps can be used as a guide to apply to each volume
separately.

For GPT style partitions, the following procedure can also be used as a guide to
apply to each volume separately. However, use the Microsoft bootcfg.exe utility
instead of editing the boot.ini as described in the procedure.

---

**Note:** A dynamic system volume on an Itanium (IA64) system with a GPT style
partition is not supported by SFW. Therefore creating a mirror of a dynamic
system volume on an IA64 system with this configuration is not supported. Refer
to the SFW Release Notes for more information about creating and booting from
a mirror on a system with this configuration.

---

**Note:** On Windows Server operating systems, although you can create and manage
the dynamic boot and system volume using the VEA GUI, the native Windows
driver handles the input/output operations for that volume. Therefore, ensure
that you comply with Windows Server OS information on best practices and
restrictions on the use of a dynamic boot and system volume.
Setting up a dynamic boot and system volume for MBR style partitions:

1. Make sure that the server has a basic system and boot partition that is active.

2. As a precaution, create a boot floppy of the system partition. If something goes wrong with the original system and boot volume or its mirror, you can boot your system from the floppy. Test the boot floppy while your system is in a known good state.

3. Make sure that there are sufficient disks attached to the server so that there will be a separate disk for the boot and system volume plus one or two more for mirroring the system disks and then additional disks for the data.

4. Create a dynamic disk group that has the disk with the existing boot and system partition plus one or two other disks to be used for mirroring purposes. See “Create dynamic disk groups” on page 47.

When you designate a disk as part of a dynamic disk group, the entire disk becomes a dynamic disk—that is, a disk capable of having dynamic volumes. Any basic partitions on that disk become dynamic volumes. Thus, the boot and system partition automatically becomes a dynamic simple volume. You do not have to mark it as the active volume, because it is automatically made active.

There is no command in Symantec Storage Foundation for Windows for making an existing dynamic volume active—that is, to make it the volume that the computer starts from. The only way to make a dynamic volume active through SFW is to upgrade the existing active basic system partition by including the disk that contains the partition as a member of a dynamic disk group. You can make a basic partition active through the command Mark Partition Active.

5. If you have not done so already, create one or more additional disk groups for your data and then create the necessary volumes for the data. See “Create dynamic disk groups” on page 47.

See “Create dynamic volumes” on page 52.
6  Create one or more mirrors on the dynamic system and boot volume.
   See “Add a mirror to a volume” on page 235.
   The troubleshooting section covers difficulties that can occur.
   See “An attempt to mirror a boot or system volume fails or has an error message” on page 288.

7  If the dynamic boot or system volume fails, you must make the change to the server’s `boot.ini` file to make one of the mirrored boot or system volumes the active volume for your computer and then restart.
   If a break-mirror operation is performed on a mirrored boot volume, the resulting new volume—the broken-off mirror—will not be usable as a boot volume.

Configuring the program options available with SFW

If you have installed any of the various Symantec Storage Foundation for Windows options, such as the Failover Cluster option, DMPW, FlashSnap, you need to do additional configuration steps. This section contains a high-level summary and references to other sections in this manual for details.

SFW HA

Symantec Storage Foundation and High Availability Solutions installs VCS on specified computers. The installation does the initial setup of the VCS cluster. However, there are additional steps you need to do to complete the cluster configuration.

See “Overview” on page 511.

Also, the VCS documentation set is included with the SFW HA product.

In addition, see the step-by-step examples in the `Symantec Storage Foundation and High Availability Solutions Solutions Guide`. If you are planning to use VCS with Microsoft Exchange Server or Microsoft SQL Server, you need to have selected the Symantec Cluster Server Enterprise Agent for Exchange or the Symantec Cluster Server Enterprise Agent for SQL. The `Symantec Storage Foundation and High Availability Solutions High Availability and Disaster Recovery Solutions Guide for Microsoft Exchange` and the `Symantec Storage Foundation and High Availability Solutions High Availability and Disaster Recovery Solutions Guide for Microsoft SQL` have step-by-step examples of what needs to be done for SFW, VCS, and Exchange and SQL Server applications to function together. In addition, a VCS documentation set is included with the program.
Microsoft failover cluster option

After Symantec Storage Foundation for Windows and the Microsoft failover cluster feature are installed, you create one or more SFW disk groups and their volumes. Then you use Microsoft failover cluster to make each disk group a resource in the cluster program. You might want to mirror the SFW cluster volumes for redundancy.

See “Overview” on page 491.

If you are installing Microsoft failover cluster with DMPW, see information on this topic in the Symantec Storage Foundation and High Availability Solutions Installation and Upgrade Guide.

The Symantec Storage Foundation and High Availability Solutions Solutions Guide has step-by-step examples of different configurations with SFW and Microsoft failover cluster. A DMPW configuration is also covered.

Symantec Dynamic Multi-Pathing for Windows option

The Symantec Dynamic Multi-Pathing for Windows (DMPW) option adds fault tolerance to disk storage by making use of multiple paths (each with its own host adapter and cabling) between a computer and the disks in a storage array.

See “DMPW overview” on page 425.

For general information about installing DMPW either by itself or with failover clusters, see the Symantec Storage Foundation and High Availability Solutions Installation and Upgrade Guide.

FlashSnap option

FlashSnap is a multi-step process that lets you create independently addressable snapshot volumes that are copies or mirrors of the volumes on your server. These snapshot volumes can be used as quick recovery images for recovering applications, such as Microsoft SQL Server. They also can be used for backup or application testing. One of the main advantages of using FlashSnap is that the snapshot volumes can be easily moved to another server. Thus, backup or other processing can be performed on another server without affecting the performance of applications on the applications server.

The only configuration step for FlashSnap that you might need to do is to upgrade your disk groups if you have installed the program on a server that has disk groups that were created with an earlier version of SFW or a related program (such as Microsoft Disk Management).

See “Upgrade a dynamic disk group version” on page 176.
Note: FlashSnap is available only with the Enterprise edition. See the "Licensing" section in the Symantec Storage Foundation and High Availability Solutions Installation and Upgrade Guide for details.

For more information about FlashSnap,

Symantec Storage Foundation Volume Replicator option

Symantec Storage Foundation Volume Replicator also requires configuration steps to work properly.

See "Summary of the steps for setting up a disaster recovery solution with Volume Replicator" on page 526.

See also the SFW Solutions Guides and the Volume Replicator documentation set for further information.

Additional SFW HA options

If you are installing Symantec Storage Foundation and High Availability Solutions, there are additional options that are agents for working with VCS: the Symantec Cluster Server Agent for Microsoft Exchange Server, the Symantec Cluster Server Agent for Microsoft SQL Server, and the Symantec Cluster Server Agent for EMC SRDF. If you are using any of these products, you will want to license and install these agents.

Set desired preferences

This section describes some of the settings in SFW. Defaults are indicated where appropriate. Some settings require input before they are enabled.

This section covers the following topics:

- Hot relocation settings
- Event notification settings
- S.M.A.R.T. monitoring for a disk
- Capacity monitoring for volumes
- Task throttling
- Configuration task performance tuning
- Track alignment settings
Hot relocation settings

Hot relocation is an automatic process that relocates subdisks from a disk that has I/O errors. If there are I/O errors on a subdisk containing a redundant volume (RAID-5 or mirrored), the redundant volume’s subdisks are moved from the failed subdisk to a hot spare disk. If there is not enough free space on designated hot spare disks, then free space on any available disk will be used.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support Hot Relocation.

**Note:** Dynamic disks belonging to a SAN Disk Group do not support Hot Relocation.

The Undo Hot Relocation command can be used to move the subdisks back to their original location after the failed disk has been repaired or replaced.

More information about how hot relocation works is available. See “Hot relocation” on page 244.

The default for Symantec Storage Foundation for Windows is to have automatic hot relocation mode inactive. This means that if an I/O error occurs in a redundant subdisk, the subdisk is not automatically relocated to another disk. Use the Set Disk Usage command to designate preferred disks as targets for hot relocation.

The option to disable the hot relocation mode is available from the Control Panel. See “Hot relocation mode” on page 246.

Event notification settings

SFW provides event notification by SMTP email, by pager, and through SNMP traps that can be displayed in HP OpenView, CA Unicenter, and IBM Tivoli. You can configure the notification service to send messages to specific individuals, to groups, or to a management console in the case of SNMP traps. The event notification service is implemented through SFW’s Rule Management utility. If you want to set up event notification, you must use the Rule Management utility to set up rules that will send out notifications after certain events occur. You access the Rule Management utility through SFW’s Control Panel.

See “Event notification” on page 216.

The details of defining the rules for events are in the online Help in the module "Optional Rules for Handling Events." To invoke the online Help, choose Contents from the Help menu in SFW. In the tree view that comes up in the left pane, you will see the help module "Optional Rules for Handling Events."
S.M.A.R.T. monitoring for a disk

Self-Monitoring, Analysis and Reporting Technology (S.M.A.R.T.) is available on many new SCSI disks. S.M.A.R.T. provides a way for disks to self-check certain physical conditions that are useful predictors of disk failure and send an alert to the SFW Event Log when conditions indicate that a failure may occur soon. This allows the system administrator to take preventive action to protect the data on the disk.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support S.M.A.R.T. monitoring.

To receive alerts in the SFW Event Log, S.M.A.R.T. monitoring must be enabled for the global configuration and also on each disk you want checked. The default is to have S.M.A.R.T. monitoring disabled.

See “Disk monitoring” on page 220.

Capacity monitoring for volumes

Capacity monitoring is a feature that monitors the capacity of SFW dynamic volumes so that when used space on any volume reaches certain size thresholds, you are notified with an alert message. The purpose of capacity monitoring is to provide you with a warning when any dynamic volume has nearly reached full capacity. You can set up capacity monitoring for individual volumes or all volumes. Capacity monitoring is turned off by default. You can set individual volumes to grow automatically when a certain threshold is met.

See “Capacity monitoring” on page 222.

Task throttling

This feature lets you control how the system allocates CPU time between I/O and other tasks that must also be performed.

See “Task throttling” on page 115.

Configuration task performance tuning

Configuration task performance tuning lets you set the number of I/O threads to perform certain mirror-related operations, such as creating a mirror or adding a mirror.

See “Configuration task performance tuning” on page 116.
Track alignment settings

This feature lets you set dynamic volumes to always store blocks of data in alignment with the boundaries of the physical track of the disk. Aligning data so that it does not straddle a track boundary helps optimize I/O performance.

You can specify track alignment through the VEA GUI.
See “Track alignment” on page 117.
You can also specify track alignment through the CLI.
See “vxdisk” on page 576.

Protecting your SFW configuration with vxcb

To protect your SFW configuration (that is, the disk group and volume layouts), it is highly recommended that you perform periodic backups of the configuration, using the vxcb utility.

More information is available about configuration backup and vxcb.
See “Configuration backup” on page 105.
See “vxcb” on page 656.

Guidelines for running SFW

Once SFW is installed, the SFW service (vxsvc) always runs in the background. The client can be stopped and started when needed. To exit the client software, select Exit from the File menu or click the Close box.

If there are a lot of processes running on the server, you may want to close the SFW GUI to improve system performance. When you do so, the SFW service continues to run.

For troubleshooting purposes only, occasionally you may need to stop and restart the SFW service.

See “Starting and stopping the Symantec Storage Foundation for Windows Service” on page 283.
Using the GUI to manage your storage

This chapter includes the following topics:

- VEA Overview
- Systems perspective
- The disk view
- Search
- Assistant perspective
- Logs perspective
- Configuring SFW

VEA Overview

The Graphical User Interface (GUI) for Symantec Storage Foundation for Windows is known as the Veritas Enterprise Administrator (VEA).

The VEA console window provides a graphical way to view and manipulate all the storage objects in your system. The VEA GUI display for Symantec Storage Foundation for Windows storage objects is shown in the sample screen that follows. The VEA GUI console is shown below.
The VEA console display has the following features:

- Perspectives of the system
- A tree view displaying the storage objects in the left pane of the window
- Tabbed views in the right pane of the window containing additional information on the storage objects
- A menu bar, toolbar, and URL bar
- A lower pane containing information on processes initiated by the program or a listing of alert messages

**Viewing disks and volumes**

The VEA console is used to view disks and volumes and their relationship with each other.

**Viewing all disks associated with a volume**

All the disks associated with a volume can be accomplished with the following steps.
To view all disks associated with a volume

1. In the left pane, click the desired volume icon.
   If the volume icon is not displayed because the tree view is not fully expanded, click the plus sign in front of the nodes starting at the top of the tree. The Volumes icon appears under the StorageAgent node.

2. If necessary, in the right pane of the console window, select the Disks tab.
   The Disks tab view displays the disk or disks associated with a particular volume.

Viewing all volumes associated with a disk

All the volumes associated with a disk can be accomplished with the following steps.

To view all volumes associated with a disk

1. In the left pane, click the desired disk.
   If the disk icon is not displayed because the tree view is not fully expanded, click the plus sign in front of the nodes starting at the top of the tree. The Disks icon appears under the StorageAgent node.

2. If necessary, in the right pane of the console window, select the Volumes tab.
   The Volumes tab view displays all the volumes that are on that disk.

Storage Foundation general preferences

Storage Foundation General preferences are settings for displaying GUI features relating to SFW. To access these settings select Preferences from the VEA Tools menu. In the dialog box that appears, select the Storage Foundation General tab, as shown in the screen below.

The General tab is shown below.
Figure 3-2  Storage Foundation General tab

Check the settings desired and click Apply to enable the settings in the VEA GUI. Click OK to exit the dialog box. To make your selected settings appear in the VEA GUI, you may need to refresh the right pane. Click an object in the left pane to refresh the right pane.

The available settings are as follows:

- **Show inline disk view**: Allows the Disk View to be accessed as a tab in the right panel of the VEA GUI.
- **Show dialog top information panel**: Enables the display of helpful information at the top of certain dialogs.
- **Launch task dialogs as modal**: Task dialogs will be launched so that the task dialog is the only active window on the desktop.
- **Enable subdisk drag and drop**: Allows the drag and drop of subdisks to a different location on the same disk or to a different disk in the Disk View.
Show write cache enabled information

If SFW determines there is a write cache enabled disk, then this setting will enable the display of a message reminding the user about write cache enabled disks every time SFW is launched.

The URL bar

The URL bar, located above the tabs of the right pane, displays the selected object's location in the tree in a URL style. If you are connected to more than one host, you can click on the drop-down to select a different host.

The Toolbar

The Toolbar provides quick access to the program's most common tasks.

Figure 3-3 Toolbar

Table 3-1 Description of Toolbar Icons

<table>
<thead>
<tr>
<th>Icon</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="connect_icon.png" alt="Connect" /></td>
<td>Connect</td>
<td>Brings up the Connection dialog box.</td>
</tr>
<tr>
<td><img src="disconnect_icon.png" alt="Disconnect" /></td>
<td>Disconnect</td>
<td>Disconnects from selected machine.</td>
</tr>
<tr>
<td><img src="new_window_icon.png" alt="New Window" /></td>
<td>New Window</td>
<td>Opens a new window that displays the console.</td>
</tr>
<tr>
<td><img src="new_volume_icon.png" alt="New Volume" /></td>
<td>New Volume</td>
<td>Brings up the New Volume wizard.</td>
</tr>
<tr>
<td><img src="new_group_icon.png" alt="New Group" /></td>
<td>New Group</td>
<td>Brings up the New Dynamic Disk Group wizard.</td>
</tr>
<tr>
<td><img src="search_icon.png" alt="Search" /></td>
<td>Search</td>
<td>Searches by specific criteria for volumes, disks, or disk groups.</td>
</tr>
</tbody>
</table>
The Perspective bar

The Perspective bar located at the far left of the console, provides quick access to different perspectives (views) of the system that you are connected to. Clicking a perspective displays certain operations and objects of the system.

The perspectives are as follows:

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>System</td>
<td>Displays the objects, details of the objects, and status of the system.</td>
</tr>
<tr>
<td>Assistant</td>
<td>Provides shortcuts to perform common tasks on the objects of the system. This provides a task based approach to operations that can be performed on the system.</td>
</tr>
<tr>
<td>Logs</td>
<td>Displays the system's task and alert logs in the right pane. Clicking the Alert Log tab or the Task Log tab in the right pane displays the corresponding log entries.</td>
</tr>
<tr>
<td>Control Panel</td>
<td>Displays the tasks related to configuring the system. The Control Panel lets you access settings for Logs, Rule Management, Configuration Backup, Historical Statistics, SMTP Configuration, Task Settings, and Track Alignment.</td>
</tr>
</tbody>
</table>

The logs are as follows:

- The Task Log is a listing of tasks, such as formatting a volume or resynchronization of a volume. In SFW, the Task Log is not implemented.
- The Alert Log lists events and alerts pertaining to the Symantec Storage Foundation for Windows program.

See “Alert log” on page 214.

Systems perspective

The Systems perspective displays the SFW console and it consists of the following:

- See “The left pane” on page 76.
- See “The right pane” on page 80.
- See “The lower pane” on page 86.

The left pane

In the System perspective, the left pane shows a tree view of the system and storage objects detected by the Symantec Storage Foundation for Windows.
software. The tree view displays the hierarchical relationships of the objects. The node at the top of the tree represents the Symantec Storage Foundation for Windows client that you are connected to. In the screen below, the client is connected to "localhost." The objects under this node are the managed servers that the client is connected to and managing. In the screen below, there is only one managed server node, a server named "jktestmachine."

The left pane is shown below.

**Figure 3-4** Tree view of objects in left pane of VEA GUI

Below each managed server icon are the following object categories:
Default

- CD-ROMs
- Disk groups
- Disks
- Enclosures
- Saved Queries
- Volumes

Systems configured for support of Microsoft multipath input/output (Microsoft MPIO) solution

- DMPW DSMs

Systems running VSS-aware applications, such as Microsoft SQL Server

The tree view can be expanded by clicking on a plus sign (+) in front of an object icon. When the tree view is fully expanded, all the objects have a minus (-) sign in front of them. By clicking on a minus sign at any level, you can collapse an object down to that level. The fully collapsed tree shows only the top-level object.

Right-clicking on an object in the tree view brings up a context menu that is appropriate to that object.

The following is additional information about the storage object categories under each managed server node.

CD-ROMs

Any CD-ROM drives recognized by Symantec Storage Foundation for Windows as existing on the computer you are managing.

Disk groups

A disk group is a grouping of disks within Symantec Storage Foundation for Windows. The two types of disk groups are basic and dynamic.

See “Disk groups overview” on page 171.

Disks

Disks are physical disks or logical disks recognized by the Windows operating system.

Depending on the type of disk, a disk may be enabled to support thin provisioning and storage reclamation. Thin provisioning is a technology to efficiently allocate storage for a disk. Thin provisioning allocates physical storage only when actual data is written to the disk. Some disks that are enabled for thin provisioning also provide storage reclamation. Storage reclamation is the operation that decreases the physical storage allocation once data is deleted from the disk. A disk that supports thin provisioning is represented with a disk icon that includes a red colored sector. A disk that supports thin provisioning and storage reclamation is represented with a disk icon that includes a green colored sector with an asterisk (*).
<table>
<thead>
<tr>
<th>Enclosures</th>
<th>Enclosures are physical objects that contain one or more physical disks. For example, the disks may be contained in arrays or JBODs. Also the disks may be internal to your server.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saved Queries</td>
<td>Saved Queries refers to queries that were saved with the Search feature of SFW. If you saved queries with the Search feature, then this node would display the results of the saved query. See “Search” on page 93.</td>
</tr>
<tr>
<td>Volumes</td>
<td>A volume is a logical entity that is made up of portions of one or more physical disks. A volume can be formatted with a file system and can be accessed by a drive letter or a mount point. Symantec Storage Foundation for Windows works with basic and dynamic volumes. A volume may be either read only or read/write. The icons for read only volumes include a picture of a padlock to differentiate them from read/write volumes. Not all commands available in Symantec Storage Foundation for Windows for read/write volumes are enabled for read only volumes because specific commands require write access to the volume. Check the access mode of a particular volume if a command is not available.</td>
</tr>
<tr>
<td>DMPW DSMs</td>
<td>On servers that are configured for support of Microsoft multipath input/output (Microsoft MPIO) solution, a node for DMPW DSMs appears. Completely expanding the DMPW DSMs node displays DSM nodes being used, nodes of arrays being controlled by the DSM, and the disks contained in the array. These nodes let you manage the settings for the arrays and disks configured for Microsoft MPIO. See “DMPW overview” on page 425.</td>
</tr>
<tr>
<td>Applications</td>
<td>On servers that are running VSS-aware applications, such as Microsoft SQL Server, a node for Applications appears. SFW provides an option of taking snapshots with Volume Shadow Copy Service (VSS). The VSS snapshot method lets you take snapshots of VSS-aware applications, such as Microsoft SQL Server, while the application files are open. When VSS-aware applications do not exist, the snapshot is taken with the SFW FlashSnap method (VM method). See “Volume Shadow Copy Service (VSS)” on page 383. See “Using the VSS snapshot wizards with Microsoft SQL” on page 389.</td>
</tr>
</tbody>
</table>
On servers that are connected to an iSCSI SAN, the following nodes may appear:

- **iSCSI Initiators**
  This node displays information about the initiators and targets of the iSCSI SAN.

- **iSCSI Arrays**
  This node displays information about the Microsoft iSCSI Target subsystems of the iSCSI SAN.

- **iSNS**
  This node displays information about the iSNS Server of the iSCSI SAN.

See “Overview of iSCSI SAN support” on page 199.

### The right pane

In the System perspective, the right pane provides information on the various storage objects. The tabs available in this pane are determined by the object you have selected in the tree view in the left pane. In each tab view, you can right-click to get a context menu of commands available in that view. In every view, you can widen or narrow columns by placing the mouse pointer on the border between two columns in the header row and moving the mouse to the left or right while holding down the mouse button.

This section focuses on how information about disks and volumes managed by Symantec Storage Foundation for Windows displays in the right pane. It contains the following topics:

- Right-pane display for disks and volumes
- Disk view tab
- Right-pane legends
- Customizing the table headers

### Right-pane display for disks and volumes

This section describes how the tabbed views change, depending on the disk and volume storage objects you select.

---

**Note:** Disks that support thin provisioning are represented as follows:

Disks that support thin provisioning are represented with a disk icon that includes a red colored sector.
Disks that support thin provisioning and storage reclamation are represented with a disk icon that includes a green colored sector with an asterisk (*).

**Note:** Information about thin provisioned disks is not automatically updated in the VEA GUI. The information about thin provisioned disks can be updated by performing a Refresh operation.

**Selecting all disks**

In the tree view in the left pane of the VEA console, if you select all disks by clicking the Disks folder, the right-pane view displays tabbed views for Disks and Disk View. The Disks tab shows information about the disks available on the selected server, as shown in the sample screen below. The Disk View tab uses a graphical format to show information about the volumes contained on each disk. The Alerts tab displays information about alerts.

The Disks View is shown below.

**Selecting an individual disk**

If you select an individual disk in the tree view, you will see a display similar to the sample screen below. Notice that the tabs have now changed to Volumes, Disk Regions, Disk View, and Alerts. The Volumes tab gives information about the volumes on the selected disk.

The volumes of a disk are shown below.

**Figure 3-5** Right-pane information for a selected disk
Viewing subdisks

If you click the Disk Regions tab, you will see all the subdisks or parts of a volume that reside on the disk, as well as any free regions on that disk. In the screen below, there are eight subdisks.

Subdisk information is shown below.

Figure 3-6 Right-pane information for subdisks on a selected disk

Every volume has at least one subdisk. A striped volume has a minimum of two subdisks. A RAID-5 volume has a minimum of three subdisks. A mirrored volume has as many subdisks as there are mirrors, which are also called "plexes."

Note: There are no subdisk storage objects in the left-pane tree view. You must access the subdisks through the right pane. You will have to click an individual disk in the left pane to gain access to the Disk Regions tab.

Selecting volumes

If you select all volumes by highlighting the Volumes folder in the tree view, the right pane displays the tabs: Volumes, Disk View, and Alerts. When you select an individual dynamic volume in the tree view, you will see a right-pane view similar to the screen below. Notice how selecting an individual volume makes available many more tabbed views.

Volume information is shown below.
A dynamic volume has the following tabbed views:

<table>
<thead>
<tr>
<th>Tab</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disks</td>
<td>Displays information about the disks in the volume.</td>
</tr>
<tr>
<td>Mirrors</td>
<td>Details the mirrors in the volume.</td>
</tr>
<tr>
<td>Logs</td>
<td>Shows any logs that are added to a volume to increase the speed of</td>
</tr>
<tr>
<td></td>
<td>resynchronizing mirrored or RAID-5 volumes after disk failures.</td>
</tr>
<tr>
<td>Subdisks</td>
<td>Lists the subdisks associated with the volume. Subdisks are the basic</td>
</tr>
<tr>
<td></td>
<td>units in which SFW allocates disk space in a volume. Each subdisk represents</td>
</tr>
<tr>
<td></td>
<td>a specific portion of a volume on a dynamic disk. For example, a mirrored</td>
</tr>
<tr>
<td></td>
<td>volume with two mirrors (plexes) has two subdisks.</td>
</tr>
<tr>
<td>Snapshot Volumes</td>
<td>Gives information on snapshots, which are mirrored volumes that have</td>
</tr>
<tr>
<td></td>
<td>been broken off from their original volume for backup or other purposes.</td>
</tr>
<tr>
<td></td>
<td>This tab appears only when you have created snapshot volumes.</td>
</tr>
<tr>
<td>DCO</td>
<td>Provides information on the Disk Change Object (DCO) volumes that are</td>
</tr>
<tr>
<td></td>
<td>used with FastResync and also with FlashSnap.</td>
</tr>
<tr>
<td>Disk View</td>
<td>A detailed view of the disks associated with the volume.</td>
</tr>
<tr>
<td>Alerts</td>
<td>Displays information about alerts. This tab appears only when an event has</td>
</tr>
<tr>
<td></td>
<td>occurred that generates an alert.</td>
</tr>
</tbody>
</table>
A volume that is not dynamic, such as a partition on your C drive, will display only the Disks, Disk View, and Alert tabs.

**Disk view tab**

The Disk View tab displays a graphical layout of the disks on your system, including removable media. As with the tree view, right-clicking on an object or portion of the window relating to an object brings up a context menu that has commands related to the object.

The Disk View is shown below.

*Figure 3-8* Disk view tab

The Disk View is also available as a separate window.

See “The disk view” on page 86.

**Right-pane legends**

This section describes the two legends in the right pane, the disk usage legend and the Disk View legend.

**Disk usage legend**

The disk usage legend, located at the bottom of the right pane, is context sensitive and will change depending on the tab selected in the right pane. The legend shows either disk usage or the volume type.
When the Disks, Subdisks, or Disk Regions tab is selected, the disk usage legend shows how to interpret symbols showing the level of I/O activity (Normal, High, or Critical) in each area.

The disk usage legend is shown below.

**Figure 3-9** Disk usage legend

| Normal usage | High usage | Critical usage |

**Disk view legend**

The legend shown in the Disk View or with the Disk View tab selected shows the volume or partition type. The colors represent the following layout characteristics: concatenated, striped, RAID-5, primary partition, extended partition, free region, mirrored concatenated, mirrored striped, root, mixed, logical drive, and unknown.

The mixed type refers to a volume that has both concatenated and striped plexes because it has been modified by using the Dynamic Relayout feature.

See “Dynamic relayout” on page 253.

The disk view legend is shown below.

**Figure 3-10** Disk view legend

| Concatenated | Striped | RAID-5 | Primary partition | Extended partition | Free Region | Mirrored | Mirrored-striped | Logical drive | Unknown |

**Customizing the table headers**

The Customize Columns window lets you customize the table headers by changing which columns are shown and in what order.

**To customize the table headers**

1. Right-click the column header.
2. Select **Customize Table Header**. The Customizing Column Settings window appears.

   Headers of columns shown in the right pane of the console are shown on the right side of the dialog. The available headers are shown on the left side.

3. Make the desired changes to the column headers.

   The options are as follows:

   - To add a column header, select it in the **Available Columns** pane and click the **Add** button.
To remove a column header, select it in the **Selected Columns** pane and click the **Remove** button.

To rearrange the sequence of the headers, select the header you want to move in the **Selected Columns** pane and use the **Up** and **Down** buttons to move it within the list.

4 Click the **OK** button to apply the settings. The column headers displayed in the console are in the order you selected in the **Selected Columns** pane.

The lower pane

In this section of the System perspective, you can toggle the display by clicking on either the Console tab or the Tasks tab at the bottom left corner. The default Console tab display shows Symantec Storage Foundation for Windows alerts. The Tasks tab shows progress on Symantec Storage Foundation for Windows tasks, such as formatting a volume. The name of the selected managed server is displayed in the bottom center. This is helpful if you have connected to multiple servers with SFW.

The disk view

This section describes the Disk View.

Disk view overview

The Disk View can be accessed in two ways.

It can be accessed as follows:

- Select the Disk View tab in the right pane.
- Right-click an object (disk group, disk, or volume) in the tree view pane, and select Disk View from the context menu that appears.

The same commands are available in both views. The Disk View available from the tree view context menu opens a separate window that can remain open as you continue to work in Symantec Storage Foundation for Windows.

Additionally, you can use the Ctrl key to select only the specific objects (disks, volumes, or disk groups) you want to include in the separate disk view. This feature is helpful if you have a very large number of disks or volumes.

The commands in Disk View include Refresh View, Print, Show Legend, and four options for different views of the selected disks: Expand, Vol Details, Full Volume Display, and Projection. These commands are available from several different places.
From the Disk View tab in the right pane, right-click in an empty space (right-click any area of the pane where there is not a graphical representation of a disk), and a context menu containing the commands appears.

The disk view menu is shown below.

**Figure 3-11** Disk view menu

If you have created a separate window by selecting Disk View from the context menu, these commands can be accessed by right-clicking in an empty space (right-clicking on any area of the pane where there is not a graphical representation of a disk), by clicking the Options or File menu on the menu bar, or by clicking on icons on the toolbar.

**Refresh view**

The Refresh View command found in the Disk View menu will update the Disk View only and ensure that any recent changes are represented accurately.

**Show legend**

The legend is located at the bottom of the Disk View. The Show Legend command toggles the Disk View legend on and off. If you are working with a large number of disks, you may want to turn the legend off to gain additional space in the window. Each volume type or partition type is assigned a color. The legend shows the color-coding scheme. When the Vol Details command is selected, there is a colored bar across the top of each subdisk that indicates its volume type.

The disk view legend is shown below.

**Figure 3-12** Disk view legend
Print

The Print command sends your current Disk View display to a selected printer. It may be convenient to have a hard copy of your disk configuration, especially if you are working with a large number of disks.

The remaining items on the Disk View context menu: Expand, Vol Details, Full Volume Display, and Projection are discussed in the sections that follow.

Options for graphical views

There are four options for different views of the selected disks: Expand, Vol Details, Projection, and Full Volume Display. The table below shows the buttons available for these commands and for the print function. The toolbar containing these buttons is displayed only in the separate Disk View window and not in the Disk View in the right pane. However, in both versions of the Disk View, you can right-click an empty space (an area of the pane where there is not a graphical representation of a disk) to bring up a context menu with these options.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Meaning</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Expand Icon" /></td>
<td>Represents the Expand function in the Disk View.</td>
<td>Lets you view detailed information about disks and the organization of the data on the disks. If this icon is not checked, the view will be contracted to show less detail.</td>
</tr>
<tr>
<td><img src="image" alt="Vol Details Icon" /></td>
<td>Represents the Vol Details function in the Disk View.</td>
<td>Displays subdisks as partial volumes.</td>
</tr>
<tr>
<td><img src="image" alt="Projection Icon" /></td>
<td>Represents the Projection function in the Disk View.</td>
<td>Highlights objects associated with the selected subdisk or volume.</td>
</tr>
<tr>
<td><img src="image" alt="Print Icon" /></td>
<td>Represents the Print function in the Disk View.</td>
<td>Lets you print the contents of the current view.</td>
</tr>
</tbody>
</table>

Note: The Full Volume Display view, which displays more detailed information about subdisks, is not represented by an icon.
Expanded view

The subdisks can be viewed in either the expanded view or nonexpanded view. Each view gives different information. When Expand is checked in the Disk View menu, the expanded view is in effect. When it is not checked, the nonexpanded view displays.

Expanded view

The expanded view, shown below, shows the subdisk names and sizes, as well as the amount of free space remaining on the disk.

The expanded view is shown below.

Figure 3-13  Expanded view

Nonexpanded view

If the expanded view is not selected, a contracted disk view is shown. This nonexpanded view, shown below, lets you easily see the number of subdisks on each disk.

The nonexpanded view is shown below.
The Vol Details view adds information to either the expanded or nonexpanded view. This view is useful if you are looking at a large number of disks, because each disk takes less space than in the full volume display, so more disks can be displayed on the screen at once.

In the nonexpanded view, Vol Details shows a colored bar at the top of each subdisk that indicates its volume type. The legend at the bottom of the pane shows the color-coding scheme. The legend can be toggled on and off with the Show Legend command.

Additionally, in the expanded view, as shown below, Vol Details shows the volume name and drive letter associated with each subdisk.

The volume details view is shown below.
As shown below, Full Volume Display provides even more information about the subdisks. It is available only in the expanded view and only when the Vol Details option is selected. In addition to the volume name and type, Full Volume Display shows the volume size and status.

The full volume display is shown below.

**Figure 3-15** Volume details view

**Figure 3-16** Full volume display view
Projection

Projection highlights all the subdisks associated with a selected volume. After the Projection command is selected, click a subdisk. The selected subdisk becomes dark purple, and the other subdisks in that volume become a lighter purple. In the example below, the projection feature was turned on, and the subdisk named "Mirrored (F:)" on Harddisk3 was selected. That subdisk became dark purple, and the other mirror that is part of the volume "Mirrored (F:)" (located on Harddisk4) became a lighter purple. This feature can be useful for viewing a volume that is spread across several disks.

The Projection feature is shown below.

Figure 3-17  Projection feature

Context menu available from disk view

The context-sensitive menu of commands that is available by right-clicking on a volume or disk in the tree view is also available by right-clicking a subdisk or disk in the Disk View. Additionally, in the separate Disk View window, the context-sensitive commands are available on the Action menu.

Also, in Disk View you can drag and drop subdisks instead of using the Subdisk Move command (if drag and drop is enabled in the general preferences).
Search

The Search feature lets you find specific volumes, disks, or disk groups on a large system or to find a list of volumes, disks, or disk groups meeting specified criteria.

**Note:** Searches are case sensitive.

Conducting a search

The following describes the search procedure.

**To conduct a search**

1. Click the **Search** button on the VEA console toolbar or select **Tools>Search** from the menu bar to open the Search window.

2. Click the **New Query** tab to display the available search criteria.

3. Select the object type from the drop-down list to the right of the words "Look for:" (near the top left corner of the window). The choices are Volumes, Disks, or Disk Groups.
4 Select the attribute you want to search for. The available attributes depend on the object type.

<table>
<thead>
<tr>
<th>Attributes for Volume</th>
<th>Attributes for Disk</th>
<th>Attributes for Disk Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Name</td>
<td>Name</td>
</tr>
<tr>
<td>Volume Name</td>
<td>Disk Group Name</td>
<td>Imported</td>
</tr>
<tr>
<td>Disk Group Name</td>
<td>Status</td>
<td>Size</td>
</tr>
<tr>
<td>Status</td>
<td>Size</td>
<td>Free Space</td>
</tr>
<tr>
<td>Device</td>
<td>Free Space</td>
<td></td>
</tr>
<tr>
<td>FS Capacity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FS Label</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FS Free Space</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** "FS" means "File System."
5 Define the limiter you want to use.

Searches may be limited by the following options:

- **Any**: Finds all instances of the selected attribute.
  
  It is not necessary to enter more criteria in the text box below the limiter box. For example, searching Disk Groups for any Free Space will return all disk groups with free space available.

- **Contains**: Finds any of the selected attributes that contain the string that is entered in the text box below the limiter box.
  
  Contains acts as a wildcard (*) and will search for the string anywhere within a longer string. For example, searching Volumes for a name that contains "Stripe" will return all volumes that have the string "Stripe" anywhere in the volume name, including "Striped (H:\)" and "JKStriped (J:)". Because searches are case sensitive, "Stripe" will not find "A striped volume (L:\)."

- **Is**: Finds only an exact match with the string entered in the text box below the limiter box.
  
  It is useful for finding a specific volume, disk, or disk group on a very large system. For example, searching Disks for "Name is Harddisk1" will return Harddisk1. You must enter the exact information, including the drive letter or location for volumes.

- **Is not**: Excludes the specific information entered in the text box below the limiter box.
  
  For example, searching Volumes for "FS Type is not FAT32" will return all volumes that are not formatted as FAT32.

6 Enter the search string in the text box below the limiter box. Searches are not case sensitive.

7 Click the **Add** button to create the search term, which appears in the box to the right.

If more than one search term is defined, they will be joined by a logical "and" operator; that is, the result will contain all of the search terms. For example, a search for the terms "Volumes with Free Space" and "any NTFS Volumes" will result in a list of all volumes that both are formatted as NTFS and contain free space.

The logical "or" operator is not provided in this search function.

The **Remove** button can be used to delete a highlighted search term.

The **Save Query** button lets you save the query you created for future use.
Use the following steps to save a query:

Save query
- Click the Save Query button to open the Save Query window.
- Enter a name to identify the query you are saving.
- Enter a brief description of the search that the query performs.
- Check the Active checkbox if you want the results of the query displayed in the VEA console.
- Click OK to save the query.

8 Click the Search Now button to complete the search.
The search results will appear in the lower pane.
You can double-click a specific storage object (disk, volume, or disk group) in the search results to bring up the information in the VEA console.

9 If you would like to save the results of the search, click the Save Results button and the Save dialog box appears.
Do the following in the Save dialog box:

Save dialog
- Select the folder where you want to save the file.
- Enter a name for the file in the File name field.
- Click Save to save the file and close the dialog box. The file will save as a text file with a .txt extension.

10 Clicking the Clear All button will delete all the search terms and results. This allows for a new search.

Using saved queries
The following procedure describes the way to use saved queries.
To use saved queries:

1. Click the **Search** button on the VEA console toolbar, or select **Tools>Search** from the menu bar to open the Search window.

2. Click the **Saved Queries** tab in the Search window.

3. Select a previously saved query from the drop-down list to the right of the words "Query:" (near the top left corner of the window). The choices are all the previously saved queries.

   If a description of the query was saved with the query, it will be displayed in the Description message box.

4. Click the **Search Now** button to run the search.

   The search results will appear in the lower pane.

   You can double-click a specific storage object (disk, volume, or disk group) in the search results to bring up the information in the VEA console.

5. If you would like to save the results of the search, click the **Save Results** button.

   The Save dialog appears: Perform the following steps:
Save results

- Select the folder you want to save the file to.
- Enter a name for the file into the **File name** field.
- Click **Save** to save the file and close the dialog box. The file will save as a text file with a .txt extension.

6. Clicking the **Clear All** button will delete the search results and let you run another search.

**Creating search reports**

This section describes how to create reports from the results of the Search feature. Using the Search command, it is possible to generate a wide variety of reports that provide information on the disk groups, disks, and volumes on each server. The results of these searches can be saved and imported into Microsoft Excel or any other spreadsheet or database application that accepts tab-delimited text files. The results can be sorted, displayed as graphs or charts, and imported into written reports or PowerPoint presentations.

Search reports provide a snapshot of a system at a particular point in time. By running the same search on a regular schedule (monthly, annually, etc.), information can be collected, evaluated, and used to better manage the system.

The following sample report was created by using the Search feature and Microsoft Excel.

Determine the categories you want to include in your report, and use the Search feature to output the results to a text file.

The Search window is shown below.
This search lists the free space available on all the volumes located on the accessed server. After the search results are saved by using the Save Results button, a Microsoft Excel report can be generated.

An example report is shown below.

Follow these steps to generate the search report:

1. Open the Excel application.
2. Click File > Open to open the .txt file saved by the SFW search.
3. You will have to select All Files (*) from the Files of type drop-down menu. Navigate to the correct file and click the Open button.
4. Do the following in the Text Import wizard that appears:
Text Import Wizard

- Select the file type that best describes your data.
- Select Tab to be the delimiter.
- Select the General data format.
- Click **Finish** to complete your report in Excel.

Refer to the Microsoft Excel help for more information about the commands and features available in Excel.

**Types of search reports**

The type of search and search report you generate depends on the object type you base your search on.

<table>
<thead>
<tr>
<th>Table 3-4</th>
<th>Attributes Available for Volume, Disk, or Disk Group Search</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attributes for a Volume Search</strong></td>
<td><strong>Attributes for a Disk Search</strong></td>
</tr>
<tr>
<td>Name</td>
<td>Name</td>
</tr>
<tr>
<td>Volume Name</td>
<td>Disk Group Name</td>
</tr>
<tr>
<td>Disk Group Name</td>
<td>Status</td>
</tr>
<tr>
<td>Status</td>
<td>Size</td>
</tr>
<tr>
<td>Device</td>
<td>Free Space</td>
</tr>
<tr>
<td>FS Capacity</td>
<td></td>
</tr>
<tr>
<td>FS Label</td>
<td></td>
</tr>
<tr>
<td>FS Free Space</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** "FS" means "File System."

Each search is run only on the specific server selected. For convenience, you can write a macro to automate the Excel steps in the report. By opening the search text files from multiple servers in Excel and running the macro, you can generate a combined report for a group of servers. The table that follows lists some sample searches and the types of report that would be generated.
### Table 3-5  Sample Searches and Results

<table>
<thead>
<tr>
<th>Search</th>
<th>Criteria</th>
<th>Report Shows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td>FS Free Space, any</td>
<td>All volumes that contain free space</td>
</tr>
<tr>
<td>Volume</td>
<td>Status is degraded</td>
<td>Volumes whose state is degraded and that might fail soon</td>
</tr>
<tr>
<td>Disk</td>
<td>Size greater than 10 GB</td>
<td>All disks larger than 10 GB</td>
</tr>
<tr>
<td>Disk</td>
<td>Free Space greater than 1 GB</td>
<td>All disks with more than 1 GB of free space</td>
</tr>
<tr>
<td>Disk</td>
<td>Disk Group is DynGrp1</td>
<td>All disks in DynGrp1</td>
</tr>
<tr>
<td>Disk Group</td>
<td>Name, any</td>
<td>All disk groups. Useful to run the search on multiple servers</td>
</tr>
</tbody>
</table>

### Assistant perspective

The purpose of the Assistant is to make available the most commonly used commands in the program.

To access the Assistant, select Assistant in the Perspective Bar. Then select the object from the drop-down located on the left side of the window that you would like to perform tasks on. To perform tasks on disks, disk groups, and volumes select StorageAgent from the drop-down.

Command icons appear in the pane located on the right side of the window when StorageAgent is selected. Clicking a command icon launches the dialog for the command.

The Assistant perspective is shown below.
The type of commands displayed in the Assistant is controlled by selecting an object in the object pane and an activity in the activity pane located on the left side of the window. For example, selecting Disk in the object pane and Modify in the activity pane displays commands that pertain to modifying disks. Selecting All Objects in the object pane and selecting All Activities in the activity pane would display all the commands that are available in the Assistant.

**Logs perspective**

The Logs perspective displays Alert Log and Task Log messages associated with the SFW storage objects. Select the appropriate tab to access the log you are interested in.

See “Alert log” on page 214.

The Alert log is shown below.
Configuring SFW

Use the following to configure Symantec Storage Foundation.

Control Panel perspective

To access the Control Panel, select Control Panel in the Perspective bar. Expanding the tree view displays the system objects. Selecting one of the system objects displays the Control Panel objects for that system object in the right pane.

Like the Windows Control Panel, this Control Panel has icons that open up into windows with settings for various functions within the program.

Selecting localhost displays the following:

- See “Log settings” on page 105.
  The Log settings icon is shown below.

**Figure 3-22** Control panel for localhost

Selecting actionagent displays the following:

- See “Rule Manager” on page 105.

**Figure 3-23** Control panel for actionagent
Selecting StorageAgent displays the following:

- See “Configuration backup” on page 105.
- See “Historical statistics” on page 106.
- See “SMTP configuration” on page 106.
- See “System settings” on page 106.

System settings include the following:

- See “Hot relocation” on page 106.
- See “Snap Shot” on page 108.
- See “GUID recycle” on page 109.
- See “SCSI Support” on page 110.
- See “SmartMove” on page 112.
- See “Disk Management Snap-in” on page 113.

- See “Task settings” on page 115.

Task settings include the following:

- See “Task throttling” on page 115.
- See “Configuration task performance tuning” on page 116.

- See “Track alignment” on page 117.

To access any of these functions, double-click the appropriate icon in the Control Panel.

The Control Panel is shown below.

**Figure 3-24**  Control panel for StorageAgent
Log settings

Double-clicking the Log Settings icon brings up the Log Settings dialog box. This dialog box lets you set the maximum amount of storage used for the Alert Log and the Task Log.

The Alert Log lists events or alerts pertaining to the Symantec Storage Foundation for Windows program.

The Task Log is a listing of tasks, such as formatting a volume or resynchronizing a volume. The Task Log Settings window lets you set the maximum log size and to specify a policy when the maximum log size is reached.

See “Log configuration” on page 215.

Rule Manager

Double-clicking this icon brings up the Rule Manager window, that lets you configure rules for event notification messages and actions.

See “Event notification” on page 216.

Configuration backup

Double-clicking the Configuration Backup icon brings up the Configuration Backup window. Configuration Backup can preserve disk group, dynamic disk, and volume configuration information that can be used in the recovery of a disk.

More information about recovering a disk is available.

See “vxcbr” on page 656.

Configuration Backup only backs up the configuration of disk groups that are online. Any offline or deported disk groups are not processed by this operation.

Enter the following settings in the Configuration Backup window to back up the configuration of disk groups:

- **Automatic Checkbox**
  The following explains the Automatic Checkbox:

  Check the checkbox Back up operation runs every time that a configuration change occurs.

  Clear the checkbox Back up operation only runs when clicking OK.

- **Number of copies** The number of back up copies of the configuration to create. (Range of copies: 5-1024.)
- Number of minutes between backups
  The interval of time between back up copies, when Automatic is selected.
  (Range of minutes: 60 minutes - 10080 minutes (1 week).) This setting is ignored when Automatic is not selected.

- Directory for automatic backup
  The path of the target directory for the back up copies, when Automatic is selected.

- Directory for manual backup
  The path of the target directory for the back up copies, when Automatic is not selected.

Click OK when all the settings have been entered. (Clicking Reset before clicking OK recalls the previously saved settings.)

**Historical statistics**

Double-clicking the Historical Statistics icon brings up the Historical Statistics Settings dialog box. This dialog box lets you define the file size for the files that will be used for historical data collection. It also has a setting for the data collection rate.

See “Configuring settings in the historical statistics settings window” on page 315.

**SMTP configuration**

Double-clicking the SMTP Configuration icon brings up the SMTP Settings dialog box. This dialog box lets you define the IP address of the SMTP mail server on your network so that email notifications can be sent automatically. It also has settings for the port of the SMTP mail server and the email address that is used for sending email.

See “SMTP configuration for email notification” on page 231.

**System settings**

Double-clicking the System Settings icon brings up the System Settings dialog box. The dialog box lets you enable the hot relocation volume feature, set the volume snapshot method, set GUID recycling, set SCSI support, and enable SmartMove.

**Hot relocation**

Clicking the Hot Relocation tab brings up the Hot Relocation window. Check the Hot Relocation Mode checkbox to enable the feature. When a subdisk containing
a redundant volume fails, hot relocation automatically moves the redundant volume from the failed disk to hot spare disks, or to other free space if no space is available on hot spare disks.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support Hot Relocation.

**Note:** Dynamic disks belonging to a SAN Disk Group do not support Hot Relocation.

The Hot Relocation tab is shown below.

**Figure 3-25** Hot relocation tab

See “Hot relocation” on page 244.
Snap Shot

Clicking the Snap Shot tab brings up the Snap Shot window. Click VSS or VM to select the snapshot method to use for taking snapshots.

The Snap Shot tab is shown below.

**Figure 3-26** Snap Shot tab

VSS and VM snapshot methods offer the following:

- The VSS snapshot method lets you create copies of volumes for VSS-aware applications, such as Microsoft SQL Server. For VSS-aware applications, the VSS snapshot method quiesces the application before taking the snapshot. For applications that are not VSS-aware, the VSS snapshot method does not quiesce the application before taking the snapshot. The VSS snapshot only creates read only snapshots.
The VM snapshot method lets you create copies of volumes for any application. The copies may be either read only or read/write depending on the setting of the volume being copied. In other words, a snapshot of a read only volume results in a read only snapshot and a snapshot of a read/write volume results in a read/write snapshot.

GUID recycle

Clicking the GUID Recycle tab brings up the GUID Recycle window. The GUID Recycle tab is shown below.

Figure 3-27 GUID Recycle tab

A Globally Unique Identifier (GUID) is a Windows convention to identify components and objects in the system. In some environments, the number of
GUIDs in the system may exhaust the storage in the Windows registry. Enabling volume GUID recycling helps to avoid this situation by using GUIDs from a GUID recycle list. The GUID recycle list is a list of GUIDs that have been previously used, but are no longer needed by the system.

To enable GUID recycling, select Enable Volume GUID Recycling and the desired settings as follows:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUID recycling</td>
<td>Enables the monitoring of how many times a GUID from the GUID recycle list is used.</td>
</tr>
<tr>
<td>statistics</td>
<td></td>
</tr>
<tr>
<td>Check for duplicate GUIDs</td>
<td>Enables a check to see if a GUID selected from the GUID recycle list is already being used in the system.</td>
</tr>
<tr>
<td>Automatically fix duplicate GUIDs</td>
<td>Enables the generation of another GUID when a GUID is found to be already in use in the system.</td>
</tr>
</tbody>
</table>

**SCSI Support**

Clicking SCSI Support brings up the SCSI Support window.

The SCSI Support tab is shown below.
Click SCSI-2 support or SCSI-3 support to select the protocol setting to support your storage devices in a clustering environment (Microsoft Failover Clustering).

The following describes the setting for Windows Server operating systems:

- For Windows Server OS, SCSI-3 is the default setting when SFW support for the Microsoft Failover Clustering is installed.
  
  If SFW support for Microsoft Failover Clustering is not installed, SCSI-2 is the default setting.

Selecting SCSI-3 enables SFW clustering support to issue SCSI-3 commands to your SCSI-3 enabled storage devices. For this selection, setting the DMPW DSMs for SCSI-3 support has no effect.

More information about DMPW DSMs is available.
See “DMPW overview” on page 425.

Selecting SCSI-2 enables SFW clustering support to issue SCSI-2 commands to your storage devices. If your storage devices are enabled for SCSI-3 commands, the DMPW DSMs translate the SCSI-2 commands into SCSI-3 commands, if the DMPW DSMs setting for SCSI-3 support is enabled.

**Note:** The SCSI Support window in the SFW Control Panel does not enable/disable SCSI-3 support of DMPW DSMs.

More information about enabling SFW SCSI support for Microsoft Failover Clustering is available. See “Additional considerations for SFW Microsoft Failover Clustering support” on page 506.

**SmartMove**

Clicking the SmartMove tab brings up the SmartMove window. The SmartMove tab is shown below.
Check Enable SmartMove to enable the SmartMove setting to help reduce the resynchronization time for mirror operations and subdisk moves. SmartMove reduces the resynchronization time by using NTFS file system metadata to resynchronize only those regions that the NTFS file system uses. When SmartMove is not enabled, SFW resynchronizes all regions.

**Note:** SmartMove does not support non-NTFS disks.

**Disk Management Snap-in**

Clicking the Disk Management Snap-in tab brings up the Disk Management Snap-in window.
The Disk Management Snap-in tab is shown below.

**Figure 3-30** Disk Management Snap-in tab

Check Replace Disk Management Snap-in to replace the Disk Management Snap-in in the Windows Computer Management and Server Manager consoles with the SFW VEA GUI. The SFW VEA GUI becomes accessible in both the Windows Computer Management console and the Windows Server Manager console.

Uncheck Replace Disk Management Snap-in to access the Disk Management Snap-in in the Windows Computer Management and Server Manager consoles.

Also, in a similar way, the following commands can be used to make the Disk Management Snap-in or the SFW VEA GUI accessible in the Windows Computer Management and Server Manager consoles.
Replace Disk Management with VEA GUI

```bash
regsvr32 "%VMPATH%\extens.dll"
```

Enable Disk Management

```bash
regsvr32 /u "%VMPATH%\extens.dll"
```

Replace Disk Management with VEA GUI (silent mode)

```bash
regsvr32 /s "%VMPATH%\extens.dll"
```

Enable Disk Management (silent mode)

```bash
regsvr32 /s /u "%VMPATH%\extens.dll"
```

**Note:** Silent mode suppresses a Windows pop-up after the command is entered.

## Task settings

Double-clicking the Task Settings icon brings up the Task Settings dialog box. The dialog box lets you enable the task throttling feature and set the configuration task performance tuning feature.

### Task throttling

Clicking the Task Throttling tab brings up the Task Throttling window. Task throttling lets you determine the priority of certain tasks.

The Task throttling tab is shown below.
Using task throttling causes an operation to insert pauses for the specified amount of time during I/O. These pauses help to reduce any interference that may occur with the I/O of other applications running on the system. By selecting the Throttle all tasks checkbox, you apply the time delay that is specified in the text field to all Storage Foundation for Windows tasks. To apply the time delay to individual tasks, uncheck the checkbox, enter the number of milliseconds in each task’s text field, and click OK. Depending on your total system I/O activity, a time delay of 300 to 500 milliseconds may result in a favorable balance of I/O for Storage Foundation for Windows tasks and other applications. The Reset button restores default settings.

See “Configuration task performance tuning” on page 116.

### Configuration task performance tuning

Clicking the Configuration Task Performance Tuning tab brings up the Configuration Task Performance Tuning window.

The Configuration Task Performance Tuning tab is shown below.
Configuration task performance tuning lets you set the number of I/O threads to perform certain mirror-related operations, such as creating a mirror or adding a mirror. The performance of the operation is affected by the number of threads specified.

Storage migration tunables lets you optimize the storage migration performance:
See “About performance tunables for storage migration” on page 476.

**Track alignment**

Double-clicking the Track Alignment icon brings up the Track Alignment Settings dialog box.

This feature lets you set dynamic volumes to store blocks of data in alignment with the boundaries of the physical track of the disk. Storing data so that it is aligned with track boundaries helps optimize I/O performance. Check the Enable track alignment support checkbox to enable the feature for the arrays listed.

You may also check the Show Free Region checkbox to display additional region information in the Disk View GUI.

The Track alignment settings are shown below.
Arrays not explicitly listed can be enabled as Default. (SFW sets all arrays in the Default category a vendor ID of 'default' and a product ID of 'default'.) This setting may or may not optimize I/O performance for the array. Contact your array manufacturer for details about track alignment and offset values.

You can use the CLI command, `vxdisk set track` to adjust the setting for track alignment for arrays enabled as Default.

See “vxdisk” on page 576.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support track alignment.
Working with disks, partitions, and volumes

This chapter includes the following topics:

- Overview
- Adding storage
- Disk tasks
- General Partition/Volume tasks
- Basic disk and volume tasks
- Automatic discovery of SSD devices and manual classification as SSD
- Volume Manager space allocation is SSD aware

Overview

This chapter describes how to manage disks, partitions, and volumes.

Adding storage

This section describes the commands that are used in adding storage to your system.

- Add a new disk to your system
- Add a disk signature to a disk
- Add a disk to a dynamic disk group
- Create new volumes
Add a new disk to your system

Perform the following steps to add a new disk.

To add a new disk to your system

1. Install the new physical disk or disks.
2. From the Actions menu, select Rescan.
   
   See “Update disk information by using rescan” on page 125.

   On Windows Server operating systems, you also need to bring the disk online to make the disk accessible. To bring the basic disk back online, right-click the disk to bring up the context menu and select the Online command.
3. After the operation is finished, the VEA GUI displays current information.

   If Symantec Storage Foundation for Windows does not detect the new disk, you may need to restart.

   A brand new disk will have no signature or partition style. You can add a signature and partition style by using the WriteSignature command described in the next topic.

   More information about partition styles is available.

   See “What can you do with a basic disk?” on page 155.

   New disks are added to the computer as basic disks. You can upgrade new disks to dynamic disks at any time.

Add a disk signature to a disk

A new disk must have a signature on it before it can be used.

When you install a new disk and then do a Rescan, the new disk appears under the Disks icon. The disk will display with the words "(No Signature)" in the tree view. If left unsigned, the disk cannot be used.

Once you bring the disk online and a signature is added to it, the disk displays as a basic disk. You can create partitions on the basic disk, or you can upgrade the disk to dynamic to let you create dynamic volumes on it.

For earlier version of Volume Manager, the command Upgrade a Dynamic Disk was used to change a basic disk to a dynamic disk. For later versions of the program, use the command Add Disk to Dynamic disk group to change a basic disk to a dynamic disk.

See “Add a disk to a dynamic disk group” on page 121.

You can also make a basic disk into a dynamic disk by including it as a member disk when creating a new disk group with the New Dynamic disk group command.
See “Create dynamic disk groups” on page 47.

To add a signature to a disk

1. To add a signature, first you need to bring the disk online. To do this, right-click the unsigned disk, and then select Online Disk.

2. Right-click the disk again, and then select Write Signature from the context menu.

   The Write Disk Signature dialog box appears. Select the disks you want to add a signature to.

   To select a disk, click on it in the list of available disks and click the Add button. To select all the disks, click the Add All button.

   To remove a disk from the Selected disks list, select the disk in the Selected disks list and click the Remove button. To remove all the disks from the Selected disks list, click the Remove All button.

3. Select the partition style of the disk by clicking the radio button for one of the following:

   - MBR (Master Boot Record)
   - GPT (GUID Partition Table)

   For more information on both partition styles, refer to the Microsoft documentation.

4. Once you have selected the disks and style, click the OK button. Click the Cancel button to exit without adding a signature to the disk or disks selected.

Add a disk to a dynamic disk group

If you want to add more disks to a dynamic disk group after the group is created, use the Add Disk to Dynamic disk group command. You can also use this command to first create a new dynamic disk group and then specify the disks to be added to it.

To add a disk to a dynamic disk group

1. Right-click a basic disk in the tree view or the Disk View tab in the right pane, and then select Add Disk to Dynamic Disk Group.

2. The Add Disk to Dynamic disk group wizard appears. Click Next to continue.
In the next screen, select one or more disks and the dynamic disk group you want to add them to.

Optionally, check the **Disk names prefix** checkbox and enter a disk name prefix to give the disks in the disk group a specific identifier.

This identifier precedes a system-generated numeric ID that SFW uses to distinguish the disks in the disk group.

For example, entering TestGroup as the prefix for a disk group that contains three disks creates TestGroup1, TestGroup2, and TestGroup3 as internal names for the disks in the disk group.

Click **Next** to continue.

If you want to create a new dynamic disk group to add the disk to, click the **New dynamic disk group** button. The New dynamic disk group window appears to let you indicate the disk group name and characteristics.

Details on the options for creating a disk group is available in the procedure on creating a dynamic disk group.

A confirmation screen appears listing the selected disk or disks. Click **Next** to continue if you are satisfied with the selections, or choose **Back** to go back to modify your disk selection.

For each disk, information is provided on whether it contains volumes and whether it will be updated. If it is not going to be updated, you will want to modify the selection.

Click **Finish** in the final screen.

You could also create a new disk group for the new storage.

See “Create dynamic disk groups” on page 47.

You can also remove a disk from a disk group.

See “Remove a disk from a dynamic disk group” on page 123.

Create new volumes

At this point, you are ready to create new volumes on the storage.

See “Create dynamic volumes” on page 52.

**Disk tasks**

This section describes commands that deal with disk changes and maintenance.

The following topics are covered in this section:
Remove a disk from a dynamic disk group
Remove a disk from the computer
Offline a disk
Update disk information by using rescan
Set disk usage
Evacuate disk
Replace disk
Changing the internal name of a disk
Renaming an enclosure
Work with removable media
View disk properties

See also the following related topics:
See “Add a new disk to your system” on page 120.
See “Add a disk signature to a disk” on page 120.
See “Disk monitoring” on page 220.
See “Merge foreign disk command” on page 276.

Remove a disk from a dynamic disk group

In the process of adding new storage, you may want to rearrange your disks in your existing disk groups. You can remove a dynamic disk from a dynamic disk group if there are no volumes on the disk. If volumes exist, you must delete them before you can remove the disk. Disks shown in Symantec Storage Foundation for Windows to be Unreadable or Foreign can be removed, but doing so causes you to lose all existing data on the disk that is removed from the group. If a disk has failed and is marked as Missing, you can also remove it from the dynamic disk group. However, you cannot remove the last disk from a disk group that is a Microsoft Failover Clustering resource.

To remove a disk from a dynamic disk group, use the Remove Disk from Dynamic disk group command. Once you remove all the disks from a dynamic disk group, the disk group is removed from the GUI and the disks become basic disks.

---

**Warning:** Removing a disk that is Unreadable or Foreign from a dynamic disk group changes the disk into a basic disk and all of its data is lost.
To remove a disk from a dynamic disk group

1. Select the disk of the dynamic disk group and select **Remove Disk from Dynamic Disk Group**.

2. Make sure the disk or disks that you want to remove are showing in the right pane of the window.
   
   Click **OK** to complete the operation.

**Remove a disk from the computer**

This section has information on removing a basic or dynamic disk from a computer.

**Identifying a physical disk**

To identify a physical disk that is represented by a disk that appears in the VEA GUI, use the Ping Disk command. This command flashes the fault light that is built into the housing of the physical disk. The command flashes the fault light until you stop the command. This is a very convenient feature when trying to identify a particular physical disk among many others.

---

**Note**: Dynamic disks belonging to a Microsoft Disk Management disk group do not support the Ping Disk command.

---

**To identify a physical disk**

1. Right-click the selected disk and select **Ping Disk** from the context menu.

2. In the screen that appears, click **Start** to begin pinging the physical disk. The fault light flashes until you click **Stop**.

3. Click **Close** when you are finished using the command.

**Basic disk**

If you remove a basic disk from the computer and then do a rescan, the disk and its volumes will no longer show up in the GUI.

**Dynamic disk**

If the status of a dynamic disk remains Offline and Missing and you determine that the disk has a problem that cannot be repaired, you can remove the disk from the system by using the Remove Disk from Dynamic disk group command.

However, before you can remove the disk, you must delete all volumes on the disk. You can save any mirrored volumes on the disk by removing the mirror that is
on the Missing disk instead of the entire volume. Deleting a volume destroys the data in the volume, so you should remove a disk only if you are absolutely certain that the disk is permanently damaged and unusable.

If a disk is marked Missing and is not connected to the computer, you can use the Remove Disk from Dynamic disk group command without worrying about the data.

Once you have removed the disk from the disk group, the disk becomes a basic disk and it can then be removed from the computer. Complete the process by doing a rescan.

See “Remove a disk from a dynamic disk group” on page 123.

---

**Note:** If you have a disk that appears to be deteriorating because it has many errors, you can easily move the data from that disk to another disk by using SFW’s Move Subdisk command.

---

See “Moving subdisks” on page 325.

**Offline a disk**

On Windows Server operating systems, a basic disk can be taken offline for maintenance by using the Offline command.

Right-click a basic disk in the GUI to bring up a context menu and select the Offline command.

Use the Online command to bring the basic disk back online.

Right-click the basic disk to bring up the context menu and select the Online command.

---

**Note:** Dynamic disks belonging to a Microsoft Disk Management disk group do not support the Offline command. However, the Online command can be used on dynamic disks belonging to a Microsoft Disk Management disk group.

---

**Update disk information by using rescan**

When Symantec Storage Foundation for Windows rescans disks, it scans all disks for disk configuration changes. It also updates information about CD-ROM drives and other removable media, basic volumes, file systems, and drive letters.

Rescanning disks can take several minutes, depending on the number of hardware devices installed.
Note the following:

- You should rescan disks when you remove disks from or add disks to a computer.
- From the Actions menu, select Rescan.
  If you click the Tasks tab at the lower left corner of the VEA window, information on the progress of the rescan will display in the window’s lower pane.
  More information is available.
  See “Additional important information about the rescan command” on page 275.

**Note:** The Rescan command is only effective on the StorageAgent node and any of its sub-nodes.

### Set disk usage

This command lets you make settings for the hot relocation function, including making a disk a hot spare.

**Note:** Dynamic disks belonging to a Microsoft Disk Management disk group do not support setting disk usage.

**Note:** Dynamic disks belonging to a SAN disk group do not support setting disk usage.

It is described in detail in the section about Hot Relocation.

See “Hot relocation” on page 244.

### Evacuate disk

The Evacuate Disk command moves the entire contents of a healthy disk to the free space on another dynamic disk. Even if there is a failed volume on the original disk, the volume is moved successfully.

**Note:** Dynamic disks belonging to a Microsoft Disk Management disk group do not support the Evacuate Disk command.
To evacuate a disk

1. Select the disk to evacuate. 
   Right-click the disk.
2. Select **Evacuate Disk**.
3. The Evacuate Disk dialog will appear. Select either **Auto Assign destination disk** or **Manually assign destination disk**. If you chose **Manually assign destination disk**, assign the destination disk by selecting one disk from the display.
   You may also check **Disable Track Alignment** to disable track alignment on the destination disk.
4. Click **OK** to evacuate the disk.

Replace disk

Disks most often need replacing when they fail or start to behave strangely. A failed dynamic disk can be replaced by an empty basic disk. The volume configuration will be recreated on the new disk. Active redundant volumes (mirrored and RAID-5) on the replaced disk will be resynchronized automatically after disk replacement.

Failed volumes on the replaced disk, however, will stay failed after disk replacement because no valid data is available for copy.

The disk replacement procedure can be performed only on a disk that has failed. The VEA console identifies the disk by renaming it "Missing Disk." If the disk replacement is successful, the replacement disk will take on the attributes of the failed disk, including the disk name.

**Note:** This option is available only on Missing Disks.

If the original disk is returned to the system after it was replaced, it will show in the VEA console as a foreign disk and a disk group called Unknown Dg will be created. Use the Merge Foreign Disk command to return the disk to the same dynamic disk group it was in before.

See “Merge foreign disk command” on page 276.

**Note:** Dynamic disks belonging to a Microsoft Disk Management disk group do not support the Replace Disk command.
To replace a disk
1 Right-click the Missing Disk.
2 Select Replace Disk.
   A dialog box appears containing a list of empty basic disks.
3 Select the disk you want to use to replace the Missing Disk.
4 Click OK to perform the disk replacement.

Changing the internal name of a disk
You can change the internal name of a disk with the VEA GUI to make it easier to identify.
The internal name of a disk can also be changed with the vxedit CLI command.
See “vxedit” on page 635.

Note: Dynamic disks belonging to a Microsoft Disk Management disk group do not support changing the internal name of a disk.

To change the internal name of a disk
1 Expand the Disks node in the tree view.
2 Right-click the desired disk node.
3 Select Change Disk Internal Name from the context menu.
   A dialog box appears to rename the disk.
4 Enter the new internal name of the disk.
5 Click OK to complete the operation.

Renaming an enclosure
You can rename an enclosure with the VEA GUI to make it easier to identify.
An enclosure can also be renamed with the vxedit CLI command.
See “vxedit” on page 635.
SFW provides an enclosure node in the tree view to represent the enclosure for the internal disks of your server. This enclosure cannot be renamed.
Renaming an enclosure in a cluster environment only renames the enclosure on the node that the rename operation occurs. You need to rename the enclosure on
each of the other nodes in the cluster to maintain the same enclosure name throughout the cluster.

To rename an enclosure
1. Expand the Enclosures node in the tree view.
2. Right-click the desired enclosure node.
3. Select Rename Enclosure from the context menu.
   A dialog box appears to rename the enclosure.
4. Enter the new name of the enclosure.
5. Click OK to complete the operation.

Work with removable media
Removable media include CD-ROM disks and other removable disks, such as Zip disks. There are a limited number of actions you can do in Symantec Storage Foundation for Windows for removable disks.

You can perform the following actions:
- You can create only one primary partition on removable-media devices. You cannot create extended partitions, logical drives, or dynamic volumes on removable-media devices. The primary partition must use up all unallocated space on the removable disk.
- You cannot upgrade removable-media devices to dynamic volumes.
- Removable-media devices can be formatted as FAT, FAT32, or NTFS.
- You cannot mark the primary partition on a removable-media device as active.
- You cannot delete the primary partition on a removable-media device.
- The Eject command lets you eject a removable-media disk through the software rather than by a manual ejection mechanism.

Working with disks that support thin provisioning
Thin provisioning is a technology to allocate disk storage on an as needed basis. Disks that support thin provisioning are disks that can allocate storage as data is written to the disk. In addition, some of these disks can reclaim unused storage on the disk.

Disks that support thin provisioning have the following characteristics:
- Disk storage allocated as data is written to the disk.
Unused storage may be reclaimed to minimize the amount of unused space on the disk.

**Note:** Not all disk vendors support storage reclamation. Disks that support both thin provisioning and storage reclamation are represented in the VEA GUI as a disk with a green colored sector with an asterisk (*). Disks that support only thin provisioning are represented in the VEA GUI as a disk with a red colored sector.

Reclaiming storage space from thin provisioned disks can be done for disk groups, disks, or volumes. The table briefly describes SFW wizards and CLI commands that support reclaiming unused storage.

<table>
<thead>
<tr>
<th>Wizard</th>
<th>CLI Command</th>
<th>Description of Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk group Reclaim Wizard</td>
<td>vxdg reclaim</td>
<td>This wizard and CLI command can reclaim unused storage from volumes and disks that reside in the disk group. Each can be set up to reclaim storage space from volumes; to reclaim free space from disks; or to reclaim from both volumes and disks that reside in the disk group.</td>
</tr>
<tr>
<td>Disk Reclaim Wizard</td>
<td>vxdisk reclaim</td>
<td>This wizard and CLI command can reclaim unused storage from a disk.</td>
</tr>
<tr>
<td>Volume Reclaim Wizard</td>
<td>vxvol reclaim</td>
<td>This wizard and CLI command can reclaim unused storage from a volume.</td>
</tr>
</tbody>
</table>

The timeout value for the reclaim I/O operations is set to 30 seconds by default. However depending on the configuration, the storage reclaim operation may sometimes take a significant amount of time to complete.

To avoid the reclaim I/O failures due to timeout errors, you can change the reclaim I/O timeout value by adjusting the following registry tunable parameter:

```
HKEY_LOCAL_MACHINE\SOFTWARE\VERITAS\VxSvc\CurrentVersion\VolumeManager\MaxReclaimIOTimeOut
```

Thin provisioning reclaim operation is blocked on the following SFW volumes:

- RAID-5, DCO, or Volume Replicator DCM volumes
- Non NTFS volumes
- It is configured for a cow snapshot
- It is a snapshot volume
- It has snapshots

**Note:** The reclaim storage operation is disabled during a shrink volume operation. The reclaim storage operation is enabled when the shrink volume operation has completed.

### View disk properties

Right-click a disk and select Properties from the context menu. The categories for the properties of a disk can differ, depending on whether the disk is basic or dynamic and whether it is directed or part of an array.

The screen that follows shows an example of a Properties window for a dynamic disk.
Figure 4-1  Disk Properties

[Image of Disk Properties window showing various disk properties such as Internal name, Types, Style, Status, Capacity, Unallocated space, Device type, Hardware vendor, Adapter name, Spares, Reserved, Hot spare, Write cache enabled, Track alignment enabled, Track size, and vendor-specific information such as Vendor ID, Product ID, Cabinet Serial Number, Revision ID, Array Volume ID, Array LUN Type, Array RAID Level, Array Port WWPN, Array Port Serial Number, Array Controller ID, and Serial Number with SiteName as Site2.]
The categories in the sample screen are described in the table that follows.

**Table 4-2** Disk Properties Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Name</td>
<td>The name of the hard disk is shown at the top of the window.</td>
</tr>
<tr>
<td>Type</td>
<td>Fields are Basic and Dynamic.</td>
</tr>
<tr>
<td>Style</td>
<td>Refers to a partition style. The two categories are Master Boot Record (MBR) and GUID Partition Table (GPT).</td>
</tr>
<tr>
<td>Status</td>
<td>Fields are Imported and Deported.</td>
</tr>
<tr>
<td>Capacity</td>
<td>Size in Sectors, KB, MB, GB, TB.</td>
</tr>
<tr>
<td>Unallocated space</td>
<td>Amount of free space that is available to create a partition or volume.</td>
</tr>
<tr>
<td>Thin Type</td>
<td>Indicates the type of thin provisioned disk, Thin or Thin Reclaim.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> For thin provisioned disks only.</td>
</tr>
<tr>
<td>Provisioned size</td>
<td>Current amount of storage allocated to the disk that supports thin provisioning.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> For Thin Reclaim provisioned disks only. Not all disks that are enabled for thin provisioning provide the provisioned size value.</td>
</tr>
<tr>
<td>Allocation unit size</td>
<td>Minimum amount of storage that is added to a thin provisioned disk to meet current storage requirements.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> For Thin Reclaim provisioned disks only.</td>
</tr>
<tr>
<td>Device type</td>
<td>The Device type category includes SCSI, Fibre, and some other less commonly used types. If a controller card is involved, gives port, channel, target, and LUN information.</td>
</tr>
<tr>
<td>Hardware vendor</td>
<td>Vendor information from the disk itself.</td>
</tr>
<tr>
<td>Adapter name</td>
<td>Gives information on the host bus adapter.</td>
</tr>
<tr>
<td>Spare</td>
<td>Indicates whether the disk is a preferred hot relocation target.</td>
</tr>
<tr>
<td>Reserved</td>
<td>Indicates whether the disk is reserved—that is, excluded from use in automatic selection operations.</td>
</tr>
<tr>
<td>Hot use</td>
<td>Indicates whether the disk can be used to receive volumes from the hot relocation procedure.</td>
</tr>
<tr>
<td>Write cache enabled</td>
<td>Indicates whether the write cache is enabled.</td>
</tr>
</tbody>
</table>
### Table 4-2: Disk Properties Categories (continued)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCSI-3 Reserved</td>
<td>Indicates whether the disk is enabled for SCSI-3 reservations.</td>
</tr>
<tr>
<td>Track alignment enabled</td>
<td>Indicates whether the disk is enabled for track alignment.</td>
</tr>
<tr>
<td>Track size</td>
<td>Indicates the size of a track on the disk.</td>
</tr>
<tr>
<td>Comment</td>
<td>User defined comment.</td>
</tr>
<tr>
<td>SiteName</td>
<td>If disk is site tagged to a host, then the name of the site is displayed to which it is added.</td>
</tr>
</tbody>
</table>

**Note:** Dynamic disks belonging to a Microsoft Disk Management disk group do not support disk comments.

You can also view disk characteristics through the Disk View in the GUI and through the GUI's right-pane view.

See “The disk view” on page 86.

### Veritas Disk ID (VDID)

The Veritas Disk ID (VDID) is a string that contains information that can identify the array that a disk is contained in. The VDID string is shown in the GUI as a part of the display of information for disks. The VDID string is also shown as a result of the `vxdisk diskinfo` and the `vxdisk list` CLI commands.

The format of the VDID string varies by array manufacturer and array model. The details of how to interpret the VDID string for a particular array are in an appendix.

See “Format of VDID strings for disks belonging to various arrays” on page 685.

### General Partition/Volume tasks

This section describes the following general partition and volume tasks:

- Delete a volume
- Delete a partition or logical drive
- Shredding a volume
- Refresh drive letter, file system, and partition or volume information
Renaming a mirror (plex)
- Changing the internal name of a volume
- Mount a volume at an empty folder (Drive path)
- View all drive paths
- Format a partition or volume with the file system command
- Cancel format
- Change file system options on a partition or volume
- Set a volume to read only
- Check partition or volume properties
- Expand a dynamic volume
- Expand a partition

See also the following related topics:
- See “Create dynamic volumes” on page 52.
- See “Create primary and extended partitions” on page 156.
- See “New logical drives” on page 161.
- See “Subdisk move, split, and join” on page 321.
- See “Set up a dynamic boot and system volume (Optional)” on page 62.

For troubleshooting volumes, see the following topics:
- See “Bring a basic volume back to a healthy state” on page 270.
- See “Bring a dynamic volume back to a healthy state” on page 270.

Delete a volume

Perform the following steps to delete a volume.

**Warning:** All data in the volume will be lost when you delete it. Make sure that the information has been backed up onto another storage medium and verified, or that it is no longer needed.
To delete a volume

1. Select the designated volume.
   Select **Delete Volume**.

2. You are prompted for verification. Click **Yes** to delete or **No** to cancel. The volume is removed immediately if you click **Yes**.

Delete a partition or logical drive

Perform the following steps to delete a partition or logical drive.

**Warning:** All data in the partition or logical drive will be lost when you delete it. Make sure that the information has been backed up onto another storage medium and verified, or that it is no longer needed.

To delete a primary partition, an extended partition, or a logical drive

1. Select the partition or logical drive you want to delete and choose the command to delete the partition or logical drive from the context menu.

2. You are prompted for verification. Click **Yes** to delete or **No** to cancel. The partition or logical drive is removed immediately if you click **Yes**.
   
   Note that you cannot delete a partition with the system files (the boot volume).

Shredding a volume

Shredding a volume destroys the data stored on a volume by overwriting the volume with a digital pattern.

SFW provides the following methods for overwriting the volume:

1 Pass algorithm
   Overwrites the volume with a pattern of zeroes.

3 Pass algorithm
   The volume is overwritten a total of 3 times. The volume is first overwritten with a pre-selected digital pattern, then overwritten with the binary complement of the pattern. In the last pass, the volume is overwritten with a randomly selected digital pattern. This 3 pass approach is based on the specifications in the US Department of Defense standard 5220.22-M (3).

7 Pass algorithm
   The volume is overwritten a total of 7 times. Each pass consists of overwriting the volume with a randomly selected digital pattern or with the binary complement of the previous pattern. This 7 pass approach is based on the specifications in the US Department of Defense standard 5200.28-STD (7).
**Warning:** Operations performed on logs will be done on the volumes that they are associated with. All data in the volume will be lost when you shred it. Make sure that the information has been backed up onto another storage medium and verified, or that it is no longer needed.

**Note:** Dynamic disks belonging to a Microsoft Disk Management disk group do not support the Shred Volume command.

**To shred a volume**

1. Right-click the designated volume in the VEA GUI and select **Shred Volume**.
2. Select the method to shred the volume and click **OK** to continue.

![Shred Volume dialog box]

3. In the confirmation dialog box, click **Yes** to confirm the operation.
   The volume is entirely overwritten and removed immediately when the operation has completed.

**Refresh drive letter, file system, and partition or volume information**

To refresh, perform the following steps:
To refresh drive letter, file system, and partition or volume

1  To refresh system information, select **Refresh** from the **Actions** menu.

   The command refreshes drive letter, file system, volume, and removable-media information on the current computer. It also checks to see whether previously unreadable volumes are now readable. It may not pick up disk changes that occurred since the last restart or rescan if there was no I/O occurring on the changed disk.

2  Click the **Tasks** tab in the lower pane to see a progress bar that displays the percentage of completion for the refresh process.

**Note:** The Refresh command is only effective on the StorageAgent node and any of its sub-nodes.

Add, change, or remove a drive letter or path

You cannot change the drive letter or path of the active volume (the computer’s boot volume). In previous versions of Volume Manager for Windows, the command **Change Drive Letter and Path** was on the context menu for a volume or partition. Now it is a subcommand under the **File System** command that is on the volume or partition context menu.

Consider the following:

- If you try to assign a drive letter to a volume that is in use, a dialog box will ask you whether you want to forcibly reassign the drive letter. You can click Yes to do so.

- If you want to modify an existing drive path, you will not be able to do so in this window. You have to remove the drive path and recreate it. Select the **Remove** option. Then you have to invoke the command again to recreate the drive path with the Add button.

**Warning:** Changing the drive letter or path of a partition or volume may cause programs installed on that partition or volume to no longer run.
To add, change, or remove a drive letter or path

1 Right-click the designated partition or volume and on the context menu, select **File System > Change Drive Letter and Path**.

The Drive Letter and Paths screen appears.

2 Select **Add**, **Modify**, or **Remove**, depending on what you want to do. Choose from the following:
   - If a partition or volume does not have a drive letter or path, select **Add**.
   - If you want to change an existing drive letter or path, select **Modify**.
   - If you want to remove a drive letter or drive path, select **Remove**.

3 Select **Add** to add a drive letter or path to a partition or volume.

You can select **Assign a drive letter** or **Mount as an empty NTFS folder**. Choose from the following:
   - The **Assign a drive letter** option lets you select a drive letter from the drop-down list. Click **OK** to assign the drive letter after you have made your selection.
   - The **Mount as an empty NTFS folder** option lets you specify the folder. To specify the folder, click the **Browse** button.
The Browse for drive path window appears:
Navigate to an existing folder or create a new folder by using the **New folder** button. Click **OK** to mount the volume.
Details on mounting a volume at an empty folder is available.
See “Mount a volume at an empty folder (Drive path)” on page 141.

4 Select **Modify** to modify the drive letter. The **Assign a drive letter** box lets you specify the drive letter. Select a new drive letter from the drop-down list, and click **OK** to assign the drive letter.

5 Select **Remove** to remove a drive letter. Click **OK** to continue.

Click **Yes** in the confirmation screen that appears to complete the operation.

### Renaming a mirror (plex)
You can change the name of a mirror to make it easier to identify.
The name of a mirror (plex) can also be changed with the vxedit CLI command.
See “vxedit” on page 635.

**Note:** Dynamic disks belonging to a Microsoft Disk Management disk group do not support the Rename Plex command.

#### To change the name of a mirror
1 Expand the Volumes node in the tree view.
2 Select the desired volume that contains the mirror that you want to rename.
3 Click the **Mirrors** tab in the right pane of the VEA GUI.
4 Select the desired mirror and select **Rename Plex** from the context menu.
   A dialog box appears to rename the mirror (plex).
5 Enter the new name of the mirror (plex).
6 Click **OK** to complete the operation.

### Changing the internal name of a volume
You can change the internal name of a volume to make it easier to identify.
The internal name of a volume can also be changed with the **vxedit** CLI command.
See “vxedit” on page 635.
Note: Dynamic disks belonging to a Microsoft Disk Management disk group do not support changing the internal name of a volume.

To change the internal name of a volume

1. Expand the Volumes node in the tree view.
2. Right-click the desired volume node.
3. Select Change Volume Internal Name from the context menu.

   A dialog box appears to rename the volume.
4. Enter the new internal name of the volume.
5. Click OK to complete the operation.

Mount a volume at an empty folder (Drive path)

Symantec Storage Foundation for Windows lets you mount a volume at any empty folder on a local NTFS volume. SFW assigns a drive path to the volume rather than a drive letter. Drive paths are useful because they eliminate the 24-drive-letter limit on hard-disk volume names. (Drive letters A and B are reserved for floppy drives.) The volume can be a partition, a logical drive that was created in Disk Administrator, or a dynamic volume.

For example, you can mount the C:\Temp folder as another drive to provide additional disk space for temporary files.

The only restrictions are that the folder you mount the volume to must be empty and it must be on an NTFS volume on a local computer. You cannot mount volumes to network-accessible drives. You can, however, assign multiple drive paths to a single volume.

Mounted drive folders are distinguished from ordinary folders by having a drive icon instead of the normal folder icon.

You can assign the drive path when you create the volume with the New Volume wizard at the Assign Drive Letter screen. You can also use the command Change Drive Letter and Path after the volume is created. A volume that already has a drive letter assigned can also have one or more drive paths. It does not have to be an unlabeled volume.

The Change Drive Letter and Path command is used to mount a volume.

See “Add, change, or remove a drive letter or path” on page 138.

See “View all drive paths” on page 142.
Unmount a volume

To unmount a volume with a drive path, use the command Change Drive Letter and Path, select the drive path, and click Remove.

**Note:** To modify a drive path, remove it and then create a new drive path using the new location. You cannot modify the drive path directly.

View all drive paths

This command lets you view all volumes that have a drive path on a selected server.

**To view all mounted volumes**

1. Right-click the computer icon and select View All Drive Paths. In addition, if the computer icon is already selected, you can choose View All Drive Paths from the Actions menu.
   
   The View All Drive Paths window appears.

2. If you want to unmount any volume listed in this window, select the drive path and click Remove Drive Path.

   You can also use the Change Drive Letter and Path command to remove a drive path.

3. Click OK.

   See “Mount a volume at an empty folder (Drive path)” on page 141.

Format a partition or volume with the file system command

If you want to format a volume after it has been created, you need to select the command File System from the context menu and then choose the subcommand Replace File System.

**Warning:** All data in the partition or volume will be lost when you format it.

**To format a partition or volume**

1. Right-click the volume or partition you want to format, click File System from the context menu, and then click the subcommand Replace File System.

2. Choose NTFS, FAT, or FAT32 as the file system to use.

3. Select an allocation size, or use the default, which is automatically selected.
4 Enter a label for the volume.

This label appears on the VEA console. If a name has been selected, this name appears in this text box, but you can change it here.

5 If desired, select the following formatting options:

- Perform a quick format — Formats the volume or partition without scanning for bad sectors in the volume or partition.
- Enable file and folder compression — Can be used only if you choose NTFS format.

Click OK.

A confirmation screen appears, warning that formatting will erase data.

6 Click OK in the confirmation screen to begin formatting.

You can view the percentage of completion for the formatting process in the bottom pane of the console on the Tasks tab.

Cancel format

The Cancel Format subcommand is a third option from the File System menu. This command appears only during the time the file system is being formatted and gives the user the option to cancel the formatting operation.

Change file system options on a partition or volume

When a partition or volume is created, a file system options screen is included with the Create Partition or New Volume wizard. Once the partition or volume is created, you can access the same file system options screen by using the File System command and then make desired changes to the options.

To change file system options

1 Right-click the partition or volume and choose the commands File System>Replace File System from the context menu.

2 Once the File System screen appears, change the desired attributes.

You may want to format the partition or volume.

See “Format a partition or volume with the file system command” on page 142.

Set a volume to read only

Perform the following steps to set a volume to read only.
Note: Changing a volume from read/write to read only may affect the applications that access the volume.

To set a volume to read only

1 Right-click the volume to be set to read only.
2 Choose Properties from the context menu that appears.
   The Properties window comes up.
3 Check the Read only checkbox.
4 Click OK.

Check partition or volume properties

You can check the properties of a partition or volume by right-clicking a partition or volume and selecting Properties from the context menu. The Properties window comes up. The categories for the properties of a volume differ, depending on the volume type.

The screen that follows shows the Properties window for a Mirrored Concatenated volume.
The categories for the Mirrored Concatenated volume shown in the sample screen are as described in the following table:

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The volume name is shown at the top of the window.</td>
</tr>
<tr>
<td>Layout</td>
<td>Indicates volume layout type. The layout categories are concatenated,</td>
</tr>
<tr>
<td></td>
<td>striped, RAID-5, mirrored, mirrored striped.</td>
</tr>
<tr>
<td>Status</td>
<td>Status of the volume.</td>
</tr>
<tr>
<td>Copies</td>
<td>Number of mirrors the volume has.</td>
</tr>
<tr>
<td>Columns</td>
<td>Number of columns. It will be two or more for striped volumes.</td>
</tr>
<tr>
<td>Log</td>
<td>Whether there is a DRL or RAID-5 log or FastResync.</td>
</tr>
<tr>
<td>Group name</td>
<td>Basic or dynamic disk group the volume is associated with.</td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Device path</td>
<td>The path to the device.</td>
</tr>
<tr>
<td>Size</td>
<td>Size of the volume in Sectors, KB, MB, GB, TB.</td>
</tr>
<tr>
<td>Comment</td>
<td>User defined comment.</td>
</tr>
<tr>
<td>File system type</td>
<td>Fields are FAT, FAT 32, NTFS.</td>
</tr>
<tr>
<td>File system label</td>
<td>Operating system file system label.</td>
</tr>
<tr>
<td>File system capacity</td>
<td>Size of file system.</td>
</tr>
<tr>
<td>File system free space</td>
<td>Amount of free space available in file system.</td>
</tr>
<tr>
<td>Aligned</td>
<td>Whether the volume is track aligned or not.</td>
</tr>
<tr>
<td>Sitetype</td>
<td>Indicates volume is Siteless, Site Confined, or Site Separated.</td>
</tr>
<tr>
<td>Attributes</td>
<td>Checkbox to enable volume as read only.</td>
</tr>
</tbody>
</table>

**Note:** Dynamic disks belonging to a Microsoft Disk Management disk group do not support volume comments.

**Expand a dynamic volume**

The Expand Volume command lets you increase a dynamic volume’s size. You can have the program automatically assign destination disks, or you can manually assign these disks.

You can expand a volume only in case of the following:

- the volume is formatted with NTFS or is a raw dynamic volume and
- there is unallocated space on a dynamic disk within the dynamic disk group onto which the volume can be extended.

You cannot expand a volume if one of the following is true:

- The volume is formatted with FAT or FAT32.
- The volume is set to read only.
- There is not enough unallocated space available on the dynamic disks within the dynamic disk group to extend the volume.

You can extend volumes onto a maximum of 256 disks. No portion of an extended volume can be deleted without deleting the entire volume.

A system or boot volume is extended in increments of the disk's cylinder size and only into contiguous space at the end of the volume.

More information is available if a dynamic boot or system volume fails to extend.

See “Cannot extend a dynamic boot or system volume” on page 287.

Auto-grow volume operations does not adhere to site boundary restrictions. If site boundary is crossed, then site-based volumes become Siteless. This is done so as not to disable hot relocation, auto grow, or any other automatic operations set as the default option by the user.

For Site-based volumes, manual grow operations will always adhere to site boundary restrictions.

See “Administering volumes for site-based allocation” on page 464.
To expand a dynamic volume

1. Right-click the dynamic volume you want to expand and select **Resize Volume > Expand volume** from the context menu that appears.
2  Complete the following on the Expand Volume panel:

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Volume Size</td>
<td>Specifies the current size of the volume.</td>
</tr>
<tr>
<td>Add by</td>
<td>This option lets you add a specific value to current volume by entering a numerical value in the box.</td>
</tr>
<tr>
<td>New volume size</td>
<td>Specifies the total volume size after growing the volume.</td>
</tr>
<tr>
<td>Max size</td>
<td>Click <strong>Max Size</strong> to enter the maximum volume size.</td>
</tr>
<tr>
<td>Auto assign destination disks</td>
<td>Select this option to assign disk or disks automatically.</td>
</tr>
<tr>
<td>Mirror across</td>
<td>Select this check box to mirror across disks by Port, Target, Enclosure, or Channel.</td>
</tr>
<tr>
<td>Thin Provisioned Disks Only</td>
<td>Select this check box to list only thin provisioned disks under the &quot;Available disks&quot; box.</td>
</tr>
<tr>
<td>Manually assign destination disks</td>
<td>Select this option to assign disk or disks manually.</td>
</tr>
<tr>
<td>Disable Track Alignment</td>
<td>Select this check box to disable track alignment for the volume.</td>
</tr>
</tbody>
</table>

Click **OK**.

**Expanding a volume that has a snapshot**

If you expand a volume that has a snapshot or detached mirror, then you also need to consider increasing the size of the DCO volume that tracks the changes
made to the volume. Increasing the size of the DCO volume allows for a more efficient mirror resynchronization process.

Before expanding the volume, you should perform snap back and snap abort operations on the volume. The snap abort operation should be done with the Convert into normal mirror option. This deletes the existing DCO volume and the snap volume becomes the mirror volume with a DCO volume. Right-click the volume and Select remove log to remove the DCO volume. After you expand the volume and prepare the volume for a snapshot with the Select existing mirror for snap option, a new DCO volume is created automatically at the optimal size for the expanded volume.

More information is available about snapshots.

See “Snapshot commands” on page 344.

More information is available about DCO volumes.

See “Disk Change Object (DCO) volume” on page 340.

**Expand a partition**

With SFW, the capability has been added to expand a partition (also known as a basic volume). The command is done online and is similar in concept to the command to expand a dynamic volume.

**To expand a partition (basic volume)**

1. Right-click the basic volume you want to expand, and then click **Expand Partition** in the context menu that appears.
2. Enter a number in the desired text box.
   The options are as follows:
   - The **Add by** option lets you add a specific amount to the partition by entering a number in the entry box.
   - The **New Partition size** option lets you specify the total partition size you want in the entry box.
   Clicking the **Max Size** button enters the maximum partition size in the **New Partition size** entry box.
   The drop-down lists next to the entry boxes let you indicate the size in Sectors, KB, MB, GB, or TB.
3. Click **OK** to complete the command.
Safeguarding the expand volume operation in SFW against limitations of NTFS

To prevent users from expanding volumes beyond the limitations of NTFS for NTFS cluster size, the following safeguard is implemented:

■ SFW does a check for the NTFS cluster size of the volume while expanding it.
■ The operation fails, if the user tries to expand the volume beyond a limit.
■ The limit depends upon the cluster size of the specified volume during its creation.

When SFW receives an expand volume request, it validates the requested new size against the MAX SIZE supported for that volume.

If the size exceeds the limit, the expand operation results in a failure, displaying the following error message:

The extend operation did not complete because the cluster count is higher than expected.

Architecturally NTFS supports : \(2^{32}\) clusters minus one cluster count.

The General formulae is:

\[
((2^{32})-1) \times \text{(user-selected size in bytes of a single cluster before format)}
\]

= maximum FS size for that instance possible during grow/extend without reformat.

So we have \((2^{32}) - 1 = (4,294,967,296) - 1 = 4,294,967,295\) clusters count.

Therefore, for a cluster size of 512 bytes, maximum size of the mountable file system:

\((2^{32})-1\) cluster count X 512 bytes represented by each cluster = 2199023255040 bytes.

Hence, for a 512 Bytes cluster sized volume, (2199023255040 bytes) 2 TB is the supported file system size.

The following table is used to check limitations against the cluster size:

<table>
<thead>
<tr>
<th>Cluster Size</th>
<th>Maximum NTFS Volume Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>512</td>
<td>2,199,023,255,040 (2TB)</td>
</tr>
<tr>
<td>1,024</td>
<td>4,398,046,510,080 (4TB)</td>
</tr>
<tr>
<td>2,048</td>
<td>8,796,093,020,160 (8TB)</td>
</tr>
</tbody>
</table>
Table 4-4  Limitation against the cluster size (continued)

<table>
<thead>
<tr>
<th>Cluster Size</th>
<th>Maximum NTFS Volume Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,096</td>
<td>17,592,186,040,320 (16TB)</td>
</tr>
<tr>
<td>8,192</td>
<td>35,184,372,080,640 (32TB)</td>
</tr>
<tr>
<td>16,384</td>
<td>70,368,744,161,280 (64TB)</td>
</tr>
<tr>
<td>32,768</td>
<td>140,737,488,322,560 (128TB)</td>
</tr>
<tr>
<td>65,536</td>
<td>281,474,976,645,120 (256TB)</td>
</tr>
</tbody>
</table>

Shrink a dynamic volume

You can decrease or shrink the size of a dynamic volume using the online volume shrink feature. The Shrink Volume command is helpful in reclaiming unused space to better use your resource. The command supports all dynamic volume types, such as simple, spanned, striped, mirrored, and RAID-5 volumes.

Note: The shrink volume operation is disabled during a reclaim storage operation for thin provisioned disks. The shrink volume operation is enabled when the reclaim storage operation has completed.

About the Shrink Volume command

The Shrink Volume command lets you decrease the size of a dynamic volume. The command calculates the amount of space that can be freed from the volume to create a new smaller volume size. The size of a volume after the shrink volume operation is approximately the difference of the current volume size and the amount of maximum reclaimable bytes. The new volume size is displayed in the Veritas Enterprise Administrator (VEA) GUI.

During the shrink volume operation, data may be relocated on the volume so that the volume can be made into the smaller specified size.

Before shrinking a dynamic volume

Consider the following before shrinking a dynamic volume.

- Before performing the volume shrink operation, you must install the KB 2615327 hotfix from Microsoft.
- If the combined length of the volume name and disk group name is more than 9 characters, then you must install the KB 2619083 hotfix from Microsoft before shrinking the volume.

- You can shrink a volume only if the dynamic volume is either on raw partition (that is, without a file system) or using the NTFS file system.

- The volume must be online.

- If a volume or degraded volume has any snapshots or detached mirrors, then the volume shrink operation is rejected. To shrink a volume that has been snapshotted, you must first snapback the volume and then shrink the volume. After shrinking a volume, you can snapshot the volume again.

- You can neither shrink a volume of less than 1 MB in size nor shrink a volume by less than 1 MB.

- You cannot shrink a volume beyond the point where any unmovable files, such as the page file or the shadow copy storage area, are located. Unmovable files are not automatically relocated when you shrink a volume. If you need to shrink the volume further, move the page file to another disk and delete the stored shadow copies, shrink the volume, and then move the page file back to the disk.

- If dynamic bad-cluster remapping detects several bad clusters, then you cannot shrink the volume. If this occurs, then you should move the data and replace the disk.

- Shrink Volume does not support read-only volumes.

- Volumes of more than 10 GB in size can be shrunk up to 3 GB approximately. In other words, the new size of the volume must be at least 3 GB approximately.

- Shrink Volume is not allowed during a mirror resynchronization, sub disk move, or thin reclamation.

- If a volume shrink fails after a successful file system shrink, it leaves the file system in shrunk state. However, the volume remains of the original size. For a workaround, refer to Known Issue 2385051 in the Symantec Storage Foundation and High Availability Solutions Release Notes.

- The time taken by the volume shrink operation depends on the size of the volume and the time required to relocate the files.

- During the volume shrink operation, if the deport disk group operation is performed, either by the user or because of a failover, then the volume shrink operation is canceled.
Shrinking a dynamic volume

Follow the steps below to shrink a dynamic volume.

To shrink a dynamic volume

1. Right-click the dynamic volume that you want to shrink, click Resize Volume, and then select Shrink.

2. The Shrink Volume dialog box appears.

3. In the Shrink Volume dialog box, provide the volume size in the Shrink by box or New volume size box, or click the Max Shrink button.

   The options offer the following:
   - The Shrink by box lets you specify an amount by which you want to decrease the volume.
   - The New volume size box lets you specify the new size of the volume.
   - The Max Shrink button lets you decrease the volume by the maximum amount possible.

   **Note:** Using the Max Shrink button with RAID-5 volumes may not yield optimal results due to the configuration of disks supporting the volume.

   The drop-down lists next to the entry box let you indicate the amount in Sectors, KB, MB, GB, or TB.

   After entering a value in the Shrink by box or clicking the Max Shrink button, the volume size that results from the Shrink Volume command is calculated and displayed in the New volume size box.

4. Click OK to start the volume shrink operation.

Cancelling the shrink volume operation

Follow the steps below to cancel the shrink volume operation.

To cancel the shrink volume operation

1. Right-click the dynamic volume you want to cancel the shrink volume operation, highlight Resize Volume, and then click Cancel Shrink in the context menu that appears.

2. Click OK to confirm the cancellation and complete the command.
Basic disk and volume tasks

This section describes the procedures for working with basic disks and volumes under SFW’s control and contains the following:

■ What can you do with a basic disk?
■ Converting the partition style of a disk
■ Create primary and extended partitions
■ New logical drives
■ Mark a partition as active
■ Change a basic disk to dynamic
■ Troubleshoot basic disks and volumes

More information is available about expanding a partition.

See “Expand a partition” on page 150.

What can you do with a basic disk?

When you first install Symantec Storage Foundation for Windows, all physical disks on your system are defined as basic. You can then upgrade them to dynamic disks.

In general, a basic disk is managed with the Master Boot Record (MBR) or GUID Partition Table (GPT) partitioning scheme and may have partitions defined on it, but this is not required. The MBR style is supported in MS-DOS, Windows 95/98, and later Windows versions. MBR disks can contain up to four primary partitions or three primary partitions plus an extended partition. The extended partition may be further divided into logical drives. The GPT style allows a maximum of 128 primary partitions.

With the MBR style, you can also create new logical drives that reside in extended partitions. The logical drives are simple volumes that are limited to the space on the extended partitions. They cannot span multiple drives.

Basic disks can also contain RAID volumes that were originally created in Windows NT Disk Administrator, including simple and spanned volumes (volume sets), mirrored volumes (mirror sets), striped volumes (stripe sets), and RAID-5 volumes (stripe sets with parity). These volumes are also called "FT volumes" in Windows NT documentation.

SFW versions 5.0 and 5.1 do not support FT volumes. Only earlier versions of SFW provide support for FT volumes.
Versions of SFW earlier than SFW 5.0 let you maintain and repair these volumes but not to create new ones. Although you cannot create new NT Disk Administrator-type volumes on a basic disk, you can upgrade the existing volumes of this type to dynamic. Then these volumes will have the full capabilities of other SFW dynamic volumes.

Converting the partition style of a disk

You can convert the partition style of a disk if the disk does not contain any data.

To convert the partition style of a disk

1. Right-click the basic disk to display the context menu, and select **Convert to MBR Disk**, if you have a GPT disk; or select **Convert to GPT Disk**, if you have an MBR disk.

   The convert pop-up window appears.

2. Read the information in the pop-up window and click **Yes** to confirm the conversion.

Create primary and extended partitions

A partition is a portion of a physical disk that functions as if it were a physically separate disk. Partitions can be created only on basic disks. Partitions cannot span disks; they must be contiguous regions. An MBR disk can contain up to four primary partitions or three primary partitions plus an extended partition. The extended partition may be further divided into logical drives. A GPT disk can contain a maximum of 128 primary partitions.

Use the Create Partition wizard to create primary partitions and extended partitions on a basic disk.
To create primary and extended partitions

1. Right-click a basic disk to display the context menu, and select **New Partition**. The Create Partition Wizard window appears.

2. Read the information on the first screen and then click **Next** to continue. The Select disk and region window comes up.
3 Select a disk and free space on which to create the partition.

The dialog box shows a list of available disks and free spaces. Check the box for the disk and free space you want to use, and click **Next** to continue.

If there is no free space on the selected disk, the free space selection and the **Next** button are grayed out. Click **Cancel** to exit the wizard.

If the free space selection is grayed out, you cannot continue. This can occur if the disk already has the maximum number of partitions (either four primary partitions or three primary partitions and one extended partition). It also can happen if the available free space is in an extended partition, because only logical drives (not partitions) can be created there.

The Select Partition Type window comes up next.
Select a partition type (primary or extended) and indicate the size of the partition. The pull-down list to the right of the entry box for the disk space lets you select Sectors, KB, MB, GB, or TB. Click **Next** to continue.

The Assign Drive Letter screen comes up next.

Assign a drive letter or drive path to this volume if you want to format the partition. You can also assign a drive letter after creating the partition. Click **Next** to continue.

When you mount a local drive at an empty folder on an NTFS volume, the operating system assigns a drive path to the volume rather than a drive letter.

To mount a volume at an empty NTFS folder, click the radio button **Mount as an empty NTFS folder** and type the path to the empty folder, or click the **Browse** button to locate it.

See “Mount a volume at an empty folder (Drive path)” on page 141.

When creating an extended partition, no additional information is required and the final screen appears. Click **Finish** to complete the operation.
In the Create File System screen that appears next, select the **Format this volume** checkbox if you want to format the partition using NTFS, FAT, or FAT32.

These options offer the following:

**FAT (File Allocation Table)**

A file system used by MS-DOS, Windows 3.x, and Windows 95/98. Later versions of Windows also can use the FAT file system. The operating system maintains a table to keep track of the status of various segments of disk space used for file storage.

**FAT32 (File Allocation Table)**

An enhanced implementation of the FAT file system. FAT32 uses smaller cluster sizes; therefore, disk space is used more efficiently, disk performance is increased, and larger drives are supported.

**NTFS (NT File System)**

An advanced file system designed for use specifically within Microsoft Windows operating systems. Use this format if you want to use file and folder compression. Note that NTFS cannot be used by MS-DOS, Windows 3.x, or Windows 95/98.

Select an allocation unit size in bytes, if you want to use a size other than the default. Default settings are strongly recommended for general use.
8 To name the partition, type a label in the "File system label" entry box. Give the partition a label that will be helpful to you in identifying it.

If desired, select the following formatting options:

Quick format  Use this method to skip scanning for bad sectors in the partition during formatting.

Enable file and folder compression  Use this method to compress the folders and files that are added to the volume. This option is available only if the partition is being formatted with NTFS.

Click Next to continue.

The final screen displays the properties of the partition.

9 Click Finish in the final screen.

You can view the percentage of completion for the formatting process in the bottom pane of the console by selecting the Tasks tab.

New logical drives

An extended partition can be subdivided into as many as 32 logical drives. You can use all or part of the free space in an extended partition when creating logical drives. An extended partition or a logical drive cannot span multiple disks.

**Note:** You cannot mark a logical drive as active. An active volume or partition is the volume or partition from which the computer starts up.

To create a new logical drive

1 Right-click an extended partition from the left panel tree view, or click the Disk View tab in the right pane and right-click the extended partition in that view.

2 In the context menu that appears, click New Logical Drive. The initial screen of the Create Partition wizard appears. Click Next.

3 Click the Free Space checkbox to select the free space to use for that logical drive. Click Next.

4 Click Next to move through the wizard’s Select disk and region screen. The Select Partition Type screen appears. The Logical drive radio button is automatically selected, and the screen displays the largest logical drive size that can be created in the extended partition.
If desired, change the size of the disk space to use, or accept it as shown.

Type the size of the logical drive that you want to create, and then click **Next**. The Assign Drive Letter screen appears.

Choose a drive letter, mount point, or neither (a drive letter can be assigned later). Click **Next** to continue.

The Create File System screen comes up next.

Select the file system type and options, and then click **Next** to continue.

Review your selections and click **Finish** to complete the process.

**Mark a partition as active**

The Mark Partition Active command lets you designate a basic primary partition as active. An active partition is the partition from which the computer starts up. The system partition or volume must be a primary partition that has been marked as active for startup purposes and must be located on a disk that the computer accesses when starting up the system. There can be only one active system partition at a time, which displays as Active in the status field.

The Mark Partition Active command can be used only on a basic primary partition, not on a dynamic volume.
The names commonly used for partitions or volumes containing the startup and operating system files are the system volume and boot volume respectively. The system volume refers to the partition or volume containing the startup files. The boot volume is a partition or volume that contains the operating system files. The boot volume can be (but does not have to be) the same as the system volume. The boot volume also cannot be part of a spanned, striped, or RAID-5 volume.

To mark a basic volume as the active volume

1. Select the primary partition that contains the startup files for the operating system that you want to activate.
2. Right-click to display the partition’s context menu, and click **Mark Partition Active** on that menu.
   A message appears, advising you that the partition will be started when you restart your computer.
3. Click **Yes** to proceed.

Change a basic disk to dynamic

To change a basic disk to dynamic, you need to create a dynamic disk group first with the New Dynamic disk group or Add Disk to Dynamic disk group command. When you do create a dynamic disk group, you can specify basic disks for the group that become dynamic through the command. If you want to add more disks later, you use the Add Disk to Dynamic disk group command.

See “Create dynamic disk groups” on page 47.

See “Add a disk to a dynamic disk group” on page 121.

Troubleshoot basic disks and volumes

Topics in this section are helpful in troubleshooting basic disks and volumes

See “Bring a basic disk back to an online state” on page 267.

See “Bring a basic volume back to a healthy state” on page 270.

See “Starting and stopping the Symantec Storage Foundation for Windows Service” on page 283.

Automatic discovery of SSD devices and manual classification as SSD

SFW has the ability to recognize solid-state devices (SSD) used in storage. This would help in identifying them in optimizing IO performance.
Disk media types

The following are the disk media types recognized by SFW:

- **HDD**: Stands for a hard disk drive which is used for storing and retrieving primary computer data. By default, all disks, unless auto-discovered as SSD, will be recognized as HDD media type.

- **SSD**: Stands for a solid-state drive, also known as solid-state disk or a flash drive which is a data storage device used for storage administration.

To manage environments containing both SSD and HDD storage devices, identify and classify them using the Volume Manager.

With this feature, you can set, change and display the media type information of the SSD disks. Once the disk is classified as SSD it will be used in all space allocation operations, across nodes, restarts and failover, provided it is part of an SFW dynamic disk group.

See “Volume Manager space allocation is SSD aware” on page 168.

Icon for SSD

The VEA GUI shows the following icon when it recognizes an SSD device:
Enclosure and VDID for automatically discovered On-Host Fusion-IO disks

- For auto discovered On-host Fusion-IO disks:
  - ARRAY_MEDIA_TYPE attribute of disk is set to ‘SSD’
  - ARRAY_TRANSPORT is set to ‘PCI’
  - Disk Connect Type is set as ‘Internal’.

- For auto discovered On-host Fusion-IO disks, the disk VDID is as follows:
  Syntax: VendorId_ProductId_LunSerNo
  VendorId: “Fusion”
  ProductId: “IODrive 160GB”
  LunSerNo: “40279”
  Disk VDID: “Fusion_IODrive 160GB_40279”

- Auto discovered On-host Fusion-IO disks, the enclosure name is as follows:
  Syntax: : VendorId_ProductId
Example for Fusion-IO IOdrive Duo SSD storage PCI card
VendorId: “Fusion”
ProductId: “IODrive 160GB”
Enclosure VDID: “Fusion_IODrive 160GB”

Classifying disks as SSD

An SSD can be an internal disk or external disk. You can manually classify any disk as SSD or HDD, change, and display the media type information.

You can set the media type and connection type for a disk using the following `vxdisk setmedia` command:

Command: `vxdisk setmedia type=<HDD|SSD> [x] <diskname | p#c#t#l#>

Here is an example of the `setmedia type` command showing how to set the media type of a disk:

C:\> vxdisk setmedia type=ssd -x harddisk4

Successfully set media type of specified disks.

**Note:** If you do not specify the disk connection type as external, then by default, that particular disk will be marked as internal.

You can get the media type and connection type information of the disk using the following `vxdisk` command:

Command: `vxdisk diskinfo -e <diskname | p#c#t#l#>

Here is an example of the `vxdisk diskinfo` command displaying the new state:

C:\>vxdisk diskinfo -e Harddisk6
Disk information
  Device Name : Harddisk6
  ...
  Array Media Type : SSD
  ...
  Disk Connection Type: External
  ...

You can get the plex media type information for the given volume using the following `vxvol volinfo` command:

Command: `vxvol -v volinfo <driveletter>

Here is an example of the `vxvol` command displaying the media type of plexes:
C:\> vxvol -v volinfo h:
Volume information
  Name : v3 (H:)
  DeviceName : \Device\HarddiskDmVolumes\SSDg\v3
  DriveLetter : H:
  Disk Group : SSDg
...
  Names of the plexes are...
  Plex 0 : v3-01
...
  **Media Type : SSD**

You can get the plex media type information for all the existing plexes using the following `vxprint` command:

Command: vxprint -l -p

Here is an example of the `vxprint` command displaying the media type of plexes:

C:\> vxprint -l -p
  Diskgroup = BasicGroup
  Diskgroup = SSDg
  Plex : v3-01
  info : len=102774784 KB
  assoc : vol=v3 sd=Disk1-02
  flags : ncolumn=1 StripeWidth=0
  GUID : 72bdc94b-ded8-4f2f-9f30-2cdd8cabc764
  type : layout=Simple
...
  **Media Type : SSD**
...

A plex can have the following four media types:

- **SSD**: All subdisks of the plex reside on SSD disks.
- **HDD**: All subdisks of the plex reside on HDD disks.
- **Mixed**: The subdisks of the plex reside on SSD and HDD disks.
- **Unknown**: If some disks on the plex are not available.

**Limitations for classifying SSD devices**

The limitations for classifying SSD devices are as follows:

- No GUI support is available for manually classifying a disk as SSD.
Classification is allowed only if the disk is part of an SFW dynamic disk group.

Classification of SFW dynamic disks is allowed only if it is in read-write imported state.

See “Volume Manager space allocation is SSD aware” on page 168.

See “Setting an SSD plex as a preferred plex to improve I/O performance” on page 169.

Volume Manager space allocation is SSD aware

Volume Manager space allocation operations are now media type aware and currently supports the media types SSD and HDD.

The following space allocation operations are SSD aware:

- **For volumes**: Volume Create, Add Mirror, Volume Grow, Add Logs, Snap Prepare, and storage migration.
- **For disks**: Disk Replace, Disk Evacuate, and Subdisk Move.

Any new plex cannot span across media types. The complete plex would either be on an SSD or HDD.

Media type restrictions are not considered for site separated volumes.

If the existing plex is media confined, the Volume Grow operation respects the media type boundary. Otherwise, the plex may be extended to either HDDs or SSDs.

For Subdisk Move and related operations, such as Disk Evacuate, and volume migration without changing the layout, a subdisk can be moved only to a target disk of the same media type as the source. However, if you opt to change the layout of the volume during migration, then the media type restriction is not considered while choosing the target.

The Array migration operation fails if HDD target disks are assigned to the SSD source disks. In such scenarios, you may change the media type of the source disks using `vxdisk setmedia` and perform Array migration.

Further, during hot relocation, the media type restriction is not considered.

See “Disk media types” on page 164.

See “Setting an SSD plex as a preferred plex to improve I/O performance” on page 169.

See “Automatic discovery of SSD devices and manual classification as SSD” on page 163.
Setting an SSD plex as a preferred plex to improve I/O performance

A volume may contain plexes from media types HDD and SSD.

The Read performance of an SSD plex is better than an HDD plex. Therefore, the SSD plex is set as the preferred plex with default Read policy based on the following conditions:

- If you have already set a preferred plex then the above mentioned changes will not take place.
- No SSD plex is set as a preferred plex if all plexes of a volume lie on SSD disks.
- The preferred plex setting on an SSD plex can be controlled using the following registry value: SetPreferredPlexonSSD

Run the command Regedit to open the registry editor.

Locate the SetPreferredPlexonSSD in the registry under the following key:

HKEY_LOCAL_MACHINE\SOFTWARE\VERITAS\VxSvc\CurrentVersion\VolumeManager

Automatic selection of an SSD plex as a preferred plex can be turned off by setting the above DWORD registry value to '0'.

- If a non-empty disk is manually tagged, then the preferred plex settings of the existing volumes on that disk is not updated.

See “Volume Manager space allocation is SSD aware” on page 168.

See “Disk media types” on page 164.

See “Automatic discovery of SSD devices and manual classification as SSD” on page 163.
Volume Manager space allocation is SSD aware
Dealing with disk groups

This chapter includes the following topics:

- Disk groups overview
- Delete a dynamic disk group
- Upgrade a dynamic disk group version
- Converting a Microsoft Disk Management Disk Group
- Importing a dynamic disk group to a cluster disk group
- Rename a dynamic disk group
- Detaching and attaching dynamic disks
- Importing and deporting dynamic disk groups
- Partitioned shared storage with private dynamic disk group protection
- Dynamic disk group properties
- Troubleshooting problems with dynamic disk groups

Disk groups overview

Symantec Storage Foundation for Windows organizes disks into disk groups. Disk groups provide a way of organizing disks and simplifying storage management for systems with large numbers of disks. They also let you move disks between computers so that you can easily transfer the storage between computers.

This section contains the following:

- Basic and dynamic disk groups
- Moving dynamic disk groups between computers
Basic and dynamic disk groups

Symantec Storage Foundation for Windows assigns one group for all basic disks, called the Basic disk group. Dynamic disks, however, can have multiple disk groups, which are called dynamic disk groups. Disks within a dynamic disk group share a common configuration. Dynamic volumes are created within a dynamic disk group and are restricted to using disks within that group.

When SFW is run for the first time on a server, all disks are in the Basic disk group. To upgrade basic disks to dynamic, one or more dynamic disk groups have to be created with the New Dynamic Disk Group command.

Moving dynamic disk groups between computers

You can move a dynamic disk group between computers by deporting it on one computer, moving the disk or disks that contain the dynamic disk group to another computer, rescanning on the new computer, and then importing the dynamic disk group. You will be able to use the volumes from the imported dynamic disk group without having to restart if you have hot-swappable disks.

Before moving the disks in a dynamic disk group, make sure that the disks are online and the volumes are healthy. You should move all disks that are part of the dynamic disk group; otherwise, the volumes will have Degraded status when the disks are moved to the other computer.

Primary and secondary dynamic disk groups

Symantec Storage Foundation for Windows makes a distinction between primary and secondary dynamic disk groups. In the user interface, the primary or secondary designation is shown in parentheses after each dynamic disk group name.

In Symantec Storage Foundation for Windows and all versions of Volume Manager for Windows, only one primary dynamic disk group can exist on a single host computer. Additional groups that are created or imported on that computer are secondary dynamic disk groups.
**Note:** A primary disk group upgraded from Microsoft Disk Management with SFW running on Windows Server operating systems always becomes a secondary dynamic disk group.

You might wonder what happens in later releases of Volume Manager or SFW if you have a primary dynamic disk group that was upgraded from Microsoft Disk Management or earlier versions of Volume Manager and that has no boot or system disk and then you create another dynamic disk group that has the computer’s boot or system disk. Once this second disk group is created, it becomes the primary dynamic disk group, and the other disk group that was upgraded from the earlier software becomes a secondary dynamic disk group.

The primary dynamic disk group that contains the computer’s system or boot disk cannot be deported because doing so would make the computer unbootable.

**Note:** A primary dynamic disk group should not be renamed.

The concept of importing dynamic disk groups is also used in Symantec Storage Foundation for Windows in connection with a single computer. If a computer is restarted, SFW makes available or "auto-imports" the primary dynamic disk group and any secondary dynamic disk groups that previously existed on the computer before the restart, providing these groups have not been deported to another computer.

### Cluster disks and cluster dynamic disk groups

Symantec Storage Foundation for Windows has a special category of disk groups for disks involved in supporting Symantec Cluster Server (VCS) and Microsoft Failover Clustering.

In order for SFW to work with VCS or Microsoft Failover Clustering, you create a cluster dynamic disk group for the disks that are part of the cluster. To create a cluster dynamic disk group, you use the New Dynamic Disk Group command and click the Create Cluster Dynamic Disk Group checkbox.

More information about Microsoft Failover Clustering is available here at:

See “Create a cluster dynamic disk group” on page 496.

More information about VCS clusters is available here at :

See “Creating cluster dynamic disk groups and volumes” on page 514.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support cluster disk groups.
Private dynamic disk group protection

This feature lets you partition shared storage on a SAN or shared array for exclusive ownership by a single machine. The storage is partitioned by using a secondary dynamic disk group. Private dynamic disk group protection provides hardware locking to the disks in the secondary dynamic disk group through a SCSI reservation thread.

See “Partitioned shared storage with private dynamic disk group protection” on page 185.

Note: Microsoft Disk Management Disk Groups do not support private dynamic disk group protection.

Delete a dynamic disk group

Deleting a dynamic disk group can be done two ways.

The recommended procedure is a two-part process and is described as follows:

- First, all the volumes in the dynamic disk group must be moved or deleted by using the Delete Volume command, then all the disks in the dynamic disk group must be removed from the disk group by using the Remove Disk from Dynamic Disk Group command. Once you remove all the disks from a dynamic disk group, the dynamic disk group will automatically be deleted.

- The alternative procedure is to use the Destroy Dynamic Disk Group command, which permanently removes the disk group and all its volumes in a one-step process.

Note: All data in a volume will be lost when you delete the volume. Make sure that the information has been transferred elsewhere or that it is no longer needed.

Recommended method for deleting a disk group

Perform the following steps to delete a disk group.

To delete a dynamic disk group by using the recommended method

1. Delete each volume by right-clicking on the volume in the tree view or in the right-pane Disk View. Select Delete Volume from the context menu.

2. You are prompted for verification. Click Yes to delete the volume.
3 Repeat steps 1 and 2 until all volumes in the dynamic disk group have been deleted.

4 Right-click on the dynamic disk group to be deleted. Select **Remove Disk from Dynamic Disk Group** from the context menu.

5 In the Remove Disk window that appears, use the **Add** or **Add All** button to move all the disks in the dynamic disk group to the **Selected Disks** column in the right pane of the window.

6 Click **OK**. The dynamic disk group will be removed from the tree view automatically.

**Alternative method for deleting a disk group**

The alternative method for deleting a disk group is to use the Destroy Dynamic Disk Group command. Because this command permanently removes the disk group and all its volumes, please use caution in implementing this command.

**Note:** Microsoft Disk Management Disk Groups do not support the Destroy Dynamic Disk Group command.

**Warning:** This command permanently removes all volumes and disks within the disk group.

**To delete a dynamic disk group with the alternative method**

1 Right-click the storage object representing the server being managed (the computer icon at the top of the tree for the server being managed).

2 Select **Destroy Dynamic Disk Group** from the context menu.

3 Enter the name of the dynamic disk group you want to delete in the dialog box that appears.

4 Click **OK**.

   A confirmation box appears asking if you are sure you want to destroy the disk group.

5 Click **Yes** to delete the dynamic disk group or **No** to cancel the operation.

   After the dynamic disk group is destroyed, the disks revert to basic disks and become part of the Basic disk group.
Upgrade a dynamic disk group version

If you have upgraded to Symantec Storage Foundation for Windows from an earlier versions of SFW or a related program (such as Microsoft Disk Management) and have existing dynamic disk groups that you created on your system, you most likely will want to upgrade those dynamic disk groups so that they are compatible with the dynamic disk group capabilities of Symantec Storage Foundation for Windows.

**Note:** Once a disk group version is upgraded, it cannot be changed back to an earlier disk group version and you will not be able to import it on another server that is running any earlier versions of SFW.

**Note:** Microsoft Disk Management Disk Groups do not support upgrading the disk group version. However, on Windows Server 2008 R2 and 2010, you can first convert the disk group to an SFW dynamic disk group, and then upgrade the SFW dynamic disk group.

You can also use the `vxdg` command to upgrade a disk group to the current SFW disk group version. The command line has the additional capability of upgrading a disk group created in Microsoft Disk Management.

**To upgrade a dynamic disk group version:**

1. In the tree view, right-click the disk group you want to upgrade and select **Upgrade Dynamic Disk Group Version** from the disk group context menu.
   - A confirmation screen appears with the text "Are you sure you want to upgrade the dynamic disk group?"
2. Click **Yes** to upgrade the dynamic disk group.

Converting a Microsoft Disk Management Disk Group

On Windows Server operating systems, converting a Microsoft Disk Management disk group to a SFW dynamic disk group can be done by using the Convert to SFW Dynamic Disk Group command.

**Note:** Converting a Microsoft Disk Management Disk Group that was created using iSCSI disks to an SFW dynamic disk group is currently not supported.
To convert a Microsoft Disk Management disk group to an SFW dynamic disk group

1. In the tree view, right-click the Microsoft Disk Management disk group and select the command Convert to SFW Dynamic Disk Group from the context menu.

2. The Convert to SFW Dynamic Disk Group confirmation box appears. Review the steps of the procedure and click Yes to begin the conversion.

3. Restart the server.

4. When the server completes the restart, launch SFW and import the converted disk group.

   **Note:** You must specify to clear the host ID for the import operation.

   **Note:** The default name of the disk group may not be user-friendly. You can change the name of the disk group in the dialog box of the import command.

5. Upgrade the imported disk group, if appropriate.

   The imported disk group is a Microsoft Disk Management compatible disk group managed by SFW. If advanced disk group features are needed, upgrade the disk group version with the Upgrade Dynamic Disk Group Version command.

   See “Upgrade a dynamic disk group version” on page 176.

### Importing a dynamic disk group to a cluster disk group

Importing a dynamic disk group as a cluster disk group can be done by using the Import as cluster disk group option of the Import Dynamic Disk Group command. This conversion to a cluster disk group requires that the dynamic disk group be connected to a shared bus.

**Note:** Microsoft Disk Management Disk Groups do not support the Import Dynamic Disk Group command.
To import a dynamic disk group to a cluster disk group

1. In the tree view, right-click the disk name in the dynamic disk group or the dynamic disk group name in the tree view and select Import Dynamic Disk Group.
2. Select the Import as cluster disk group option to import the dynamic disk group as a cluster disk group.

rename a dynamic disk group

Perform the following steps to rename a disk group.

Note: You should not rename a primary dynamic disk group if it contains the boot or system volume.

Note: Microsoft Disk Management Disk Groups do not support the Rename Dynamic Disk Group command.

To rename a dynamic disk group

1. In the tree view, right-click the disk group and select the command Rename Dynamic Disk Group from the context menu.
2. The Rename Dynamic Disk Group dialog box comes up. Type the new name in the New Name text entry box, and click OK.

Note: The dynamic disk group name is limited to 18 ASCII characters. It cannot contain spaces, slash mark (/), backslash (\), exclamation point (!), angle brackets (< >), or equal sign (=). Also, a period cannot be the first character in the name.

Detaching and attaching dynamic disks

Symantec Storage Foundation for Windows supports detaching and attaching disks of dynamic disk groups. This feature lets you detach dynamic disks for maintenance or other reasons and then attach the dynamic disks when they become available for use. Detached disks are no longer accessible and cannot be operated on until they are reattached.

Detaching and attaching disks using the VEA GUI is described in this section.
You can also detach and attach a disk using the vxdisk CLI command. See “vxdisk” on page 576.

Detaching dynamic disks

The Detach Disk command stops disk access and disconnects the disks from SFW control.

Note the following:

■ The detach disk operation can only be performed on disks that are in the attached state.
■ You may detach disks that may or may not contain any data.
■ This operation can be used on all the disks in a dynamic disk group, however at least one disk in the dynamic disk group must remain in attach state to maintain the last active configuration or log copy.
■ Detaching disks of dynamic disk groups is not recommended for disks that contain system or boot volumes, or disks that contain a page file or quorum resource.

**Note:** This operation fails the volume if all the plexes of a redundant volume are contained only on the disks specified for the detach operation.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Detach Disk command.

To detach disks

1. Stop all processes using the volumes in the dynamic disk group, including all I/O to files.

   If you do not stop the processes using the volumes, there is the possibility that data written to internal buffers may not get written to disk, resulting in data loss. It is also recommended that you back up all data on your volumes before you detach disks.

2. Make sure the status of the volumes on the disks is Healthy and the disks are online.

   If the status is not Healthy, you should repair the volumes before you detach the disks.
3 Select the disks in a dynamic disk group or the individual disks, and select **Detach Disk** from the menu.

A warning message asks if you are sure you want to detach the disks.

4 Click **Yes** to detach the disk.

When disks are detached, their redundant volumes are shown as degraded. For non-redundant volumes, the disks are shown as failed.

If a disk is enabled for Hot Relocation and is detached, its subdisks are not hot relocated. Also subdisks cannot be hot relocated from other disks to a disk that has been detached.

5 Remove the disks from the system.

You may need to prepare disks for removal in some cases. See your hardware manual for information.

### Attaching dynamic disks

The Attach Disk command connects the disks and enables access to the disks.

Note the following:

- The attach disk operation can only be performed on disks that are in the detach state.
- You may attach disks that may or may not contain any data.
- When attaching a disk and bringing it online, the disk's volumes should be reactivated and any redundant volumes should be synchronized automatically.
- When an Attach Disk command is issued for the disks, the disks come back online and volumes return to the state they were in at the time of the detach (assuming that all the disks in the disk group are present).

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Attach Disk command.

### To attach disks

1 Select the disks in a dynamic disk group or the individual disks, and select **Attach Disk** from the menu.

2 Click **Yes** to attach the disks.

The **Attach Disk** command automatically resynchronizes the plexes of redundant volumes that are contained on the specified disks. However, non-redundant volumes must be reactivated manually.
Importing and deporting dynamic disk groups

Symantec Storage Foundation for Windows supports deporting and importing of dynamic disk groups. This feature lets you move disks belonging to a dynamic disk group between computers and make their storage available for use. If you have hot-swappable disks, it is possible to move disks between systems without a system shutdown and restart.

**Note:** You must have administrator privileges on the source and destination computers to be able to move Symantec Storage Foundation for Windows storage between computers.

Import a dynamic disk group

Perform the following steps to import a disk group.

**Note:** Normally, you cannot import a dynamic disk group on a computer without having deported it on the computer where the disk group was located previously. However, the Import Dynamic Disk Group command has an option to clear the host ID of the previous computer, so that you can do an import operation. This option should be used with caution.

**Note:** Microsoft Disk Management Disk Groups do not support the Import Dynamic Disk Group command.

Once you have deported a dynamic disk group and disconnected the disks from the original machine, do the following to import the dynamic disk group

**To import a dynamic disk group:**

1. Reinstall the hardware in the destination machine.

2. If the disks are hot swappable, open the VEA console on the destination machine and issue a **Rescan** command. If the system had to be shut down to install the disks, it will have done a rescan automatically during the restart.

Once the rescan completes or the system restarts, the dynamic disk group and disks should be listed; but the dynamic disk group will be in a Deported state, and the disks will be in the Offline or Foreign state.

Occasionally, you may have to rescan a second time to get the disks showing as Offline or Foreign, particularly if you do the first rescan very quickly after installing the disks on the second computer system.
3 Right-click on a disk name in the dynamic disk group or the dynamic disk group name in the tree view, and select **Import Dynamic Disk Group** from the menu that appears.

4 If you want to change the dynamic disk group’s name, type in a new name for the group in the screen that comes up.

**Note:** The dynamic disk group name is limited to 18 ASCII characters. It cannot contain spaces, slash mark (/), backslash (\), exclamation point (!), angle brackets (< >), or equal sign (=). Also, a period cannot be the first character in the name.

If the disk group you are importing has a name longer than 18 characters (as was possible in earlier versions of Volume Manager for Windows), you may be asked to shorten the disk group name at this point. It is possible that you will be asked to shorten the name to fewer than 18 characters if the disk group’s volumes also have very long names.

Do not rename a dynamic disk group that contains a system or boot volume, otherwise an error can occur.

See “Error that the boot device is inaccessible, bugcheck 7B” on page 292.

On this screen, you may also check **Clear host ID** to clear the host id of the previous computer that had the dynamic disk group.

This screen also lets you import the dynamic disk group as a cluster disk group. Select **Import as cluster disk group** to import the dynamic disk group as a cluster disk group. Importing the dynamic disk group to a cluster disk group requires that the dynamic disk group be connected to a shared bus.

The **Import as cluster disk group** option is already selected if you are importing a cluster disk group. Select **Import as dynamic disk group** to import the cluster disk group as a dynamic disk group.

In addition, you can specify that the dynamic disk group be imported as a SAN disk group. This option is already selected if you are importing a SAN disk group. Select **Import as SAN disk group** to import the dynamic disk group as a SAN disk group.
If you have not done a deport command on the computer where the disk group was located previously, click the checkbox to clear the host ID of the other computer.

Click **OK** to import the dynamic disk group.

If the volumes in the dynamic disk group come up as Failed or Degraded, you need to repair the volumes.

See “Repair a volume with degraded data after moving disks between computers” on page 272.

### Deport a dynamic disk group

The Deport Dynamic Disk Group command stops access to disks. If you are moving hot-swappable disks between computers, it is important to use the Deport Dynamic Disk Group command. Using the command ensures that the data has been preserved in a clean state before you move the disks to the other computer. The Deport Dynamic Disk Group command also clears the host ID of the computer on which the disk group is located, so that it can be imported on another computer.

---

**Warning:** Though it is possible to deport dynamic disk groups containing volumes that are in a Degraded state, this is not recommended. If a disk failed during transport between systems or during the import, it is possible that data would be lost for volumes running in the Degraded state.

---

**Note:** Microsoft Disk Management Disk Groups do not support the Deport Dynamic Disk Group command.

---

**Note:** Symantec Storage Foundation for Windows does not let you deport a cluster disk group that is a Microsoft Failover Clustering disk group resource.
To deport a dynamic disk group

1. Stop all processes using the volumes in the dynamic disk group, including all I/O to files.
   
   If you do not stop volume processes, there is the possibility that data written to internal buffers may not get written to disk, resulting in data loss. It is also recommended that you back up all data on your volumes before you move disks to another computer.

2. Make sure the status of the volumes on the disks is Healthy and the disks are online.
   
   If the status is not Healthy, you should repair the volumes before you move the disks.

3. Select a disk in the dynamic disk group or the dynamic disk group name, and select **Deport Dynamic Disk Group** from the menu that appears.

   A warning message asks if you are sure you want to deport the disk group.
4  Click Yes if you wish to deport the dynamic disk group or No if you decide not to deport the dynamic disk group.

The process of deporting a dynamic disk group puts the contained disks in the Offline state and all volumes in the Stopped state. This applies only while the dynamic disk group is deported. Once an Import Dynamic Disk Group command is issued, disks will come back online and volumes will return to the state they were in at the time of the deport (assuming that all the disks in the disk group are present).

5  Remove the disks from the current system.

If the disks are hot swappable, you can move disks between systems without performing a system shutdown. If the drives are NOT hot swappable, it is necessary to shut down and power off the computer to remove or install the drives.

You may need to prepare disks for removal in some cases. See your hardware manual for information.

Be sure to move all the disks that are members of the dynamic disk group at the same time.

Normally, you need to move all the disks in the dynamic disk group to the other computer. The only exception would be if you were moving disks temporarily to another computer to copy one or more of the volumes that resided on some of the disks. In that case, when you import the disks to the other computer, the volumes that are not complete because of missing disks will display a Missing status. If you reactivate the disks and the volumes, the true status of the volumes will appear, such as Failed or Degraded. Once you move the disks back to the original computer, rescan, and reimport the dynamic disk group, all the volumes in the dynamic disk group should come back in a Healthy state. You may need to use the Merge Foreign Disk command.

See “Merge foreign disk command” on page 276.

Partitioned shared storage with private dynamic disk group protection

Partitioned shared storage with private dynamic disk group protection allows administrators to partition storage and assign exclusive ownership in a SAN or shared disk array. In early releases of Volume Manager for Windows, partitioned shared storage was implemented through cluster disk groups without the use of a cluster application. In later releases of Volume Manager and Symantec Storage...
Foundation for Windows, the feature of private dynamic disk group protection makes it possible to partition shared storage with a regular dynamic disk group.

Private dynamic disk group protection uses hardware locking techniques to protect secondary dynamic disk groups located on shared storage from access by other hosts connected to the shared storage pool. The hardware locking is implemented by using a SCSI reservation thread to maintain a current reservation for each disk in a protected group.

In later releases of Volume Manager and SFW, partitioned shared storage is available for secondary dynamic disk groups on shared storage. Private dynamic disk group protection can be assigned when a secondary dynamic disk group is created, or it can be added to an existing secondary dynamic disk group. The protection is in place as long as the disk group is imported; and since secondary dynamic disk groups are auto-imported, protected disk groups come online at system startup with a SCSI reservation thread started automatically.

If disks are being added to a dynamic disk group that has a SCSI reservation, they will get a reservation automatically. However, if a new disk group is being created, you must choose to add private group protection to the disk group.

Private dynamic disk group protection can be removed if the disk group no longer needs protection or is being reassigned to another Symantec Storage Foundation for Windows host. If you deport the dynamic disk group and move it to another host, the protection will be removed and you will need to add it back again. Also, if you uninstall Symantec Storage Foundation for Windows and then reinstall it, the group protection will have been removed and you will need to reapply the protection.

Note: Microsoft Disk Management Disk Groups do not support private dynamic disk group protection.

This section contains the following topics:

- Create a new dynamic disk group with private dynamic disk group protection
- Add private dynamic disk group protection to an existing dynamic disk group
- Remove private dynamic disk group protection from a dynamic disk group

Create a new dynamic disk group with private dynamic disk group protection

The following steps describe how to use the GUI to partition shared storage using private dynamic disk group protection.
**Note:** Microsoft Disk Management Disk Groups do not support private dynamic disk group protection.

To use the GUI to partition shared storage using private dynamic disk group protection

1. Identify the set of shared basic disks you want to assign to a particular Symantec Storage Foundation for Windows server.
2. Use the VEA console to connect to Symantec Storage Foundation for Windows on that machine.
3. Select one of the basic disks you wish to upgrade, and select **New Dynamic Disk Group** from the context menu.
4. The initial screen of the New Dynamic Disk Group wizard appears. Click **Next** to continue.
5. The screen for entering the disk group attributes comes up. Do the following:
   - Type a name for the new group in the **Group Name** entry box.
   - Click the **Add private group protection** checkbox.
   - Move each of the basic disks that you want to include in the new disk group from the left pane of the wizard to the right pane by using the **Add** button.
   - Click **Next** to continue.
6. Click **Next** to confirm the group of disks to be included in the new dynamic disk group.
7. Select **Finish** on the next screen to create the new group.

The icon for the new disk group will include a lock icon superimposed on its lower right quadrant. The disk group Properties display will show that the group is of type "Dynamic(Secondary,Private)."

**Using the vxdg init command**

It is possible to perform the operation described above by using the following command line command:

```sh
vxdg init -g<NewDynamicGroupName> -R <DiskName> ...
```

where `<DiskName>` is of the form `harddisk0, harddisk1, etc.`

Disks added to the group, either through the Add Disk to Dynamic Disk Group wizard or by a Join Dynamic Disk Group operation, will be automatically protected as soon as the add operation is complete. Disks that are removed from the group,
using either the Remove Disk from Dynamic Disk Group or Split Dynamic Disk Group operations, will no longer be protected.

Add private dynamic disk group protection to an existing dynamic disk group

Perform the following steps to add private dynamic disk group protection to an existing disk group.

Note: Microsoft Disk Management Disk Groups do not support private dynamic disk group protection.

To add private dynamic disk group protection to an existing secondary disk group
1 Right-click dynamic disk group in the tree view of the VEA console.
2 Select Add Private Dynamic Disk Group Protection.
3 A popup confirmation window will appear. Click Yes.

The disk group’s icon will now include a lock icon superimposed on its lower right quadrant. The disk group properties display will show that the group is of the type Dynamic(Secondary,Private).

Using the vxdg protect command

It is possible to perform the operation described above by using the following CLI command:

vxdg -g<DynamicDiskGroupName> protect

Remove private dynamic disk group protection from a dynamic disk group

Perform the following steps to remove private dynamic disk group protection from a disk group.

Note: Microsoft Disk Management Disk Groups do not support private dynamic disk group protection.
To remove private dynamic disk group protection from a disk group

1. Right click a dynamic disk group from the left pane of the VEA console.
2. Select **Remove Private Dynamic Disk Group Protection**.
3. A popup confirmation window will appear. Click **Yes**.

   The lock icon previously superimposed on the disk group icon’s lower right quadrant is removed. The disk group properties display will show that the group is of type Dynamic(Secondary).

**Using the vxdg release command**

It is possible to perform the operation described above by using the following CLI command:

```
vxdg -g<DynamicDiskGroupName> release
```

**Dynamic disk group properties**

If you select a dynamic disk group and then select Properties from the context menu, the Properties for that dynamic disk group displays.

The screen below is an example of the Dynamic Disk Group Properties screen. The status category is either Imported or Deported. "Current Version" refers to the disk group version that supports advanced disk group features.

The categories of a disk group's properties are described in the table below:

<table>
<thead>
<tr>
<th>Table 5-1 Dynamic Disk Group Properties Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
</tr>
<tr>
<td>Name</td>
</tr>
<tr>
<td>Status</td>
</tr>
<tr>
<td>Type</td>
</tr>
<tr>
<td>Disks</td>
</tr>
<tr>
<td>Volumes</td>
</tr>
<tr>
<td>Version</td>
</tr>
<tr>
<td>Recovery needed</td>
</tr>
</tbody>
</table>
Table 5-1  Dynamic Disk Group Properties Categories *(continued)*

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared</td>
<td>Fields are Yes and No. Indicates whether the disk group has private dynamic disk group protection. See “Partitioned shared storage with private dynamic disk group protection” on page 185.</td>
</tr>
<tr>
<td>Enabled</td>
<td>Fields are Yes and No. Indicates whether the disk group is functioning or not.</td>
</tr>
<tr>
<td>Size</td>
<td>Size of the disk group.</td>
</tr>
<tr>
<td>Free space</td>
<td>Free space remaining in the disk group.</td>
</tr>
<tr>
<td>Comment</td>
<td>User defined comment.</td>
</tr>
</tbody>
</table>

**Note:** Microsoft Disk Management Disk Groups do not support disk group comments.

The following are the disk group versions:

<table>
<thead>
<tr>
<th>Version Number</th>
<th>Version Used in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Microsoft Windows Disk Management, Volume Manager for Windows NT, Volume Manager 2.5 and 2.7 for Windows 2000</td>
</tr>
<tr>
<td>30</td>
<td>Volume Manager 3.0 and 3.1 for Windows 2000</td>
</tr>
<tr>
<td>40</td>
<td>Symantec Storage Foundation for Windows 4.0, 4.1, and 4.2</td>
</tr>
<tr>
<td>43</td>
<td>Symantec Storage Foundation for Windows 4.3</td>
</tr>
<tr>
<td>50</td>
<td>Symantec Storage Foundation for Windows 5.0 and 5.1</td>
</tr>
<tr>
<td>60</td>
<td>Symantec Storage Foundation for Windows 6.0, 6.0.1, and 6.0.2</td>
</tr>
</tbody>
</table>

**Troubleshooting problems with dynamic disk groups**

The following are troubleshooting topics in the Troubleshooting chapter.

See “Repair a volume with degraded data after moving disks between computers” on page 272.

See “A disk is marked as foreign” on page 285.
Fast failover in clustered environments

This chapter includes the following topics:

■ What is fast failover
■ SFW changes for fast failover
■ Enabling fast failover for disk groups in a VCS environment
■ Enabling fast failover for disk groups in a Microsoft Failover Clustering environment
■ Limitations

What is fast failover

Fast failover is a new feature that improves the failover time for the storage stack configured in a clustered environment. Fast failover includes several design changes and enhancements to the core SFW components. These changes provide significant reduction in the failover time taken by storage resources during service group failovers.

The following factors determine how fast SFW fails over the storage stack:

■ Fault detection
  How fast a fault is detected by the clustering software
■ Fault notification
  How fast SFW is able to get the fault notification
■ Storage management and remedial actions
  How SFW manages configuration changes and the actions it takes on the storage
With fast failover, SFW addresses Fault notification and Storage management and remedial actions factors. SFW has optimized the algorithms and enhanced the internal logic used to manage disk groups and the storage configuration changes across the nodes in a cluster.

Symantec Cluster Server (VCS) addresses the Fault detection factor with the Intelligent Monitoring Framework (IMF) feature that provides instantaneous fault detection capability.

Fast failover integrates with the IMF feature to provide a significant performance improvement in SFW HA cluster environments.

**SFW changes for fast failover**

The following changes are introduced in SFW to support fast failover:

- **New dynamic disk group state** Deported Read-Only
  
  SFW supports two disk group states; Imported and Deported. When storage resources are online on a node (the active node), the disk group is imported in a Read/Write mode. In this state the disk group is accessible and writeable on the active node. When storage resources are offline on a node (the passive node), the disk group is in a deported state. In this state the disk group is not accessible from the passive node.

  With fast failover, a new state, Deported Read-Only, is added to the SFW dynamic disk group entity. The disk group status on passive nodes now displays as Deported Read-Only.

  In this state, the disk group is imported in a “Read-Only” mode on the passive node. All the volumes are in an offline state and no transactions are allowed on the disk group.

  During failover, SFW normally performs a complete disk group deport operation on the active node followed by a Read/Write import operation on a passive node.

  With fast failover, instead of performing deport and import operations, SFW now performs only a mode change for the disk group. The disk group state on the passive node is changed from Read-Only to Read/Write.

  A mode change (Read-Only to Read/Write) is a much faster operation compared to a full deport and import (Deport None to Import Read/Write) and thus results in faster disk group failovers.

  The following table describes the different disk group states. The 4th column shows the new Deported, Read-Only state introduced as part of fast failover.
<table>
<thead>
<tr>
<th>Disk group property</th>
<th>Imported, Read/Write</th>
<th>Deported, None</th>
<th>Deported, Read-Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can disk group configuration be modified?</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Are volume devices created?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Are disks reserved?</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

### Changes to vxdg command

The SFW vxdg command is modified to display the new disk group state introduced for fast failover. The `vxdg list` and `vxdg dginfo` options now display the new Deported Read-Only state of fast failover enabled disk groups.

Here’s an example of the `vxdg list` command displaying the new state:

```bash
C:\vxdg list
Disk groups are....
Name : dg1
Disk Group Type : Dynamic (Cluster)
DiskGroup ID : 689ef763-9c1f-4e96-807e-1b97543b3dba
Status : Deported
Access : Read-Only
```

Here’s an example of the `vxdg dginfo` command displaying the new state:

```bash
C:\vxdg -gSQL_DG dginfo
Disk group information for the disk group SQL_DG
Name : SQL_DG
DiskGroup ID : b1f9e838-0689-4b91-b737-cd33f60cdcf4
Disk Group Type : Dynamic (Cluster)
Private Group Protection : No
Status : Deported
Access : Read-Only
Current Version : Yes
Version Number : 60
Comment :
Number of Volumes : 5
Number of Disks : 1
Names of the Volumes are....
\Device\HarddiskDmVolumes\SQL_DG\REGREP
\Device\HarddiskDmVolumes\SQL_DG\DB_LOG
\Device\HarddiskDmVolumes\SQL_DG\DB_VOL
```
The `vxdg` command has a new option, `vxdg refreshff`, which refreshes the state of disk groups on a system in order to support the new Deported Read-Only state. You must run this command if the disk group state on a passive node does not display the Read-Only state even though FastFailover is enabled for the VMDg resources. This typically occurs in cases where a new node is added to a service group where FastFailover is already enabled.

## Enabling fast failover for disk groups in a VCS environment

To support the fast failover feature, a new attribute, `FastFailOver`, is added to the VCS Volume Manager Disk group (VMDg) agent. This attribute decides whether or not a disk group is enabled for fast failover. The `FastFailOver` attribute can take values of 1 and 0. The value 1 indicates that the agent enables fast failover for the configured disk group. The default value 0 indicates that fast failover is disabled for the disk group.

Refer to the *Symantec Cluster Server Bundled Agents Reference Guide* for more information about the VMDg agent.

**Note**: The disk group version must be 60 or later for fast failover to work. To verify the disk group version, from the VEA console, right-click the disk group and click Properties. Disk group upgrade is required if you have upgraded SFW HA on the cluster nodes. Refer to the *Symantec Storage Foundation and High Availability Solutions Installation and Upgrade Guide* for more information.

### To enable the `FastFailover` attribute for a VMDg resource

1. In Cluster Manager (Java Console), select a service group with VMDg resource configured for it. Select the Properties tab from the right pane.
2. Scroll down to choose the `FastFailOver` attribute and click to edit the attribute value.
3. In the Edit Attribute dialog box, check the `FastFailOver` check box and then click OK.
4. Repeat these steps for every VMDg resource in the service groups.
Enabling fast failover for disk groups in a Microsoft Failover Clustering environment

Enabling fast failover for SFW disk groups in a Microsoft Failover Clustering environment involves the following tasks:

- Configuring SFW fast failover support using the SFW Configuration Wizard for Microsoft Failover Cluster
- Enabling FastFailover attribute for SFW VMDg resources

To support the fast failover feature, a new attribute, FastFailOver, is added to the Volume Manager Disk Group (VMDg) resource. This attribute decides whether or not a disk group is enabled for fast failover. The FastFailOver attribute can take values of True or False. The value True indicates that the agent enables fast failover for the configured disk group. The default value False indicates that fast failover is disabled for the disk group.

Note: The disk group version must be 60 or later for fast failover to work. To verify the disk group version, from the VEA console, right-click the disk group and click Properties. Disk group upgrade is required if you have upgraded SFW HA on the cluster nodes. Refer to the Symantec Storage Foundation and High Availability Solutions Installation and Upgrade Guide for more information.

Using the SFW Configuration Wizard for Microsoft Failover Cluster to configure fast failover

1. From the Start menu (the Start screen on Windows 2012 operating systems), type Run, and then press Enter to open the Run dialog box.
   In the Run dialog box, type scc, and then click OK to launch the Solutions Configuration Center (SCC).

2. From the Solutions view in the SCC, click on SFW Configuration Wizard for Microsoft Failover Cluster to launch the wizard.

3. The SFW Configuration Wizard for Microsoft Failover Cluster panel displays cluster and system (node) information and allows you to configure or unconfigure systems for fast failover as described below.

<table>
<thead>
<tr>
<th>Fields</th>
<th>Description</th>
</tr>
</thead>
</table>

Refer to the Symantec Cluster Server Administrator’s Guide for more information about the Cluster Manager (Java Console).
Enabling fast failover for disk groups in a Microsoft Failover Clustering environment

Cluster Name
The automatically-assigned name for the cluster configuration. This name will be the same as that of the Microsoft failover cluster.

System Name
This table lists all the systems (nodes) that can participate in the cluster. Select the required cluster nodes that you want to configure for fast failover.

Configuration Status
The following configuration statuses are displayed:
- **Configured**: The node is configured in the cluster.
- **Not Configured**: The node is not configured in the cluster.
- **Invalid Configuration**: There are configuration issues with the node.
- **Not Supported**: Unsupported configuration. SFW is installed without the Microsoft Failover Clustering option.

Configuration Status Details
Displays the configuration status information for the selected systems.

Select one or more systems that are not yet configured and click **Configure** to configure fast failover support for the selected systems.

To unconfigure fast failover support, select one or more configured systems and click **Unconfigure** to unconfigure fast failover support for the selected systems.

4 Click **Done** to exit the wizard.

**Enabling fast failover for SFW VMDg resources**

1 From the **Start** menu (the **Start** screen on Windows 2012 operating systems), click **Administrative Tools**.

Launch the Failover Cluster Manager snap-in by clicking **Failover Cluster Manager**.

2 Right-click **Services and Applications**. Select **More Actions > Create Empty Service or Application**. This creates a service group, for example, **SG1**.

3 Right-click the new service group and select **Add a Resource > More Resources > Add a Volume Manager Disk Group** from the context menu.

A new Volume Manager Disk Group (VMDg) resource is created with a default name.

4 Right-click the VMDg resource and select **Properties**.

Complete the following on the **Properties** window:
Select the **General** tab to change the default name of the **New Volume Manager Disk Group** to a name of your choice. Say, for example: VMDg1

Now select the **Properties** tab and perform the following steps:

- In the **DiskGroupName** box enter the dynamic cluster disk group name created earlier in this document. Say, for example GuestDG1.

- Edit the **FastFailOver** attribute value to **TRUE**. Displayed default value is **FALSE**.

---

**Note:** To enable live migration, you must set the **FastFailOver** attribute to **TRUE** for all VMDg resources in a cluster.

---

Right-click the VMDg resource and select **Bring this resource online** option from the center pane of the Failover Cluster Manager snap-in.

---

**Limitations**

The following limitations are applicable for fast failover in this release:

- Failover may take longer time to complete when subdisk move operation is in progress
Failover on iSCSI storage may take long time after NIC pull
If storage and network is configured on the same NIC, then during a NIC pull event, it is observed that the disk groups and the application resources take a longer time to go offline resulting in delayed service group failover.
Recommendation: Configure your storage and network over two independent network adapters. There should be one additional NIC, which is not configured under VCS, connected to storage network.

Majority Disk Loss scenario in case of partial storage disconnect may take around 30 seconds to declare the disk group as faulted after disk removal events are seen in the VEA console.

Fault detection takes 20 - 25 seconds in case of active node restart or crash

Configuration and functionality not supported
Fast failover is currently not supported for the following:
- RAID-5 volumes
- SCSI-2
  Disk group failovers are not affected. However, the disk groups will not be able to use the fast failover feature if configured using SCSI-2.
- Active/Passive (A/P) arrays for DMPW
  Only A/PF, A/A, and ALUA arrays are supported.
iSCSI SAN support

This chapter includes the following topics:

- Overview of iSCSI SAN support
- Configuring an iSCSI SAN with SFW
- Managing an iSCSI SAN with SFW

Overview of iSCSI SAN support

An iSCSI SAN is a storage array network that uses the iSCSI protocol that is built on top of TCP/IP for block level I/O. In an iSCSI SAN the basic unit of data transport is called a protocol data unit (PDU). The PDU is transmitted over a session with one or more TCP/IP connections. Each TCP/IP connection is called a portal and is a member of a portal group.

Data stored in an iSCSI SAN is stored on iSCSI targets. An iSCSI target can be a hardware array or a software iSCSI target node such as Microsoft’s iSCSI Software Target. An iSCSI initiator is a server that initiates requests to and receives responses (I/O) from an iSCSI target. An iSCSI session is started when an iSCSI initiator sends a login request to an iSCSI target. The iSCSI target then responds with a login response. To complete the login, a series of key=value pairs are negotiated and agreed upon. Logins can be made persistent so that the associated storage is available to the iSCSI initiator following a restart.

Challenge Handshake Authentication Protocol (CHAP) and Internet Protocol Security (IPSec) can be used to make the transmission of commands and data secure in an iSCSI SAN. CHAP can be used with IPSec to ensure an authorized connection between an iSCSI initiator and an iSCSI target.
About iSNS servers

An Internet Storage Name Service (iSNS) Server processes iSNS registrations and queries from iSNS clients. It maintains a database to manage the registrations.

The role of the iSNS Server in an iSCSI SAN is to allow iSCSI initiators and iSCSI targets to register and to query for other registered iSCSI initiators or iSCSI targets.

A Discovery Domain (DD) is a security and management mechanism used by iSNS Servers to administer access and connectivity to iSCSI initiators or iSCSI targets (storage nodes) in an iSCSI SAN.

A Discovery Domain Set (DDS) is a mechanism to store sets of discovery domain mappings in an iSNS database. A discovery domain set may contain one or more discovery domains and a discovery domain can be a member of one or more discovery domain sets. Multiple discovery domain sets may be active at the same time.

For the purpose of query and registration, discovery domains are viewed as containers for storage nodes and portal objects. A discovery domain is active if it is a member of at least one active discovery domain set. Discovery domains that are not members of an enabled discovery domain set are considered disabled. A storage node can be a member of one or more discovery domains. An enabled discovery domain establishes connectivity among the storage nodes in that discovery domain.

At the storage node level, a discovery domain is used to make iSCSI targets inaccessible to iSCSI initiators that are not members of the discovery domain. When first identified by the iSNS server, the Default DD in an iSCSI SAN contains all storage nodes except ones already assigned to a discovery domain.

SFW enables you to register with Microsoft's iSNS service and to manage discovery domains and discovery domain sets.

Configuring an iSCSI SAN with SFW

The Veritas Enterprise Administrator (VEA) GUI provides support for managing an iSCSI SAN.

On an iSCSI initiator node, SFW enables you to define iSCSI target portals, log into and out of iSCSI targets, and view the target portal group configuration. With SFW, you can also connect to and manage iSNS objects on a Microsoft iSNS server. If your server's iSCSI initiator is connected to a Microsoft iSCSI Software Target, you can view the set of LUNs that are accessible to your initiator and assign LUNs on the Target to any of its defined targets from an initiator.
Setting up an iSCSI SAN

Setting up an iSCSI SAN requires configuring target portals, setting up the iSCSI targets and iSCSI initiators, configuring the storage, assigning access rights, and registering with an iSNS server.

Setting up the iSCSI targets and configuring the storage should be done according to the instructions of the manufacturer of the storage device.

Setting up the iSCSI initiators requires that iSCSI initiator software be installed on each server to enable them to connect to the iSCSI targets. Optionally, the iSNS server software needs to be installed on a server to allow automatic discovery of the iSCSI targets on the network.

If the iSCSI target you plan to connect to is not displayed in the VEA GUI, under the iSCSI Initiators node, you need to add a target portal for it. This occurs when iSNS is not used or the iSCSI target is not registered with iSNS. This also occurs when there is an iSCSI HBA that is not configured to connect to a particular target.

Assigning access rights

The following shows how to assign access rights.

To assign access rights

1. From the tree view of the VEA GUI on the left pane, click the iSCSI node.

   If DHCP has been configured to report iSNS servers, the iSNS server automatically discovers the initiators and targets. Expanding the iSCSI node displays all the available initiators and targets in the network. If DHCP has not been configured, you need to register the initiator with iSNS to display the available initiators and targets.

2. Login to the required targets to make them available to the initiator.

Making a target available

The following shows how to make a target available.

To login to a target and make them available to initiators

1. Select a target and select Login from its context menu.

2. Check any desired optional login settings. The available login settings are to allow persistent restore of the login or to enable multi-path login.

3. To set any security settings, such as CHAP or IPsec, check Advanced Settings to access the security settings dialog.

   Make sure that the security settings are compatible with the settings that were set up for the storage device.
Using SFW vxdg latestart for iSCSI

SFW provides for dynamic disk groups that contain iSCSI storage to be available at system start up. SFW automatically does this by configuring the Veritas DG Delayed Import Service (VxDgDI) and issuing the \texttt{vxdg latestart} command when a dynamic disk group is created. This automatic configuration of the dynamic disk group is only done on the system where the dynamic disk group is created. SFW also automatically checks the dynamic disk group for persistent login to the iSCSI target where the iSCSI disks are located. If necessary, SFW configures the iSCSI target where the iSCSI disks are located for persistent login.

If this dynamic disk group is moved to another system, you must manually configure the VxDgDI service, issue the \texttt{vxdg latestart} command, and set up iSCSI target persistent login (if required) to make the iSCSI storage available at system startup on the new system.

You can do this by making the VxDgDI service dependent on the iSCSI service (MSiSCSI) in the Windows registry and issuing the \texttt{vxdg latestart} command. You must also change the VxDgDI service startup type to automatic. This allows SFW access to the iSCSI storage when it becomes available. You must also manually configure the iSCSI target where the iSCSI disks are located for persistent login.

See “vxdg” on page 550.

In addition to automatically enabling the latestart feature for dynamic disk groups that are created, SFW automatically maintains or disables the feature as appropriate for the following operations:

- Destroy disk group
- Remove disk from disk group
- Add disk to disk group
- Upgrade dynamic disk group version
- Split disk group
- Join disk group

Managing an iSCSI SAN with SFW

Symantec Storage Foundation allows components of the iSCSI SAN to be accessed and managed with the VEA GUI.
Managing with the VEA Console

When an iSCSI SAN has been configured and the Microsoft iSCSI initiator service is installed, SFW displays an iSCSI Initiators node, an iSNS node, and an iSCSI Arrays node in the tree view of the VEA Console.

When managing an iSCSI SAN, you should be already familiar with the usage and settings described in the documentation that accompanies each of the pieces of software that these nodes represent.

The iSCSI nodes are shown below.

**Figure 7-1**  iSCSI nodes displayed in the tree view.

About the iSCSI initiators node

Double-clicking the iSCSI Initiators node in the tree-view displays the initiators on the local machine. Selecting one of the nodes enables the display of the initiator adapters, target portals, and the targets for the initiator. These are displayed by clicking the appropriate tab in the right pane. Fully expanding the iSCSI Initiators node in the tree-view displays the target portals and the targets for each initiator in the tree-view.

Selecting a target portal in the tree view displays information about the target portal in the right pane.
Selecting a target node in the tree view displays information about the target portal groups and the sessions of the target in the right pane. Clicking on the portal groups tab displays details about the portal. Clicking on the sessions tab displays details about the connection between the target and initiator. Fully expanding the target node in the tree-view displays the target portals, LUNs associated with the target, and the target sessions for the target.

The following functions to manage the initiators are available in a context menu for each initiator node:
- Configure iSNS Server
  - Add
  - Remove
- Add Target Portal
- Set Initiator shared secret
- Set All IPSec Tunnel Mode Addresses
- Set IPSec Group Pre-Shared Key
- Properties

The following functions to manage the targets portals are available in a context menu for each target portal:
- Remove Target Portal
- Properties

The following functions to manage the targets are available in a context menu for each target node:
- Login To Target
- Logout From Target
- Remove Persistent Login
- Properties

The following functions to manage the sessions are available in a context menu for each session node:
- Add Connection
- Logout
- Properties

Details for these functions are as follows:
Configuring an iSNS server
To register the initiator with an iSNS server, right-click the initiator node and select the Configure iSNS Server to open the dialog box. The dialog box lets you add or remove the initiator from an iSNS server and to enter the IP address or DNS name of the server.

Adding a target portal
To add a target portal to an initiator, right-click the initiator node, select Target Portal, and select Add to launch the Add Target Portal Wizard. The wizard also lets you enter the security settings for communicating with the target.

Setting up security for an initiator
You can set up security for an initiator.
Use the following to set up the security for an initiator:

■ Set Initiator Shared Secret
■ Set All IPSec Tunnel Mode Addresses
■ Set IPSec Group Pre-Shared Key

To access the appropriate dialog box, right-click the initiator node and select the type of security. For enabling persistent login to the target, check Persist in the Set All IPSec Tunnel Mode Addresses dialog box.

Removing a target portal
To remove a target portal from an initiator, use the Remove Target Portal dialog box. To access the dialog box, right-click the appropriate target portal node and select Remove Target Portal. Click Yes to complete the operation.
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Login to a target and setting security</td>
<td>To log in to a target, right-click the target node, select Login To Target, to launch the Login to Target Wizard. The wizard also lets you enter the login settings and security settings for communicating with the target. The available login settings are to allow persistent login and to enable multi-path login. Check the Advanced Settings checkbox to open the dialog box for security settings. The following security settings are available:  ■ General Settings tab:  ■ Initiator Adapter  ■ Target Portal  ■ CHAP Logon Settings  ■ Perform mutual authentication  ■ CRC/Checksum Data digest and/or Header digest  ■ IPsec Settings tab:  ■ Pre-Shared Key  ■ IKE protocols  ■ ESP protocols  ■ Perfect Forward Secrecy</td>
</tr>
<tr>
<td>Logout from a target</td>
<td>To logout of a target, use the Logout From Target dialog box. To access the dialog box, right-click the target node and select Logout From Target.</td>
</tr>
<tr>
<td>Removing persistent login from a target</td>
<td>Enabling persistent login for a target causes the target to be logged in automatically across system restarts. Removing or disabling persistent login means that manual login to the target is required after a restart. To remove the persistent login from a target, use the Remove Persistent Login dialog box. To access the dialog box, right-click the target node and select Remove Persistent Login.</td>
</tr>
<tr>
<td>Adding a connection</td>
<td>To add a connection to a session, right-click the session node and select Add Connection to launch the Add Connection window. The window lets you select initiators and portals to establish the connection. <strong>Note:</strong> Not all iSCSI initiators, such as the Microsoft iSCSI Initiator, let you add connections.</td>
</tr>
<tr>
<td>Logout from a session</td>
<td>To logout of a session, use the Logout dialog box. To access the dialog box, right-click the session node and select Logout</td>
</tr>
</tbody>
</table>
About multiple sessions

Symantec Storage Foundation supports multiple sessions to a target. Multiple sessions are used to support fault tolerance for the iSCSI storage using the Microsoft Multipath I/O (Microsoft MPIO) solution, and SFW's Symantec Dynamic Multi-Pathing for Windows option. Installing the DMPW Device Specific Module (DMPW DSM), VITARGET, and configuring the connections to the sessions, lets you set up fault tolerance for the iSCSI storage.

See “DMPW overview” on page 425.

About the iSCSI arrays node

If a VDS iSCSI hardware provider for the storage array is installed on the SFW server, then expanding the iSCSI array node displays the Microsoft iSCSI Software Target subsystem that contain the LUNs and physical disks that make up your iSCSI SAN. The LUNs in a subsystem can be one of the following types shown in the following table.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LUN</td>
<td>LUN contained in the subsystem and assigned to this iSCSI initiator.</td>
</tr>
<tr>
<td></td>
<td>Foreign LUN</td>
<td>LUN contained in the subsystem and assigned to another iSCSI initiator.</td>
</tr>
<tr>
<td></td>
<td>Idle LUN</td>
<td>LUN contained in the subsystem, but not assigned to any iSCSI initiator.</td>
</tr>
</tbody>
</table>

Selecting a subsystem displays the tabs that let you view lists of the targets, LUNs, or drives in the right pane.

You can view additional information as follows:

- Double-clicking an entry in the list of targets displays the tabs that let you view the sessions and the portal groups of the target.
Double-clicking an entry in the list of LUNs displays the tabs that let you view the paths that connect to the physical disk, details of the physical disk, and the targets that the LUN supports.

Double-clicking an entry in the list of drives displays its details.

Selecting a LUN under the subsystem node displays the tabs that let you view the paths that connect to the physical disk, details of the physical disk where the LUN is located on the target server, and targets.

Expanding a LUN in the tree-view that is assigned to the iSCSI initiator, displays the physical disk for the LUN. Selecting the physical disk displays details of the physical disk in the right pane.

To support an SFW Symantec Dynamic Multi-Pathing for Windows (DMPW DSMs) environment, the MPIO option of the Microsoft iSCSI Initiator and the appropriate DSM for the iSCSI target need to be installed. (SFW provides the VITARGET DSM to support Microsoft iSCSI Target.)

In an SFW Symantec Dynamic Multi-Pathing for Windows environment, selecting a physical disk under the subsystem node displays the tabs that let you view the volumes, disk regions, disk views, and alerts associated with the physical disk.

The following functions to manage the targets are available in a context menu for each LUN node:

- Assign To Target
- Unassign Target
- Properties

Details for these functions are as follows:

**Assign To Target**

To assign a LUN to a target, right-click the LUN node (under the tree view of the target, under the tree view of the array, or under the LUNs tab when selecting an array), select Assign To Target to launch the Assign LUN To Target Wizard. The wizard lets you select from a list of available targets.

**Unassign Target**

To unassign a LUN from a target, right-click the LUN node (under the tree view of the target, under the tree view of the array, or under the LUNs tab when selecting an array), select Unassign Target to launch the Unassign LUN From Target Wizard. The wizard lets you select from a list of assigned targets.
About the iSNS server node

The iSNS server node appears in the tree view of the VEA GUI on the left pane after performing the Configure iSNS Server option to register the Microsoft iSCSI initiator with the iSNS server you want to manage.

Clicking the iSNS server node displays the discovery domains (DD), discovery domain sets (DDS), and the targets and initiators registered with the server.

Generally speaking, discovery domains and discovery domain sets are a way to organize and control access to various initiators and targets. Discovery domains contain a collection of initiators and targets. Discovery domain sets are a collection of discovery domains.

Selecting one of the iSNS server nodes enables the display of discovery domains and discovery domain sets. These are displayed by clicking the appropriate tab in the right pane.

Selecting one of the discovery domain nodes enables the display of the set of targets, initiators, and portal groups assigned to the discovery domain. These are displayed by clicking the appropriate tab in the right pane.

Selecting one of the discovery domain set nodes enables the display of discovery domains for the discovery domain set. These are displayed in the right pane.

The following functions to manage the iSNS servers are available in a context menu for each iSNS server node:

- Login
- Log out
- Create Discovery Domain
- Create Discovery Domain Set

The following functions to manage the discovery domains are available in a context menu for each discovery domain node:

- Add node
- Remove node
- Delete

The following functions to manage the discovery domain sets are available in a context menu for each discovery domain set node:

- Add Discovery Domain
- Remove Discovery Domain
- Delete
Details for these functions are as follows:

- **Login to an iSNS server**
  To view or manage an iSNS server you must first login to the iSNS server. To login to an iSNS server, use the Login to iSNS Server dialog box. To access the dialog box, right-click the iSNS server node and select Login.

- **Log out of an iSNS server**
  To log out from an iSNS server, use the Log out from iSNS Server dialog box. To access the dialog box, right-click the iSNS server node and select Log out.

- **Creating discovery domains**
  To create a discovery domain, use the Create Discovery Domain dialog box. To access the dialog box, right-click the iSNS server node and select Create Discovery Domain. Select from the available iSCSI nodes to add to the discovery domain.

- **Creating discovery domain sets**
  To create a discovery domain set, use the Create Discovery Domain dialog box. To access the dialog box, right-click the iSNS server node and select Create Discovery Domain Set. Select from the available discovery domains to add to the discovery domain set.

- **Adding nodes to a discovery domain**
  Adding a node to a discovery domain adds an iSCSI initiator or an iSCSI target to the discovery domain. To add nodes to a discovery domain, use the Add Node dialog box. To access the dialog box, right-click the discovery domain node and select Add Node. Select from the available nodes to add to the discovery domain.

- **Removing nodes from a discovery domain**
  Removing a node from a discovery domain removes an iSCSI initiator or an iSCSI target from the discovery domain. To remove nodes from a discovery domain, use the Remove Node dialog box. To access the dialog box, right-click the discovery domain node and select Remove Node. Select from the available nodes to remove from the discovery domain.

- **Deleting a discovery domain**
  To delete a discovery domain, use the Delete dialog box. To access the dialog box, right-click the discovery domain set node and select Delete.

- **Adding discovery domains to a discovery domain set**
  To add discovery domains to a discovery domain set, use the Add Discovery Domain dialog box. To access the dialog box, right-click the discovery domain set node and select Add Discovery Domain. Select from the available discovery domains to add to the discovery domain set.
### Removing discovery domains from a discovery domain set
To remove discovery domains from a discovery domain set, use the Remove Domain dialog box. To access the dialog box, right-click the discovery domain set node and select Remove Discovery Domain. Select from the available discovery domains to remove from the discovery domain set.

### Deleting a discovery domain set
To delete a discovery domain set, use the Delete dialog box. To access the dialog box, right-click the discovery domain set node and select Delete.

### Disabling a discovery domain set
Disabling a discovery domain set makes all the discovery domains in the discovery domain set not available for discovery by other registered targets and initiators in the iSCSI SAN. To disable a discovery domain set, use the Disable dialog box. To access the dialog box, right-click the discovery domain set node and select Disable.

### Enabling a discovery domain set
Enabling a discovery domain set makes all the discovery domains in the discovery domain set available to other registered targets and initiators in the iSCSI SAN. To enable a discovery domain set, use the Enable dialog box. To access the dialog box, right-click the discovery domain set node and select Enable.
Settings for monitoring objects

This chapter includes the following topics:

- Overview
- Event monitoring and notification
- Event notification
- Disk monitoring
- Capacity monitoring
- Configuring Automatic volume growth
- SMTP configuration for email notification

Overview

Symantec Storage Foundation (SFW) provides different ways to monitor objects.

Event monitoring and notification

Symantec Storage Foundation for Windows reports storage subsystem events that you can view in the Alert Log. The log can provide information on significant incidents, such as a disk failure. Also, Symantec Storage Foundation for Windows provides event notification by SMTP email, by pager, and through SNMP traps that can be displayed in HP OpenView, IBM Tivoli, and CA Unicenter.

This section covers the following topics:

Alert log
Alert log

Click the Logs folder in the Logs Perspective to display the Alert Log, a listing of alerts that pertain to the Symantec Storage Foundation for Windows program. For each alert listing, you will see information about the date and time of the message, the message text, and its class.

The Alert log is shown below.

The most recent alert listings can also appear in the new section at the bottom of the Veritas Enterprise Administrator (VEA) GUI. This happens when the Console tab is selected from the bottom left corner of the VEA GUI. If the Tasks tab is selected, text appears in the bottom section of the window that gives the progress of system tasks, such as format, refresh, and rescan. These items also appear in the Logs Perspective under the Task Log tab.

You can view specific information on each event by double-clicking on it to display the Alert Log Details dialog box. This shows an alert description, recommended action, and properties. The dialog box provides an easier way to read the description of the event. The arrows that appear at the upper-right corner can be used for scrolling in the alerts listing.

The Alert log is shown below.
Severity levels

Alerts listed in the Alert Log have severity levels

The severity levels are as follows:

- Critical — Indicates alerts of high importance involving a system crash or unrecoverable data loss.
- Error — Indicates a loss of functionality or data.
- Warning — Indicates recoverable errors and no data corruption.
- Information — Indicates an informational event, such as a new disk has been added to the system.

Log configuration

You can configure the Alert Log and Task Log through the Log Settings dialog box. To access this dialog box, select the Control Panel Perspective, select the host you are connected to, and double-click the Log Settings icon in the right-pane.

The following dialog box appears:
In this dialog box, you can enter the maximum log size for each of the logs. You can access the Event Log through the VEA console.

**Event notification**

Symantec Storage Foundation for Windows provides event notification by SMTP email, by pager, and through SNMP traps that can be displayed in HP OpenView, CA Unicenter, and IBM Tivoli. You can configure the notification service to send messages to specific individuals or groups and also set up rules for filtering the event messages. You can also set up rules that will run a script when specified conditions apply.

This section presents an overview of the Rule Manager utility, which provides the event notification service for Symantec Storage Foundation for Windows. The full details for this utility are given in the online Help module titled "Optional Rules for Handling Events." To access the online Help, select Contents from the SFW Help menu.

This section covers the following topics:

Accessing the Rule Manager utility
Preliminary setup
Steps for creating rules
Accessing the SFW SNMP MIB files

**Accessing the Rule Manager utility**

The commands for configuring the service are all accessed through the Rule Manager icon. If you click Control Panel in the Perspective bar and expand the tree view, the actionagent node is displayed. Clicking the actionagent node displays the Rule Manager icon in the right pane.

The Rule Manager icon is shown below.
Double-click the Rule Manager icon to bring up the Rule Manager window. All functions relating to event notification rules are initiated from this window.

From the Rule Manager, you can create, enable, disable, modify, and delete rules relating to event notification. The New Rule button at the top of the window is used to create new rules. The Configure Mail button is used to configure settings, such as the settings for the Mail Server, Default Sender, and SMTP Port.

**Preliminary setup**

Before creating rules, you must configure the SMTP mail notification settings you want to use.

**Note**: Note that this is a one-time setting. After providing this information, you don’t need to repeat this step unless the Mail Server changes for your system.

**To configure the SMTP mail notification settings**

1. From the VEA Control Panel perspective, select the `actionagent` node in the tree view.
2. Double-click **Rule Manager** in the right pane.
3 Click **Configure Mail**.
   The Mail Settings window is displayed.
4 Provide information about your Mail Server, Default Sender, and SMTP Port.
   The default SMTP Port is 25.
   Check the Enable checkbox and click **OK**.

**Steps for creating rules**

After the preliminary setup, you create rules for notifications.

To create rules
1 From the VEA Control Panel perspective, select the **actionagent** node in the tree view.
2 Double-click **Rule Manager** in the right pane.
   The Rule Manager window is displayed.
3 Click **New Rule** to start the New Rule Wizard.
   The New Rule Wizard Welcome appears.
4 Review the steps of the wizard and click **Next** to continue.
5 On the Rule Properties window, do the following:
   - Enter a name for the rule.
   - Select the type of rule you want to create. Choose one of the following:
     - A rule based on the Alert topic.
     - A rule based on the severity of alerts.
   - Further define your rule by selecting either an Alert topic or a severity level as follows:
     - Enter a topic or click **Select** to select a topic from a list if you chose a rule based on an Alert topic.
     - Select one of the severity levels if you chose a rule based on the severity of the alerts.
     - Click **Next** to continue.
6 On the Select host for Rule window, select **Trigger rule for alerts originating from specific hosts** and check the appropriate host in the lower part of the window.
   Click **Next** to continue.
7 On the Select Actions window configure one or more of the following actions to be taken when the events are detected:

- Send email notification to recipients.
  Enter the email addresses that are to receive notification.

- Send SNMP Trap notification to a host.
  Specify the hostname and port number to use to send the notification.

- Execute command on a host.
  Specify the name of the host, source host that has the source file (script), path of the source file, and the parameters for the source file. The source file can be of any executable file type, such as `.cmd` or `.bat`; and the source file must not be dependant on any libraries. Separate the parameters by spaces or by the delimiter recognized by the source file. In standalone mode, the host and source host identify the same host.

An individual log file is created and maintained for each rule that executes a command on a host. Each time the command is executed entries are made into its log file. The log files are located at `C:\Documents and Settings\All Users\Application Data\Veritas\VRTSaa\Log`.

Click Next to continue.

8 On the Finish Rule Setup window, review your settings and check the Enable Rule checkbox.

Click Finish to complete setting up the rule.

About SNMP traps

If you are planning to send SNMP traps, the MIB files should be loaded and compiled into the management application to which traps will be sent.

To accomplish this, do the following:

- Load the product-specific MIB into your SNMP management software database according to instructions provided by your management platform. See “Accessing the SFW SNMP MIB files” on page 220.

- If the platform you’re using requires a configuration file, such as `trapd.conf`, you should load that file as well. Consult the user’s guide for the management platform to determine how to map your traps to the platform’s alarm system. Any configuration files associated with your product are stored in the same location as the MIB files.

Note: For details on creating rules, see the "Optional Rules for Handling Events" online Help module. To access this module, select Contents from the Help menu.
Accessing the SFW SNMP MIB files

If you want to receive Symantec Storage Foundation for Windows SNMP traps on a management platform (such as HP OpenView), you will need to compile and load the Veritas SNMP MIB files into your management platform, following the procedures outlined in the documentation for your specific platform.

When you install Symantec Storage Foundation for Windows, the Veritas MIB files are installed on a local hard drive along with the Veritas Object Bus files and the SFW installation files. (The Veritas Object Bus is associated with the VEA console and is needed to run Symantec Storage Foundation for Windows.)

The default path to the MIB files directory is as follows:

- For 32-bit servers
  C:\Program Files\Veritas\VRTSaa\snmpmibfiles

- For 64-bit servers
  C:\Program Files (x86)\Veritas\VRTSaa\snmpmibfiles

The Symantec Storage Foundation for Windows MIB file for the Veritas Object Bus is VRTS-vm.mib and can be found in the snmpmibfiles directory.

Disk monitoring

Self-Monitoring, Analysis and Reporting Technology (S.M.A.R.T.) is available on many new SCSI disks. S.M.A.R.T. provides a way for disks to self-check certain physical conditions that are useful predictors of disk failure and send an alert when conditions indicate that a failure may occur soon. This allows the system administrator to take preventive action to protect the data on the disk. To receive alerts in the Symantec Storage Foundation for Windows Event Log, S.M.A.R.T. monitoring must be enabled for the global configuration and also on each disk you want checked. The default is to have S.M.A.R.T. monitoring disabled.

If S.M.A.R.T. predicts that a failure will occur, an alert is sent to the Event Log. You can also receive event notification by SMTP email, by pager, and through SNMP traps that can be displayed in HP OpenView, IBM Tivoli, and CA Unicenter.

See “Event notification” on page 216.

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support S.M.A.R.T. monitoring.
To enable S.M.A.R.T. monitoring

1. Right-click on a disk for which you want to enable S.M.A.R.T. monitoring.
2. Select \textit{S.M.A.R.T. Monitoring} from the context menu.

If the \textit{S.M.A.R.T. Monitoring} command on the context menu is grayed out, then the S.M.A.R.T. monitoring technology is not available on that disk.

A S.M.A.R.T. monitoring dialog box will appear as shown below.

3. If it is not already checked, check the \textbf{Enable S.M.A.R.T. monitoring} checkbox in the global configuration.

The \textbf{Enable S.M.A.R.T. monitoring} checkbox acts as an on/off switch for the entire system and lets you temporarily disable S.M.A.R.T. monitoring if desired.

4. Select the rate in hours for S.M.A.R.T. monitoring to occur.

Since this is a global configuration, the monitoring rate will be the same for all disks in the system. The default rate is one hour.

S.M.A.R.T. monitoring will use system resources as it checks the device.

5. Check the \textbf{Enable S.M.A.R.T. check on this device} checkbox at the bottom of the window to have S.M.A.R.T. monitoring be performed on the specific disk you selected.

6. Click \textbf{OK}.

7. Repeat steps 1, 2, 5, and 6 for each disk you want to monitor.
Capacity monitoring

Capacity monitoring is a feature that monitors the capacity of Symantec Storage Foundation for Windows dynamic volumes and Microsoft Disk Management dynamic volumes so that when the used disk space on a volume reaches a user specified threshold, an email alert message is sent.

You can also use SFW’s Rule Manager event notification function to set up an email message that is sent when thresholds are reached and logged.

See “Accessing the Rule Manager utility” on page 216.

Capacity monitoring is set at the individual volume level and is turned off by default. You will need to enable it for each volume you want to monitor.

The capacity monitoring settings you establish only affect existing volumes. New volumes that are added to a server after any capacity monitoring settings are made have the default capacity monitoring settings applied to them. If the default is not appropriate, you must change the settings for any new volumes that are added.

Capacity monitoring is also available in the CLI with vxvol capacitymonitor.
To enable a volume warning notification

1. Right-click on the volume you want to manage and click **Capacity Monitoring**

   The Capacity Monitoring window appears.
2 Set the capacity monitoring parameters.

To set the capacity monitoring parameters, perform the following:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable Capacity Monitoring for Volume</td>
<td>Check this option to enable capacity monitoring for a selected volume</td>
</tr>
<tr>
<td>Disable Capacity Monitoring for Volume</td>
<td>Check this option to disable capacity monitoring for a selected volume</td>
</tr>
<tr>
<td>Polling interval for checking capacity (sec)</td>
<td>The polling interval is the interval of time, in seconds, at which Storage Foundation for Windows checks volume capacities. The minimum and default value is 20 seconds.</td>
</tr>
<tr>
<td>Minimum time between alerts</td>
<td>To keep the event log file from getting full, you can limit how often an alert message is generated after the warning threshold is reached for a volume. The default is 100 seconds between messages.</td>
</tr>
<tr>
<td>Critical threshold</td>
<td>The percentage of volume capacity that Storage Foundation for Windows reports an error. The default critical threshold is 90% of capacity.</td>
</tr>
<tr>
<td>Warning threshold</td>
<td>The percentage of volume capacity that Storage Foundation for Windows logs a warning alert message. This is a warning that the volume is reaching full capacity. The default warning threshold is 80% of capacity.</td>
</tr>
<tr>
<td>Send email notification when volume.......</td>
<td>Enable the checkbox marked against &quot;Send email notification when volume.....&quot; if you wish to send email notifications. In the Recipient Email Address(es), enter the email IDs to whom notification needs to be sent.</td>
</tr>
<tr>
<td>Make Policy available to another cluster node when failover</td>
<td>Enable the checkbox Make Policy available to another cluster node when failover if you have a cluster setup. This checkbox appears only in case of a clustered setup.</td>
</tr>
</tbody>
</table>

3 Click OK to enable the settings.

**Configuring Automatic volume growth**

The Automatic Volume Growth feature is a command to have an individual volume grow (increase capacity) automatically by a user specified amount when the used
disk space on the volume reaches a certain threshold. This threshold is set in the Capacity Monitoring wizard.

By automating the growth process, the Automatic Volume Growth feature enhances the capability of dynamic volumes to expand without requiring that the underlying disks be off-line.

The advantages of this automatic process include the following:

■ Reduced need for a System Administrator to monitor volume capacity at all times.

■ Disk space is allocated on an as-needed basis; no idle excess capacity.

■ Space will always be available for mission-critical data.

Automatic Volume Growth is set at the individual volume level and is turned off by default. You will need to enable it for each volume you want to grow. Enabling a volume for Automatic Volume Growth requires the volume to be enabled for Capacity Monitoring.

The following gives more information about configuring Automatic Volume Growth in a cluster environment.

See “Enabling Automatic Volume Growth in a non-clustered and clustered environment” on page 226.

---

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support Automatic Volume Growth.

---

A policy file is used to record the settings for the volumes that use the Automatic Volume Growth feature. This XML file is automatically set up when Automatic Volume Growth is enabled, and it reflects the current settings for a volume. You can view and change the current settings with the Automatic Volume Growth wizard.

Alternately, you can use SFW’s Rule Manager event notification function to grow a volume automatically. With Rule Manager, you can set up a script that can grow a volume automatically when a specified threshold is reached.

The current Automatic Volume Growth settings of all your volumes are also available to help you manage your volumes. Selecting the volume node in the tree-view of the GUI and selecting Automatic Volume Growth Information in the context menu, displays the growth size, the maximum growth limit, and if Automatic Volume Growth is enabled for your volumes.

The following topics give more information on Rule Manager:

See “Automatic volume growth script for volume capacity monitoring” on page 228.
See “Accessing the Rule Manager utility” on page 216.

Automatic Volume Growth is also available in the CLI and with `vxvol autogrow`.

**Warning:** If you use a script to enable volume growth, do not enable the Automatic Volume Growth function through the Automatic Volume Growth wizard. If you enable a volume growth script and enable the Automatic Volume Growth function for a volume, the volume will increase in size by the combined amount. If you prefer to use the new feature, you must disable the script.

Enabling Automatic Volume Growth in a non-clustered and clustered environment

Automatic volume growth feature can be enabled on a non-clustered and clustered environment as shown in the below procedure.

**Note:** In a cluster environment, you must configure the Veritas Scheduler Service on all nodes in the cluster environment to allow the transfer of Capacity Monitoring and Automatic Volume Growth settings to other nodes after failover. These settings are done once for each node after installing or upgrading SFW.

To enable the Automatic Volume Growth feature, perform the following steps:

**To enable automatic volume growth in a non-clustered and clustered environment**

1. Right-click on the volume you want to manage and click **Automatic Volume Growth**.
   
   The Automatic Volume Growth wizard appears.

   Click **Next** to continue.

2. Highlight any additional volumes you want to manage and click **Add**.

   Click **Next** to continue.

3. Check the **Enable automatic volume growth** checkbox.

4. Set the Automatic Volume Growth parameters as follows:

   - Volume growth
     
     Enter the size by which you want the volume to expand each time the growth threshold is reached.

   - Maximum volume size
     
     Select the maximum volume size for the volume:
### Unrestricted volume growth
Default setting. Allows the volume to grow without an upper limit to the volume size.

### Restricted volume growth
Lets you enter a maximum size for the volume. The volume growth is limited to this specified size. This setting may be useful to manage a database volume that may be vulnerable to uncontrolled rapid growth due to malicious updates, spam, or virus attack.

5 Enable notification by email (optional) as follows:

- **Send email notification when volume has reached its growth threshold**
  Check this checkbox, if you want an email sent when a volume has reached its growth threshold.
  Enter the email address(es) to where the notifications should be sent in the Recipient E-mail Address(es) box. Separate multiple addresses with commas.
  Make sure the SMTP Configuration settings have been set. If they have not, you should set them now.
  See “SMTP configuration for email notification” on page 231.

6 Enable the checkbox **Make policy available to another cluster node when failover**, if you have a cluster environment and want the automatic volume growth policy to be available to another cluster node after a failover.

**Note:** This checkbox is available only when the volume belongs to a cluster disk group.

7 Click **Next** to continue.

8 Select which disks to automatically grow the volume as follows:

- **Auto select disks**
  SFW automatically selects which disks to grow.

- **Manually select disks**
  Highlight which disks you want to grow and click **Add**.
  Click **Next** to continue.

9 Review the summary of the Automatic Volume Growth settings and click **Finish** to apply.
Configuring the Veritas Scheduler Service on a clustered environment

To configure the Veritas Scheduler Service on cluster nodes, perform the following steps:

To configure the Veritas Scheduler Service in a cluster environment

1. Create a domain user that has administrator privileges that can access every cluster node.

   **Note:** For Windows Server operating systems, the user must be the domain administrator.

   **Note:** For Exchange 2010, the user account that is configured for the Scheduler Service should have read-write permissions to the file share path in case of a VCS cluster setup.

2. From the Start menu (the Start screen on Windows 2012 operating systems), click Administrative Tools.
   Under Services, select Veritas Scheduler Service.

3. Right-click Veritas Scheduler Service and select Properties from the context menu.

4. Click the Log On tab on the Properties window.

5. Click the This Account option and enter the domain user/administrator ID and password that was created in an earlier step of this procedure.
   Confirm the password and click Apply, then OK.

6. On the Windows Services GUI, restart the Veritas Scheduler Service to complete the configuration.

Automatic volume growth script for volume capacity monitoring

The volume capacity monitoring feature can send alert messages when dynamic volumes reach certain size thresholds. In addition, with the use of a script, volume capacity monitoring can automatically grow a volume when it reaches a specified capacity. With a script, you can conserve disk space on your servers because space is distributed automatically on an as-needed basis. You do not have to manually allocate the additional disk space when it is required.

The following steps set up a rule for growing a volume when a Capacity Monitoring threshold error occurs. The volume capacity monitoring feature monitors the capacity of the volume on your system; it has two thresholds—a Warning threshold
with a default setting of 80% of capacity and a Critical threshold with a default setting of 90% of capacity. These are the points at which the volume capacity monitoring feature sends an alert. To automate volume growth, you can associate an executable file, volgrow.cmd, with a Rule Manager rule so that when the Critical threshold is passed, a command to expand the volume is automatically sent.

Before setting up a new rule to execute a command, you must enable the VEA service and the GridNode service to interact with the desktop. These steps are not required if the new rule is only sending email notifications.

**Enabling the VEA and GridNode to interact with the desktop**

The following describes how to enable the VEA service and the GridNode service with the desktop.

**To enable the VEA service and the GridNode service to interact with the desktop**

1. Stop the following services in the order shown below before configuring a new rule:
   - Action Agent
   - Storage Agent
   - Veritas Enterprise Administrator
   - GridNode

2. Right-click the Veritas Enterprise Administrator service. Select Properties, click **Allow service to interact with desktop** under the Log On tab, and click OK.

3. Right-click the GridNode service. Select Properties, click **Allow service to interact with desktop** under the Log On tab, and click OK.

4. Start the following services in the order shown below after configuring a new rule:
   - GridNode
   - Veritas Enterprise Administrator
   - Storage Agent
   - Action Agent

**Configuring a rule to execute volume growth**

The following describes how to configure a rule to execute volume growth when capacity thresholds are met.
To configure a new rule to execute volume growth when capacity thresholds are met

1. Make sure that the volume capacity monitoring feature is turned on for the volume you want to monitor and that the thresholds are set to the desired percentages. The volume capacity monitoring feature is off by default.
   
   The following enables volume capacity monitoring:
   
   - Right-click the volume and select **Capacity Monitoring**.
   - Select enable capacity monitoring for the volume.
   - Change the appropriate settings.
     
     You may want to set the **Minimum time between alerts if condition persists** to a large number, such as 3600 seconds (equivalent to one hour), so that you won’t get so many messages while the volume is being enlarged.
   - Click **OK** after the settings are completed.

2. If you have not already done so, set up the recipient or recipients that will receive the alert messages about the capacity threshold.
   
   See “Event notification” on page 216.

3. Select the Control Panel perspective in the VEA GUI.

4. Click the **actionagent** node in the tree view.

5. Double-click the **Rule Manager** icon to display the Rule Manager window.

6. Click the **New Rule** button to display the Rule wizard.
   
   Click **Next** to continue.

7. In the window that appears, do the following:
   
   - Enter a name for the rule and select **A rule based on the alert topic**.
   - Click **Select** to select the Alert topic.
   - Check the **Volume capacity reached error condition** alert checkbox to select the alert.
   - Click **OK** to close the windows and return to the wizard.

   Click **Next** to continue the wizard.

8. Specify if the rule is triggered for alerts from any host or from specific hosts. If you specify alerts originating from specific hosts, then check the appropriate hosts in the lower part of the window.
   
   Click **Next** to continue.
9 Check both checkboxes in the Select actions window to enable the following actions:

- **Send Email Notification**
  Enter the email addresses of the recipients.

- **Execute Command**
  Enter the name of the hosts, the source host, and the path of the source file.
  Enter the path for the `volgrow` command file for the source file. The default path for `volgrow.cmd` is:

  ```
  C:\Program Files\Veritas\Veritas Volume Manager\Sig\volgrow.cmd <VolumeName|DriveLetter>
  ```

  The included `volgrow.cmd` script is set to grow a volume by 150 MB. The size for growing the volume can be changed by modifying the `volgrow.cmd` script to a desired number. Please read the comments in the script for more information.

  Click **Next** to continue.

10 Check **Enable Rule** and click **Finish** to complete the setup.

The Rule Manager window displays listing the new rule. With the new rule, once the amount of data in the volume reaches the point where the error threshold is reached, the rule activates, a message is sent that the error threshold has passed, and the command to grow the volume is implemented immediately. Once the process for growing the volume is complete, you will stop receiving error messages about the volume capacity.

### SMTP configuration for email notification

The SMTP Configuration settings are global settings and need to be set only once for all the capacity monitoring and automatic volume growth email messages that are sent.

**To configure SMTP**

1 From the VEA Control Panel Perspective, select the StorageAgent node in the tree view.

2 Select **SMTP Configuration** in the right pane. The SMTP Settings screen appears.

3 Enter the following information:
SMTP server: enter the name or IP address of the SMTP mail server on your network.

Port: the default port for the SMTP mail server is usually 25.

Sender: enter the name that should appear as the sender.

Sender email address: enter the full SMTP email address for the sender.

4 Click OK to save your settings.
Standard features for adding fault tolerance

This chapter includes the following topics:

- Fault tolerance overview
- Mirroring
- RAID-5 and RAID 0+1
- Hot relocation
- Dirty region logging (DRL) and RAID-5 logging
- Dynamic relayout

Fault tolerance overview

Fault tolerance is the capability of ensuring data integrity when hardware and software failures occur. This chapter focuses on the Symantec Storage Foundation for Windows standard features that provide fault tolerance.

Note: Additional fault tolerance for your storage can be gained through the program’s options. The Microsoft Failover Clustering support option provides fault tolerance for up to eight servers through clustering. The Symantec Dynamic Multi-Pathing for Windows option provides multiple paths from the server to a storage array to ensure application availability.
Mirroring

This section covers the following topics:
About mirroring
Add a mirror to a volume
Two methods for creating a mirror
Break or remove a mirror
Set the mirrored volume read policy
Mirror a dynamic boot or system volume
Reactivate a mirrored volume
Repair a mirrored volume
In addition, the following advanced procedures exist for mirrored volumes:
Dirty region logging for mirrored volumes
FastResync
In addition, the FastResync feature is an advanced procedure for mirrored volumes. FastResync is a feature that is part of the FlashSnap option.

**Note:** FlashSnap is available only with the Enterprise edition. See the "Licensing" section in the *Symantec Storage Foundation and High Availability Solutions Installation and Upgrade Guide* for details.

See “FastResync” on page 336.

About mirroring

A mirrored volume consists of at least two subdisks of identical size located on separate disks. Each time a file system or application writes to the volume, Symantec Storage Foundation for Windows transparently writes the same data to each of the volume’s subdisks. With Symantec Storage Foundation for Windows, you can have up to 32 mirrors for all volume types except for RAID-5.

**Add Mirror:** The primary purpose of mirroring is to provide fault tolerance; however, mirrored volumes can also improve I/O performance for most I/O-intensive applications, which make substantially more read requests than writes. With mirrored volumes, write requests may take longer than with non-mirrored volumes, but the effects are typically minor.
**Break Mirror**: An important use of mirroring is the practice of breaking off a third mirror that can be used as a snapshot for backup or for other activities, such as uploading or updating data warehouses or performing application testing.

**Remove Mirror**: Removing a mirror from a volume "removes" or destroys the data from the selected mirror and leaves the other mirror or mirrors intact. After you remove a mirror, the space on the disk used by the removed mirror becomes unallocated free space.

You use the Mirror Wizard to complete these tasks. The end of the Mirror Wizard displays a summary of the details of the operation.

### Two methods for creating a mirror

You can create a mirror on an existing volume or create a new mirrored volume. For details, see the following:

- To create a mirror on an existing volume, use the Add Mirror command. See “Add a mirror to a volume” on page 235.
- To create a new mirrored volume, use the New Volume wizard. You select a mirrored layout when you create the volume. See “Create dynamic volumes” on page 52.

---

**Note**: The mirroring process is disabled if the volume cannot be mirrored or if there is no unallocated space on another dynamic disk large enough to mirror the volume. A RAID-5 volume cannot be mirrored.

### Add a mirror to a volume

The basic process of adding a mirror is described in this section.

The Add Mirror wizard also enables you to implement the Dynamic Relayout feature.

See “Dynamic relayout” on page 253.

---

**Note**: If SFW is installed on Windows Server 2008 R2, then the Add Mirror operation for dynamic volume gets disabled if this operation is performed through the Logical Disk Management (LDM) console. In such cases, it is recommended to perform the Add Mirror operation through the Veritas Enterprise Administrator (VEA) console.

If you create more than one mirror at a time, you may see inconsistent information on the progress bar. Also, the generation of multiple mirrors does affect system
resources. After creating a mirror, you may want to wait until it has finished generating before creating another mirror.

**Warning:** Adding mirrors to a volume involves a certain amount of time for mirror resynchronization. Take care not to perform actions on the volume until the command is complete. Also, if you inadvertently shut down the server or deport the disk group containing the volume before mirror resynchronization completes, any mirrors that were being added to the volume will be deleted when the disk group with the volume comes online again.

Note that the SmartMove feature can help reduce mirror resynchronization time. See “SmartMove” on page 112.

**To add a mirror to a volume**

1. Right-click on the volume you want to mirror.
2. Select **Mirror>Add** from the context menu.
   The Add Mirror wizard appears.
3. Specify how many mirrors you want to add to the volume, and, if desired, manually assign the destination disks for the mirrors.
   To assign the disks manually, click the **Manually select disks** radio button. Then use the buttons for adding and removing disks to move the disks you want assigned as destination disks to the right pane of the window.
   You may also check **Disable Track Alignment** to disable track alignment for the mirrors.
   Click **Next** to continue.
4. In the Specify the attributes dialog box, select the Concatenated or Striped volume layout type. If you are creating a striped mirror, the **Columns** and **Stripe unit size** boxes need to have entries. Defaults are provided.
   You may also specify a mirror that mirrors across disks with the following attributes:
   - Connected by port
   - Identified by target
   - Contained in an enclosure
   - Connected by channel
   In addition for a striped layout, you may specify to have the stripe across disks done by the following:
The operation to create a new dynamic volume fails if the appropriate resources are not available to support the selected attributes to mirror across disks.

5 On the summary page, click **Finish** to add the mirror.

**Break or remove a mirror**

You can break or remove a mirror. It is important to understand the difference between these operations.

Breaking a mirror takes away a redundant mirror (or plex) of a volume and assigns it another drive letter. The data on the new volume is a snapshot of the original volume at the time of breaking. Breaking off a plex of the mirrored volume does not delete the information, but it does mean that the plex that is broken off will no longer mirror information from the other plex or plexes in the mirrored volume.

Removing a mirror from a volume "removes" or destroys the data from the selected mirror and leaves the other mirror or mirrors intact. After you remove a mirror, the space on the disk used by the removed mirror becomes unallocated free space.

---

**Note**: Symantec Storage Foundation for Windows does not let you remove the mirror of the volume that Windows is using to boot from. Also, if you break a mirrored boot volume, you cannot boot from the portion that was broken off.

The details on breaking and removing a mirror are included in the next two sections, "Break Mirror" and "Remove Mirror."

**Break mirror**

This section explains how to break a mirror.

---

**Note**: If you have a mirrored volume with two plexes and you break one off, the remaining plex is no longer a mirrored volume. It too assumes its other layout characteristics without the mirroring, but it does keep the drive letter of the original mirrored volume.
To break a mirror

1. Right-click on the volume from which you want to break a mirror. Click Mirror on the context menu that comes up, and then select Break from the submenu.

2. In the Break Mirror dialog box that appears, select the mirror you want to break off.

   Choose whether or not to assign a drive letter to the broken-off volume. You may assign a specific letter from the drop-down list or accept the default. You can also assign a label to the detached mirror.

   When you are satisfied with your choices, click OK.

   Once the command is completed, the broken-off plex is no longer part of the mirrored volume and is assigned the drive letter specified, if **Assign a drive letter** was selected. The broken-off plex retains all other volume layout characteristics except the mirroring. For example, if you had a mirrored striped volume, the broken-off plex would become a striped volume.

Remove mirror

After a mirror is removed, the space formerly allocated to it reverts to free space.
Warning: When a mirror is removed, all of the data on the removed mirror is deleted.

To remove a mirror

1. Right-click on the volume from which you want to remove the mirror.
2. Select **Mirror > Remove**.

The Remove Mirror dialog box will appear as shown below:

![Remove Mirror Dialog Box](image)

The name of the volume with the mirror appears in the upper left.

3. The available mirrors will appear in the left pane. Use the **Add** or **Add All** button to move the desired mirrors to the list of mirrors selected to be removed in the right pane. To move mirrors from the **Selected mirrors** list to the **Available mirrors** list, select them in the right pane and click the **Remove** button. To move all of the mirrors from the **Selected mirrors** list back to the **Available mirrors** list, click the **Remove All** button.

4. Select the mirror to remove.
   
   Click **OK** to remove the mirror or mirrors.

5. Click **Yes** at the message warning you that removing mirrors will reduce the redundancy of the volume.
Set the mirrored volume read policy

Setting the read policy on a dynamic volume lets you specify either that a particular mirror be used for reads or that all mirrors be read in turn in "round-robin" fashion for each nonsequential I/O detected. The default is that mirrors be read "round robin."

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support setting the volume read policy.

**To set the volume read policy**

1. Right-click on the volume you want to set the read policy for.
2. Select **Set Volume Usage** on the context menu.
   
   The Set Volume Usage dialog appears.

3. Select either the **Round robin** or **Preferred** option.
   
   These options are as follows:
   
   - The Round robin option reads each plex in turn in "round-robin" fashion for each nonsequential I/O detected. Sequential access causes only one plex to be accessed. This takes advantage of the drive or controller read-ahead caching policies.
If you select the Preferred option, you must select the mirror you want to set as the preferred option from the list of mirrors shown. This mirror will be used for reads whenever possible. This can improve your system’s read performance, particularly if the drive used for the target mirror is a high-performance drive or if the target mirror is located on a drive that is geographically closer. If a mirror has already been set as preferred, you will see the text "(Preferred plex)" after the mirror’s name in the dialog box. When a preferred plex has an error, the read operation is completed by another plex. This happens automatically, as if there were no preferred plex.

4 Click OK to set the volume usage, or click the Cancel button to exit without setting the read policy.

**Mirror a dynamic boot or system volume**

This section presents items to consider when you plan to mirror a dynamic boot or system volume.

You need to be aware of the following:

- Be sure to back up any data on the system before you create the mirror.
- For information on how you can boot your system from the mirror for Windows Server operating systems, refer to the Microsoft documentation.
- If a break-mirror operation is performed on a mirrored boot volume, the resulting new volume—the broken-off mirror—will not be usable as a boot volume.

Under certain conditions, you may be unable to create a mirror on a boot or system volume or get an error message during the process.

See “An attempt to mirror a boot or system volume fails or has an error message” on page 288.

You must follow specific steps in setting up a dynamic boot or system volume. See “Set up a dynamic boot and system volume (Optional)” on page 62.

**Reactivate a mirrored volume**

If there is a problem with one of the disks on which a mirrored volume resides, make sure that the disk is properly connected, and then try to bring that disk back online by first using Rescan. If Rescan does not work, then use the Reactivate Disk command. In most cases, Reactivate Disk will bring the disk online and all of the volumes will be healthy.
**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Reactivate Disk command.

However, if any of the mirrors of the mirrored volume are still not healthy, you may need to resynchronize the degraded volume with the Reactivate Volume command. Resynchronizing makes the data consistent on all mirrors of a mirrored volume.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Reactivate Volume command.

Right-click the volume and select **Reactivate Volume** from the context menu. The mirrored volume should come back to a Healthy state unless there is a serious problem with the volume.

See also the following topics:
- See “Rescan command” on page 275.
- See “Reactivate disk command” on page 280.
- See “Reactivate volume command” on page 281.

### Repair a mirrored volume

When a disk on which a mirrored volume resides fails, the volume displays a Degraded status. The disk’s name is changed to Missing Disk, and an icon (X) appears on the Missing Disk icon. The status of the disk will be Offline.

You can use the Repair Volume command to repair a mirrored volume.

See “Repair a mirrored volume” on page 242.

### RAID-5 and RAID 0+1

This section describes the fault tolerance capabilities of RAID-5 and RAID 0+1.

#### RAID-5

A RAID-5 volume is a fault-tolerant volume with data and parity striped intermittently across three or more physical disks. Parity is a calculated value that is used to reconstruct data after a failure. If a portion of a physical disk fails, the data on the failed portion can be recreated from the remaining data and parity.
You can create RAID-5 volumes only on dynamic disks. You cannot mirror RAID-5 volumes.

The advantage of RAID-5 is that it provides fault tolerance with less hardware than that required for mirroring. RAID-5 supports the configuration of any number of data disks with the hardware cost of only one disk for parity. Mirroring requires separate disks for each mirror. RAID-5 protects against data loss when one disk fails. However, it is necessary to resynchronize the data from the other disks to access the data. With mirroring, if one disk fails, the data is available from another mirror right away. Also, RAID-5 does not have the advantage of adding more mirrors for increased fault tolerance. With mirroring, you can have three or more mirrors so that if more than one disk fails, there is still fault tolerance. With RAID-5, once two disks fail, the RAID-5 volumes on multiple disks will fail. Now that the cost of storage has decreased, mirroring is a better choice for fault tolerance.

You can resynchronize a RAID-5 volume after it is degraded (having lost one disk). See “Repair volume command for dynamic RAID-5 volumes” on page 281.

RAID 0+1

Mirroring with striping, RAID 0+1, offers the protection of mirroring and the speed of striping.

The following are some advantages of RAID 0+1 volumes:

- Very large fault-tolerant volumes can be created that can hold large databases or server applications.
- Read performance is very high. A preferred plex can be designated. Within each plex, striping balances the load.
- The write penalty (that is, the multiple writes SFW must perform to keep all plexes’ contents synchronized) is mitigated by the striping of data across multiple disks.

---

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support RAID 0+1.

About the only disadvantage to RAID 0+1 is the hardware cost. The user must purchase, house, power, and operate twice as much raw storage capacity as the data requires. Today with lower storage costs, mirroring with striping is becoming a preferred RAID layout for mission-critical data.
"Hot relocation" describes the ability of a system to automatically react to I/O failures. It is an automatic process that relocates subdisks from a disk that has I/O errors.

The default for Symantec Storage Foundation for Windows is to have automatic hot relocation mode inactive. This means that if an I/O error occurs in a redundant subdisk, the subdisk is not automatically relocated to another disk. The tasks to enable the hot relocation mode are described in the following hot relocation setup section.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support hot relocation.

**Note:** Dynamic disks belonging to a SAN Disk Group do not support hot relocation.

This section covers the following topics:
- Hot relocation overview
- Hot relocation setup summary
- Hot relocation mode
- Customize target disks with set disk usage
- Undo hot relocation
- Clear hot relocation information

### Hot relocation overview

In hot relocation mode, if there are I/O errors on a subdisk containing a redundant volume (RAID-5 or mirrored), the redundant volume’s subdisks are moved from the failed subdisk to a hot spare disk. If there is not enough free space on designated hot spare disks, then free space on any available disk will be used. Depending on available disk space, the subdisks will not always be moved to the same disk, but may be scattered within the dynamic disk group. The Undo Hot Relocation command can be used to move the subdisks back to their original location after the failed disk has been repaired or replaced.
Note: The hot relocation operation is performed only for redundant subdisks with I/O errors if there are healthy plexes of the volume available elsewhere within the dynamic disk group. Nonredundant subdisks with I/O errors are not relocated; the volume fails, and an alert message is sent to the Event Log.

When selecting space for relocation, hot relocation preserves the redundancy characteristics of the dynamic volume that the relocated subdisk belongs to. For example, hot relocation ensures that a failed subdisk is not relocated to a disk containing its mirror. If redundancy cannot be preserved by using any available spare disks or free space, hot relocation does not take place. If relocation is not possible, the system administrator is notified and no further action is taken.

Note: The hot relocation operation does not adhere to site boundary restrictions. If hot relocation causes the site boundary to be crossed, then the Site Separated property of the volumes is changed to Siteless. This is done so as not to disable hot relocation. To restore site boundaries later, you can relocate the data that crossed the site boundary back to a disk on the original site and then change back the properties of the affected volumes.

See “Administering disks for site-based allocation” on page 461.

When hot relocation takes place, the failed subdisk is removed from the configuration database, and Symantec Storage Foundation for Windows takes precautions to ensure that the disk space used by the failed subdisk is not recycled as free space.

The default is to have all disks available as targets for hot-relocated subdisks. Using the Set Disk Usage command, you can choose to designate specific disks as not available.

See “Disk usage options” on page 247.

Note: The Reset button restores default settings.

Hot relocation setup summary

There are two tasks that must be done to ensure that the hot relocation mode is properly configured.

The first task uses the Hot Relocation command from System Settings to verify that the hot relocation mode is enabled.
The second task uses the Set Disk Usage command to define within each disk group which disks, if any, should be selected as preferred targets for hot-relocated subdisks or never used as targets for hot-relocated subdisks.

**Hot relocation mode**

The default for Symantec Storage Foundation for Windows is to have automatic hot relocation mode inactive. This means that if an I/O error occurs in a redundant subdisk, the subdisk is not automatically relocated to another disk. Use the Set Disk Usage command to designate preferred disks as targets for hot relocation.

The option to enable the hot relocation mode is available from System Settings in the Control Panel or from Edit Configuration in the Storage Foundation Assistant.

**To enable the hot relocation mode**

1. Open **System Settings** in the Control Panel or open **Edit Configuration** in the Storage Foundation Assistant.
2. Click the **Hot Relocation** tab in **System Settings** or click **Hot Relocation** in **Edit Configuration**.
3. Check the checkbox to enable the hot relocation mode. If automatic hot relocation is disabled and an I/O failure occurs, an alert will be sent to the Event Log, but no further action will take place.
4. When you are satisfied with your selection, click **OK**.

**Customize target disks with set disk usage**

The Set Disk Usage command lets you specify how individual disks within a dynamic disk group will be used by Symantec Storage Foundation for Windows. If an I/O failure occurs, SFW looks for free space on preferred or secondary target disks within the dynamic disk group that contains the failing disk to determine where to move the subdisks. Thus, it is important to consider the entire disk group when configuring disk usage. In addition, you need to consider the track alignment settings of the failing disk and the target disks. SFW does not preserve the track alignment settings of the failing disk. SFW adopts the track alignment settings of the target disk after hot relocation takes place.

The default for each disk is "secondary hot relocation target." This will probably be the state you prefer for the majority of disks within each disk group. If hot relocation occurs and subdisks from a specific disk are scattered throughout the disk group, it is possible to repair or replace the failed disk and then use the Undo Hot Relocation command to return all the subdisks back to their original location.
Disk usage options

The Set Disk Usage command is used to set disk usage options.

It provides the following options:

- Reserved for manual use
  Disks reserved for manual use are not available in automatic selection operations, including hot relocation. In an automatic selection operation, Symantec Storage Foundation for Windows chooses the storage where the operation occurs. Generally, the user is given a choice between allowing SFW to "Auto select disks" or "Manually select disks." Examples of commands that allow automatic selection are New Volume and Add Mirror. Reserving a disk for manual use lets you prevent any unwanted volumes or subdisks from being placed on that disk and gives you complete control over the disk.

There are three options related to how a disk is used as a target for hot-relocated subdisks. In considering how to mark each disk, remember that the hot relocation operation occurs at the disk group level, and only target disks within the same disk group will be considered.

The three options are as follows:

- Preferred hot relocation target
  If there is an I/O failure anywhere in the system, SFW first looks for space on disks that have been marked as preferred hot-relocation targets for redundant subdisks.

- Secondary hot relocation target
  This is the default for all disks. During the hot relocation operation, if there are no disks selected as preferred targets or if there is no space available on those disks, SFW chooses space on disks marked as secondary targets.

- Not used as a hot relocation target
  This option does not allow any hot-relocated subdisks to be moved to the selected disks. It differs from the "Reserved for manual use" option in that the disk remains available for other automatic selection operations.

To set disk usage

1. Right-click on the desired disk.

2. Select Set Disk Usage from the context menu.

   The Set Disk Usage dialog box appears.
3 Choose how you want Symantec Storage Foundation for Windows to use the disk.

4 When you are satisfied with your selection, click **OK**.

You can review the settings for all your disks by selecting the Disks node in the tree view and then viewing the **Disks** tab in the right pane. The settings for each disk are listed in the Reserved and Hot Use columns.

### Undo hot relocation

The command Undo Hot Relocation relocates subdisks back to their repaired original disk or replacement disk and restores a system to its original configuration, less any failed volumes. If hot relocation scattered subdisks from a failed disk to several disks within a dynamic disk group, the Undo Hot Relocation command will move all of them back to a single disk without requiring the user to find and move each one individually.

---

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Undo Hot Relocation command.

---

**Note:** Dynamic disks belonging to a SAN Disk Group do not support the Undo Hot Relocation command.

---

**Note:** This command is available only after a hot relocation procedure has occurred.
To undo a hot relocation

1. Select the dynamic disk group that contains the hot-relocated volumes.
2. Select **Undo Hot Relocation** from the context menu.
   
   A window appears showing the original disks that had I/O errors.

   ![Undo Hot Relocation Window]

3. Click in the column under the checkmark to select the disks you want to restore. The hot-relocated subdisks will return to this disk.
4. Click **OK**.

Clear hot relocation information

The Clear Hot Relocation Information command deletes the information that describes the original location of any subdisks that have been moved by the hot relocation process. Use this command only if you do not plan to move the hot-relocated subdisks back to their original configuration.

**Warning:** Once you clear the hot relocation information, you will not be able to perform an Undo Hot Relocation command for that dynamic disk group.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Clear Hot Relocation Information command.

**Note:** Dynamic disks belonging to a SAN Disk Group do not support the Clear Hot Relocation Information command.
To clear hot relocation information

1. Right-click on a disk group that contains hot-relocated subdisks.
2. Select **Clear Hot Relocation Information** from the context menu.
3. A dialog box will appear asking if you are sure you want to clear the relocation information for the dynamic disk group. Click **Yes** if you want to clear the hot relocation information.

**Dirty region logging (DRL) and RAID-5 logging**

This section describes the dirty region logging (DRL) and RAID-5 logging features. Dirty region logging (DRL) and RAID-5 logging greatly speed-up the time that it takes to recover from a system crash for mirrored volumes and RAID-5 volumes.

This section covers the following topics:
- Dirty region logging for mirrored volumes
- RAID-5 logging
  - Add a log
  - Remove a log

**Dirty region logging for mirrored volumes**

DRL uses a log-based recovery method to quickly resynchronize all the copies of a mirrored volume when a system is restarted following a crash. If DRL is not used and a system failure occurs, all mirrors of the volume must be restored to a consistent state by copying the full contents of the volume between its mirrors. This process can be lengthy and I/O intensive.

A log can be created when the volume is created or can be added later.

**Warning**: Although DRL makes sure that the mirror copies of the mirrored volumes are in sync following a system crash, it does not guarantee data integrity. The data integrity will be preserved by the file system, for example, NTFS.

When a dirty region log is created, a log subdisk is added to the volume. Multiple logs can be associated with a single mirrored volume as a fault-tolerant measure. Depending on the number of logs configured, this may result in degraded performance.
**RAID-5 logging**

The primary purpose of RAID-5 logging is to quickly reactivate a RAID-5 volume when a system is restarted following a crash. Without RAID-5 logging enabled, a time-consuming reactivation of the entire RAID-5 volume is necessary.

When a RAID-5 log is created, a log subdisk is added to the volume. Multiple RAID-5 logs can be associated with a single RAID-5 volume as a fault-tolerant measure. Depending on the number of logs configured, this may result in degraded performance. If more than one log is added, then the logs are just mirrored. DRL logs for RAID volumes are called RAID-5 logs and provide the same functionality.

If a RAID-5 log is available, updates need to be made only to the data and parity portions of the volume that were in transit during a system crash. The entire volume does not have to be resynchronized.

A log can be created when the volume is created or can be added later.

**Add a log**

This operation adds a log plex containing a log subdisk to a volume. For mirrored volumes, a dirty region log is added. For RAID-5 volumes, a RAID-5 log is added.

---

**Note:** Logs are used only for mirrored volumes or RAID-5 volumes.

---

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support adding a log.
To add a log to a mirrored or RAID-5 volume

1. Right-click on the volume you want to add the log to.
2. Select Log>Add from the context menu.
   The Add Log dialog box appears.
3. Choose either the default setting Auto assign destination disks or the option to manually assign the destination disks. Click OK to create the log.

**Auto assign destination disks**
This option adds one log to the selected volume.

**Manually assign destination disks**
You can create multiple logs with this option.

Click the Manually assign destination disks radio button.

Available disks appear in the left pane. To add destination disks for the logs, select them in the left pane and click the Add button. To add logs to all available disks, click the Add All button.

To remove destination disks, select them in the right pane and click the Remove button. To remove all of the destination disks, click the Remove All button.

**Disable Track Alignment**
This option disables track alignment for the logs being added.

Remove a log

After a log is removed, the space formerly allocated to it reverts to free space.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support removing a log.
To remove a log

1. Right-click on the volume you want to remove the log from.
2. Select Log>Remove.

The Remove Log dialog box will appear as shown in the sample screen below:

![Remove Log dialog box](image)

The name of the volume with the log appears in the upper left.

3. The available logs will appear in the left pane. Use the Add or Add All button to move the desired logs to the list of logs selected to be removed in the right pane. To move the logs from the Selected logs list to the Available logs list, select them in the right pane and click the Remove button. To move all the logs from the Selected logs list back to the Available logs list, click the Remove All button.

4. After selecting the log, click OK to remove the log.

5. Click Yes at the message warning you that removing logs will potentially increase recovery time.

Dynamic relayout

Storage Foundation for Windows lets you reconfigure the layout of a volume without taking it offline with the Dynamic Relayout feature.

You can make the following dynamic volume layout changes:
Table 9-1  Dynamic Relayout Changes

<table>
<thead>
<tr>
<th>Changed from</th>
<th>Changed to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concatenated</td>
<td>Striped</td>
</tr>
<tr>
<td>Striped</td>
<td>Concatenated</td>
</tr>
<tr>
<td>Striped</td>
<td>Striped with changes in column size or stripe unit size</td>
</tr>
</tbody>
</table>

This feature is implemented through the Add Mirror window. That window has a section called “Choose the layout.”

The add mirror layout section is shown below.

Figure 9-1  Choose the layout section of add mirror window

The basic concept is that you select the features you want the volume layout to be changed to, and the program creates a mirror or plex of the original volume with the desired attributes of the new layout. If you no longer have a need for the original volume, you remove it with the Remove Mirror command.

Thus, the conversion or relayout is a two-step process. First, you select the desired attributes and create the mirror through the Add Mirror command. Second, you remove the original plex through the Remove Mirror command.

Examples of dynamic relayout

This section provides examples of the different layout types. The section that follows gives the step-by-step process for Dynamic Relayout.

The following are the different layout types:

- Concatenated to Striped
  For example, if you want to convert a concatenated volume on a single disk to a striped volume with two columns, you select striped and two columns in the Add Mirror window. The resulting volume will have two mirrors or plexes—one is the original plex, and the second is a copy of the original volume striped across two disks. Thus, the entire volume requires a total of three disks. The volume’s type is designated as Mixed. At this point, you can remove the original
plex by deleting it with the Remove Mirror command. Now you have a striped volume in place of the concatenated one that existed before.

- Striped to Concatenated
  Changing a striped volume to a concatenated volume probably won’t be done very often. Assume the example of an existing two-column striped volume. If you open the Add Mirror window and select the concatenated layout, the resulting volume will involve three disks: the first two disks have the plex of the two-column striped original volume, and the third disk contains a concatenated plex of the volume. By removing the original plex, the volume will now reside on one disk.

- Striped to Striped
  The purpose of converting a striped volume to another striped volume is to change the attributes of the volume (the stripe unit size and the number of columns) without having to recreate the volume.
  For example, you can convert a two-column striped volume to a three-column striped volume. First, you would select three columns in the Add Mirror window. The resulting volume would involve five disks: two disks for the original two-column striped plex and three disks for the new three-column striped mirror. Again, you can remove the original plex by deleting it with the Remove Mirror command, leaving only a three-column striped volume.

**Detailed steps for dynamic relayout**

Dynamic Relayout lets you change dynamic volume layout types while the volumes are still online. You use both the Add Mirror command and the Remove Mirror command to complete the Dynamic Relayout process.

**To complete the Dynamic Relayout process:**

1. Select the volume with the layout that will be converted. Choose **Mirror>Add** from the context menu.

2. Set the number of mirrors setting to 1. If desired, you can manually select the disks.

   To select the disks and use the Add or Add All button to move the disks you want to the Selected disks pane on the right side of the window.

   You may also check **Disable Track Alignment** to disable track alignment for the mirrors.

   Click **Next** to continue.
3 Select the desired layout for the volume in the "Choose the layout" section of the window.

If you choose striped, make sure that you have the number of columns desired and the stripe unit size that you want.

Click Next to continue.

4 When you are satisfied with your settings, click Finish.

The program creates a mirror or plex of the original volume with the attributes of the new layout. If you no longer have a need for the original volume, you can remove it with Remove Mirror.

You may want to review the information on how the program implements the dynamic relayout for each of the possible layout types.

See “Examples of dynamic relayout” on page 254.

5 If you want to delete the original plex, right-click on it and select Mirror>Remove from the context menu. In the Remove Mirror window that appears, use the Add button to move the plex to be removed to the Selected mirrors pane on the right side of the window, and click OK.

The process for converting the layout type on the volume is now complete.
Troubleshooting and recovery

This chapter includes the following topics:

■ Overview
■ Using disk and volume status information
■ SFW error symbols
■ Resolving common problem situations
■ Commands or procedures used in troubleshooting and recovery
■ Additional troubleshooting issues
■ Tuning the VDS software provider logging

Overview

This chapter describes ways to use Symantec Storage Foundation (SFW) to troubleshoot and recover from problems.

Note: It is recommended that you use a Volume Manager Disk Group (VMDg) resource for creating Microsoft file shares.

Using disk and volume status information

If a disk or volume fails, it is important to repair the disk or volume as quickly as possible to avoid data loss. Because time is critical, Symantec Storage Foundation for Windows makes it easy for you to locate problems quickly. In the Status column
of the Disks tab view or Volumes tab view, you can view the status of a disk or volume. You can also see indications of abnormal status in the tree view or the Disk View tab. If the status is not Healthy for volumes, Imported for dynamic disks, or Online for basic disks, use this section to determine the problem and then fix it.

The topics are the following:
- Disk status descriptions
- Volume status descriptions

Note: When there is a problem with a disk or volume, you can also look at the Events tab view for messages about problems that may have occurred.

## Disk status descriptions

One of the following disk status descriptions will always appear in the Status column of the disk in the right pane of the console window. If there is a problem with a disk, you can use this troubleshooting chart to diagnose and correct the problem. Caution: The suggested actions may bring the disks to an Imported status, but they do not guarantee data integrity.

### Table 10-1 Disk Status Descriptions

<table>
<thead>
<tr>
<th>Status</th>
<th>Meaning</th>
<th>Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Imported</strong></td>
<td>The disk is accessible and has no known problems. This is the normal disk status for dynamic disks.</td>
<td>No user action is required.</td>
</tr>
<tr>
<td><strong>Online</strong></td>
<td>The disk is accessible and has no known problems. This is the normal disk status for basic disks.</td>
<td>No user action is required.</td>
</tr>
<tr>
<td><strong>No Media</strong></td>
<td>No media has been inserted into the CD-ROM or removable drive. Only CD-ROM or other removable disk types display the No Media status.</td>
<td>Insert the appropriate media into the CD-ROM or other removable drive, and the disk status will become Online. If you do not see the disk status change immediately, use the Refresh command to refresh the GUI.</td>
</tr>
</tbody>
</table>
# Table 10-1  Disk Status Descriptions (continued)

<table>
<thead>
<tr>
<th>Status</th>
<th>Meaning</th>
<th>Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign</td>
<td>Only dynamic disks display this status. There are three situations where a disk may be marked as Foreign:</td>
<td>See “Bring a foreign disk back to an online state” on page 268.</td>
</tr>
<tr>
<td>Situation 1</td>
<td>The disk was created as a dynamic disk on another computer and has been moved to your computer and has not been set up for use.</td>
<td>Situation 1: Use Import Dynamic Disk Group to make the disk group available for use.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In the Import Dynamic Disk Group dialog box, be sure to click the checkbox to clear the host ID of the other system.</td>
</tr>
<tr>
<td>Situation 2</td>
<td>The disk contains a secondary disk group (that is, a disk group other than disk group containing the computer’s boot or system disk) and you have a dual-boot system. When you switch between operating systems, the disk with a secondary disk group is marked as Foreign and does not auto-import.</td>
<td>Situation 2: Use Import Dynamic Disk Group to make the secondary disk group available for use. The primary disk group will import automatically when you switch between operating systems. In the Import Dynamic Disk Group dialog box, be sure to click the checkbox to clear the host ID of the other system.</td>
</tr>
<tr>
<td>Situation 3</td>
<td>The disk was originally created on this computer. It was moved or deleted. Now you want to bring it back to this computer as a member of the disk group in which it was originally created.</td>
<td>Situation 3: Use the Merge Foreign Disk command to restore the disk as a member of its former disk group.</td>
</tr>
<tr>
<td>No Disk Signature</td>
<td>Displays for new disks. The disk cannot be used because it has no signature.</td>
<td>Right-click on the disk and select Write Signature from the menu. The disk type will change to Basic Disk and the disk can be accessed or upgraded.</td>
</tr>
<tr>
<td>Status</td>
<td>Meaning</td>
<td>Action Required</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Offline</td>
<td>Only dynamic disks display this status. There are two situations where a disk may show a status of Offline:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Situation 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The disk was part of the system's disk configuration but currently cannot be found.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Make sure the disk is connected to the computer. Then use Rescan to bring the disk online.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>See “Bring an offline dynamic disk back to an imported state” on page 266.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Situation 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The disk is not accessible. The disk may be corrupted or intermittently unavailable. An error icon appears on the offline disk.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If the disk status is Offline and the disk's name changes to Missing Disk (#), the disk was recently available on the system but can no longer be located or identified.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Make sure the disk is connected to the computer. Then use Rescan to bring the disk online.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>See “Bring an offline dynamic disk back to an imported state” on page 266.</td>
<td></td>
</tr>
<tr>
<td>Disconnected</td>
<td>Displays for a dynamic disk when the system can no longer find the disk. The name of the disk becomes &quot;Missing Disk.&quot;</td>
<td>Reconnect the disk.</td>
</tr>
<tr>
<td>Import Failed</td>
<td>The import of the dynamic disk group containing the disk failed. All disks in a dynamic disk group that failed to import will show this status.</td>
<td>Examine your configuration to determine what the problem might be.</td>
</tr>
</tbody>
</table>

**Table 10-1** Disk Status Descriptions *(continued)*
Table 10-1  Disk Status Descriptions (continued)

<table>
<thead>
<tr>
<th>Status</th>
<th>Meaning</th>
<th>Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failing</td>
<td>Failing is a secondary message shown in parentheses after a disk status. This status indicates that I/O errors have been detected on a region of the disk. All the volumes on the disk will display Failed, Degraded, or Failing status, and you may not be able to create new volumes on the disk. Only dynamic disks display this status.</td>
<td>Right-click on the failing disk and select Reactivate Disk to bring the disk to Online status and all its volumes to Healthy status.</td>
</tr>
</tbody>
</table>

Volume status descriptions

One of the following volume status descriptions will always appear in the graphical view of the volume and in the Status column of the volume in list view. If there is a problem with a volume, you can use this troubleshooting chart to diagnose and correct the problem.

Warning: The suggested actions may bring the volumes to a Healthy status, but they do not guarantee data integrity.

Table 10-2  Volume Status Descriptions

<table>
<thead>
<tr>
<th>Status</th>
<th>Meaning</th>
<th>Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy</td>
<td>The volume is accessible and has no known problems. This is the normal volume status. Both dynamic volumes and basic volumes display the Healthy status.</td>
<td>No user action is required.</td>
</tr>
</tbody>
</table>
Table 10-2 | Volume Status Descriptions (continued)

<table>
<thead>
<tr>
<th>Status</th>
<th>Meaning</th>
<th>Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resynching</td>
<td>The volume’s mirrors are being resynchronized so that both mirrors contain identical data. Both dynamic and basic mirrored volumes display the Resynching status. When resynchronization is complete, the mirrored volume’s status returns to Healthy. Resynchronization may take some time, depending on the size of the mirrored volume.</td>
<td>No user action is required. Although you can safely access a mirrored volume while resynchronization is in progress, you should avoid making configuration changes (such as breaking a mirror) during resynchronization.</td>
</tr>
<tr>
<td>Regenerating</td>
<td>Data and parity are being regenerated for a RAID-5 volume. Both dynamic and basic RAID-5 volumes display the Regenerating status. When regeneration is complete, the RAID-5 volume’s status returns to Healthy.</td>
<td>No user action is required. You can safely access a RAID-5 volume while data and parity regeneration is in progress.</td>
</tr>
<tr>
<td>Degraded</td>
<td>The Degraded status applies only to mirrored or RAID-5 volumes on basic or dynamic disks. There are three situations where Degraded status can occur:</td>
<td>Take the following actions to resolve these situations:</td>
</tr>
</tbody>
</table>
|           | Situación 1
The data on the volume may no longer be fault tolerant because one of the underlying disks is not online. A RAID-5 volume loses redundancy if one disk is offline or failed. A mirrored volume can lose redundancy if one of the disks containing one of its subdisks fails. | Situación 1
You can continue to access the volume using the remaining online disks, but you should repair the volume as soon as possible. It is important to repair the volume because if another disk that contains the volume fails, you will lose the volume and its data. See “Bring a dynamic volume back to a healthy state” on page 270. See “Bring a basic volume back to a healthy state” on page 270. |
### Table 10-2  Volume Status Descriptions (continued)

<table>
<thead>
<tr>
<th>Status</th>
<th>Meaning</th>
<th>Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situation 2</td>
<td>A Degraded status will also display if a disk involving a RAID-5 or mirrored volume was physically moved.</td>
<td>Situation 2 To correct the problem, you must move all the disks that contain the volume to the new location or return the moved disk or disks to the original location.</td>
</tr>
<tr>
<td>Situation 3</td>
<td>The data on the volume is no longer fault tolerant, and I/O errors have been detected on the underlying disk. If an I/O error is detected on any part of a disk, all volumes on the disk display the (At Risk) status. Only dynamic mirrored or RAID-5 volumes display the Degraded (At Risk) status.</td>
<td>Situation 3 To return the underlying disk to the Online status, reactivate the disk (using the Reactivate Disk command). Once the disk is returned to the Online status, the volume status should change to Degraded. Take further action as necessary to bring the volume back to a healthy state. See “Bring a dynamic volume back to a healthy state” on page 270.</td>
</tr>
<tr>
<td>Failed</td>
<td>A failed volume will be started automatically. An error icon appears on the failed volume. Both dynamic and basic volumes display the Failed status. There are two situations where Failed status can occur:</td>
<td>Take the following actions to resolve these situations:</td>
</tr>
<tr>
<td>Situation 1</td>
<td>A volume that spans two or more disks has one or more disks fail. A striped volume, simple volume, spanned volume, or extended partition will fail with one disk failure. A RAID-5 volume will fail with two disk failures. A mirrored or mirrored-striped volume will fail when the disks containing all the mirrors in the volume fail.</td>
<td>Situation 1 Replace or repair the failed or malfunctioning disk or disks.</td>
</tr>
<tr>
<td>Status</td>
<td>Meaning</td>
<td>Action Required</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Situation 2</td>
<td>A disk or disks involving a volume that spans multiple disks is moved to another computer.</td>
<td>Situation 2</td>
</tr>
<tr>
<td></td>
<td>Move all the disks that contain subdisks of the volume, or return the moved disk or disks to the original location.</td>
<td>Move all the disks that contain subdisks of the volume, or return the moved disk or disks to the original location.</td>
</tr>
<tr>
<td>Formatting</td>
<td>The volume is being formatted using the specifications you chose for formatting.</td>
<td>No user action is required.</td>
</tr>
<tr>
<td>Stopped</td>
<td>The volume is in a dynamic disk group that is not imported.</td>
<td>Import the dynamic disk group containing the volume.</td>
</tr>
<tr>
<td>Missing</td>
<td>The volume status will be Missing if any of the subdisks of the volume are on disks that show an Offline status.</td>
<td>Reactivate the offline disks and Rescan. If the volume status changes to Stopped or Failed, reactivate the volume.</td>
</tr>
<tr>
<td>Failing</td>
<td>Failing is a secondary message shown in parentheses after a volume status. Failing means Symantec Storage Foundation for Windows encountered some I/O errors on at least one disk that contains subdisks of the volume; however, these errors did not compromise the data on the specific volume. Failing sends the message that the disk integrity is deteriorating. When the volume status is Degraded (At Risk), the underlying disk’s status is usually Online (Failing).</td>
<td>Determine which disk is failing, and take corrective action.</td>
</tr>
<tr>
<td></td>
<td>See “Disk status descriptions” on page 258.</td>
<td>See “Disk status descriptions” on page 258.</td>
</tr>
</tbody>
</table>

### SFW error symbols

When a problem occurs in a computer's storage subsystem, Symantec Storage Foundation for Windows will alert the user with error messages and error symbols placed on top of the disk or volume icons to show the source of the problem.

The table below lists these error symbols, explains their meaning, and gives examples of their usage.
Table 10-3  Symantec Storage Foundation for Windows Error Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Disk 4" /> <img src="image2" alt="Disk 5" /></td>
<td>Warning. The yellow caution symbol indicates there is a potential problem but the system can still function normally.</td>
<td>Capacity warning, Degraded warning.</td>
</tr>
<tr>
<td><img src="image3" alt="Informational" /></td>
<td>Informational. The blue information symbol indicates that an object is not completely accessible or fully functional; it also indicates various informational events. This state is often caused by a user operation. No degradation or loss of data; the system can still function normally.</td>
<td>Disk group is deported, disks do not have signatures, disk group has some legacy objects (such as DCO, snapshotted volumes) that would not work until the disk group is upgraded, shared volume is not online on the node, server started, device arrival, etc.</td>
</tr>
<tr>
<td><img src="image4" alt="Dynamic Mirrored" /> <img src="image5" alt="Dynamic Spanned" /></td>
<td>Failure. The X symbol on a red circle indicates that a serious storage failure has occurred. Users need to look at the source of the problem and fix it as soon as possible. Any attempt to access the object will result in an error.</td>
<td>Failed volume, Missing disk.</td>
</tr>
</tbody>
</table>

Resolving common problem situations

This section provides information on how to resolve the most common problem situations that users encounter when managing their storage with Symantec Storage Foundation for Windows.

This section covers the following topics:

- Bring an offline dynamic disk back to an imported state
- Bring a basic disk back to an online state
- Remove a disk from the computer
- Bring a foreign disk back to an online state
- Bring a basic volume back to a healthy state
Bring a dynamic volume back to a healthy state
Repair a volume with degraded data after moving disks between computers
Deal with a provider error on startup

Bring an offline dynamic disk back to an imported state

An Offline dynamic disk may be corrupted or intermittently unavailable.

To bring an offline dynamic disk back to an imported state

1 Repair any disk or controller problems, and make sure that the disk is turned on, plugged in, and attached to the computer.

2 Use the Rescan command to rescan all the devices on the SCSI bus to bring the disk back online.
   Select Rescan from the Actions menu, or right-click the StorageAgent node in the tree view to get a context menu and select Rescan from that menu. If you have a lot of devices on the computer’s SCSI bus, the rescan of the bus may take some time.
   See “Rescan command” on page 275.
   If one of the disks has failed and you have a mirrored or RAID-5 volume, the repair involves recreating part of the volume in a different location.
   For more information:
      See “Repair volume command for dynamic RAID-5 volumes” on page 281.
      See “Repair volume command for dynamic mirrored volumes” on page 282.

3 If the disk does not come back after doing a rescan, select the disk and use the Reactivate Disk command to manually bring the disk back online.
   Right-click the disk’s label in the tree view or the Disk View tab view to bring up the disk’s context menu and select the Reactivate Disk command from the menu.
   See “Reactivate disk command” on page 280.
   Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Reactivate Disk command.
   If reactivating the disk does not change its status, something must be wrong with the disk or its connections.
4 If a disk comes back online after reactivating, check to see whether its volumes are healthy. If not, try the Reactivate Volume command on its volumes.

See “Reactivate volume command” on page 281.

Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Reactivate Volume command.

5 Run Chkdsk.exe to make sure that the underlying data on the disk is not corrupted.

To run Chkdsk, open a command prompt window and enter the following command:

```
chkdsk x: /f
```

where \( x \) is the drive letter of the volume you want to check. The /f option tells Chkdsk to fix any errors it finds. If the /f option is omitted, Chkdsk will operate in a read-only mode.

Although Chkdsk will clean up the file system structure, there may still be invalid data on the disk if users were working when a problem occurred on the disk. It is highly recommended that you run utilities to check the integrity of the data. If the data is corrupted, you will need to replace it from backup storage.

Bring a basic disk back to an online state

If a basic disk is corrupted or unavailable, it will not show in the VEA GUI.

To bring a basic disk back to an online state

1 Repair any disk or controller problems, and make sure that the disk is turned on, plugged in, and attached to the computer.

2 Use the Rescan command to rescan all the devices on the SCSI bus to bring the disk back online.

Select Rescan from the Actions menu, or right-click the StorageAgent node in the tree view to get a context menu and select Rescan from that menu. If you have a lot of devices on the computer’s SCSI bus, the rescan of the bus may take some time.

See “Rescan command” on page 275.
3 If a disk comes back online after rescanning, check to see whether its volumes are healthy.
   If they are not, you need to bring the volumes back to a healthy state.
   See “Bring a basic volume back to a healthy state” on page 270.

4 Run Chkdsk.exe to make sure that the underlying data on the disk is not corrupted.
   Even if the disk and volumes come back online, it is important to check whether the underlying data is intact.
   To run Chkdsk, open a command prompt window and enter the following command:
   chkdsk x: /f
   where x is the drive letter of the volume you want to check. The /f option tells Chkdsk to fix any errors it finds. If the /f option is omitted, Chkdsk will operate in a read-only mode.
   If the data is corrupted, you will need to replace it with data from backup storage.

Remove a disk from the computer
   As part of troubleshooting you may need to remove a basic or dynamic disk from the computer. This information is covered in the topics on disk tasks.
   See “Remove a disk from the computer” on page 268.

Bring a foreign disk back to an online state
   To bring a foreign disk back to an online state depends on the original context of the disk.

   Note: Because a volume can span more than one disk (such as with a mirrored or RAID-5 volume), it is important that you first verify your disk configurations and then move all the disks that are part of the volume. If you do not move all the disks, the volume will have a Degraded or a Failed error condition.

   The following describe the various contexts:
   - Use Import Dynamic Disk Group to bring a Foreign disk online if the disk was part of a dynamic disk group that was created on another computer and moved to the current computer.
**Note:** Microsoft Disk Management Disk Groups do not support the Import Dynamic Disk Group command.

To add a foreign disk that was created on another computer

1. Right-click on the disk and select **Import Dynamic Disk Group**.

   A dialog box comes up that displays the name of the dynamic disk group.

   ![Dialog box](image)

2. Indicate the name for the dynamic disk group as follows:
   - If you want to leave the name as is, click **OK**.
   - If you want a new name for the dynamic disk group, type a new name for the group in the **New name** entry box and then click **OK**.

3. If you are importing a dynamic disk group from a different system, then click the checkbox to clear the host ID of the other system.

   The disk group then imports. All existing volumes on the disk will be visible and accessible.

   More information on importing and deporting dynamic disk groups is available.

   See “Importing and deporting dynamic disk groups” on page 181.

   - Use Import Dynamic Disk Group if the Foreign disk has a secondary dynamic disk group (that is, a dynamic disk group other than the dynamic disk group containing the computer’s boot or system disk) and you have switched between operating systems on a dual-boot machine.

   When you have one or more secondary dynamic disk groups on a disk in a dual-boot environment, the disk will be marked as Foreign when you switch between operating systems, because the secondary disk groups are not automatically imported. A shared primary dynamic disk group on a disk in that situation is automatically imported.
Use Merge Foreign Disk if the disk was originally created on the current computer but was removed and now you have reattached it to the current computer and want to restore it to its status as a member its original dynamic disk group.
See “Merge foreign disk command” on page 276.

Bring a basic volume back to a healthy state

The following steps bring back a basic volume to a healthy state.

To bring a basic volume back to a healthy state

1. Repair any disk or controller problems, and make sure that the disk is turned on, plugged in, and attached to the computer.

2. Use the Rescan command to rescan all the devices on the SCSI bus to bring the disk that the volume belongs to back online.

   Select Rescan from the Actions menu, or right-click the StorageAgent node in the tree view and select Rescan from the context menu. If you have a lot of devices on the computer’s SCSI bus, the rescan of the bus may take some time.

   See “Rescan command” on page 275.

Bring a dynamic volume back to a healthy state

The following steps bring back a dynamic volume to a healthy state.
To bring a dynamic volume back to a healthy state

1 First you need to attempt to bring the disk or disks to which the volume belongs to Online status by doing a Rescan and, if necessary, a Reactivate Disk.

Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Reactivate Disk command.

See “Rescan command” on page 275.

If one of the disks has failed and you have a mirrored or RAID-5 volume, the repair involves recreating part of the volume in a different location.

See “Repair volume command for dynamic RAID-5 volumes” on page 281.

2 If a disk comes back online after reactivating, check to see whether its volumes are healthy. If not, try the Reactivate Volume command on its volumes.

Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Reactivate Volume command.

See “Reactivate volume command” on page 281.

3 Run Chkdsk.exe to make sure that the underlying file system structure is intact.

To run Chkdsk, open a command prompt window and enter the following command:

```bash
chkdsk x: /f
```

where x is the drive letter of the volume you want to check. The /f option tells Chkdsk to fix any errors it finds. If the /f option is omitted, Chkdsk will operate in a read-only mode.

Although Chkdsk will clean up the file system structure, there may still be invalid data on the disk if users were working when a problem occurred on the disk. It is highly recommended that you run utilities to check the integrity of the data. If the data is corrupted, you will need to replace it from backup storage.
Repair a volume with degraded data after moving disks between computers

This section gives steps you can take if you used the Deport Dynamic Disk Group and Import Dynamic Disk Group commands to move disks between computers and the disks contain mirrored or RAID-5 dynamic volumes with degraded data.

To resolve the problem:

1. Deport the disks on the computer they were moved to and then physically move the disks back to the computer where they originated.
2. Use Rescan to make sure all the disks are installed correctly.
   If the volume showed Degraded status before the disks were moved, the volume will still show Degraded status when the disks are moved back.
3. Make sure the status of the disk that contained the degraded mirror or parity information is not Offline.
   If the status is Offline, check for any hardware problems, and reconnect the disk, if necessary.
4. Use the Reactivate Disk command to bring the disk back online.
   Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Reactivate Disk command.
   If the hardware problem is corrected, the disk will show Healthy status, and any mirrored volumes on the disk will be resynchronized and any RAID-5 volumes will regenerate parity.
5. If any volume still shows Degraded status, use the Reactivate Volume command on that volume.
   Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Reactivate Volume command.
   Symantec Storage Foundation for Windows will attempt to bring the volume back online. You may see a warning message indicating that Symantec Storage Foundation for Windows may not be able to bring back all of the data on the volume.
   If Symantec Storage Foundation for Windows successfully brings the volume back online, the status of the volume becomes Healthy.
6. Now you can deport the dynamic disk group and move all the dynamic disk group’s disks to the second computer.
   Be sure to move all the disks involved in the disk group at the same time to ensure that your volumes will have the Healthy status on the second computer.
Deal with a provider error on startup

In Symantec Storage Foundation for Windows, providers are similar to drivers. Each provider manages a specific hardware or software storage component. For example, there is a disk provider that manages all disks that the Windows operating system sees as disks. The providers discover the existing physical and logical entities and store that information in the Symantec Storage Foundation for Windows distributed database.

If you receive an error at Symantec Storage Foundation for Windows startup that a provider failed to load, you can check the provider status by right-clicking the managed server node in the Veritas Enterprise Administrator tree view and selecting Properties from the context menu that appears.

An example of the Properties window is shown in the screen below.

Figure 10-1 Computer node properties window

![Properties window](image)

The top section of the window displays the loaded providers. The bottom section of the window displays any providers that failed to load. Normally, the bottom section is blank.

If a certain provider failed to load at SFW startup, the features that the provider supplies will not work in SFW. It is necessary to determine why the provider did
not load and start the application again. For assistance, contact Symantec Technical Support at
http://www.symantec.com/business/support/index.jsp

Commands or procedures used in troubleshooting and recovery

This section covers ways to perform troubleshooting and recovery.
The section covers the following topics:
Refresh command
Rescan command
Replace disk command
Merge foreign disk command
Reactivate disk command
Reactivate volume command
Repair volume command for dynamic RAID-5 volumes
Repair volume command for dynamic mirrored volumes
Starting and stopping the Symantec Storage Foundation for Windows Service
Accessing the CLI history

Refresh command

If you do not believe that anything is wrong with the disks or volumes but the VEA GUI has not updated a recent change, try the Refresh command. Refresh refreshes drive letter, file system, volume, and removable-media information on the current computer. It also checks to see whether previously unreadable volumes are now readable. It may not pick up disk changes that occurred since the last restart or rescan if there was no I/O occurring on the changed disk.

Select Refresh from the Actions or View menu of the VEA, or right-click the StorageAgent node in the tree view to get a context menu and select Refresh from that menu.

Note: The Refresh command is only effective on the StorageAgent node and any of its sub-nodes.
Rescan command

The Rescan command rescans the SCSI bus for disk changes. It also does the equivalent of the Refresh command, updating information on drive letter, file system, volume, and removable media.

It is recommended that you use Rescan every time you make disk changes, such as removing or adding a disk. Rescanning can take several minutes, depending on the number of devices on the SCSI bus.

From the toolbar, select Actions, then Rescan.

A progress bar showing the percentage of completion for the rescan process is available by clicking on the Tasks tab located in the lower pane. When Rescan is finished, you should see accurate information about your system.

If error flags remain, you may need to reactivate the disks or volumes.

---

**Note:** The Rescan command is only effective on the StorageAgent node and any of its sub-nodes.

---

**Additional important information about the rescan command**

This section gives additional information on how a rescan affects redundant and nonredundant volumes.

The details are as follows:

- **Redundant volumes (Mirrored and RAID-5)**
  
  If a RAID-5 or a mirrored volume is in a Degraded state, doing a rescan also will automatically trigger an attempt to reactivate the disks and resynchronize the volume on the disks. This is done in the background and is the reason why it is not always necessary to invoke the Reactivate Disk and Reactivate Volume commands.

- **Nonredundant volumes (Simple, spanned, and striped)**
  
  If you have a simple, spanned, or striped volume that has failed, a rescan will NOT automatically attempt to reactivate the disk and the volumes. The data on these failed volumes may already be corrupted.

  For a failed simple, spanned, or striped volume, you must manually reactivate the disk(s) and the volume. The error messages you receive may give you a hint of the reason for the problem. After manually reactivating the disk(s) and volume, the disks may come back as Online and the volume as Healthy, but you cannot assume that the underlying data has not been affected.

  In this situation, you should also run Chkdsk. Although Chkdsk will clean up the file system structure, there may still be invalid data on the disk if users were working when a problem occurred on the disk. It is highly recommended...
that you run utilities to check the integrity of the data. If the data is corrupted, you will need to replace it from backup storage.

**Note:** If you have mirrored or RAID-5 volumes with a Failed state, a rescan will not automatically reactivate the disks and resynchronize the volumes on the disks. Once a redundant volume has failed, it is subject to the same conditions as a failed nonredundant volume.

### Replace disk command

This command lets you replace a failed disk with an empty basic disk. The volume configuration will be recreated on the new disk. The contents of the nonredundant volumes are not guaranteed. Redundant volumes will be automatically resynchronized. This command can be performed only for a disk that is designated as "Missing."

See “Replace disk” on page 127.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Replace Disk command.

### Merge foreign disk command

If you remove a disk from the server and also remove it in Symantec Storage Foundation for Windows and then decide to reattach it to the server as a member of the same dynamic disk group, you will need to use the Merge Foreign Disk command. This command will reinstate the disk to its old status as a member of its former dynamic disk group on that server.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Merge Foreign Disk command.

You will also need to use this command if you remove a disk without taking its disk group offline, move the disk to another server, and then attempt to reinstall it in the original server. The command is necessary in this case because the disk has the other server’s disk group ID.

In Symantec Storage Foundation for Windows, this command will probably not need to be used very often, because if a disk is removed from a computer that has subdisks from a redundant volume (such as a RAID-5 volume or a mirrored volume), the Hot Relocation command will automatically rebuild the missing
subdisk on the volume. However, if the hot relocation feature is turned off, you may need this command.

See “Hot relocation” on page 244.

If you have a dynamic disk group with one disk marked as Missing and you revert the remaining disks in the group to basic, the dynamic disk group will no longer exist, and the disk marked as Missing will also disappear from the VEA GUI. This happens because the information about a dynamic disk group is stored in a database on each of the disks that reside in the group. The dynamic disk group information is no longer available from the disks that were reverted to basic, and the Missing disk is not connected. If you reconnect the Missing disk and rescan, it will show up as Foreign. Now its database is available, but the remaining disks in the group are gone.

More information about removing a dynamic disk from the computer is available. See “Remove a disk from the computer” on page 268.

---

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support hot relocation.

**Note:** Dynamic disks belonging to a SAN Disk Group do not support hot relocation.

**To use the merge foreign disk command**

1. Reattach the disk to the original server.
2. In the VEA console, do a rescan (select **Rescan** from the **Actions** menu). The disk will show up in the tree with a red X. Its dynamic disk group will display as "Unknown Group."
3 Right-click the disk label in the tree view to bring up the disk context menu.

```
New Volume...
New Dynamic Disk Group...
Add Disk to Dynamic Disk Group...
Remove Disk from Dynamic Disk Group...
Evacuate Disk...
Replace Disk...
Reactivate Disk
Merge Foreign Disk...
Import Dynamic Disk Group...
Split Dynamic Disk Group...
Set Disk Usage...
S.M.A.R.T. monitoring...
Disk View...
Graph Historical Statistics Information...
Properties
```

4 Select **Merge Foreign Disk** from the disk context menu.

5 After reading the first screen of the Merge Foreign Disk wizard, click **Next** to continue.

6 In the Merge Foreign Disk wizard screen that appears, select the disk that you want to merge.

   Using the **Add** button, move it from the left pane of the screen to the right pane and then click **Next** to continue.
7 In the next screen, click **Next** to continue if the data condition on the disk is Healthy.

![Merge Foreign Disk Wizard](image)

The final screen of the Merge Foreign Disk wizard appears.
The volume condition types are shown below:

- **Failed**  
  Volume is not functional. Volume will be merged, may be unusable.

- **Failed Redundancy**  
  Volume contents will not be current. Volume will be merged.

- **Missing**  
  Volume does not have a subdisk on merged disks.

If the volume condition type is Failed, there is no guarantee that the data will be intact (though it may be).

See “Bring a dynamic volume back to a healthy state” on page 270.

If the disk is Missing, make sure that it is properly connected.
8 Click **Finish** to complete the process of merging the Foreign disk into the server.

The merged disk should now appear as it was before it was removed from the server. It should now be shown as being in its former dynamic disk group.

9 If the disk still has an error symbol, right-click the disk and click **Reactivate Disk** from the context menu that appears.

The disk now should appear as normal.

Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the **Reactivate Disk** command.

**Reactivate disk command**

Occasionally, Rescan will not clear error flags on a dynamic disk. When this happens, you can use Reactivate Disk to clear these flags. This command does a manual restart on a disk. Dynamic disks that are marked as Missing or Offline can be reactivated. After reactivating, disks should be marked as Online if they are attached and are not in a Failed condition.

---

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Reactivate Disk command.

---

**To clear error flags using the reactivate disk command**

1 Right-click the disk with the error flags and select **Reactivate Disk** from the context menu that appears.

A dialog box appears with a confirmation message.

2 Click **Yes** to reactivate the disk.

The disk should be marked Online after it is reactivated unless there is a mechanical or other serious problem with the disk.

See “Additional important information about the rescan command” on page 275.
Reactivate volume command

If you have errors on a dynamic volume, you must try to bring any disks on which it resides back online by first using Rescan and then, if that does not work, Reactivate Disk.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Reactivate Disk command.

Once the disk or disks come back online, if the volume does not return to a Healthy state, use the Reactivate Volume command.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Reactivate Volume command.

Right-click on the volume to bring up the context menu, and then click Reactivate Volume.

This can be necessary if any of the mirrors or plexes of a mirrored volume are still not healthy. The same situation applies to a RAID-5 volume; you may need to use Reactivate Volume to allow the volume to regenerate.

If the underlying disks for a volume are sound, the volume most likely will come back to a Healthy state, but the data on it may be corrupted or stale. It is recommended that you run Chkdsk.exe before using the volume. If Chkdsk fails or finds an excessive number of errors, you may need to reformat the volume and restore its contents from backup.

The difference between the Reactivate Volume and Repair Volume commands is that Reactivate Volume resynchronizes the volume to bring it to a Healthy state in its existing location, while Repair Volume removes the damaged section of the volume and recreates it in another location on a healthy dynamic disk.

See “Additional important information about the rescan command” on page 275.

Repair volume command for dynamic RAID-5 volumes

You can repair a RAID-5 volume if its status is Degraded and if there is enough unallocated space available on other dynamic disks to recreate the degraded subdisks of the volume. To avoid data loss, you should attempt to repair the volume as soon as possible.

**Note:** After a disk fails, you may need to rescan before this menu option is available.
The difference between the Reactivate Volume and Repair Volume commands is that Reactivate Volume resynchronizes the volume to bring it to a Healthy state in its existing location, while Repair Volume removes the damaged section of the volume and recreates it in another location on a healthy dynamic disk.

**To repair a dynamic RAID-5 volume using the repair volume command**

1. Right-click the degraded volume. Select **Repair Volume** from the context menu that appears.
   
The Repair Volume dialog box appears.

2. The default setting is for Symantec Storage Foundation for Windows to automatically assign the destination disks. To manually select the disks, click the **Manually assign destination disks** radio button and then select the disks you want assigned as destination disks. You may also check **Disable Track Alignment** to disable track alignment for the recreated volume.

3. When you are satisfied with your selection, click **OK**.

**Repair volume command for dynamic mirrored volumes**

When a disk on which a mirrored volume resides fails, the volume displays a Degraded status. The disk’s name is changed to Missing Disk, and an icon (X) appears on the Missing Disk icon. The status of the disk will be Offline.

The difference between the Reactivate Volume and Repair Volume commands is that Reactivate Volume resynchronizes the volume to bring it to a Healthy state in its existing location, while Repair Volume removes the damaged section of the volume and recreates it in another location on a healthy dynamic disk.

**Using the repair volume command**

The following describes how to repair a mirrored volume using the repair volume command.

**To repair a mirrored volume using the repair volume command**

1. Right-click the degraded volume. Select **Repair Volume** from the context menu that appears.
   
The Repair Volume dialog box appears.

2. Select the mirror or mirrors to repair by clicking in the corresponding checkboxes. You may also check **Disable Track Alignment** to disable track alignment for the recreated mirrors.

3. Click **OK**.
   
New mirrors will be created on available disk space on other dynamic disks.
Repairing a volume and manually selecting target disks

The following describes how to repair a volume and manually select target disks for new mirrors.

**To repair a volume and manually select the target disks for the new mirrors**

1. Right-click the degraded volume. Select **Mirror** from the context menu, then **Remove** from the submenu.

   The **Remove Mirror** dialog box appears.

2. Remove the degraded mirror.

   See “Remove mirror” on page 238.

   Note that the mirrors on preserved disks (in the right pane) will not be removed.

3. Right-click the volume again. Select **Mirror** from the context menu, then **Add** from the submenu.

4. Manually select the target disk to add the mirror to and then click **OK**.

   See “Add a mirror to a volume” on page 235.

Starting and stopping the Symantec Storage Foundation for Windows Service

It is useful to know how to start and stop the Symantec Storage Foundation for Windows service when you are troubleshooting. For example, if Symantec Storage Foundation for Windows stops running on the server, you can try restarting the service instead of restarting. Sometimes stopping the service and restarting it again can resolve temporary problems. The Symantec Storage Foundation for Windows service is also referred to as the **vxsvc**.

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**Note:** For the current release, to start or stop the Symantec Storage Foundation for Windows service you start or stop the **vxsvc** service (or the Veritas Storage Agent in the Windows Services GUI).

The following describes how to start and stop the Symantec Storage Foundation for Windows service:

- Start the Symantec Storage Foundation for Windows service

  Bring up the command window and enter the following command:

  ```
  net start vxsvc
  ```
Accessing the CLI history

The history of CLI commands issued on a system and the system responses is contained in the command line log, vxcli.log. It is typically located at C:\Program Files\Veritas\Veritas Volume Manager\logs. This history is useful when trying to understand the problems that may arise from running or creating CLI scripts.

Each entry in the log is prefixed with the date and time of the command or system response, followed by the process identification and thread identification. Each CLI command is a separate entry in the log and each is identified by "---------- Command : ". Each system response is also a separate entry in the log and follows the CLI command.

Note: Help messages are not recorded in the command line log.

Additional troubleshooting issues

This section describes additional troubleshooting issues.

The topics are organized in the following areas:

- Disk issues
- Volume issues
- Disk group issues
- Connection issues
- Issues related to boot or restart
- Cluster issues
- Symantec Dynamic Multi-Pathing for Windows issues
- vxsnap issues
- Other issues
Disk issues

This section describes the following disk issues.

Disk type shows no signature
A disk is marked as foreign
Error when upgrading a basic disk to dynamic

**Disk type shows no signature**

If the type of disk shows No Signature, you need to write a signature to the disk. When installing a new disk, the software must write a signature to the disk that prepares it for use. This signature is not written automatically, in case that disk has been imported from another operating system and the configuration information needs to be kept intact.

Check the following:

- To write the configuration data to the disk, right-click on the disk under the Disks node and choose Write Signature.

**A disk is marked as foreign**

This section contains information about foreign disks.

See “Bring a foreign disk back to an online state” on page 268.

See “Disk status descriptions” on page 258.

**Error when upgrading a basic disk to dynamic**

This topic describes known problems when upgrading a basic disk to dynamic.

**Basic disk has more than 32 logical drives**

If you attempt to upgrade a basic disk that has more than 32 logical drives in its extended partition, it will not upgrade to a dynamic disk. You will get the error message "Disk cannot be partitioned after it has been upgraded." There is a limit of 16 logical drives for a basic disk to be upgraded to a dynamic disk.

**Basic disk has an "Active" volume with no system files**

If you mark a basic mirrored volume active that does not contain the current system files, the computer will not be able to restart. A basic disk that contains an unbootable active volume cannot be upgraded to dynamic.
You receive an error about disk geometry

If you receive an error about disk geometry when you are trying to upgrade a basic disk to a dynamic disk and the disk does not upgrade, the geometry on the disk is inconsistent with the disk geometry used on the current Windows operating system. If the disk is not upgraded, Symantec Storage Foundation for Windows maintains the disk with its current partition structure; but if the partition structure is changed in any way, the disk partitions and their data become inaccessible.

The following describes the fix for the situation:

- Back up all your data from the affected disk.
- Delete all partitions on the disk.
- Upgrade the disk to dynamic.
- Create volumes on the disk.
- Restore your data to the disk.

It is very likely that you have a disk that was created under NT 4.0 with partitions on it and this disk has a different geometry because it was attached to a secondary host bus adapter with the BIOS turned off and mapping features turned off.

Once you have done the above steps, the disk will have the proper geometry and can still be connected to the secondary host adapter with the BIOS and mapping features turned off. The geometry problem was the result of the change from NT 4.0 to Windows 2000. It is a known problem and is discussed in more detail on the Microsoft Web site.

Volume issues

This section contains information about volumes.

This section has the following issues:

[Unresolved xref]

Cannot create a RAID-5 volume
Cannot create a mirror
Cannot extend a volume
Cannot extend a dynamic boot or system volume
When creating a spanned volume over multiple disks within a disk group, you are unable to customize the size of subdisks on each disk
An attempt to mirror a boot or system volume fails or has an error message
Cannot create a RAID-5 volume

This section contains information about not being able to create a RAID-5 volume. Check the following:

■ Adequate unallocated space on three or more disks? You must have at least three disks to create a RAID-5 volume or four disks to create a RAID-5 volume with a log.

Cannot create a mirror

This section contains information about not being able to create a mirror. Check the following:

■ Adequate unallocated space on two or more dynamic disks? You must have two or more disks to create a mirrored volume.

See “An attempt to mirror a boot or system volume fails or has an error message” on page 288.

Cannot extend a volume

One possible reason for not being able to extend a volume is that the RAID-5 or DRL log that was associated with the volume cannot be found, possibly because a disk has failed or is offline. The workaround is to delete the log from the failed disk or bring the missing disk back online, and then you should be able to extend the volume. If your volume has a boot or system disk, see the next section.

Cannot extend a dynamic boot or system volume

The following are possible reasons for this issue:

■ A boot or system volume cannot be extended unless there is enough contiguous space after the volume for the desired extension. If you have another volume on the disk, you cannot use space before that volume and after that volume for the extension.

■ If the extension of a dynamic boot or system volume requires adjustment of an extended partition boundary, then the extension will not be allowed. The error message "Requested operation not supported" will be returned.

■ A boot or system disk volume that was originally created on a logical drive and later upgraded to a Symantec Storage Foundation for Windows dynamic volume cannot be extended in Symantec Storage Foundation for Windows.
When creating a spanned volume over multiple disks within a disk group, you are unable to customize the size of subdisks on each disk

When you create a spanned volume over multiple disks, Symantec Storage Foundation for Windows does not let you use the Custom mode to create subdisks of a specified size on the disks in the volume. Symantec Storage Foundation for Windows automatically uses all the available disk space in the first disk before moving to the second disk, and likewise does the same with the second disk before moving to the third, and so on.

To work around this problem, create a simple volume on the first disk with a specified size (the size will be a fraction of the total size needed). Once this is created, use the Expand Volume command with the Custom mode to specify additional space on another disk. Repeat for the total number of disks being used.

This technique will let you create a spanned volume with specific subdisk sizes on each disk in the group.

An attempt to mirror a boot or system volume fails or has an error message

The following are possible causes for this problem:

- The Only Available Dynamic Disk Large Enough for the Mirror Has More than Two Retained Partitions
  If you try to add a mirror to a system or boot disk but the only dynamic disks that have enough space contain more than two retained partitions, the Add Mirror operation will fail. The error message will say "insufficient disk space," even though there is plenty of space on the disk.

- No Available Dynamic Disk Has the Same Offset as the Original Boot or System Disk
  To boot from a mirrored system volume, its offset from the beginning of the disk must be in the same location as that of the original system volume’s offset. If you try to add a mirror to a system volume where there are no dynamic disks that can have the offset in the same location, you will receive a message to that effect and be asked whether you want to continue. You can choose to continue, so that a mirror at a different offset will be created. The mirror will correctly mirror the data, but you cannot boot from the mirror.

Disk group issues

This section contains information about disk groups.

This section has the following issues:
Unknown group appears after upgrading a basic disk to dynamic and immediately deporting its dynamic disk group

Cannot use SFW disk groups in disk management after uninstalling Symantec Storage Foundation for Windows

After uninstalling and reinstalling Symantec Storage Foundation for Windows, the private dynamic disk group protection is removed

Cannot import a cluster dynamic disk group or a secondary disk group with private dynamic disk group protection when SCSI reservations have not been released

If you are having a problem with the dynamic disk group split and join commands, see the following topic:

See “Dynamic Disk Group Split and Join troubleshooting tips” on page 378.

Sometimes, creating dynamic disk group operation fails even if disk is connected to a shared bus

This happens while creating a cluster dynamic disk group. In some cases, this operation fails if the disk (to which the disk group belongs) contains an OEM partition even if it's connected to a shared bus. You can resolve this issue by deleting the OEM partition and restarting the Veritas Enterprise Administrator Service (VxSVC) service.

Unknown group appears after upgrading a basic disk to dynamic and immediately deporting its dynamic disk group

Upgrading a basic disk and immediately deporting its dynamic disk group will occasionally result in the appearance of a dynamic disk group named "Unknown." Refreshing the display or trying to import the deported dynamic disk group will remove the original group from the display and, in the case of import, generate an error that the disk could not be found.

Do not attempt any other operations on these disks from within Symantec Storage Foundation for Windows. Doing so can result in a loss of data. To recover the dynamic disk group and its contents requires a restart of the computer. After restarting, the dynamic disk group will display correctly as a deported group as "Offline, Foreign." Then you can import it without any problems.

Cannot use SFW disk groups in disk management after uninstalling Symantec Storage Foundation for Windows

After uninstalling Symantec Storage Foundation for Windows, the existing disk group may not be able to be imported and used in Disk Management.
When you uninstall Symantec Storage Foundation for Windows, Disk Management will automatically import only primary disk groups.

If, in Symantec Storage Foundation for Windows, you do not have a primary disk group because your system or boot disk is not encapsulated, and then you uninstall Symantec Storage Foundation for Windows, Disk Management will be unable to import the disk group or groups, because it cannot import a secondary disk group as a primary disk group. Without a primary disk group, you cannot merge the foreign disk group.

The workaround is to create a new dynamic disk group in Disk Management and then the Foreign disk group(s) can be merged into the dynamic disk group.

**After uninstalling and reinstalling Symantec Storage Foundation for Windows, the private dynamic disk group protection is removed**

If you uninstall Symantec Storage Foundation for Windows and then reinstall it again (either through an upgrade or for other purposes), the private dynamic disk group protection is removed during the uninstall process. If you then reinstall Symantec Storage Foundation for Windows and want to continue the private dynamic disk group protection for the disk groups that had it previously, add the feature back to the disk groups through the Add Dynamic Disk Group Protection command. Private dynamic disk group information is stored in the registry; and, by necessity, the registry entries are removed during an uninstall.

**Cannot import a cluster dynamic disk group or a secondary disk group with private dynamic disk group protection when SCSI reservations have not been released**

Importing a cluster dynamic disk group or a secondary disk group with private dynamic disk group protection may not be possible when a Storage Foundation server on a shared bus had failed to release SCSI reservations when the cluster dynamic disk group or secondary disk group was deported. Performing the clear SCSI reservation operation releases these reservations and allows importing the cluster dynamic disk group or secondary disk group.

**To clear SCSI reservation**

1. Select the StorageAgent node in the VEA tree view and click Actions>Clear SCSI reservation.
   
   Alternatively, you may right-click the Storage Agent node and select Clear SCSI reservation on the context menu.

2. Review the information message in the window that appears and click Yes to complete the operation.
Connection issues

This section describes computer connection issues.

When attempting to connect to a remote computer, you are denied access or get an error message

This topic describes situations where you cannot connect to a remote computer.

Most common situation

In SFW, when you attempt to connect to a remote computer but are denied access, your situation probably falls under one of two conditions.

The conditions are as follows:

- You are logged on to a local server that is not in any domain.
- You are logged on to a domain, but that domain does not contain the remote server. Also your domain does not have a trust relationship with the domain that the remote server is in.

The workaround in this situation is to create an account on the local machine that has the name and password that are the same as the administrator name and password of the remote computer and then use that account to log on to the local machine.

Client-only installation

Another situation where you may get an error message is when you have just done a client-only installation of SFW and you bring up the SFW client and attempt to connect to a remote server that has Disk Management.

Symantec Storage Foundation for Windows assumes that its client will connect first to a remote server running SFW or Volume Manager for Windows before connecting to a system running Disk Management.

Once you connect to a server with SFW or Volume Manager for Windows, you will then be able to connect successfully to a remote system running Disk Management.

Note: Windows Disk Management is the disk and volume management program that comes with the Windows operating system. Symantec Storage Foundation for Windows can connect to a remote server with Disk Management because the Disk Management software was jointly developed by Symantec and Microsoft.
Error message: "The connection to RemoteComputer has terminated. RemoteComputer will be removed from view."

The remote computer that you were connected to has been disconnected from your console. Most often there is a problem with the network connection and the transmissions timed out. This can also occur if the remote machine was restarted or the Symantec Storage Foundation for Windows service on the remote machine was stopped. You can also get the message "Connection Failed" instead.

Check the following:
- Make sure that the remote machine is turned on and available to the network and that the service is started.
- Reconnect to the remote computer.

Issues related to boot or restart

This section contains information about issues related to booting or restarting.

This section has the following issues:

During restart, a message may appear about a "Corrupt drive" and suggest that you run autocheck

Error that the boot device is inaccessible, bugcheck 7B

Error message "vxboot- failed to auto-import disk group repltest_dg. all volumes of the disk group are not available."

A related issue is unable to extend a dynamic boot or system volume.

See “Cannot extend a dynamic boot or system volume” on page 287.

During restart, a message may appear about a "Corrupt drive" and suggest that you run autocheck

Let autocheck run, but do not worry about the message. Autocheck will finish and the restart will be complete. Depending on the size of the system, this may take quite a while.

Error that the boot device is inaccessible, bugcheck 7B

There are two known situations that can result in this message:
After a Dynamic Disk Group with a Boot Device Has Been Renamed

A dynamic disk group that contains a boot volume should not be renamed when the dynamic disk group is imported. Normally, SFW does not let you deport a dynamic disk group that contains the current boot volume. However, if you move a disk to another system or boot from another boot volume in a different dynamic disk group on the same system, you will then be able to deport the dynamic disk group that contains the boot volume.

Booting from a boot volume contained in a renamed dynamic disk group can, under certain circumstances, cause the error message "Bugcheck 7B, Inaccessible Boot Device."

When Attempting to Boot from a Stale or Damaged Boot Plex

If you get the error message "Bugcheck 7B, Inaccessible Boot Device" and the boot volume is mirrored, try booting off one of the other mirrors. You are not allowed to boot from a stale mirror. A stale mirror is one that was detached because it was missing at some point or because it had errors.

Error message "vxboot- failed to auto-import disk group repltest_dg. all volumes of the disk group are not available."

The situation that causes the error message is that disks from a dynamic disk group in SFW have been removed without being deported, deleted, or converted to basic disks. The next time the computer is restarted, SFW expects to find these disks so that the disk group can be autoimported and when the disks are not there, the error message is generated.

Even when you have uninstalled SFW and reinstalled it again, information about the disk group is retained in the registry because it is needed in upgrading from one version of the program to the next.

If you are not planning to use the disk group again, you need to remove the record of that disk group from the registry; otherwise, you will continue to get this message on restart.

To remove the record of that disk group from the registry:

1. Run the command **Regedit** to bring up the Registry Editor window.
2. Locate the reference to the disk group in the registry. It is under the following key:
   
   HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\vxio\Boot Info\Disk Group 1, Disk Group 2, ...
3 The disk groups are not listed by the actual name, only by a general name of Disk Group 1, Disk Group 2, and so on. To determine which disk group to delete, click the general name to see a further listing that includes the actual name of the disk group.

4 Once you have determined which disk group to delete, highlight its general name (such as Disk Group 2) and hit the Delete key.

Cluster issues

This section contains information about cluster issues.

This section has the following issues:

Unable to bring a cluster disk group online when a minority of the disks in the disk group are available

Bring a cluster online that has a minority of the disks in the cluster

Unable to bring a cluster disk group online when a minority of the disks in the disk group are available

Safeguards are put into effect so that normally you cannot bring a cluster disk group online on a node when a minority of disks in the disk group are available. However, in certain situations, you may want to force the import of the disk group or find some other way to bring the disk group online. One example is a campus cluster situation with a two-node cluster, where each node of the cluster is located in a separate physical location and each node has an even number of disks, with the disks evenly distributed between the two sites. In such a situation, if one site goes down, the remaining site will not be able to access the cluster data because it cannot reserve a majority of the disks in the disk groups.

With Microsoft Failover Clustering and other cluster types, there are methods to allow a site with a minority of the disks to bring disk groups online, if necessary, until the site with failed equipment can be repaired. The following section describes these methods.

Bring a cluster online that has a minority of the disks in the cluster

When bringing a cluster disk group online with a minority of cluster disks, make sure that a majority of the disk group disks are not online on any other cluster node before (and after) onlining the disk group. If a majority of disk group disks are online on another node, data corruption can occur.

Considerations to bring a cluster online:
If you have a cluster, use the following `vxclus` command for each disk group on your cluster node:

```
vxclus enable -g<DynamicDiskGroupName>
```

You will be asked to confirm the use of this command.
If necessary, start the cluster service (`clussvc`) if the cluster service has stopped because of a dynamic quorum resource failure.
Then using the Windows Server Failover Cluster Manager, bring the cluster disk groups online.
More information about the `vxclus` utility is available.
See “`vxclus`” on page 572.

If you have any other cluster type, enter the following command at the command line to receive further information on how to force an import of a cluster disk group when the cluster disk group does not have a majority of disks available.

```
vxdg -g<DynamicDiskGroupName> -s import
```

A message comes up describing the command for forcing the import and giving cautions about the use of the command.
Enter the command to force the import as follows:

```
vxdg -g<DynamicDiskGroupName> -s -f import
```

You will be asked to confirm the use of this command.

Symantec Dynamic Multi-Pathing for Windows issues

This section contains information about the Symantec Dynamic Multi-Pathing for Windows (DMPW) issues.

This section has the following issues:

When a Symantec Dynamic Multi-Pathing for Windows license is no longer valid

When an unknown disk group appears in a Symantec Dynamic Multi-Pathing for Windows environment

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**Note:** See the *SFW Release Notes* for documentation of additional issues relating to Symantec Dynamic Multi-Pathing for Windows. Also, refer to the Hardware Compatibility List on the Symantec Technical Support web site for the list of equipment that has been tested to work with Symantec Dynamic Multi-Pathing for Windows.
When a Symantec Dynamic Multi-Pathing for Windows license is no longer valid

If you have a demo license and have DMP DSMs installed on an array and your demo license expires or you replace the demo license key with a permanent license key that does not include Symantec Dynamic Multi-Pathing for Windows, the program will not let you make changes to your settings. However, all of your current settings will remain in effect. You need to purchase a license that enables Symantec Dynamic Multi-Pathing for Windows to make any additional changes to your settings.

When an unknown disk group appears in a Symantec Dynamic Multi-Pathing for Windows environment

When an unknown disk group appears in a Symantec Dynamic Multi-Pathing for Windows environment, it is likely that there is a problem with a path to a storage array or that a storage array was not placed under the control of Symantec Dynamic Multi-Pathing for Windows. Make sure that all paths are healthy and perform a rescan of all the disks and re-check the status of the disk groups.

vxsnap issues

This section contains a general issue with vxsnap and a listing of vxsnap error codes with suggested actions to take for each error code.

A description of the vxsnap CLI command is available.

See “vxsnap” on page 658.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the vxsnap command.

In some cases, updated VSS components are not displayed in VEA console

It is observed that when adding or removing the VSS components or when connecting to the VEA console for the first time, the updated VSS components are not displayed on the VEA console. To view the updated VSS components, you must manually refresh the VEA. To manually refresh the console, run either the vxsnap refresh command or perform a Refresh operation through the VEA console.
In VEA GUI, SQL Server database does not show volumes on which they are mounted

This issue is specific to SQL Server 2012 only. To resolve this, ensure that the [NT AUTHORITY\SYSTEM] account is granted the sysadmin server role (from SQL Management Studio Console) on each node.

vxsnap command error codes

Occasionally, you may encounter a vxsnap error code. For example, the following command can result in the error code 8004230e, if there are conditions that cause the vxsnap operation to fail.

C:\Documents and Settings\Administrator>vxsnap create source=A:

Failed to complete the operation...

8004230e:

Error code 8004230e is probably the most common vxsnap error code and can occur for several different reasons. In the list below, error code 8004230e and other codes are given, along with suggested actions to take to overcome the error condition.

ERROR CODE: 8004230e

VSS snapshot is not supported for the volume(s).

■ Possible Reason: Basic partition on a basic disk was used.
   Suggested Action: Create a new dynamic disk group or add the disk to an existing dynamic disk group of SFW.

■ Possible Reason: Dynamic disk group version has a version earlier than 4.0 version, when vxsnap was introduced.
   Suggested Action: Upgrade the dynamic disk group to 6.0 or later versions.

■ Possible Reason: Snapshot operation is not supported.
   Suggested Action: Install the FlashSnap option.

ERROR CODE: 80042316

VSS snapshot already in progress.

Possible reasons and suggested actions:

■ Possible Reason: Another VSS job is running.
   Suggested Action: VSS supports only one job at a time. Wait for the other job to finish and then retry the command.
Possible Reason: A VSS job was abruptly terminated, leaving the VSS Service in an intermediate state.
Suggested Action: Wait for at least 3 minutes for VSS to reset the state, or, if you are sure there is not another job running, restart the Volume Shadow Copy Service.

ERROR CODE: 80042301
The VSS service timed out.
Suggested Action: Wait for at least 3 minutes, then retry.
Suggested Action: When using the vxsnap command to snapshot multiple volumes under stress conditions, close the VEA GUI and retry the vxsnap command.

ERROR CODE: e5090008
The path cannot be used for creating a drive path.
Suggested Action: Make sure that the folder used for the drive path is an empty NTFS folder on the local computer.

Other issues
This section contains information about other issues.

An option is grayed out

Disk view on a mirrored volume does not display the DCO volume

An option is grayed out
When an option is grayed out in a menu, the task cannot be performed on the object at this time. Certain operations are valid only for certain types of objects. If there is a task currently running on that object, wait until it has finished and try again. Otherwise, the operation may not be appropriate at this time.

Disk view on a mirrored volume does not display the DCO volume
The Disk View for a selected mirrored volume will not show the DCO volume if that DCO volume was moved to a disk that does not contain any of the other plexes of the mirrored volume. A DCO volume can be moved manually by the user through a subdisk move or it can be moved automatically with the hot relocation function when the subdisk has an I/O error.
If you select the Disk View for all disks (by selecting the Disks folder and clicking the Disk View tab in the right pane or by selecting Disk View from the Disks folder context menu), you can see the DCO volume. However, finding the DCO volume on all disks may not be practical if you have a large number of disks.

## Tuning the VDS software provider logging

New registry keys are added to tune the Virtual Disk Service software provider logging. The VDS software provider can be tuned using the following details:

- **Location:** %vmpath%/log
- **Filenames:** vxvds.log and vxvdsdyn.log

The following two registry keys are used to tune the VDS software provider logging:

- **MAXSIZE** gives the maximum size of an individual log file in KB units. A backup log file is created when the log file exceeds the default size. The default value of **MAXSIZE** is 16384 KB. However, you can customize the default value.
  - Run the command `Regedit` to open the registry editor.
  - Locate the MAXSIZE of the VDS software provider in the registry under the following key:
    SOFTWARE\Veritas\VxSvc\CurrentVersion\Tracing\vds\MaxSize.

- **MAXFILES** gives the maximum number of log files that can be present at a time. The old log files are deleted once they exceed the limit of maximum number of files. The default value of **MAXFILES** is 5. However, you can customize the default value.
  - Run the command `Regedit` to open the registry editor.
  - Locate the MAXFILES of the VDS software provider in the registry under the following key:
    SOFTWARE\Veritas\VxSvc\CurrentVersion\Tracing\vds\MaxFiles

For example, the default log file is vxvds.log. If the created log file exceeds MAXSIZE, it is copied to vxvds1.log, and vxvds.log is erased. New logs are appended to the vxvds.log file.
Troubleshooting and recovery

Tuning the VDS software provider logging
Performance tuning

This chapter includes the following topics:

- Overview
- Statistics overview
- Real-time statistics collection and display
- Historical statistics collection and graphing
- Subdisk move, split, and join
- Command line commands for statistics
- SmartMove

Overview

Symantec Storage Foundation for Windows (SFW) provides performance tuning for storage objects on dynamic disks.

Statistics overview

The statistics feature of Symantec Storage Foundation for Windows provides I/O statistics to let you do performance tuning to improve overall disk and system performance.

Symantec Storage Foundation for Windows provides the following statistics parameters:

- Read Requests/Second
  The number of read requests per second for selected storage objects.
- Write Requests/Second
The number of write requests per second for selected storage objects.

- **Read Blocks/Second**
  The amount of read request data (in blocks per second) that is processed for selected storage objects. It is the throughput on the read requests made.

- **Write Blocks/Second**
  The amount of write request data (in blocks per second) that is processed for selected storage objects. It is the throughput on the write requests made.

- **Average Time/Read Block**
  The average time in microseconds that it takes to process a read block from the time a request is made until the data is returned.

- **Average Time/Write Block**
  The average time in microseconds that it takes to process a write block from the time a request is made until the data is returned.

- **Read and Write Requests/Second**
  The number of read and write requests per second for selected storage objects.

- **Read and Write Blocks/Second**
  The number of read and write blocks per second for selected storage objects.

- **Queue Depth**
  The current number of read and write requests in the queue for selected disks. It does not apply to volumes and subdisks.

With these statistical tools, you will be able to improve disk and system performance by the following actions:

- Identifying high I/O areas, known as "hot spots."

- Moving data among physical drives to evenly balance the I/O load among the disk drives. This is known as "load balancing."

Bottlenecks occur when a program or device uses too much disk I/O, creating a hot spot and degrading performance. By monitoring a system’s I/O, you can find the problem areas and prevent bottlenecks, thus ensuring smooth operation. The Performance Monitoring utility of Symantec Storage Foundation for Windows (SFW) lets you continuously monitor and tune system performance. You can make adjustments by moving subdisks from an area of high I/O usage to another disk that has lower usage. You also have the feature of splitting subdisks and joining them back together again. This gives you added flexibility of breaking subdisks down to smaller parts and then moving them.

You can view the statistics in a real-time format in the Online Monitoring window. You can also set up the statistics collection so that you can do an analysis of the statistics over time with the historical statistics collection and graphing functions.
The table below summarizes the similarities and differences between the two types of statistics.

**Table 11-1**  Comparison of real-time and historical statistics

<table>
<thead>
<tr>
<th>Displays in</th>
<th>Real-time</th>
<th>Historical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The Online Monitoring window that shows real-time statistical values in a</td>
<td>A graph that represents historical statistics for one storage object.</td>
</tr>
<tr>
<td></td>
<td>tabular format for selected storage objects.</td>
<td>You can select multiple storage objects to track, but each object is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>graphed individually.</td>
</tr>
<tr>
<td>Statistical</td>
<td>You can select one or more of nine statistical parameters to display in</td>
<td>All nine statistical parameters are included in the data collection, but</td>
</tr>
<tr>
<td>Parameters</td>
<td>the Online Data Display Options window.</td>
<td>you select one parameter at a time for graphing from the graphing window.</td>
</tr>
<tr>
<td>Storage Objects</td>
<td>When you select Online Monitoring, the Select Objects for Online</td>
<td>You select storage objects to monitor in the Start Historical Data</td>
</tr>
<tr>
<td></td>
<td>Monitoring window comes up first to let you select the storage objects</td>
<td>Collection window.</td>
</tr>
<tr>
<td></td>
<td>to monitor.</td>
<td></td>
</tr>
<tr>
<td>Time Frame</td>
<td>Current values since last refresh. Data is not saved. Online monitoring</td>
<td>Data is accumulated over time and saved in a file. You indicate the file</td>
</tr>
<tr>
<td></td>
<td>data is available only when the Online Monitoring window is open.</td>
<td>size. You can start and stop data collection. You view the data only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>through a graph.</td>
</tr>
</tbody>
</table>

For details on these two types of statistics formats, see the following topics:

See “Real-time statistics collection and display” on page 303.

See “Historical statistics collection and graphing” on page 312.

**Real-time statistics collection and display**

This section describes real-time statistics collection and its display, which is done in the Online Monitoring window.

Online monitoring window features

Setup steps for real-time statistics
Online monitoring window features

The Online Monitoring window displays real-time statistics for storage objects you select. It can include disks, subdisks, and volumes. To access the Online Monitoring window, select Statistics>Online Monitoring from the Tools menu, then select the storage objects to monitor in a preliminary window that comes up, and click OK.

The online monitoring window is shown below.

Figure 11-1 Online monitoring window

The Online Monitoring window collects statistics as long as you have it open. The window can operate in the background. You can do other commands while the window is open. When you set up the real-time statistics, you can change the refresh rate, the time interval of the refresh of the screen display. The default is 5 seconds. The statistics are being computed continuously in the background.

The Online Monitoring window is organized as follows:

- **Name**
  The first column contains the names of the storage objects that have been selected for monitoring. Thus, each row contains the statistical data on a selected storage object.

- **Hot Spot**
  The second column has a pie symbol that is designed to be used as an indicator for hot spot detection. A hot spot is an area of high I/O activity that may cause bottlenecks in I/O throughput. The color and shading of each pie symbol indicate the current state of I/O activity for the associated storage object. The pie symbol for the highest amount of I/O activity, Critical activity, is red and
fully shaded, making it easy to notice on the screen. You can select the statistical parameters you want to use for hot spot detection.

- **Statistical Parameters**
The remaining columns represent the different statistical parameters available in the program. By default, Read Requests per Second, Write Requests per Second, Read and Write Requests per Second, Read and Write Blocks per Second, and Queue Depth are selected, but you can select any of the nine statistical parameters. See “Statistics overview” on page 301.

- **Legend for the Hot Spot Indicator**
The legend at the bottom of the window describes the four pie symbol categories for the hot spot indicator. The table below gives more detail on these categories. If the pie symbol indicator displays the High or Critical category, it signals the fact that you have a hot spot—that is, an area of high I/O activity.

<table>
<thead>
<tr>
<th>I/O Activity</th>
<th>Pie Symbol</th>
<th>Subdisk I/O</th>
<th>Dynamic Disk I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Blue</td>
<td>Does not apply</td>
<td>More than 30% below average if it is not below minimum I/O threshold</td>
</tr>
<tr>
<td></td>
<td>Small section in pie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>Green</td>
<td>80% or less of parent disk I/O</td>
<td>30% below average up to 30% above average</td>
</tr>
<tr>
<td></td>
<td>Section less than half of pie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Yellow</td>
<td>81% to 90% of parent disk I/O</td>
<td>31% to 50% above average</td>
</tr>
<tr>
<td></td>
<td>Section more than half of pie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical</td>
<td>Red</td>
<td>More than 90% of parent disk I/O</td>
<td>More than 50% above average</td>
</tr>
<tr>
<td></td>
<td>Color in all of pie</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Context Menu**
If you right-click any row in the Online Monitoring window, a context menu appears with the following two menu choices relating to the storage object being monitored:
  - Graph Historical Statistics Information
  - Remove Object from Online Monitoring
The first menu choice is grayed out unless you have previously selected that storage object for historical statistics monitoring.

Setup steps for real-time statistics

This section describes what is involved in setting up the real-time statistics, so that you can view them in the Online Monitoring window.

Getting acquainted with the statistics submenu

Selecting online display options

Selecting storage objects to monitor

Getting acquainted with the statistics submenu

The commands for setting up the real-time statistics are located on the Statistics submenu on the Tools menu.

The statistics menu is shown below.

Figure 11-2 Statistics menu

The table that follows summarizes the available commands:

Table 11-3 Table of statistics commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online Data Display Options</td>
<td>Sets display options for real-time statistics.</td>
</tr>
<tr>
<td>Online Monitoring</td>
<td>Brings up the Select Objects to Monitor window to let you select objects to monitor for a real-time statistics session. Once you have selected objects to monitor, the Online Monitoring window appears.</td>
</tr>
<tr>
<td>Start Historical Data Collection</td>
<td>Starts the data collection for historical statistics.</td>
</tr>
</tbody>
</table>
Table 11-3 Table of statistics commands (continued)

| Stop Historical Data Collection | Stops the data collection for historical statistics. |

Historical statistics are displayed as graphs of individual storage objects that you select.

See “Historical statistics collection and graphing” on page 312.

Selecting online display options

The first task in the setup process is to set the display options. This task is not absolutely necessary. If you do not use this window, the default settings, which are shown in this window the first time you bring it up, will apply. The default settings are shown in the sample screen below.
To select the online data display options

1. Choose **Statistics>Online Data Display Options** from the **Tools** menu to bring up the Online Data Display Options window.

2. If desired, change the **I/O Refresh Rate/Sec** setting.
   This is the time interval of the refresh of the screen display. The program continuously runs the actual statistics in the background but changes the display of them in the Online Monitoring window according to the refresh rate you set. The default and minimum I/O refresh rate is 5 seconds.

3. If desired, change the **Threshold** setting.
   The threshold is the minimum amount of I/O per second that a disk or subdisk has to have to display a color other than blue. Blue is the lowest state, low I/O activity. The default threshold is 15.

4. Determine which statistical parameter or parameters to use for the **hot spot indicator**.
   The window provides the following two places to enter a hot spot indicator:
   - The drop-down list that is labeled "Hot spot indicator based on."
"The checkbox labeled "Use queue depth as hot spot indicator." 
Queue depth applies only to disks. The other eight statistical parameters that are in the "Hot spot indicator based on" drop-down list apply to disks, volumes, and subdisks.

If you select the checkbox to use queue depth as a hot spot indicator, queue depth will be used to calculate the hot spot statistic for disks only. The indicator that is used to calculate the hot spot statistic for volumes and subdisks will be the statistical parameter shown in the "Hot spot indicator based on" drop-down list.

If you don’t select queue depth as a hot spot indicator, then the indicator that is used to calculate the hot spot statistic for volumes, subdisks, and disks will be the statistical parameter shown in the "Hot spot indicator based on" drop-down list.

Why Use Queue Depth?

It is recommended that you select queue depth when you have both disks that are directly connected to your computer and disks that are in a hardware disk array. Because a disk in a disk array can have a much higher level of reads or writes and still function well, reads or writes per second are not really a good way to compare directly connected disks and array disks. Queue depth is the current number of read and write requests in the queue for selected disks. It is a better indicator of how well a disk in an array is working, and it also works for disks that are directly attached to the computer.

5 Select the statistics parameters you want to monitor by clicking the checkbox in front of each parameter. The statistics parameters are described as follows:

- **Read Requests/Second**
  The number of read requests per second for selected storage objects.

- **Write Requests/Second**
  The number of write requests per second for selected storage objects.

- **Read Blocks/Second**
  The amount of read request data (in blocks per second) that is processed for selected storage objects. It is the throughput on the read requests made.

- **Write Blocks/Second**
  The amount of write request data (in blocks per second) that is processed for selected storage objects. It is the throughput on the write requests made.

- **Average Time/Read Block**
The average time in microseconds that it takes to process a read block from the time a request is made until the data is returned.

- **Average Time/Write Block**
  The average time in microseconds that it takes to process a write block from the time a request is made until the data is returned.

- **Read and Write Requests/Second**
  The number of read and write requests per second for selected storage objects.

- **Read and Write Blocks/Second**
  The number of read and write blocks per second for selected storage objects.

- **Queue Depth**
  The current number of read and write requests in the queue for selected disks. It does not apply to volumes and subdisks.

By default, Read Requests per Second, Write Requests per Second, Read and Write Requests per Second, Read and Write Blocks per Second, and Queue Depth are selected parameters. The **Reset** button restores default settings.

6. When you are finished with your changes, click **OK**.

**Selecting storage objects to monitor**

When you select the Online Monitoring command, the Select Objects for Online Monitoring window appears to let you select the storage objects to monitor. The detailed steps are given in the procedure that follows.
To select objects for online monitoring

1 Choose **Statistics>Online Monitoring** from the **Tools** menu, or click the **Online Monitoring** button from the Storage Foundation Assistant.

   The Select Objects for Online Monitoring window appears. You can select an entire disk group or its individual disks, subdisks, and volumes.

   You may need to click on the plus symbol next to a disk group icon to display the disks, subdisks, and volumes.

2 Select the storage objects you want to display by using the following options:

   - **Add**: Adds one or more selected objects in the left pane of the window to the **Selected List** in the right pane of the window. If you select a dynamic disk group and click **Add**, all associated objects (disks, subdisks, and volumes) will be added to the **Selected List** in the right pane.

   - **Add All**: Adds all disks, subdisks, and volumes to the **Selected List** in the right pane.

   - **Remove**: Removes any objects that are selected from the **Selected List** in the right pane.
Historical statistics collection and graphing

The historical statistics collection and graphing function lets you monitor one or more storage objects (disks, subdisks, or volumes) over time and to create individual graphs for these storage objects. You invoke the graphing function by right-clicking a storage object and then selecting the command Graph Historical Statistics Information from the context menu that appears. However, the command will not be available on the context menu without certain setup steps having been done first.

This section first describes the graphing window and then details the setup functions that are necessary before you can do the graphing.

Features of the graphing window

Setup steps for historical statistics

Stopping historical data collection
Features of the graphing window

After you select the Graph Historical Statistics Information command from a storage object's context menu, a graphing window comes up, but it does not display a graph because no statistical parameter has been selected. To display the statistics, you select the View menu at the top left corner of the graph and click to choose one of the nine statistical parameters to graph.

The View menu is shown below.

**Figure 11-3** View menu in graphing window

The graph then generates and displays, as shown in the sample graph shown below.
The features of the graph include the following:

- The vertical axis displays a scale for the statistical parameter being graphed, and the name of the statistical parameter is also displayed vertically next to the axis.

- The horizontal axis shows time, which is determined by the data collection rate setting. The name of the storage object being graphed is displayed under the axis.

- The View menu, as mentioned previously, has the various statistical parameters, letting you change the graph to show a different parameter.

- The File menu has an Exit command, but you can also close the graph window by clicking the close box in the top right corner.

A graph can be saved and printed by copying it to the Clipboard with Alt+PrintScreen and then pasting it into a program, such as Microsoft Word.
Setup steps for historical statistics

This section describes how to configure and graph historical statistics.

Configuring settings in the historical statistics settings window

Selecting storage objects and starting the data collection for historical statistics

Graphing steps

**Configuring settings in the historical statistics settings window**

The first task in the setup process is to configure the settings in the Historical Statistics Settings window. This window is accessed by clicking StorageAgent in the tree view and then clicking Control Panel in the Perspective bar. If you accept the default settings, which are settings that are appropriate for most data collection purposes, then you do not need to use the following procedure.
To access the historical statistics settings window to view and adjust settings

1  In the VEA console tree view, click the **StorageAgent** node and then click **Control Panel** in the Perspective bar.

   The Control Panel icons appear in the right pane of the window, including the **Historical Statistics** icon.

2  Double-click the **Historical Statistics** icon to bring up the Historical Statistics Settings window.

3  Check the settings in the Historical Statistics Settings window (as described below), and make changes if desired. Click **OK** to confirm the settings and close the window.

   Note that the **Reset** button restores default settings.
Historical Statistics Window Settings

This section describes the settings for historical statistics.

The are as follows:

■ Data collection rate in seconds
  This is the rate at which the data is collected. It is the time interval between data samples. The default is every 5 seconds. You may prefer the data to be collected every hour (3,600 seconds). This setting establishes the point when the data is graphed. If you plan to run the statistics for several days, it is easier to read the graph with a longer data collection rate.

■ File size per object monitored
  Symantec Storage Foundation for Windows collects the data in a file. You set the desired size of the file. Once the file reaches the specified size, the older statistics information is deleted as new information is added. This feature lets you continuously monitor the statistics without taking up increasing file space.

■ Disk Usage Information section
  The numbers at the bottom of this window are an estimate of how long (in days and hours) it would take to compile statistics per storage object monitored to fill up the file size indicated. If you change either the data collection rate or the file size per object monitored, click the Check button to update the estimate.

Selecting storage objects and starting the data collection for historical statistics

The next task in the setup for the historical statistics is to select the storage objects you want to monitor and start the historical statistics data collection. These functions are available through the Start Historical Statistics command. This task is not optional.
To select storage objects and start the historical data collection

1. Select **Tools>Statistics>Start Historical Data Collection** to bring up the Start Historical Data Collection window, as shown in the sample screen.

This window lets you select the storage objects for historical data collection. Once you have made your selection and clicked **OK**, the historical data collection begins. The data collection continues in the background until you stop it with the **Stop Historical Data Collection** command or until Symantec Storage Foundation for Windows is stopped or the computer is restarted.
2 Select the storage object or objects you want to monitor for historical statistics data collection by highlighting the object or objects and using the **Add** button to move the objects to the **Selected List**.

You can also move the objects to the right pane by double-clicking them or by dragging them to the right pane. Use the **Remove** or **Remove All** button to move items on the **Selected List** in the right pane back to the **Devices** list in the left pane.

3 Click **OK** when you have made your selection.

The data collection begins in the background. You now have the settings necessary for invoking the graphing function. If you select a storage object that was one of the selected objects or that is included under a selected object (for example, if you selected an entire disk group), the **Graph Historical Statistics Information** command will be available on that storage object’s context menu.

### Graphing steps

This section covers the specific steps for creating a graph.

You must have selected one or more storage objects and have started the historical data collection for the graph to be displayed.

See “Selecting storage objects and starting the data collection for historical statistics” on page 317.

When creating a graph, you select which statistical parameters to use.

See “Statistics overview” on page 301.

#### To create a graph

1 Right-click the storage object you want to graph, and select **Graph Historical Statistics Information** from the context menu that appears.

   A graphing window appears, but no graph is generated until you select a statistical parameter.

2 Choose **View** from the menu bar at the top of the screen, and then click one of the statistical parameters from the **View** menu.

   Once you click a parameter, the **View** menu closes and the graph is generated.

See “Features of the graphing window” on page 313.
Stopping historical data collection

You can stop the collection of historical data by using the Stop Historical Data Collection command. The historical data collection is also stopped when Symantec Storage Foundation for Windows is stopped or when the computer is restarted.

In those cases, you will need to restart the historical data collection.

See “Selecting storage objects and starting the data collection for historical statistics” on page 317.
To stop the historical data collection

1. Select **Tools>Statistics>Stop Historical Data Collection** to bring up the Stop Historical Data Collection window, as shown in the sample screen that follows.

![Stop Historical Data Collection window](image)

2. In the left pane of the window, highlight the storage objects for which you no longer want to collect historical data, and use the **Add** or **Add All** button to move the objects to the right pane. You can also move the objects to the right pane by double-clicking them or by dragging them to the right pane.

3. Click **OK** when you are satisfied with your selections.

**Subdisk move, split, and join**

This section describes the Subdisk Move, Split, and Join commands.

Topics include the following:

- Purpose of the subdisk commands
Subdisk context menu
Subdisk properties
Moving subdisks
Splitting subdisks
Joining subdisks

Purpose of the subdisk commands

With the commands Move Subdisk, Split Subdisk, and Join Subdisk, you can move subdisks to other locations within the dynamic disk group, split subdisks, and join them back together. The flexibility of moving subdisks, splitting them, and joining them lets you make best use of your disk space.

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Move Subdisk, Split Subdisk, and Join Subdisk commands.

Following are the main purposes for moving and splitting your subdisks:
Load balancing
Disk failure or removal
Disk phaseout

Load balancing

If disk activities are heavily concentrated on one or a small number of disks in the storage subsystem, it may create bottlenecks. You can use the Move Subdisk and possibly the Split Subdisk command to spread out disk accesses more evenly across all the disks.

If a disk has High or Critical I/O activity (shown by a yellow or red pie symbol), you may consider moving one or more of its subdisks to another disk that shows below-average I/O activity (shown by a blue pie symbol). The idea is to move just enough activity to achieve balance. A careful study of the statistics for the disk with Critical activity may identify the best subdisks to move. You should move subdisks only when a disk has High or Critical I/O activity over a prolonged time and performance is affected. Moving a subdisk to another disk has an effect on I/O as well, but it should be compensated for by the other disk's having much lower I/O activity. You would need to look at the statistics after the subdisk move to see whether the move was effective in balancing the load.
Disk failure or removal

The Move Subdisk command can also be used to move the part of a volume that is on a failed or missing disk to a healthy one. Moving a subdisk for redundant volumes (mirrored or RAID-5) will use the redundant data to recreate the subdisk on the healthy disk. However, for nonredundant volumes (concatenated or striped), the data cannot be recreated, and doing a subdisk move will therefore lose data, which could be recovered if the disk can be repaired. Thus, when you attempt to move a subdisk from a failed or missing disk that has nonredundant data, a dialog box appears that asks if you want to force the move. You may want to force the move if you don't need the data any more or you can no longer recover the data. By doing so, you will retain the volume structure, but there is no guarantee that the data will be recoverable.

Disk phaseout

When a disk starts getting intermittent I/O errors and shows signs of hardware fatigue, you can use the Move Subdisk command to move all its subdisks to healthier disks. The benefit of moving subdisks instead of copying the volumes is that you need only enough space on the receiving disks for the subdisks on the one failed disk, not for entire volumes that may span multiple disks. Another advantage is that there is no interruption in I/O.

Moving subdisks provides you a flexible means of making adjustments in your storage system while it is up and running.

Subdisk context menu

The subdisk commands are available from the subdisk context menu shown below.

Figure 11-5  Subdisk context menu
To access this menu, display the subdisk you want to work with by first clicking on its volume in the tree view and then clicking the Subdisks tab above the right pane. Once the subdisk is displayed, right-click the subdisk to bring up this menu.

Subdisk properties

When you select Properties from the subdisk context menu.

The properties of the selected subdisk is shown below.

Figure 11-6 Subdisk properties screen

![Subdisk properties screen](image)

**Note:** The Size, Disk offset, and Plex offset fields have pull-down lists that let you select the units you want the number to be displayed in (Sectors, KB, MB, GB, or TB).

The properties are as follows:
In the screen captures showing subdisks in this chapter, you may have noticed that the subdisks on a disk are assigned numbers in a sequence, such as 1-01, 1-02, 1-03 or 12-01, 12-02, 12-03. The subdisk number is an internal number generated by the program. There is no particular significance to the one or two digits before the dash except that for any one disk, the first one or two numbers identifying its subdisks must be the same. The numbers after the dash represent a number for the subdisk within the disk. Thus, if the subdisk was the first one created for a particular disk, it would have a 01 after the dash, the second disk created would have a 02 after the dash, and so on.

<table>
<thead>
<tr>
<th>Name</th>
<th>Column displays the column that the subdisk occupies in the volume. Striped and RAID-5 volumes have multiple columns.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column</td>
<td>This field displays the size of the subdisk.</td>
</tr>
<tr>
<td>Disk offset</td>
<td>This is the offset where the subdisk starts on the disk. This is included in the Properties window because for a subdisk to be split, it must be contiguous to the subdisk next to it. By looking at the offsets, you can determine which subdisks are contiguous.</td>
</tr>
<tr>
<td>Plex offset</td>
<td>This is the offset of a subdisk within a plex. It shows the distance from the start of a plex to the start of a specific subdisk. The first subdisk within a plex will have an offset of 0. The second subdisk will be offset by the size of the first subdisk.</td>
</tr>
</tbody>
</table>

**Moving subdisks**

The purpose of moving a subdisk is discussed in another section.

See “Purpose of the subdisk commands” on page 322.

**Note:** You are not allowed to move a subdisk that is part of a boot or system volume.

Symantec Storage Foundation for Windows automatically checks the state of the data before beginning the subdisk move. If the data is degraded, the subdisk can still be moved. After moving, you will need to reactivate the disk to clear the Degraded state.

Moving a subdisk from one disk to another involves a certain amount of time. The SmartMove feature can help reduce the time for this operation.

See “SmartMove” on page 112.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Move Subdisk command.
To move a subdisk

1. In the tree view, select the volume that contains the subdisk you want to move.

2. Identify the subdisk that you want to move, and display it in the right pane of the VEA console.

   If you are concerned about load balancing, look for a disk with High or Critical I/O activity. It will have a yellow or red pie symbol in the cell to the right of its name in the Statistics tabular view. You may also be aware that a disk has had difficulties because of minor disk errors that have occurred. Such a disk may display an Online (Errors) state from time to time.

   To display the subdisk in the right pane, click on its volume in the tree view, and then click on the Subdisks tab in the right pane. The subdisks for that volume will display. You can use the subdisks’ Properties command to further identify the characteristics of a volume’s subdisks.

3. Right-click the subdisk you want to move to bring up its context menu.
4 Select **Move Subdisk** from the context menu.

The Move Subdisk window appears.

Choose either automatic or manual selection of the destination disk or disks for the subdisk to be moved to.

If you want to select the destination disk(s), click **Manually assign destination disks**. In the left panel of the window, highlight the disk(s) you want to assign as the destination disk or disks and use the **Add** or **Add All** button to move the disk(s) to the right pane of the window.

You may also check **Disable Track Alignment** to disable track alignment on the destination disks.

5 Click **OK** when you are satisfied with the changes.

**Splitting subdisks**

The Split Subdisk command lets you split a subdisk. After the subdisk is split, the resulting two subdisks will reside on the same sections of the same disk. You can then use the Move Subdisk command to move one or both subdisks to other disks. You may want to split and move a subdisk to make the best use of your disk space. A split subdisk can be joined back together with the Join Subdisk command.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Split Subdisk command.
To split a subdisk

1. In the tree view, select the volume that contains the subdisks you want to split.
2. In the right pane, click the **Subdisks** tab to display the volume’s subdisks.
3. Right-click on the subdisk you want to split to bring up its context menu.
4. Select **Split Subdisk** from the context menu.
5. In the window that comes up, specify the subdisk size for the first of the two subdisks.
   
   The remaining space will be assigned to the second subdisk. For example, if the original subdisk was 100 MB and you assigned 40 MB to the first subdisk, the other subdisk will be 60 MB.

   The drop-down list to the right of the **Size** and **First subdisk size** text entry boxes let you select sectors, KB, MB, GB, or TB.

6. Click **OK** to complete the command.

   After a few moments, two subdisks will appear in the right pane of the VEA console.

Joining subdisks

The Join Subdisk command lets you join subdisks. You can join two subdisks that had been one subdisk but that were split by the Split Subdisk command. You cannot split a subdisk and join it back to another subdisk that it was not split from. There also has to be room on the disk for the two subdisks.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Join Subdisk command.
To join subdisks
1. In the tree view, select the volume that contains the subdisks you want to join.
2. In the right pane, click the **Subdisks** tab to display the volume’s subdisks.
3. Right-click on a subdisk you want to join to bring up its context menu.
4. Select **Join Subdisk** from the context menu.
5. In the window that appears, select the subdisks to be joined.
6. Click **OK** to complete the command.

Within a short time, the two subdisks in the right pane of the VEA GUI will be replaced with one subdisk.

**Command line commands for statistics**

Statistics commands can be done through the command line interface.
See “vxstat” on page 631.

**SmartMove**

The performance of mirror operations and subdisk moves can be enhanced with the SmartMove feature. SmartMove helps reduce the resynchronization time required by mirror operations and subdisk moves. The resynchronization time is reduced by using the NTFS file system metadata to resynchronize only selected
regions. Operations that involve mirrors, like adding a mirror to a volume, off-host backup, and array migration, may have improved performance by using the SmartMove feature.

More information about SmartMove is available.

See “SmartMove” on page 112.

**Note:** SmartMove does not support non-NTFS disks.
This chapter includes the following topics:

■ Flashsnap overview
■ FlashSnap components
■ FastResync
■ Snapshot commands
■ Dynamic Disk Group Split and Join
■ CLI FlashSnap commands
■ Fast File Resync
■ Volume Shadow Copy Service (VSS)
■ Using the VSS snapshot wizards with Microsoft SQL
■ Copy on Write (COW)
■ Using the VSS COW snapshot wizards with Microsoft SQL

Flashsnap overview

Veritas FlashSnap is a multi-step process that lets you create independently addressable snapshot volumes that are copies or mirrors of the volumes on your server. These snapshots can be used for backup, application testing, or reporting and analysis. One of the main advantages of using FlashSnap is that the snapshot volumes can be easily moved to another server. Thus, backup or other processing can be performed on another server without affecting the performance of applications on the applications server.
With Symantec Storage Foundation for Windows (SFW), you also have the capability of creating simultaneous, multiple split-mirror snapshots. These snapshots can be done either through the VEA GUI or through the \texttt{vxsnap} CLI command.

\textbf{Note:} FlashSnap is available only with the Enterprise edition. See the “Licensing” section in the \textit{Symantec Storage Foundation and High Availability Solutions Installation and Upgrade Guide} for details.

SFW supports both traditional full snapshots or Microsoft Copy on Write (COW) snapshots. The VEA GUI or the \texttt{vxsnap} CLI utility can be used to take COW snapshots. Microsoft COW snapshots are faster than full snapshots and take up less storage space because COW snapshots use a shadow copy that is differential. The initial state of the original volume can be reconstructed using the blocks in the differences area and unchanged blocks in the original volume.

SFW provides support for taking snapshots of Microsoft SQL databases. FlashSnap integrates with the Microsoft Volume Shadow Copy Service (VSS) to allow snapshots to be taken of all volumes associated with an SQL database without taking the database offline.

FlashSnap integrates with the Microsoft Volume Shadow Copy Service (VSS) to allow snapshots to be taken of all volumes associated with an Exchange storage group without taking the database offline. The VSS Snapshot wizard and the \texttt{vxsnap} CLI command both use VSS and either can be used to take snapshots of storage groups. The VSS process allows the storage group’s databases to be quiesced before the snapshot operation and reactivates them immediately after. The quiescing at the storage group level allows for Microsoft supported and guaranteed persistent snapshots of the data. Snapshots of the storage groups can be reattached and resynchronized to match the current state of the storage group with the VSS Snapback wizard or the \texttt{vxsnap reattach} CLI command.

Refer to the \textit{Symantec Storage Foundation and High Availability Solutions High Availability and Disaster Recovery Solutions Guide for Microsoft Exchange} for detailed procedures on how to use the VSS Snapshot wizard or the \texttt{vxsnap} utility with Microsoft Exchange to perform and to implement recovery procedures. This guide is included in PDF format with the product.

See “\texttt{vxsnap}” on page 658.

SFW also provides a VSS Snapshot Scheduler Wizard that enables you to set up a schedule for automating the snapback process.

At the time scheduled for the snapshot, the snapshot volumes are automatically reattached, resynchronized, and then snapshotted again. The schedule is
maintained by a scheduler service, VxSchedService.exe, that runs in the background.

Fast File Resync is a feature that uses Veritas FastResync technology to resynchronize selected files in a snapshotted volume to the original volume. It is designed for database applications using volumes with multiple database files and can be used to restore one or more corrupt files.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support Flashsnap or SFW VSS-related commands.

## FlashSnap components

FlashSnap is a multi-step process.

It includes the following components:

- **FastResync**
  
  FastResync (FR) supports resynchronizing of mirrors by copying only changes for the temporarily split mirror by using FR logging. This reduces the time it takes to rejoin a split mirror to the mirror set and also reduces the server CPU cycles needed to complete the resynchronization.

  The Fast File Resync command provides the capability to restore a single file from a snapshot back to the original volume.

  See “Fast File Resync” on page 380.

- **Snapshot commands**
  
  The snapshot commands are used to create the mirrored volumes that are useful for backup or other resource-intensive processing purposes.

  These features are necessary for the FlashSnap procedure, but they can also be used for other, more general purposes. The descriptions of these features in this section contain complete information about each feature, not just the part of the feature used in the FlashSnap procedure. However, to make use of these commands, you have to install the FlashSnap option.

  **Note:** Some snapshot commands, such as Prepare, may take a significant amount of time. These mirror-related operations can be tuned for better performance with the Configuration Task Performance Tuning settings.

  See “Configuration task performance tuning” on page 116.
Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support snapshot commands.

- Dynamic Disk Group Split and Join
  Dynamic Disk Group Split and Join supports the ability to split a dynamic disk group into two disk groups so that the newly formed disk group can be moved to another server. This allows splitting a mirror for backup and having a separate server handle the backup. After the backup is completed, the split-off disk group is moved back to the original server and joined to its former disk group, and the mirror is reassigned with its mirror set and resynchronized. Dynamic Disk Group Split and Join also can be done on the same server for same-host backup or for reorganizing the disk groups on the server. The Dynamic Disk Group Split and Join commands are necessary for FlashSnap, but they can also be used for other, more general purposes.

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support Dynamic Disk Group Split and Join commands.

Summary of the FlashSnap procedure

You can use the FlashSnap procedure with two servers (using a remote server to do the processing of the backup or other resource-intensive activities), or you may prefer to have the processing done on the same server.

This section includes a summary for both situations. These steps can be implemented through the VEA GUI or through the command line.

Note: The same host procedure can be used for quick recovery snapshots to recover a data.

Off-host FlashSnap procedure (Two servers)

The following is the off-host FlashSnap procedure.
To use the off-host FlashSnap procedures with two servers

1 Use the **Prepare** command to attach a snapshot mirror to a volume on the working server.

   This step of creating the snapshot mirror of the volume and resynchronizing it to the volume does take considerable time, but it has to be done only once for the initial setup.

   The **Prepare** command replaces the **Snap Start** command in the GUI. Both *prepare* and *start* keywords are available in the CLI, however *prepare* is the recommended keyword.

2 Use the **Snap Shot** command to automatically detach the snapshot mirror and create a new volume that is associated with the snapshot mirror.

   This new volume can be used for backup or other purposes. The snapshot process typically takes less than 20 seconds.

3 Split the new volume from its dynamic disk group with the **Split Dynamic Disk Group** command, creating a new dynamic disk group on the server.

4 Deport the new dynamic disk group from the original server.

   When using the command line, a separate deport command is not necessary. It is needed only for the VEA GUI command.

5 Rescan on the second server so that the computer recognizes the split-off dynamic disk group.

6 Import the dynamic disk group on the second server where the backup or other off-host processing occurs.

7 Perform the backup or other off-host processing activity, using the snapshot volume.

   If you are backing up the server, Veritas NetBackup or Veritas Backup Exec is recommended for the backup software.

8 Deport the dynamic disk group from the second server.

   If you do not have a SAN where you can access the deported dynamic disk group from the original server, physically move the split-off disk group’s disks back to the original server.

9 Rescan on the original server, so that the server recognizes the split-off dynamic disk group.

   You do not need to import the dynamic disk group back to the original server.
10  Use the **Join Dynamic Disk Group** command to join the split-off dynamic disk group back to its original dynamic disk group.

11  Join the mirrored volume back to its original volume, using the **Snap Back** command.

   The mirrored volume is now resynchronized to the data source and is continually updated. Because FastResync (FR) is used in resynchronizing the mirrors, the time for the resynchronization is greatly reduced.

   The next time the sequence of commands is run again, the snapshot mirror is ready for the snapshot step. The **Prepare** step, step 1, does not have to be done again.

**Same-host FlashSnap procedure (One server)**

Steps 1 and 2 are the same as in the two-server procedure: 1) using Snap Prepare to attach a snapshot mirror to the original volume, and 2) detaching the snapshot mirror and creating a new volume that is associated with it.

Because no remote host is involved, you do not need to use Disk Group Split and Join to do any deporting or importing of the disk group. The backup or other resource-intensive processing is done on the same server.

In both the off-host and same-host procedures, the final step is to join the mirrored volume back to its original volume, using the Snap Back command. In this step, as already mentioned, the time for synchronizing the mirrors is greatly reduced.

FlashSnap on the same host can also be used for quick recovery snapshots to recover data. Quick Recovery is the process of using on-host point-in-time copies of production data and a transaction log to recover a database that has been corrupted or that has missing data. If a database becomes corrupted, for example, you could reload the original data from the most current snapshot, and then use the transaction log to bring the database current to the point before the corruption.

For a general discussion of Quick Recovery, see the Quick Recovery section of the *Symantec Storage Foundation and High Availability Solutions Solution Guide*. For detailed information, refer to the Quick Recovery Solutions guide for the respective application.

**FastResync**

FastResync (FR) provides enhancements to Symantec Storage Foundation for Windows.

These include the following:

- Resynchronization
Optimizes the resynchronization of a mirror that is detached from and then returned to a volume.

- **Reconnection**
  Extends the snapshot model by providing the ability to refresh and reuse a snapshot, rather than discarding it.

FR increases the efficiency of the Symantec Storage Foundation for Windows snapshot mechanism and improves the performance of operations, such as backup and decision support (organized methods of collecting data that are designed to facilitate decision-making). Typically, these operations require that a volume is quiescent and that they are not impeded by updates to the volume by other activities in the system. FR reduces the amount of time that a volume must be out of service during such operations.

FR can be enabled or disabled by the user on a per-volume basis. When you enable FR for a volume, a DCO (Disk Change Object) volume is created to track the regions on a volume that are changed while a mirror is detached.

**Note:** Only a limited subset of operations is permitted on a DCO volume. You can perform a subdisk move, or add and remove a mirror.

FR is automatically enabled for a volume when **prepare the volume for snapshot operation** is performed on the volume.

The volume can be prepared through the command line interface `vxassist prepare` command or through the VEA GUI Prepare command.

**Note:** The Prepare command replaces the Snap Start command in the VEA GUI. Both `prepare` and `start` keywords are available in the CLI, however `prepare` is the recommended keyword.

### FastResync limitations

FastResync cannot be used with software RAID-5 volumes.

### Resynchronization

FastResync (FR) keeps track of data store updates missed by mirrors that are unavailable at the time that the updates are applied to a volume. When a mirror returns to service, FR resynchronizes the mirror with the volume by applying only the updates missed by that mirror while it was detached. This generally takes
less time than the traditional method of copying the entire data store to the returning mirror.

If you want FR to resynchronize a mirror, FR must be enabled for the volume before the mirror is detached and continue to be enabled until after the mirror is reattached and resynchronized. However, if you are using any of the snapshot commands, FR is automatically turned on.

FR does not alter the traditional mirror failure and repair administrative model. The only visible effect is that typical mirror repair operations conclude more quickly.

Although both FR and dirty region logging (DRL) keep track of regions on a volume where the mirrors are not synchronized, they perform different functions. FR keeps track of data store updates missed by a detached mirror, while DRL keeps track of whether a write to a mirrored volume has been completed on all mirrors. The write region on the volume is considered "dirty" because the mirrors are out of sync until the write to all mirrors is completed. DRL is used to resynchronize mirrors following a system crash.

See “Dirty region logging (DRL) and RAID-5 logging” on page 250.

**Reconnection**

Reconnection extends the snapshot model by providing the ability to refresh and reuse a snapshot mirror, rather than discarding it. FR is automatically enabled when you take a snapshot of a volume. FR retains the association between the snapshot mirror and the volume when the snapshot mirror is detached from the volume.

See “Resynchronization” on page 337.

FR reattaches and resynchronizes the snapshot mirror with the volume when the Snap Back command is issued, either through the `vxassist` command line command or the GUI.

See “vxassist” on page 589.

See “Snapshot commands” on page 344.

**Enabling and disabling FastResync**

FastResync (FR) can be enabled and disabled on a per-volume basis. For FR to be active when a mirror is reattached and resynchronized with its associated volume, FR must be enabled before the mirror is detached and remain enabled until the mirror has been reattached and resynchronized with the volume.

The procedure for enabling FR from the GUI is described below.
You can also enable and disable FR from the command line. See “vxvol” on page 538.

**Note:** You cannot enable FR on RAID-5 volumes.

**Note:** If you are using snapshot commands, you do not need to use the following steps, because FR is automatically enabled for snapshot commands. These steps are needed only when you want to enable FR on a volume that is not used with any snapshot commands.

### Enabling FastResync

The following describes how to enable FR.

**To enable FastResync for a volume through the VEA GUI**

1. Select the mirrored volume that you want to enable FR for. The volume context menu is displayed.
2. Select **FastResync > Add**. A dialog box is displayed, asking you to confirm adding FR for the volume.
3. Click **Yes**. FR is now enabled for the volume.

### Disabling FastResync

The following describes how to disable FR.

**To disable FastResync for a volume through the VEA GUI**

1. Select the mirrored volume that you want to disable FR for. The volume context menu is displayed.
2. Select **FastResync > Remove**. A dialog box is displayed asking you to confirm removal of FR.
3. Click **OK**. FR is now disabled for the volume.
Disk Change Object (DCO) volume

The DCO volume is created when you enable FR or when a snapshot operation is started. The DCO volume keeps track of the changes made to a volume while a mirror is detached.

The DCO volume is not visible in the tree view in the left pane of the VEA console. It is visible in the Disk View (when volume details is not selected).

You can perform the following on a DCO volume:

- Add or remove a mirror — you can add a mirror to the DCO volume and remove a mirror from it.
- Move a subdisk — you can move the DCO volume and the mirrored subdisk associated with it to another disk with the Subdisk Move command.

Add a mirror to a DCO volume

You might want to add a mirror to a DCO volume to have a backup copy of the DCO volume.

To add a mirror to a DCO volume

1. Select the volume whose DCO volume you want to add a mirror to.
2. From the volume’s context menu, select Disk View to get a separate Disk View window. You can also select the Disk View tab to have the Disk View display in the right pane.
3 Right-click the DCO volume to bring up a context menu, as shown in the sample screen.

![Sample Screen](image)

4 Select **Mirror/Add**.

The Add Mirror window is displayed.
5. If you want to add the mirror to a specific disk, click the radio button **Manually select disks**, select the desired disk, and then click the **Add** button to move the disk to the right pane. If you want the disk to be selected automatically, leave the default setting of **Auto assign destination disks** selected.

6. Click **OK** to add the mirror.

   Note that any mirrors added to the DCO volume of a snapshot volume are deleted when you snap back the snapshot volume.

   The process for adding a mirror to a volume that is not a DCO volume is different.

   See “Add a mirror to a volume” on page 235.

**Remove a mirror from a DCO volume**

The following is the procedure to remove a mirror from a DCO volume.

**To remove a mirror from a DCO volume**

1. Select the volume whose DCO volume you want to remove a mirror from.

2. Select the **Disk View** tab in the right-hand pane, and right-click on the DCO volume.

   A context menu is displayed.

3. Select **Mirror>Remove**.

   A dialog box is displayed, asking you to select the mirror to remove.
4. Select the mirror.
   Click the **Add** button to move it to the right pane.

5. Click **OK**.
   The mirror is removed from the DCO volume.

**Move the DCO volume subdisk**

You might want to move a DCO volume and the mirrored subdisk associated with it to another disk if something happens to the original disk, or you may prefer to have this subdisk on another disk to split the disk group differently. The DCO volume and the mirrored subdisk associated with it have to be moved to a disk in the same disk group.

**To move a DCO volume subdisk**

1. Under the Volumes folder, select the volume whose DCO volume subdisk you want to move.

2. Right-click in the empty space on the **Disk View** tab in the right-hand pane.
   A context menu is displayed.

3. Select **Vol Details**.
   The display changes. The **Disk View** tab now displays the subdisk names for the volumes.

4. Right-click on the subdisk containing the DCO volume.
   A context menu is displayed.

5. Select **Move Subdisk**.
   The Subdisk Move window appears.

6. Click the radio button **Manually assign destination disks**.

7. Highlight the disk you want to move the mirrored volume subdisk with the DCO volume to, and click the **Add** button. The selected disk is moved to the right pane of the window.

8. Click **OK** to complete the command.
   The mirrored volume subdisk with the DCO volume is moved to the other disk.

More information about subdisk move is available.

See “Subdisk move, split, and join” on page 321.
Snapshot commands

You can use the Veritas Enterprise Administrator (VEA) GUI to take a snapshot of a volume.

The snapshot feature can also be accessed through the command line interface. See “CLI FlashSnap commands” on page 379.

You can take a snapshot of mirrored or unmirrored volumes, but not of RAID-5 volumes.

The Snapshot feature enables quick and efficient online backup of volumes, with minimum disruption to the user. Snapshot automatically enables FastResync (FR) and creates a snapshot image of a volume, which can be detached from the volume. The detached snapshot image can be used for backup or other purposes, while the original volume remains in service.

The snapshot can then be quickly reattached and resynchronized with the volume through the FR reconnection capability. See “Reconnection” on page 338.

The snapshot volume can also be permanently disconnected from the original volume.

You can attach more than one snapshot plex to a volume by issuing successive Prepare commands on the volume. This enables you to take multiple snapshots of a single volume.

**Note:** The Prepare command replaces the Snap Start command in the VEA GUI.

You can attach a snapshot to either the original volume or the snapshot volume.

The following snapshot commands are supported by the GUI and are accessed through the volume context menu:

- **Prepare**
  Creates the snapshot mirror and attaches it to the original volume.

- **Snapshot**
  Detaches the snapshot mirror from the original volume and creates a snapshot volume that is associated with the snapshot mirror.

- **Snap back**
  Reattaches the snapshot mirror to the original volume.

- **Snap clear**
  Permanently removes the snapshot mirror from the original volume.
Snap abort
Aborts the snapshot operation after a Prepare or Snap Back command is issued. Snap Abort permanently removes the snapshot mirror from the volume and releases its space.

The five snapshot commands are subcommands of the Snap command on the volume context menu.

Figure 12-1 snapshot commands are shown below.

Figure 12-1 Snap command submenu

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support snapshot commands (Prepare, Snap Shot, Snap Back, Snap Clear, or Snap Abort).

Using the snapshot procedure
In summary, the snapshot procedure consists of a few steps. These include the following:

- Attaching a snapshot mirror to a volume, using Prepare.
- Detaching the snapshot mirror and creating the snapshot volume that is associated with the snapshot mirror.
Either reattaching the snapshot to the volume after you are done using it, or
permanently disconnecting it from the volume. Snap Back reattaches the
snapshot mirror; Snap Clear permanently disconnects the snapshot mirror
from the volume, removing the association between the snapshot volume and
the original volume.

The Prepare procedure takes considerable time because it involves creating a
mirror, but it has to be done only the first time you perform the snap commands
sequence. After that, you use the commands Snap Shot to break off the mirror
for backup (or other purposes) and then Snap Back to reattach the snapshot mirror
to the original volume. Both of those are very quick procedures (typically less
than a minute for each one).

Snap Abort aborts the snapshot operation after the Prepare or Snap Back command
is issued.

Prepare

Prepare creates a snapshot mirror or plex, which is attached to and synchronized
with a volume. Alternatively, if you are applying the command to a volume that
already has one or more normal mirrors, you can designate an existing mirror to
be used for the snapshot mirror. The advantage of selecting an existing mirror is
that it saves time, since it is not necessary to resynchronize the mirror to the
volume.

Note: The Prepare command replaces the Snap Start command in the VEA GUI.

The mirror synchronization process can take a while, but it does not interfere
with use of the volume. If the prepare the volume for snapshot process fails, the
snapshot mirror is deleted if it was created from scratch, and its space is released.
If you selected a normal mirror to be used for the snapshot mirror, that mirror
reverts to its normal state if the prepare the volume for snapshot process fails.

When the prepare the volume for snapshot process is complete, the status of the
snapshot mirror displays as Snap Ready on the Mirrors tab in the right pane of
the VEA GUI. The snapshot mirror can be associated with a snapshot volume by
using the Snap Shot command. Once the snapshot mirror is created, it continues
to be updated until it is detached.

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do
not support the Prepare or Snap Start commands.
To create a snapshot mirror

1 Right-click on the volume that you want to take a snapshot of.
   A context menu is displayed.

2 Select Snap>Prepare.
   The Prepare volume for Flashsnap wizard welcome screen appears.
   Click Next to continue.

3 The screen that appears depends on whether you already have a mirrored volume or not. If you already have a mirrored volume, the snapshot mirror continues to be updated until it is detached by using the SnapShot command.

The various screens are as follows:

- Mirrored volume: If you have a mirrored volume, a screen appears to let you select an existing mirror to be used for the snapshot mirror.
  - If you have a mirrored volume and there is also a disk available on your system to create an additional mirror, the screen lets you choose either to use an existing mirror for the snapshot or to have a new mirror created.
  - If you have a mirrored volume and there is no disk available for creating a new snapshot mirror, the screen lets you select from existing mirrors in the volume.

If you select an existing mirror, click Next to continue to the summary screen and click Finish to complete the Prepare command.
If you do not select an existing mirror, click Next to continue and follow the instructions for an unmirrored volume.

- Unmirrored volume: If you have an unmirrored volume or you have not selected an existing mirror to use for the snapshot mirror, select the disk to be used for the snapshot mirror from the window for disk selection.
The default setting is to have the program automatically select the disks where the mirror is created.
Alternatively, you can specify the disks that can be used to create the snapshot mirror by clicking the Manually select disks radio button. If you select the manual setting, use the Add or Add All button to move the selected disks to the right pane of the window. The Remove and Remove All buttons let you move selected disks back to the left pane.
You may also check Disable Track Alignment to disable track alignment on the snapshot mirror volume.
Click Next to continue to specify attributes.

Specify attributes

On this screen select one of the following volume layout types:

- Concatenated
- Striped
If you are creating a striped volume, the **Columns** and **Stripe unit size** boxes need to have entries. Defaults are provided.

For a concatenated or striped volume, you may also specify to mirror across disks by the following:

- Port
- Target
- Enclosure
- Channel

The operation to prepare a volume for a snapshot fails if the appropriate resources are not available to support the selected attributes to mirror across disks.
After the Prepare command completes, a new snapshot mirror is attached to the volume. See the sample screen below. In that screen, the volume Flash has a snapshot mirror attached to it.

The new mirror is added to the Mirrors tab for the volume. In the sample screen, the mirror is identified as a snapshot mirror and has the Snapshot icon. After the snapshot mirror is synchronized with the volume, its status becomes Snap Ready.

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Status</th>
<th># Columns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash-01</td>
<td>Snapshot</td>
<td>Snap Ready</td>
<td>1</td>
</tr>
<tr>
<td>Flash-03</td>
<td>Concatenated</td>
<td>Attached</td>
<td>1</td>
</tr>
</tbody>
</table>

It is important to make sure that the snapshot mirror (or snap plex) has completed its resynchronization and displays the status of Snap Ready before continuing with the Snap Shot command or doing any other operations on the snapshot mirror. Also, if you shut down the server or deport the disk group containing the volume being prepared for a snapshot before resynchronization completes, the snapshot mirror is deleted when the disk group with the original volume comes online again.

The DCO (Disk Change Object) volume is created to track the regions on a volume that are changed while a mirror is detached.

See “Disk Change Object (DCO) volume” on page 340.

The DCO volume is not included in the tree view of the VEA GUI. To view the DCO volume, you must use the Disk View. To access the Disk View, click the Disk View tab in the right pane or select Disk View from a disk’s or volume’s context menu.

The sample Disk View screen that follows shows the DCO log that is created by the Prepare command.
Note: The Break Mirror and Remove Mirror commands do not work with the snapshot mirror.

Snap shot

Snap Shot detaches the snapshot mirror and creates a new volume that is associated with that mirror. This process takes a relatively short time, typically less than a minute, during which users can be requested not to access the original volume. After the snapshot volume is created, it can be used for backup or other purposes. Snap Shot can also make snapshots of more than one volume at the same time.

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Snap Shot command.
To take a snapshot

1. Right-click on one of the volumes with a snapshot mirror. A context menu is displayed.

2. Select **Snap > Snap Shot**.

3. The Snap Shot Volume Wizard Welcome screen appears. Click **Next** to continue.
In the Select Volumes window that appears, select the volumes that you want to take a snapshot of.

Highlight the volumes in the **Available volumes** pane and click **Add**. Your selected volumes should appear in the **Selected volumes** pane.

You have the option of taking the snapshot with Volume Shadow Copy Service (VSS). The VSS snapshot method lets you take snapshots of VSS-aware applications, such as Microsoft SQL Server, while the application files are open. When VSS-aware applications do not exist, the snapshot is taken with the SFW FlashSnap method (VM method).

See “Volume Shadow Copy Service (VSS)” on page 383.

When the VSS snapshot method is used, snapshots can only be taken of read/write volumes and the resulting VSS snapshot is read only. The V snapshot method may take snapshots of read/write or read only volumes and the resulting snapshots match the access mode of the original volume. However, when the VM snapshot method is used the Snap Shot Volume Wizard presents a **Force Read Only** checkbox to let you specify the resulting snapshot to have read only access.

You can set the snapshot process to use the VSS or the VM snapshot method by using Systems Settings.

See “System settings” on page 106.

Click **Next** after selecting your volumes.
In the Change Attributes window that appears, you may edit the following attributes of the snapshot:

- Snap Volume Label

**Note:** The default Snap Volume Label begins with “SnapV” followed by a 12 character alphanumeric string. The 12 character alphanumeric string is a coded hexadecimal timestamp based upon the time that the snapshot was taken. For example, a default Snap Volume Label would be “SnapV4A7337AE038A”.

**Note:** The Snap Volume Label cannot be changed for read only snapshots.

- Drive Letter
- Plex
After editing the attributes, click **Next** to continue.

6  **Click Finish** in the final window to begin the Snap Shot process.

The snapshot mirror is detached from each of the original volumes, and new volumes are created that are associated with the snapshot mirrors. This process usually takes less than a minute.

The snapshot mirrors are no longer displayed on the **Mirrors** tab of the original volumes. The new snapshot volumes are displayed under the Volumes folder in the tree view. The program assigns them the next available drive letters (drive letters F and L in the tree view of the following sample screen).

You can now use the snapshot volume for backup or other purposes.

**Snap back**

Snap Back reattaches a detached snapshot mirror to its original volume.

After you are done using the snapshot, you can reattach it to the volume, where it is resynchronized to the data store and continually updated. You can then get a current copy of the original volume, with minimal disruption to users, by issuing Snap Shot again.
**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Snap Back command.
To reattach a snapshot mirror to the original volume

1 Right-click the snapshot volume whose snapshot mirror you want to reattach to its original volume.

   A context menu is displayed.

2 Select **Snap > Snap Back**.

   A dialog box appears with two options for resynching the snapshot, as shown in the screen that follows:
Specify whether the snapshot volume is to be resynchronized to match the original volume or the original volume is to be resynchronized to the snapshot volume, and click OK.

One situation where you might want to resynchronize using the snapshot volume rather than the original volume is when something has happened to the original volume so that its data integrity is no longer sound.

The middle of the screen displays a further explanation of the selected option. The snapshot mirror is reattached to the original volume, and the snapshot volume is deleted if it is the last plex of the volume. (If the snapshot volume has other mirrors associated with it, it is not deleted.)

As shown in the following figure, the snapshot volume, identified as L in the previous figure, is removed from the Volumes folder in the tree view, and the snapshot mirror is now shown on the Mirrors tab for the original volume. After the resynchronization, the original volume is now in a similar situation as it was after the first Prepare command, but any changes to it have been updated on the snapshot mirror.

Now it is possible to do another SnapShot command on the volume and repeat the process. If you are resynchronizing to the original volume, the resynchronization should take very little time because that volume was being constantly updated all the time.

Only the original synchronizing of the mirror in the original Prepare command takes the normal amount of time to create the snapshot mirror. Once you have completed the original Prepare command, the repeat procedure for SnapShot and Snap Back are very quick. You have to do the Prepare command only once.

Note that any mirrors added to the DCO volume of a snapshot volume are deleted when you snap back the snapshot volume.
Snap clear

Snap Clear permanently removes the link between a snapshot volume and its original volume. Snap Clear can be specified after the Snap Shot command has been issued. After a Snap Clear, the snapshot volume becomes an ordinary volume.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Snap Clear command.

**To change a snapshot volume to an ordinary volume**

1. Right-click on the snapshot volume that you want to change to an ordinary volume.
2. Selecting the snapshot volume and after the **Snap Clear** command is completed, the volume is no longer linked to its original volume.
3 Select **Snap > Snap Clear**.

A message box is displayed asking you to confirm the **Snap Clear** operation for the specified volume.

4 Click **Yes**.

The snapshot mirror becomes an ordinary volume. The original volume goes back to the state that it was in before the **Prepare** command.

**Snap abort**

Snap Abort aborts the changes made by the Prepare or Snap Back command. In both these commands, a snapshot mirror plex is attached to a volume. Snap Abort either deletes this snapshot mirror plex or converts the snapshot mirror plex to an ordinary mirror. In cases where the deleted snap plex is the last snap plex and the resulting volume is simple or striped, the Snap Abort command deletes the DCO log volume also. The command cannot be done directly after a Snap Shot command.

---

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Snap Abort command.

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**To delete a snapshot mirror or change it into an ordinary mirror**

1 Right-click the volume on which you want to abort the **Prepare** operation.

2 Select **Snap > Snap Abort** from the context menu that comes up.
3 Select the options in the Snap Abort Volume window that appears.

If you have only one mirror, you can leave the default automatic selection setting. If there are multiple mirrors, you can manually select the mirrors to snap abort. If you click the checkbox Convert into a normal mirror, the selected mirror or mirrors become normal mirrors.

Click OK when you are satisfied with your selections.

4 Respond to the message box asking you to confirm the SnapAbort operation for the specified volume. The snapshot mirror is deleted or converted. The DCO volumes are removed.

Using the Snapshot Scheduler wizard

You can use the Snapshot Scheduler wizard to add a snapshot schedule.

The scheduling capability automates the process of taking snapshots. At the scheduled time, the specified volumes are automatically snapshotted. Once configured and applied, the schedule is maintained by a scheduler service, VxSchedService.exe, that runs in the background.

Note: Information about the operations performed by the schedule can be found by expanding the nodes under the Scheduled Tasks node in the tree-view of the GUI. Expand the appropriate application node to locate the schedules for that application. Right-click the node and select Job History to view information about the operations performed by the schedule.
Note: The Snapshot Scheduler only supports VSS snapshots (read-only snapshots).

Note: You must prepare the snapshot mirror with the Prepare command before running the Snapshot Scheduler wizard.

To create a schedule for snapshots

1. Right-click a volume in the tree-view.
2. Click Snap>Schedule SnapShot in the context menu.
3. In the wizard, review the Welcome page and click Next.
4. In the Select Volumes window that appears, select the volumes that you want to take a snapshot of.
   Highlight the volumes in the Available volumes pane and click Add. Your selected volumes should appear in the Selected volumes pane.
   Specify the snapshot set parameters as appropriate and then click Next.

   Directory
   The wizard creates the snapshot set metadata XML file. The XML metadata file is stored by default in the directory shown on the screen.

   Snapshot set
   Enter a name for the snapshot set, for example, billing or accept the default name. The wizard generates a default snapshot set name that includes the term "SnapshotSet.vol.timestamp".

5. In the Change Attributes window that appears, you may edit the following attributes as appropriate. Click Next to continue.
   ■ Drive Letter
   ■ Plex
In the Schedule Information panel, on the General Options tab, specify the following:

- **Name of this schedule**: Enter a unique name for the snapshot set schedule. This name identifies the snapshot schedule if you later want to view information about the snapshot status. A default name consists of a prefix, "Generic", and a numbered suffix that increments with each schedule.

- **Description of this schedule**: Optionally, enter a description to help you identify the schedule when you view information about the snapshot status.

- **Start Time**: The time of the day to begin taking snapshots.

- **End Time**: The time of day to end taking snapshots. If a snapshot is in progress it is completed but a new one is not started after the end time.

- **Schedule takes effect on**: The date on which the specified schedule takes effect. The default is the current date.

- **Restart task every**: The interval between snapshots, in minutes. For example, if the interval is 360 minutes and you schedule a snapshot start time of 12 P.M. and an end time of 7 P.M, the snapshot occurs twice. If no interval is specified the snapshot occurs once.

- **Every**: Enable the **Every** option to have the snapshot schedule continue to occur. Otherwise the schedule applies only for one day. Specify the number of days before restarting the snapshot schedule. For example, 1 day would mean the schedule takes effect daily, 2 days would mean every other day.

- **Start On**: If you enable the Every option, specify the starting date.

- **Pre Command**: Optionally, specify the full path of a command script to run before the scheduled snapshot occurs.

- **Post Command**: Optionally, specify the full path of a command script to run after the snapshot is complete.
7 To specify run days for the schedule, make selections on the following tabs:

- **Days of Week**: Select one or more days on one or more weeks of the month. You can click a button at the top of the column to select the entire column or a button to the left of a row to select the entire row. For example, clicking *First* schedules the snapshots to occur on the first occurrence of all the week days for the month.

- **Days of Month**: Select one or more days of the month. You can also check the *Last Day* checkbox to schedule the snapshot for the last day of each month.

- **Specific Dates**: Select one or more specific dates to include in or to exclude from the schedule. Excluding a date takes precedence over days scheduled on the other tabs. For example, if you schedule every Monday on the Days of Week tab, and you exclude Monday October 9 on the Specific Dates tab, the snapshots are not taken on October 9.

If two schedules overlap for the same snapshot set, only one snapshot is taken. For example, if you select every Thursday plus the last day of the month, and the last day of the month occurs on Thursday, only one snapshot is taken on Thursday.

8 Click *Next*.

9 Review the specifications of the snapshot set and click *Finish*.

### Displaying the status of the scheduled snapshot

If a scheduled snapshot fails for some reason, the scheduler process will attempt to rerun it. You may want to verify that scheduled snapshots completed successfully. From the VEA console, you can view snapshot results.

**To view a scheduled snapshot status**

1 From the VEA console, navigate to the system where the production volumes and snapshot mirrors are located.

2 Expand the system node and the *Storage Agent* node.

3 Click *Scheduled Tasks*.
Expand the **Generic** node. The scheduled snapshots are listed on the right pane of the VEA.

All scheduled snapshots not associated with an Application are displayed under the **Generic** node.

Choose one of the following:

- To view the status of all scheduled jobs, right-click **Generic** and click **All Job History**
- To view the status of a particular schedule, right-click the snapshot schedule name and click **Job History**.

In the dialog box, view the schedule information.

You can sort listed schedules by clicking the column headings. The Status column shows if the snapshot completed successfully.

### Deleting a schedule for a snapshot

The following is the procedure to delete a schedule.

**Note:** You cannot modify a schedule that has expired.

You can also delete (but not modify) a schedule from the GUI console.

**To delete a schedule with the GUI**

1. From the VEA console, navigate to the system where the production volumes and snapshot mirrors are located.
2. Expand the system node and the **Storage Agent** node.
3. Click **Scheduled Tasks**.
4. Expand the **Generic** node for which you scheduled the snapshot. The scheduled snapshots are listed on the right pane of the VEA.
5. Right-click the name of the snapshot schedule and click **Delete Schedule**.

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**Dynamic Disk Group Split and Join**

This section describes Dynamic Disk Group Split and Join.

**About Dynamic Disk Group Split and Join**

**Dynamic disk group split**

**Recovery for the split command**
Dynamic disk group join
Using Dynamic Disk Group Split and Join with a cluster on shared storage
Limitations when using dynamic disk group split and join with Volume Replicator
Dynamic Disk Group Split and Join troubleshooting tips

About Dynamic Disk Group Split and Join

Dynamic Disk Group Split and Join refers to two related commands—Split Dynamic Disk Group and Join Dynamic Disk Group. Split Dynamic Disk Group splits a dynamic disk group into two dynamic disk groups. Join Dynamic Disk Group joins two dynamic disk groups into one merged disk group. You can join two disk groups that were originally split apart with the Split Dynamic Disk Group command, but you can also join two dynamic disk groups that started out as separate disk groups. Dynamic Disk Group Split and Join can be used for the FlashSnap process and to reorganize dynamic disk groups.

It can be implemented through the VEA console or through the command line by using the `vxdg split` and `vxdg join` commands.

With the Split Dynamic Disk Group command, you can take some but not all disks from one dynamic disk group to another. The source dynamic disk group retains its identity as the original, while the other dynamic disk group, called the target disk group, becomes a new dynamic disk group. After the split operation, the target dynamic disk group is in the Imported state if you used the GUI to implement the command. If you used the command line to do the split, the target dynamic disk group is by default in the Deported state (though you can use the -i switch to have it remain in the Imported state). In both the GUI and the command line, the source dynamic disk group continues to remain online after the split operation.

Primary dynamic disk groups cannot be split because primary dynamic disk groups usually contain the computer’s boot and system disks. Also, only healthy dynamic volumes can be transferred in the split operation.

You can upgrade disk groups through the GUI.
See “Upgrade a dynamic disk group version” on page 176.
You can also upgrade disk groups through the command line.

The Split Dynamic Disk Group command works on the premise that the split-off disk group should contain all disks that are needed to make the volumes in the new disk group complete. If the disks that you select to split the disk group result in incomplete volumes, the logic built into the command adds the remaining disk or disks needed to split the disk group with complete volumes. A screen is
presented to you that lists the disks needed for the split. You can decide at that time whether you want to go ahead with the dynamic disk group split.

Thus, you are not able to split a dynamic disk group into two disk groups if any of the volumes allocated to either split disk group are incomplete.

The Join Dynamic Disk Group command lets you combine dynamic disk groups. It does not require that the dynamic disk groups to be joined were previously split. When you join two dynamic disk groups, the dynamic disk group you designate as the source becomes the one that loses its identity in the merge. The target dynamic disk group is the one that remains after the join.

With the join command, all the disks of the source dynamic disk group are joined with all the disks of the target dynamic disk group. Symantec Storage Foundation for Windows allows a partial join—that is, volumes in the source disk group can have missing or nonfunctional disks and the join command can still succeed. In this situation, you must click the Allow Partial Join checkbox to indicate that you want a partial join to take place. When the missing disk or disks come back to an online state, then you need to do another Join Dynamic Disk Group command to add the missing disk or disks to the target disk group.

**Warning:** If you have a partial join in place, you must wait until the missing disks or disks are joined to the target disk group before making the following configuration changes to either the source or target disk group: replace or evacuate disk, split or move a subdisk, extend a volume, add a mirror, and clear hot relocation. Doing so before all disks are joined can result in data loss.

The procedures in this section focus on the CLI commands related to Dynamic Disk Group Split and Join.

You can also perform Dynamic Disk Group Split and Join through the command line.

See “vxdg” on page 550.

**Note:** Microsoft Disk Management Disk Groups do not support Dynamic Disk Group Split and Join.

### Dynamic disk group split

After a dynamic disk group is split through the CLI command, the target disk group is in an Imported state. If you want the dynamic disk group to be in a Deported state, use the CLI version of the command, `vxdg split`, in which the
default state of the target disk group is Deported. However, you can also use the
-i switch with vxdg split to have the target disk group be Imported.

With the dynamic disk group split command, if the source disk group is a cluster
disk group or a disk group with private dynamic disk group protection, the
resulting target disk group becomes the same disk group type.

With the CLI disk group split command, these disk group types need additional
parameters to ensure that they retain their respective disk group type.

See “vxdg split” on page 564.

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**Note:** Microsoft Disk Management Disk Groups do not support dynamic disk group split.

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**To split a dynamic disk group**

1. Make sure that the volumes to be split are not in use and that they are healthy. Similarly, make sure that any disks that are split do not have a Missing status.

   It is a good idea to use the Disk View to look at the disk group’s volumes and subdisks, so you can see which disks are appropriate to split. The disks in the new split-off disk group have to contain complete volumes.

   If a volume is in use, an error message comes up, asking if you want to force the split operation.

   See “Error message about forcing a split or join operation” on page 379.

2. Right-click a dynamic disk group, disk, or volume in the tree view of the VEA console, and click **Split Dynamic Disk Group** from the context menu. You can also select the command from the **Actions** menu on the VEA console menu bar.

3. The Dynamic Disk Group Split wizard appears. Click **Next** to continue.

4. In the screen that appears next, specify the information needed for splitting the disk group as follows:

   - Enter the new dynamic disk group name.
Note: The disk group name should be unique. The dynamic disk group name is limited to 18 ASCII characters. It cannot contain spaces, slash mark (/), backslash (\), exclamation point (!), angle brackets (< >), or equal sign (=). Also, a period cannot be the first character in the name.

- Choose either the "Split dynamic disk group by disks" option or the "Split dynamic disk group by volumes" option.
  When you choose to split by disks, disks appear in the panes in the lower section of the window. If you choose to split by volumes, volumes appear instead of disks.

- Select the disks or volumes that you want to split.
  The currently available disks or volumes in the specified disk group are displayed in the left pane, which is labeled "Available disks" or "Available volumes." You select disks or volumes in the left pane and then click the Add button to move them to the right pane, which is labeled "Selected disks" or "Selected volumes.
  "The Add All button is provided for convenience in moving many disks at once. If all disks are moved, you need to move at least one of them back to the left pane, because you cannot split a dynamic disk group if you include all the disks in the target disk group.
  The volumes and disks that belong to the source dynamic disk group and that are not being split remain accessible during the entire dynamic disk group split operation.

After entering the specifications, click Next to continue.
Verify the information for the dynamic disk group split.

The screen that follows shows the type of information you may see. The purpose of this screen is to let you confirm the disk group split.

The wizard shows the disks selected for the split in the left column and the volumes that are split in the right column. In this screen, you may see more disks than what you selected for the split. If the disks you have selected would result in a disk group with partial volumes, the program supplies the disks needed to ensure that the split-off dynamic disk group have complete volumes.

If you want to make the split-off dynamic disk group larger, you can click Back to go back and add more disks.

When you are satisfied that the information is correct, click Next.

Click Finish to confirm the dynamic disk group split.

If the dynamic disk group split is successful, you’ll be able to view the new target dynamic disk group in the tree view and in the right pane of the console. By default, the new target disk group is in the Imported state if you are using the GUI to perform the split. If you use the command line to execute the split, the new target disk group is in the Deported state by default, because it assumes you want to deport the disk group and then import it on another computer. However, with the command line, you can use the -i switch with the vxdg split command to have the disk group remain in the Imported state.

If the Split Dynamic Disk Group command fails, an error dialog box is displayed showing the reason for failure. The dynamic disk group split operation fails if the target disk group already exists or if a problem occurs when the split operation is taking place.

If the computer fails during the split operation, Symantec Storage Foundation for Windows provides a recovery process. The next section has the details on the recovery process.
Recovery for the split command

If disk and, or system failures occur during the disk group split operation, Symantec Storage Foundation for Windows generally performs any necessary recovery operations automatically. The recovery procedure performs any operations necessary to restore the disk group to a consistent state. On successful recovery, the disk groups are again available for use.

For example, if there is a power outage during the split operation, it results in incomplete information on the disk and in the disk group. The recovery mechanism ensures that when the host boots up the next time or if the disk group is imported on a host (the same host or another host), the inconsistencies in the information are removed. Depending on the amount of processing completed by the split operation at the time of the failure, the recovered disk group is either in the state it was in before the split operation or be successfully split into two disk groups.

Recovery has the following two modes:

■ Automatic recovery
  If it is possible to restart the system, Symantec Storage Foundation for Windows attempts automatic recovery after the restart. If the automatic recovery process is able to detect sufficient information to perform the recovery, the recovery is successful and the disk group appears in a normal state after the automatic recovery process.

■ Manual recovery
  In the following situations, it is necessary to do manual recovery:
  ■ If the automatic recovery runs after the restart and there is not sufficient information for recovery, the disk group is in a Deported state and displays an alert icon (a yellow caution icon).
  ■ If you cannot restart the system because it has failed completely, then you must move the disk group’s disks to another system and then do a manual recovery. In this situation, it is recommended that you move the entire source disk group to another computer, rescan, and implement the recovery manually.
  ■ It becomes clear that a disk group needs manual recovery after a split command when Symantec Storage Foundation for Windows does not allow imports of the disk group to succeed or it blocks the join of a disk group. You receive an error message indicating that the disk group needs recovery.

Recovery should be done as soon as possible to preserve the integrity of the data. You can perform manual recovery through the GUI as described in the following procedure.

You can also perform manual recovery through the command line.
See “vxdg recover” on page 567.

On the successful completion of the manual recovery operation, you can perform all Symantec Storage Foundation for Windows operations. The only exception is that if a host crashes during a particular stage of the split operation, one or more of the disk group’s disks and volumes may come up in an unhealthy state after recovery. In that situation, use the Reactivate Disk command on the unhealthy disks and then the Reactivate Volume command on each of the unhealthy volumes involved in the split command. After running these commands, the disk group’s disks and volumes should be healthy.

See “Reactivate disk command” on page 280.

See “Reactivate volume command” on page 281.

To manually recover the dynamic disk group

1. Select the disk group in the VEA GUI and select **Recover Dynamic Disk Group** from the context menu.

2. In the dialog box that appears, make sure the proper disk group name is showing, and click **OK** to have Symantec Storage Foundation for Windows start the recovery process.

### Dynamic disk group join

This section describes the procedures for a dynamic disk group join operation.

When you join two dynamic disk groups, the disk group you designate as the source becomes the one that loses its identity in the merge. The target dynamic disk group is the one that remains after the merge.

Symantec Storage Foundation for Windows allows a partial join—that is, volumes in the source disk group can have missing or nonfunctional disks and the join command can still succeed.

See “About partial disk group join” on page 374.

The disk group type after the join becomes the type of the target disk group. For example, if the target disk group before the join had private dynamic disk group protection, the combined disk group has private dynamic disk group protection after the join.
**Note:** A cluster dynamic disk group that is part of the cluster resources cannot be a source disk group for a join command. However, it can be a target disk group for the command.

**Note:** It is possible to force the join command when a volume is in use or if disks from the source disk group’s disks are missing, but doing so is not recommended as a best practice.

**Note:** Microsoft Disk Management Disk Groups do not support dynamic disk group join.

**To join two disk groups into one disk group:**

1. Make sure that the volumes in the source dynamic disk group are not in use and are healthy.

2. Right-click the disk group object in the left pane of the VEA console, and then click the **Join Dynamic Disk Group** command, or select the **Join Dynamic Disk Group** command from the **Actions** menu on the VEA console menu bar.

   The Join Dynamic Disk Group dialog box appears as shown:
In the Join Dynamic Disk Group dialog box, make sure the correct source and target disk groups are indicated. If necessary, use the drop-down lists to change the disk group names.

The source dynamic disk group is the disk group that is merged with the target dynamic disk group. The source disk group ceases to exist after the join.

The target dynamic disk group is the disk group that remains after the join. It retains its identity and becomes larger with the addition of the disks from the source disk group.

The Clear host ID checkbox should be used when you want to import a disk group from another node and that disk group was not properly deported. A host ID might not be cleared, for example, if the host computer became nonfunctional. When a host ID has not been cleared, SFW does not permit the join without the Clear host ID override. Use this override with care.

The Allow Partial Join checkbox can be used when you have a missing or nonfunctional disk or disks in the source disk group and you want SFW to allow the join to occur.

See “About partial disk group join” on page 374.

Click OK.

If the join operation is successful, the source dynamic disk group merges into the target dynamic disk group. The changes in the target dynamic disk group are reflected in the VEA console tree view and right pane.

If a volume is in use, SFW displays an error message about forcing the join command.

See “Error message about forcing a split or join operation” on page 379.

If there is an error message about the disks not being ready, you can click the checkbox for the partial join to allow the command to complete.

If the join operation fails, an error dialog box is displayed, showing the reason for the failure.

The new dynamic disk group after the join command are of the same type as the target dynamic disk group. For example, if a cluster dynamic disk group is joined with a normal dynamic disk group, then the new dynamic disk group is a normal dynamic disk group.

About partial disk group join

Symantec Storage Foundation for Windows facilitates for a disk partial join—that is, volumes in the source disk group can have missing or nonfunctional disks and
the join command still succeeds. However, you need to click the Allow Partial Join checkbox in the Join Dynamic Disk Group window for the join to take place. When the missing disk or disks come back to an Online state, then you need to do another Join Dynamic Disk Group command to add the missing disk or disks to the target disk group.

**Warning:** If you have a partial join in place, you must wait until the missing disks or disks are joined to the target disk group before making the following configuration changes to either the source or target disk group: replace or evacuate disk, split or move a subdisk, extend a volume, add a mirror, and clear hot relocation. Doing so before all disks are joined can result in data loss.

**Using Dynamic Disk Group Split and Join with a cluster on shared storage**

This section describes the use of the Dynamic Disk Group Split and Join operations with SFW cluster disk groups on shared storage. SFW supports cluster dynamic disk groups with either Symantec Cluster Server (VCS) or Microsoft Failover Clustering.

Using Dynamic Disk Group Split and Join with VCS or Microsoft Failover Clustering

Example of an off-host backup procedure using SFW and VCS or Microsoft Failover Clustering

**Using Dynamic Disk Group Split and Join with VCS or Microsoft Failover Clustering**

If a disk group is under Symantec Cluster Server (VCS) or Microsoft Failover Clustering control, SFW imposes certain conditions on the functioning of the Dynamic Disk Group Split and Join operations.

These conditions are the following:

- If a shared dynamic cluster disk group is joined to another (possibly shared) dynamic disk group and the source disk group is configured as a VCS or Microsoft Failover Clustering resource, then the join operation fails.

- If a dynamic disk group (possibly shared) is joined to another shared cluster dynamic disk group and the target disk group is configured as a VCS or Microsoft Failover Clustering resource, then the join operation is allowed to proceed.

- (VCS only) If a shared dynamic cluster disk group is split into another (possibly shared) disk group and the source disk group is configured as a VCS resource, then the split operation is not allowed to proceed, with one exception. The
exception is that the split operation can proceed when the volumes selected
to be split off are not configured under VCS.
Thus, in this situation, if users want to split any volumes that are configured
under VCS, they should remove the volumes from VCS monitoring and retry
the split operation.

■ (Microsoft Failover Clustering only) If a shared dynamic cluster disk group is
split into another (possibly shared) disk group and the source disk group is
configured as a Microsoft Failover Clustering resource, the split operation is
allowed to proceed. However, before the command completes, a confirmation
window appears to remind you that if you split a disk group resource so that
a volume on which other cluster resources depend is moved to a new SFW
cluster disk group, it is necessary to define the new cluster disk group as a
Microsoft Failover Clustering resource and to modify the properties of
dependent resources to reflect the change.
If necessary, use Windows Server's Failover Cluster Manager to check and
modify resource dependency fields as follows:

■ Define the new cluster disk group as a Volume Manager cluster disk group
resource.
Even though the name of the program has changed to Storage Foundation
for Windows, the resource group is still named "Volume Manager."

■ If the new disk group resource is in a different Microsoft Failover Cluster
group than the original cluster disk group resource, move all resources
that depend on the new cluster disk group resource to the Microsoft Failover
Cluster group where it resides.

■ For each dependent resource, do the following:
  ■ Offline the resource.
  ■ Select the resource and select Properties.
  ■ Select Dependencies in the resource's Properties window.
  ■ If the resource lists the disk group that was the source of the split
    operation as a dependency, click the Modify button.
  ■ Move the new disk group from the Available Resources pane of the
    Modify Dependencies window to the Dependencies pane, and move the
    old disk group from the Dependencies pane to the Available Resources
    pane, if it appears in the Dependencies pane.
  ■ Online the resource.

■ (VCS only) If there is a hardware failure or a power failure during an ongoing
disk group split operation and the disk group being split is configured under
VCS, then VCS attempts to failover that disk group to another node in the cluster and brings the disk group online. At that time, appropriate disk group split recovery is carried out as required to bring the disk group online.

See “Recovery for the split command” on page 371. Manual intervention may or may not be required to recover the disk group.

- If you are splitting a dynamic cluster disk group that contains the quorum volume, make sure that the quorum volume is not part of the target disk group after the split operation. If you fail to do so, the quorum volume is not able to function and the cluster fails.

**Example of an off-host backup procedure using SFW and VCS or Microsoft Failover Clustering**

This section describes how to use SFW and VCS or Microsoft Failover Clustering in a typical off-host backup procedure.

In the example, a disk group named "SQL" has volume "V" on which a SQL Server database is under heavy use by clients. This disk group is imported on one node of a cluster running VCS or Microsoft Failover Clustering. VCS or Microsoft Failover Clustering monitors the disk group as well as the volume, ensuring high availability.

In the off-host backup solution outlined below, the high availability of the volume V is not affected at all. While the successful backup is taking place, the SQL server provides uninterrupted service to its clients with minimum configuration changes on both nodes in the cluster.

The procedure is fully scriptable and thus can be automated to provide a backup on an hourly, daily, weekly, or monthly basis.

**To implement off-host backup**

1. Create a snapshot "V1" of the volume V with the snap commands in the VEA GUI or the CLI.
   
   See “Snapshot commands” on page 344.

2. Split the dynamic disk group SQL into another dynamic disk group "Temp" so that V1 resides on the disks in the Temp disk group. Since VCS or Microsoft Failover Clustering is monitoring V (and not V1), the split operation succeeds.
   
   See “Dynamic disk group split ” on page 367.

3. Deport the Temp disk group and import it on another node in the cluster.
   
   See “Importing and deporting dynamic disk groups” on page 181.

4. Back up volume V1 on the second node, using the backup software.
5 After backup is complete, deport the Temp disk group on the second node.
6 Join the Temp disk group to the SQL disk group on the first node. Since the SQL disk group is a VCS or Microsoft Failover Clustering resource (and the Temp disk group is not monitored), the Join operation succeeds.
   See “Dynamic disk group join” on page 372.
7 The snapshot volume V1 can then be snapped back to its parent volume V.
   See “Snap back” on page 355.

Limitations when using dynamic disk group split and join with Volume Replicator

If you are using the Dynamic Disk Group Split and Join commands with volumes that are under Symantec Storage Foundation Volume Replicator (Volume Replicator) control, some limitations apply.

These include the following:

- A volume under replication cannot be part of the volumes split off to the target disk group. It can remain in the source disk group.
- A join operation is not allowed if the source disk group has any Volume Replicator objects.

Dynamic Disk Group Split and Join troubleshooting tips

This section provides information and workarounds for problems that might arise when using the Dynamic Disk Group Split and Join commands.

Error message, "The disk group requires recovery. please recover..."

This message can occur when you attempt to import a disk group or do a join command. The message indicates that the disk group needs recovery because of a problem that occurred during a disk group split operation.

See “Recovery for the split command” on page 371.

Error message, "One or more disk(s) in the source dynamic disk group are missing."

This message can occur when you attempt a disk group split or join operation and a disk in the disk group is no longer functional or has gone offline. It is recommended that you rescan and then retry the disk operation. However, if one or more disks in the disk group is missing or nonfunctioning, you can click the
Allow Partial Join checkbox to have the join command succeed even though one or more disks are missing.

See “About partial disk group join” on page 374.

Error message about forcing a split or join operation

If you attempt a dynamic disk group split or join command when a volume is in use, Symantec Storage Foundation for Windows puts up a message asking whether you want to force the split or join. If the volume is in use because it is selected in Windows Explorer, then you can force the split or join safely. However, if the volume is actually in use within an application, it is not recommended that you attempt to complete the command. If a volume is regenerating, resynching, or recovering, then even if you force the split or join, the operation is not successful.

CLI FlashSnap commands

SFW provides command line interface commands corresponding to the VEA GUI FlashSnap commands presented in this chapter. The following table lists each GUI FlashSnap command with a cross reference to its corresponding CLI command. It also has some additional comments to clarify distinctions between the two CLI snapshot commands, vxsnap and vxassist snapshot.

The following are the FlashSnap commands:

Table 12-1 FlashSnap GUI and CLI Commands Correspondences

<table>
<thead>
<tr>
<th>GUI Command</th>
<th>Corresponding CLI Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>FastResync</td>
<td>See “vxvol set fastresync=on</td>
</tr>
<tr>
<td>Prepare</td>
<td>See “vxassist prepare” on page 614.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> The Prepare command replaces the Snap Start command in the GUI. Both <strong>prepare</strong> and <strong>start</strong> keywords are available in the CLI, however <strong>prepare</strong> is the recommended keyword.</td>
</tr>
<tr>
<td>Snap Shot</td>
<td>There are two types of snapshot commands.</td>
</tr>
<tr>
<td></td>
<td>• The command <strong>vxassist snapshot</strong> allows snapshotting only a single volume at a time. See “vxassist” on page 589.</td>
</tr>
<tr>
<td></td>
<td>• The command <strong>vxsnap</strong> allows simultaneous, multiple snapshots. See “vxsnap” on page 658.</td>
</tr>
<tr>
<td></td>
<td>The <strong>vxsnap</strong> command integrates with VSS to enable VSS snapshots.</td>
</tr>
</tbody>
</table>
Table 12-1  FlashSnap GUI and CLI Commands Correspondences (continued)

<table>
<thead>
<tr>
<th>GUI Command</th>
<th>Corresponding CLI Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snap Back</td>
<td>See “vxassist snapback” on page 619.</td>
</tr>
<tr>
<td>Snap Clear</td>
<td>See “vxassist snapclear” on page 620.</td>
</tr>
<tr>
<td>Snap Abort</td>
<td>See “vxassist snapabort” on page 622.</td>
</tr>
</tbody>
</table>

**Note:** For information on how to use FlashSnap to perform snapshots and implement recovery procedures, refer to the SFW HA Quick Recovery (QR) Solutions guides.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxassist prepare`, `vxassist snapshot`, `vxassist snapback`, `vxassist snapclear`, and `vxassist snapabort` commands.

## Fast File Resync

Fast File Resync (FFR) lets you resynchronize one or more files in a snapshotted volume back to the original volume.

This section covers the following topics:

- Overview
- Prerequisites
- Resynchronizing a file
- Possible error for small files

**Note:** Fast File Resync requires the FlashSnap option be installed.

### Overview

Fast File Resync uses Veritas FastResync technology to resynchronize selected files in a snapshotted volume to the original volume. Fast File Resync is designed for database applications using volumes with multiple database files and can be used to restore one or more corrupt files. A snapback command that resynchronizes the split-mirror snapshot back to the original files is performed for the selected files. Other databases do not have to be off-lined during the Fast File Resync process, and the entire volume is not resynchronized. The Fast File
Resync command restores the file or files on the original volume but does not bring the database to a current state.

In general, the FastResync technology used by Fast File Resync is more efficient for files greater than 50 MB, and the Windows Explorer copy function or Windows xcopy command is more efficient for files smaller than approximately 50 MB. Fast File Resync is unable to restore a file that has been deleted.

---

**Note:** Fast File Resync will not work on files smaller than 8 KB.

See “Possible error for small files” on page 382.

---

**Warning:** It is important to wait until the FFR process is complete before accessing and using the restored file. Data corruption can occur if the file is used before the resynchronization is complete.

---

The Fast File Resync command can be issued through the VEA or through a CLI command, `vxfsync`.

However, the CLI command does not support resynchronization of multiple files. It supports the resynchronization of one specified file at a time.

See “vxfsync” on page 676.

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**Note:** Fast File Resync is not available through the VEA GUI of a SFW remote client connected to a SFW server.

---

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support Fast File Resync.

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**Prerequisites**

Prerequisites must be met for a successful FFR resynchronization of a file. These include the following:

- The names and creation times of the snapshot and original files are identical.
- The file is formatted using NTFS.
- The file is not compressed.
- The file is not encrypted.
- There are no open handles on either file.
Resynchronizing a file

The following is the procedure to resynchronize a file.

To resynchronize corrupted files

1. Right-click on the original volume containing the corrupted file and select Fast File Resync.

   The Fast File Resync dialog box appears.

2. Click Browse and navigate to the file or files that you want to copy from the snapshot volume back to the original volume. Use the Control and Shift keys to select multiple files. Click Select.

3. Select the desired snapshot volume from the Snap list.

   A snapshot volume must have either a drive letter or a mount point assigned for it to be available for selection from the Snap list in the Fast File Resync window.

4. Click OK.

Possible error for small files

When using Fast File Resync to resynchronize files smaller than 8 KB, the file extents call to the operating system may fail and an error message notifies you that the call has failed and refer you to the trace for further information.

If this error occurs, use the Windows Explorer copy function or Windows xcopy command to copy the file.
The trace can be found at Veritas\Veritas Object Bus\logs\vxisis.log. The error is prefixed by vxffr.

Volume Shadow Copy Service (VSS)

This section describes how Symantec Storage Foundation for Windows works with Volume Shadow Copy Service (VSS) to provide snapshots.

This section covers the following topics:

Overview
VSS components
Overview of VSS process for SFW snapshots

Overview

Volume Shadow Copy Service (VSS) is a Windows service that provides the capability of creating snapshots or volume shadow copies. A volume shadow copy is a volume that represents a duplicate of the state of the original volume at the time the copy began. Thus, through VSS, point-in-time copies of data can be saved and used for different purposes, such as backup or application testing.

VSS snapshots represent an advance in snapshot technology because snapshots can be taken when application files are open. VSS interacts with an application (such as Microsoft SQL Server) and can quiesce the application for the moment when the snapshot is created. VSS restarts the application immediately after the snapshot. VSS only takes snapshots of read/write volumes and the resulting volume shadow copy is a read only volume.

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the Volume Shadow Copy Service (VSS).

VSS components

VSS works through an infrastructure that coordinates the snapshot process by using software components from Microsoft itself and from various storage software and hardware vendors.

The illustration below indicates the VSS service and the three key software components used in the VSS process—requestors, writers, and providers. Figure 12-2 shows VSS components.
Requestors

The software component that requests the creation of the snapshot is known as the requestor. NTBackup is the default requestor that comes with Windows. Veritas Backup Exec and NetBackup also have requestor components for VSS. In addition, SFW can function as a VSS requestor when the FlashSnap option is installed.

Writers

These are application-specific software components that ensure that the application data is quiesced and then restarted after the snapshot. Microsoft has provided the writer software component in SQL Server and in the Active Directory and DHCP software features that are included in Windows.

Providers

Providers are the software components that implement the snapshots. Windows comes with a default provider. However, the SFW VSS provider and providers from hardware array manufacturers offer enhanced functionality. For SFW to act as a provider, the FlashSnap option must be installed.

For the VSS process to work properly, the different software programs involved in the process need to be "VSS-aware" – that is, the necessary software components have been added to the programs so that they can participate. Again, it may take time for software and hardware vendors to provide the various VSS components with their products.
SFW as a VSS Provider and Requestor

An example in which SFW acts as a provider is a backup situation where Veritas Backup Exec is the requestor, initiating a snapshot of a SFW volume that is part of a Microsoft Exchange 2010 mailbox database. Microsoft Exchange is the VSS-aware writer.

As a VSS requestor, SFW with FlashSnap can initiate snapshots at any time. It is not dependent on a backup program to initiate the snapshot. Thus, SFW with FlashSnap integrates with VSS and is able to snapshot volumes associated with an Exchange 2010 mailbox databases without taking the databases offline. The VSS process allows the databases of the storage group to be quiesced before the snapshot operation occurs and then reactivated immediately after it. This quiescing, supported by Exchange 2010 at the mailbox database level, allows for Microsoft supported and guaranteed persistent snapshots of your data.

Recovery

Through SFW’s VSS Snapshot wizard or `vxsnap restore` command, the VSS snapshots can be used for a point-in-time recovery of databases or a roll-forward recovery to the point of failure of either the mailbox databases or individual database within it.

In Symantec Storage Foundation for Windows, these different types are supported using the VSS Restore operation.

The point-in-time recovery restores the data to the point in time that the quick recovery image was last refreshed—that is, it restores all the data to what was recorded in the snapshot.

The point-of-failure recovery recovers the SQL Server databases by restoring the old image of the data volumes only and replaying the logs to accomplish a roll-forward recovery, provided that the log volume is intact.

Refer to the application-specific Quick Recovery Solutions guide for detailed procedures on how to use FlashSnap with the application, such as Microsoft SQL Server, to perform snapshots and to implement recovery procedures.

See “vxsnap” on page 658.

Advantage of SFW Snapshots

The snapshots created with VSS through the Windows default provider are limited to copy-on-write snapshots. That is, the snapshot does not include a full copy of the original image but refers back to the original volume. For this reason, the default provider snapshots cannot be used for any procedures that involve off-host processing. The Veritas FlashSnap snapshot procedures produce independent
split-mirror snapshot volumes that can be used for off-host processing. Thus, the FlashSnap snapshots implemented through SFW offer a definite advantage over snapshots created with the Windows default provider.

Overview of VSS process for SFW snapshots

The process for creating SFW snapshots with VSS can be done through the GUI, the command line, or a script with CLI commands.

**Note:** Snapshots can only be taken of read/write volumes when VSS is used. The resulting VSS snapshot is read only. The file system label of VSS snapshot volumes cannot be changed.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support snapshot or VSS related commands.

It is recommended that you use the VEAG GUI Snap Back operation or `vxassist snapback` to reattach the snapshot mirror to its original volume. This enables you to update the snapshot mirror and make it available for more timely backups.
To create SFW snapshots with VSS

1 Use the **Prepare** command through the VEA GUI to attach a snapshot mirror to a volume on the working server.

   The `vxassist prepare` command can also be used.

   Creating the snapshot mirror of the volume and resynchronizing it to the volume takes considerable time, but it only has to be done once for the initial setup.

   The **Prepare** command replaces the **Snap Start** command in the GUI.

   Both `prepare` and `start` keywords are available in the CLI, however `prepare` is the recommended keyword.

2 Request a snapshot through a backup program (such as Veritas Backup Exec) or through SFW. In SFW, initiate a VSS snapshot through the GUI with the **Snap Shot** command. Be sure to enable the VSS snapshot method in the Systems Settings.

   You can also use the `vxsnap` CLI command to take the snapshot.

   If you are planning to use these snapshots to recover a VSS-aware application's database, use the VSS Snapshot wizard.

   You can also use the `vxsnap` command.

   The `vxsnap` command lets you snapshot multiple volumes simultaneously; thus, you can snapshot all the volumes in a VSS-aware application's storage group at one time. The VSS Snapshot wizard can also snapshot a storage group one at a time.

3 VSS interacts with a writer utility for the application to make sure that the application is momentarily quiesced for the snapshot.

4 VSS determines the appropriate provider for the snapshot. The Microsoft default provider is used only if another provider is not present. If an SFW dynamic volume is involved, then SFW would be selected as the provider.

5 After the snapshot is taken, the writer utility makes sure the application is restarted.

6 Once the snapshot takes place successfully, VSS communicates the successful result to the program with the requestor software.

**VSS snapshot wizard for Microsoft Exchange, Microsoft Sharepoint, and Microsoft SQL**

SFW integrates with the Windows Volume Shadow Copy Service (VSS) as both a VSS Requestor and a VSS Provider. This integration is provided by FlashSnap.
Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support snapshot or VSS-related commands.

FlashSnap integrates with VSS to provide the ability to detach multiple split-mirror snapshot volumes simultaneously. This lets you snapshot all volumes associated with an Exchange storage group, Sharepoint components, or SQL database at exactly the same point in time without taking the databases offline. When viewed all together these snapshots form a snapshot set of the storage group, component, or database. These persistent FlashSnap snapshots, taken through VSS, can later be used for either a point-in-time recovery or a roll forward recovery to point of failure of the storage group or database.

FlashSnap calls VSS to perform a "copy backup" of Exchange, which does not truncate the transaction log files.

The following occur during the snapshot process:

- Acting as a VSS Requestor, FlashSnap notifies the VSS coordinator service to prepare for a split-mirror snapshot of an Exchange storage group, Sharepoint component, or SQL database.
- The VSS coordinator service calls the Exchange VSS Writer, Sharepoint VSS Writer, or SQL VSS Writer to find out which volumes contain the databases and transaction logs.
- The VSS coordinator service notifies the FlashSnap VSS Provider to prepare for the snapshot.
- Acting as a VSS Requestor, FlashSnap requests that the VSS coordinator service begin the snapshot call.
- The VSS coordinator service notifies the Exchange VSS Writer, Sharepoint VSS Writer, or SQL VSS Writer to quiesce the databases in preparation for the snapshot. When this is accomplished, the Exchange Writer, Sharepoint VSS Writer, or SQL Writer informs the VSS coordinator service to proceed.
- The VSS coordinator service calls the FlashSnap Provider to create the split-mirror snapshot by detaching the snapshot volume from the original volume. After the snapshot volume is detached, the FlashSnap Provider informs the VSS coordinator service to proceed.
- The VSS coordinator service notifies the Exchange Writer, Sharepoint Writer, or SQL Writer to resume normal I/O.
Using the VSS snapshot wizards with Microsoft SQL

SFW provides support for taking snapshots of Microsoft SQL databases. FlashSnap integrates with the Microsoft Volume Shadow Copy Service (VSS) to allow snapshots to be taken of all volumes associated with an SQL database without taking the database offline. The VSS Snapshot wizard uses VSS to take snapshots of the database. The VSS process allows the database to be quiesced before the snapshot operation and reactivates it immediately after. The quiescing of the database and guarantees persistent snapshots of the data. A snapshot of a database can be reattached and resynchronized to match the current state of the database with the VSS Snapback wizard.

**Note:** Snapshots can only be taken of read/write volumes when VSS is used. The resulting VSS snapshot is read only. The file system label of VSS snapshot volumes cannot be changed.

SFW also provides a VSS Snapshot Scheduler wizard that can be used as an alternative to the VSS Snapshot wizard and the VSS Snapback wizard. It enables you to set up a schedule for taking the initial snapshots and for automating the snapback refresh process. At the scheduled time for the snapshot, the snapshot volumes are automatically reattached, resynchronized, and then split again. The schedule is maintained by a scheduler service, VxSchedService.exe, that runs in the background.

SFW also provides recovery support for a SQL database. Using the VSS Restore Wizard, the snapshots taken with the VSS Snapshot wizard can be used for a recovery of the database with or without logs.

Refer to the *Symantec Storage Foundation and High Availability Solutions Solutions Guide for Microsoft SQL* for additional information about how to use FlashSnap with Microsoft SQL to perform and to implement recovery procedures.

Using the VSS Snapshot wizard
Using the VSS Snapback wizard
Using the VSS Snapshot Scheduler wizard
Using the VSS Restore Wizard

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support snapshot or VSS related commands.
Using the VSS Snapshot wizard

Creating a snapshot is a two-step process. The first step, prepare the volume for snapshot, creates snapshot mirrors attached to all the original volumes in the specified database. Depending on the size and number of volumes, the process of synchronizing the new snapshot mirrors with the original production volumes can take a long time. The second step uses the VSS Snapshot wizard to create the snapshot set by detaching the snapshot mirrors from the original volumes and creating separate on-host snapshot volumes as well as an XML file to store the database and snapshot volume metadata. The VSS Snapshot wizard integrates with VSS to quiesce the database and then simultaneously snapshot the volumes in the database. This snapshot is done while the database is online and without disrupting processing. Once a snapshot set has been created, it can be reattached and resynchronized with the VSS Snapback wizard.

**Note:** After performing operations for snapshots, the VEA GUI may not be updated to reflect the results of the operation. Use the VSS Refresh command to update the VEA GUI.

Ensure that the [NT AUTHORITY\SYSTEM] account is granted the sysadmin server role (from SQL Management Studio Console) on each node. This is applicable only for SQL Server 2012.

**Creating the snapshot set**

The following is the procedure to create a snapshot set.

**To create the snapshot set**

1. From the VEA console, navigate to the system where the production volumes and snapshots mirrors are located.
2. Expand the system node, the Storage Agent node, and the Applications node.
   
   If the Applications node is not shown, start the SQL Server VSS Writer service and then select the Storage Agent node and refresh the VEA display (Actions > Refresh).
3. Expand the SQL node.
4. Right-click the instance and click VSS Snapshot.
5. In the wizard, review the Welcome page and click Next.
6 Specify the snapshot set parameters as follows and then click **Next**:

Select **Component for snapshot operation**

**Directory**

The wizard creates the snapshot set metadata XML file. The XML metadata file is stored by default in the directory shown on the screen.

There are two ways to change the XML file location.

First, edit the directory path in the Directory field for this wizard screen. Second, change the XML file location. Use a text editor to create a text file named `redirect.txt`. This text file should contain a single text line specifying the full path to the location of the XML file, for example, `G:\BackupSets`. **Save the redirect.txt file in the default directory** `C:\Program Files\Veritas\Veritas Volume Manager\VSSXML`.

If SFW/SFW HA is installed on the D drive, then the path will be the same as above, but on the D drive.
Enter a name for the snapshot set, for example, billing or accept the default name. The wizard generates a default snapshot set name that includes the term "SnapshotSet", component name, date, and time.

Select the snapshot type.

You can specify that snapshots be created as either a Full backup or Copy backup type. Either type can be used to restore a database. However, if you want to replay logs in SQL Server as part of restoring a database, a Full backup needs to have been created earlier. When replaying logs, you can replay from the time of the last Full backup. A Copy backup does not affect this sequence of log replay and therefore is often used as an "out of band" copy for purposes such as testing or data mining.

In the Change Attributes panel, optionally change the attributes for the snapshot volumes and click Next:

Volume Name Displays the name of the volume.

Snapshot Volume Label Displays the read-only label for the snapshot volume.

Drive Letter Optionally, click a drive letter and select a new choice from the drop-down menu.

Plex Optionally, click a plex and select a new choice from the drop-down menu.

On the Synchronized Snapshot panel (Volume Replicator only), select the secondary hosts for which you want to create synchronized snapshots. Either double-click on the host name or click the Add option to move the host into the Selected Secondary Hosts pane. To select all the available hosts, click the Add All option. The VSS wizard creates synchronized snapshots on all the selected secondary hosts.

This panel is displayed only in an environment using Symantec Storage Foundation Volume Replicator (Volume Replicator). Otherwise, you will be directly taken to the Schedule Information panel.


Review the specifications of the snapshot set and click Finish.
Using the VSS Snapback wizard

The VSS Snapback wizard reattaches and resynchronizes an existing snapshot set so that it matches the current state of its original SQL database. The wizard is available in the context menu of the VSS Writer object.

Resynchronizing the snapshot set

The following is the procedure to resynchronize (snapback) a snapshot set.

To snapback a snapshot set

1. Close the database application GUI and all Explorer windows, applications, consoles (except the VEA console), or third-party system management tools that may be accessing the snapshot set.

2. From the VEA, select the system where the production volumes and snapshot mirrors are located, as the active host.

3. Expand the system node, the Storage Agent node, and the Applications node.

4. Right-click the node of the selected application and click VSS Snapback.

5. Review the Welcome page and click Next.

6. Select the snapshot set you want to snapback and click Next.

The XML metadata file contains all required information needed to snapback the snapshot set, including the names of the database and transaction logs volumes. Click the appropriate header to sort the list of available files by File Name or Creation Time. This file is deleted after the snapback operation has completed successfully.

7. If a message appears that indicates some volumes have open handles, confirm that all open handles are closed and then click Yes to proceed.

8. Verify that the snapback specifications are correct and click Finish.

Using the VSS Snapshot Scheduler wizard

You can use the VSS Snapshot Scheduler wizard to add a snapshot schedule. The scheduling capability automates the process of refreshing snapshots sets. At the time scheduled for the snapshot, the snapshot volumes are automatically reattached, resynchronized, and then split again. Once configured and applied, the schedule is maintained by a scheduler service, VxSchedService.exe, that runs in the background. In a clustered server environment, ensure that the scheduler service is configured on each node with domain administrator privileges so that any node in the cluster can run the schedule after a failover.
**Note:** Information about the operations performed by the schedule can be found by expanding the nodes under the Scheduled Tasks node in the tree-view of the VEA GUI. Expand the appropriate application node to locate the schedules for that application. Right-click the node and select **Job History** to view information about the operations performed by the schedule.

The VSS Snapshot Scheduler wizard does not prepare the snapshot mirror. Prepare the snapshot mirror with the **Prepare** command before running the VSS Snapshot Scheduler wizard.

**Note:** The Prepare command replaces the Snap Start command in the GUI.

**To schedule a snapshot for a selected component**

1. From the VEA console, navigate to the system where the production volumes and snapshot mirrors are located.
2. Expand the system node, the Storage Agent node, and the **Applications** node. If the Applications node is not shown, start the SQL Server VSS Writer service and then select the Storage Agent node and refresh the VEA display (Actions > Refresh).
3. Expand the **SQL** node.
4. Right-click the instance, and click **Schedule VSS Snapshot**.
5. In the Welcome panel, review the information and click **Next**.
Specify the snapshot set parameters as follows and then click **Next**: 

Select component for snapshot operation

Directory

The XML file is stored by default in the directory shown on the screen.

In a clustered server environment, the XML file must be saved on shared storage to be available from all nodes in the cluster.

There are two ways to change the XML file location.

First, edit the directory path in the Directory field for this wizard screen. Second, change the XML file location. Use a text editor to create a text file named `redirect.txt`. This text file should contain a single text line specifying the full path to the location of the XML file, for example, `G:\BackupSets`. Save the `redirect.txt` file in the default directory `C:\Program Files\Veritas\Veritas Volume Manager\VSSXML`.

If SFW/SFW HA is installed on the D drive, then the path will be the same as above, but on the D drive.
Enter a name for the snapshot set, for example, billing or accept the default name. The wizard generates a default snapshot set name that includes the term "SnapshotSet", component name, date, and time.

The wizard creates the snapshot set metadata XML file with this name, with the prefix "VM_".

Select the snapshot type.

You can specify that snapshots be created as either a Full backup or Copy backup type. Either type can be used to restore a database. However, if you want to replay logs in SQL Server as part of restoring a database, a Full backup needs to have been created earlier. When replaying logs, you can replay from the time of the last Full backup. A Copy backup does not affect this sequence of log replay and therefore is often used as an "out of band" copy for purposes such as testing or data mining.

7 In the Change Attributes panel, optionally change the attributes for the snapshot volumes and click Next:

- **Volume Name** Displays the name of the volume.

- **Snapshot Volume Label** Displays the read-only label for the snapshot volume.

- **Drive Letter** Optionally, click a drive letter and select a new choice from the drop-down menu.

  The drive letters specified may not be available when the snapshot is taken. When this occurs, the snapshot operation is performed, but no drive letters are assigned.

- **Plex** Optionally, click a plex and select a new choice from the drop-down menu.
8 Optionally, in the Synchronized Snapshot panel (Volume Replicator only), select the secondary hosts for which you want to create synchronized snapshots. Either double-click on the host name or click the **Add** option to move the host into the Selected Secondary Hosts pane. To select all the available hosts, click the **Add All** option. The VSS wizard creates synchronized snapshots on all the selected secondary hosts.

This panel is displayed only in an environment using Symantec Storage Foundation Volume Replicator (Volume Replicator). Otherwise, you will be directly taken to the Schedule Information panel.

See *Symantec Storage Foundation Volume Replicator Administrator’s Guide*. 
9  In the Schedule Information panel, on the General Options tab, specify the following:

![VSS SQL Snapshot Scheduler Wizard](image)

**Name of this schedule**
Enter a unique name for the snapshot set schedule. This name identifies the snapshot schedule if you later want to view information about the snapshot status. A default name consists of the VSS writer name and a numbered suffix that increments with each schedule.

**Description of this schedule**
Optionally, enter a description to help you identify the schedule when you view information about the snapshot status.

**Start Time**
The time of the day to begin taking snapshots.

**End Time**
The time of day to end taking snapshots. If a snapshot is in progress it is completed but a new one is not started after the end time.

**Schedule takes effect on**
The date on which the specified schedule takes effect. The default is the current date.
Restart task every  The interval between snapshots, in minutes. For example, if the interval is 360 minutes and you schedule a snapshot start time of 12 P.M. and an end time of 7 P.M, the snapshot occurs twice. If no interval is specified the snapshot occurs once.

Every  Enable the Every option to have the snapshot schedule continue to occur. Otherwise the schedule applies only for one day.

Specify the number of days before restarting the snapshot schedule. For example, 1 day would mean the schedule takes effect daily, 2 days would mean every other day.

Start On  If you enable the Every option, specify the starting date.

Pre Command  Optionally, specify the full path of a command script to run before the scheduled snapshot occurs.

Post Command  Optionally, specify the full path of a command script to run after the snapshot is complete.

10 To specify run days for the schedule, make selections on the following tabs:

Days of Week  Select one or more days on one or more weeks of the month. You can click a button at the top of the column to select the entire column or a button to the left of a row to select the entire row. For example, clicking First schedules the snapshots to occur on the first occurrence of all the week days for the month.

Days of Month  Select one or more days of the month. You can also check the Last Day checkbox to schedule the snapshot for the last day of each month.

Specific Dates  Select one or more specific dates to include in or to exclude from the schedule. Excluding a date takes precedence over days scheduled on the other tabs. For example, if you schedule every Monday on the Days of Week tab, and you exclude Monday October 9 on the Specific Dates tab, the snapshots are not taken on October 9.

If two schedules overlap for the same snapshot set, only one snapshot is taken. For example, if you select every Thursday plus the last day of the month, and the last day of the month occurs on Thursday, only one snapshot is taken on Thursday.
11  Click Next.
12  Review the snapshot set and schedule details and click Finish.

Displaying the status of the scheduled VSS SQL snapshot
If a scheduled snapshot fails for some reason, the scheduler process will attempt
to rerun it. You may want to verify that scheduled snapshots completed
successfully. From the VEA console, you can view snapshot results.

To view a scheduled snapshot status
1  From the VEA console, navigate to the system where the production volumes
   and snapshot mirrors are located.
2  Expand the system node and the Storage Agent node.
3  Click Scheduled Tasks to view all the applications that have schedules.
4  Select the application for which you scheduled the snapshot.
   The scheduled snapshots are listed in the pane on the right.
5  Choose one of the following:
   ■  To view the status of all scheduled jobs, right-click the selected application
      and click All Job History.
   ■  To view the status of a particular schedule, right-click the snapshot
      schedule name and click Job History.
6  In the dialog box, view the schedule information.
   You can sort listed schedules by clicking the column headings. The Status
column shows if the snapshot completed successfully.

Deleting a schedule for a VSS SQL snapshot
The following is the procedure to delete a schedule.

Note: You cannot modify a schedule that has expired.

You can also delete (but not modify) a schedule from the GUI console.

Note: The VEA GUI can delete snapshot schedules only; it does not delete mirror
preparation scheduled with the Quick Recovery Configuration Wizard. In addition,
deleting a snapshot schedule using the VEA GUI does not update template settings
created with the Quick Recovery Configuration Wizard.
To delete a schedule with the GUI

1. From the VEA console, navigate to the system where the production volumes and snapshot mirrors are located.
2. Expand the system node and the Storage Agent node.
3. Click **Scheduled Tasks** to view all the applications that have schedules.
4. Select the application for which you scheduled the snapshot. The scheduled snapshots are listed in the pane on the right.
5. Right-click the name of the snapshot schedule and click **Delete Schedule**.

Using the VSS Restore Wizard

SFW provides recovery support for a SQL database. Using the VSS Restore Wizard, the snapshots created with the VSS Snapshot wizard can be used to restore the database with or without logs.

- **Restoring the database with logs (recovery and log replay)** restores the database and the transaction log volumes. Backup transaction logs are also applied. This leaves the database in an online state.
- **Restoring the database without logs (recovery and no log replay)** restores the database and the transaction log volumes. No other logs are applied. This leaves the database in an online state.
- **Restoring the database with no recovery (no recovery and no log replay)** restores the database and the transaction log volumes. However no logs are applied. This leaves the database in a loading state and ready for backup transaction logs to be applied.

**Restoring the database with recovery and logs**

The following is the procedure to restore the database with recovery and logs.

**To use log replay for an automatic roll-forward recovery to a point of failure**

1. Ensure that you have backed up the transaction logs within SQL Server using the "overwrite existing media" option to create uniquely-named backup files.
2. Close the SQL GUI and all Explorer windows, applications, consoles, or third-party system management tools that may be accessing the volumes. It is also recommended to bring the database offline.
3. From the VEA console, navigate to the system where the database volumes are located.
4. Expand the system node, the Storage Agent node, and the **Applications** node.
5 Right-click SQL and click **VSS SQL Restore**.
6 Review the Welcome page and click **Next**.
7 Select the snapshot set XML metadata file to be used for this operation and click **Next**.

The XML metadata file contains all required information needed to restore the snapshot set, including the names of the database and transaction logs volumes. Click the appropriate header to sort the list of available files by **File Name** or **Creation Time**.

8 On the Select Restore Type panel, do the following and click Next:
   - Click **Recovery + Log replay**.
   - Enter the full path of each log file, in the order they are to be applied.

9 You may receive a message "Some volumes in this component have open handles. Do you want to override these handles and do this restore? Click **Yes** to proceed." Click **No**, close any open handles and retry the command.
10 Verify the restore specifications and click **Finish**.

After the most recent backup log is replayed, the SQL Server database is closed and left in an operational state. If you took it offline earlier, bring it back online.

11 The restore operation leaves the snapshot volumes snapped back to the production volumes. To ensure that another split-mirror snapshot set is immediately available, use the VSS Snapshot Wizard to create a new snapshot of all the volumes in the database.

**Restoring the database with recovery without logs**

The following is the procedure to restore the database with recovery without logs.

**To recover a database without log replay**

1 Close the SQL GUI and all Explorer windows, applications, consoles, or third-party system management tools that may be accessing the volumes. It is also recommended to bring the database offline.

2 From the VEA console, navigate to the system where the database volumes are located.

3 Expand the system node, the Storage Agent node, and the **Applications** node.

4 Right-click **SQL** and click **VSS SQL Restore**.

5 Review the Welcome page and click **Next**.

6 Select the snapshot set XML metadata file to be used for this operation and click **Next**.

   The XML metadata file contains all required information needed to restore the snapshot set, including the names of the database and transaction logs volumes. Click the appropriate header to sort the list of available files by **File Name** or **Creation Time**.
On the Select Restore Type panel, click **Recovery**.

You may receive a message "Some volumes in this component have open handles. Do you want to override these handles and do this restore? Click **Yes** to proceed." Click **No**, close any open handles and retry the command.

Verify the restore specifications and click **Finish**.

The database is restored to the time the snapshot set was created or last refreshed. If you took it offline earlier, bring it back online.

The restore operation leaves the snapshot volumes snapped back to the production volumes. To ensure that another split-mirror snapshot set is immediately available, use the VSS Snapshot Wizard to create a new snapshot of all the volumes in the database.

**Restoring the database with one or more missing volumes**

The following is the procedure to restore the database with a missing volume.
To recover a database with one or more missing volumes

1. Close the SQL GUI and all Explorer windows, applications, consoles, or third-party system management tools that may be accessing the volumes. It is also recommended to bring the database offline.

2. From the VEA console, navigate to the system where the database volumes are located.

3. Expand the system node, the Storage Agent node, and the Applications node.

4. Right-click SQL and click VSS SQL Restore.

5. Review the Welcome page and click Next.

6. Select the snapshot set XML metadata file to be used for this operation and click Next.

   The XML metadata file contains all required information needed to restore the snapshot set, including the names of the database and transaction logs volumes. Click the appropriate header to sort the list of available files by File Name or Creation Time.

7. On the Select Restore Type panel, click Recovery and select Recovery with missing original volume.

**Note:** COW snapshots are not supported for recovery with missing volumes.
8 You may receive a message "Some volumes in this component have open handles. Do you want to override these handles and do this restore? Click Yes to proceed." Click No, close any open handles and retry the command.

9 Verify the restore specifications and click Finish.

The snapshot of the missing volume is changed from a read-only volume to a read-write volume.

10 If you have not already done so, ensure that the drive letter or mount path of the missing production volume is assigned to the snapshot volume.

11 Bring the database online.

If the production volume was missing, the snapshot volume is now changed to the production volume. The database is restored to the time the snapshot set was created or last refreshed.

12 To ensure that another split-mirror snapshot set is immediately available, use the VSS Snapshot Wizard to create a new snapshot of all the volumes in the database.

Restoring the database with no recovery

The following is the procedure to restore the database with the No Recovery option.

To restore using the No Recovery option

1 Ensure that you have backed up the transaction logs within SQL Server using the "overwrite existing media" option to create uniquely-named backup files.

2 Close the SQL GUI and all Explorer windows, applications, consoles, or third-party system management tools that may be accessing the database volumes. It is also recommended to bring the database offline.

3 From the VEA console, navigate to the system where the database volumes are located.

4 Expand the system node, the Storage Agent node, and the Applications node.

5 Right-click SQL and click VSS SQL Restore.

Review the Welcome page and click Next.

6 Select the snapshot set XML metadata file to be used for this operation and click Next.

The XML metadata file contains all required information needed to restore the snapshot set, including the names of the database and transaction logs volumes. Click the appropriate header to sort the list of available files by File Name or Creation Time.
7 On the Select Restore Type panel, click **No Recovery** and click **Next**.

![VSS Restore Wizard](image)

8 You may receive a message "Some volumes in this component have open handles. Do you want to override these handles and do this restore? Click **Yes** to proceed." Click **No**, close any open handles and retry the command.

9 Verify the restore specifications and click **Finish**.

The database and log snapshot volumes are restored and the SQL Server database is left in a loading state.

10 Use your preferred method to manually restore the backup transaction logs to the desired point in time and then bring the database back online.

11 The restore operation leaves the snapshot volumes snapped back to the production volumes. To ensure that another split-mirror snapshot set is immediately available, use the VSS Snapshot Wizard to create a new snapshot of all the volumes in the database.

**Copy on Write (COW)**

This section describes how Symantec Storage Foundation for Windows works with Microsoft Copy on Write (COW) to provide snapshots.
COW overview

SFW supports Microsoft Copy on Write (COW) snapshots. The VEA GUI or the vxsnaps CLI utility can be used to take COW snapshots. Microsoft COW snapshots are faster than full snapshots and take up less storage space.

A COW snapshot creates a shadow copy that is differential. When a change to the original volume occurs, the block that is about to be modified is read and then written to a “differences area”, which preserves a copy of the data block before it is overwritten with the change. This approach stores a copy of the block before it is changed. Using the blocks in the differences area and unchanged blocks in the original volume, a copy of the volume can be constructed that represents the volume in the state before any changes occurred.

The benefit of the COW snapshot is that it creates shadow copies very rapidly because it is only writing changed blocks at a given time.

SFW VSS COW snapshot process

The process for creating COW snapshots with VSS is a two step process. The first step is to create a Shadow Storage area (differences area). A Shadow Storage area must exist before taking a COW snapshot to preserve data blocks before they are overwritten. The second step is to create the COW snapshot.

The process for creating COW snapshots with VSS can be done with the GUI or the command line.

For more information about the command line operations, see the vxsnaps CLI command.

Managing Shadow Storage

With the Shadow Storage dialog, you may add, remove, or specify another size for the Shadow Storage area.

- Add Shadow Storage lets you add a shadow storage area for a volume.

  Note: Shadow storage areas are supported only on NTFS volumes.

- Remove Shadow Storage lets you remove the shadow copy storage area for a volume.

- Resize Shadow Storage lets you update the shadow copy storage area maximum size for a volume. This dialog lets you specify an unlimited or exact volume size.
To add Shadow Storage

1. Right-click the volume you want to add shadow storage.
2. Click Shadow Storage > Add in the context menu.
3. Select the volume to store shadow copies and the disk space size.
   - Choose the No limit option to specify that unlimited disk space can be used to store shadow copies.
   - Choose the Use limit option to set the maximum amount of disk space allowed to store shadow copies. Also specify the exact amount of disk space (MB) to be used.
4. Click OK to complete the settings.

**Note:** The `vxsnap diffarea` command can also be used to create the Shadow Storage area.

**Note:** A basic volume cannot be used as a Shadow Storage area.

To resize Shadow Storage

1. Right-click the volume that contains the shadow storage you want to resize.
2. Click Shadow Storage > Resize in the context menu.
3. Choose the disk space size.
   - Choose the No limit option to specify that unlimited disk space can be used to store shadow copies.
   - Choose the Use limit option to set the maximum amount of disk space allowed to store shadow copies. Also specify the exact amount of disk space (MB) to be used.
4. Click OK to complete the command.

To remove Shadow Storage

1. Right-click the volume that contains the shadow storage you want to remove.
2. Click Shadow Storage > Remove in the context menu.
3. Click Yes to complete the command.

Using the VSS COW Snapshot wizard

Perform a COW snapshot with the COW Snap Shot wizard.
To create VSS COW snapshots

1 Right-click a volume in the tree-view.

2 Click COW> Snap Shot in the context menu.

3 In the wizard, review the Welcome page and click Next.

4 In the Select Volumes window that appears, select the volumes that you want to take a snapshot of.

   Highlight the volumes in the Available volumes pane and click Add. Your selected volumes should appear in the Selected volumes pane.

   The list of available volumes is a list of all volumes that have a shadow storage area and are in the same disk group of the selected volume.

   Specify the snapshot set parameters as appropriate and then click Next.

5 Review the specifications of the snapshot set and click Finish.

Note: You can also use the vxsnap create CLI command to take the snapshot.

Using the VSS COW Snapshot Scheduler wizard

You can use the VSS COW Snapshot Scheduler wizard to add a snapshot schedule.

The scheduling capability automates the process of taking snapshots. At the scheduled time, the specified volumes are automatically snapshotted. A new snapshot set is made every time the schedule calls for a snapshot to be taken. In this way, a series of snapshot sets can be made with the scheduler. Once configured and applied, the schedule is maintained by a scheduler service, VxSchedService.exe, that runs in the background.
**Note:** Information about the operations performed by the schedule can be found by expanding the nodes under the Scheduled Tasks node in the tree-view of the GUI. Expand the Generic node to locate the schedules for snapshots of volumes. Right-click the node and select **Job History** to view information about the operations performed by the schedule.

**Note:** You must create a shadow storage area before running the VSS COW Snapshot Scheduler wizard.

**To create a schedule for VSS COW snapshots**

1. Right-click a volume in the tree-view.
2. Click **COW > Schedule COW SnapShot** in the context menu.
3. In the wizard, review the Welcome page and click **Next**.
4. In the Select Volumes window that appears, select the volumes that you want to take a snapshot of.

   Highlight the volumes in the **Available volumes** pane and click **Add**. Your selected volumes should appear in the **Selected volumes** pane.

   The list of available volumes is a list of all volumes that have a shadow storage area and are in the same disk group of the selected volume.

   Specify the snapshot set parameters as appropriate and then click **Next**

   **Directory**

   The wizard creates the snapshot set metadata XML file. The XML metadata file is stored by default in the directory shown on the screen.

   **Snapshot set**

   Enter a name for the snapshot set, for example, billing or accept the default name. The wizard generates a default snapshot set name that includes the term "SnapshotSet.cow" date, and time. Every time a snapshot is taken, a unique snapshot set name is generated.
**5** In the Schedule Information panel, on the General Options tab, specify the following:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of this schedule</td>
<td>Enter a unique name for the snapshot set schedule. This name identifies the snapshot schedule if you later want to view information about the snapshot status. A default name consists of a prefix, &quot;Generic&quot;, and a numbered suffix that increments with each schedule.</td>
</tr>
<tr>
<td>Description of this schedule</td>
<td>Optionally, enter a description to help you identify the schedule when you view information about the snapshot status.</td>
</tr>
<tr>
<td>Start Time</td>
<td>The time of the day to begin taking snapshots.</td>
</tr>
<tr>
<td>End Time</td>
<td>The time of day to end taking snapshots. If a snapshot is in progress it is completed but a new one is not started after the end time.</td>
</tr>
<tr>
<td>Schedule takes effect on</td>
<td>The date on which the specified schedule takes effect. The default is the current date.</td>
</tr>
<tr>
<td>Restart task every</td>
<td>The interval between snapshots, in minutes. For example, if the interval is 360 minutes and you schedule a snapshot start time of 12 P.M. and an end time of 7 P.M, the snapshot occurs twice. If no interval is specified the snapshot occurs once.</td>
</tr>
<tr>
<td>Every</td>
<td>Enable the <strong>Every</strong> option to have the snapshot schedule continue to occur. Otherwise the schedule applies only for one day. Specify the number of days before restarting the snapshot schedule. For example, 1 day would mean the schedule takes effect daily, 2 days would mean every other day.</td>
</tr>
<tr>
<td>Start On</td>
<td>If you enable the Every option, specify the starting date.</td>
</tr>
<tr>
<td>Pre Command</td>
<td>Optionally, specify the full path of a command script to run before the scheduled snapshot occurs.</td>
</tr>
<tr>
<td>Post Command</td>
<td>Optionally, specify the full path of a command script to run after the snapshot is complete.</td>
</tr>
</tbody>
</table>
6 To specify run days for the schedule, make selections on the following tabs:

- **Days of Week**: Select one or more days on one or more weeks of the month. You can click a button at the top of the column to select the entire column or a button to the left of a row to select the entire row. For example, clicking **First** schedules the snapshots to occur on the first occurrence of all the week days for the month.

- **Days of Month**: Select one or more days of the month. You can also check the **Last Day** checkbox to schedule the snapshot for the last day of each month.

- **Specific Dates**: Select one or more specific dates to include in or to exclude from the schedule. Excluding a date takes precedence over days scheduled on the other tabs. For example, if you schedule every Monday on the Days of Week tab, and you exclude Monday October 9 on the Specific Dates tab, the snapshots are not taken on October 9.

If two schedules overlap for the same snapshot set, only one snapshot is taken. For example, if you select every Thursday plus the last day of the month, and the last day of the month occurs on Thursday, only one snapshot is taken on Thursday.

7 Click **Next**.

8 Review the specifications of the snapshot set and click **Finish**.

**Displaying the status of the scheduled VSS COW snapshot**

If a scheduled snapshot fails for some reason, the scheduler process will attempt to rerun it. You may want to verify that scheduled snapshots completed successfully. From the VEA console, you can view snapshot results.

**To view a scheduled snapshot status**

1 From the VEA console, navigate to the system where the production volumes and snapshot mirrors are located.

2 Expand the system node and the Storage Agent node.

3 Click **Scheduled Tasks**.
4 Expand the Generic node. The scheduled snapshots are listed in the pane on the right.

All scheduled snapshots not associated with an Application are displayed under the Generic node.

5 Choose one of the following:
   - To view the status of all scheduled jobs, right-click **Generic** and click **All Job History**
   - To view the status of a particular schedule, right-click the snapshot schedule name and click **Job History**.

6 In the dialog box, view the schedule information.

You can sort listed schedules by clicking the column headings. The Status column shows if the snapshot completed successfully.

**Deleting a schedule for a VSS COW snapshot**

The following is the procedure to delete a schedule.

You can also delete (but not modify) a schedule from the VEA GUI console.

To delete a schedule with the VEA GUI

1 From the VEA console, navigate to the system where the production volumes are located.
2 Expand the system node and the Storage Agent node.
3 Click **Scheduled Tasks**.
4 Expand the Generic node for which you scheduled the snapshot. The scheduled snapshots are listed in the pane on the right.
5 Right-click the name of the snapshot schedule and click **Delete Schedule**.

**Using the VSS COW Restore Wizard**

Uses the snapshot volume in a snapshot set created by VSS COW snapshot to restore data, for example, after an original volume has become corrupted.

To restore a volume with COW snapshot

1 Right-click a volume or a component of an application in the tree-view.
2 Click **COW>Restore** in the context menu.
3 In the wizard, review the Welcome page and click **Next**.
Select the snapshot set XML metadata file to be used for this operation and click Next.

The XML metadata file contains all required information needed to restore the volume.

In the Select Volumes window that appears, select the volumes that you want to restore.

Highlight the volumes in the Available volumes pane and click Add. Your selected volumes should appear in the Selected volumes pane.

Review the specifications of the snapshot set and click Finish.

Additional information about COW snapshots

Since COW snapshots rely on a Shadow Storage area, COW snapshots have the following constraints:

- COW snapshots are developed by keeping track of blocks that have changed. If the original volume that the COW snapshot is based upon becomes unavailable or corrupted, then the COW snapshot cannot be used to restore the snapshotted volume.
- After restoring the original volume with a COW snapshot, any subsequent COW snapshots taken after that snapshot are automatically deleted by Windows.
- The number of COW snapshots for a volume is limited by the size of the shadow storage area allocated. When the shadow storage area has reached its capacity, then older snapshots are deleted to make room for new snapshots. In addition, 512 COW snapshots is the maximum number allowed per volume.
- During a restore operation, a forced dismount of the original volume or the volume containing the shadow storage area may result in I/O corruption and the loss of COW snapshots.
- Due to the incremental nature of COW snapshots, COW snapshots can only be used to restore the snapshotted volume to a point in time.
- For every write operation on a new block of the snapshotted volume, a read operation is performed to allow the COW snapshot to store the block in the shadow storage area. As a result, a COW snapshot may impact the I/O performance of the snapshotted volume.
- SFW only supports COW snapshots of dynamic volumes.
- Both the shadow storage area and the snapshotted volume must reside in the same dynamic disk group.
If a volume containing a shadow storage area is a part of a snapshot set and the shadow storage area volume is restored, then all snapshots that were stored on that volume are deleted automatically by Windows. Make sure that volumes containing shadow storage areas for other volumes are not part of the same snapshot set. Otherwise COW snapshots may automatically get deleted during a restore operation, resulting in a snapshot not found error.

After performing operations for COW snapshots or operations on the Shadow Storage area, the VEA GUI may not be updated to reflect the results of the operation. Use the VSS Refresh command to update the VEA GUI.

Using the VSS COW snapshot wizards with Microsoft SQL

SFW provides support for taking VSS COW snapshots of Microsoft SQL databases. FlashSnap integrates with the Microsoft Volume Shadow Copy Service (VSS) to allow snapshots to be taken of all volumes associated with an SQL database without taking the database offline. The VSS COW Snapshot wizard uses VSS to take snapshots of the database. The VSS process allows the database to be quiesced before the snapshot operation and reactivates it immediately after.

SFW also provides a VSS COW Snapshot Scheduler wizard that can be used as an alternative to the VSS COW Snapshot wizard. It enables you to set up a schedule for taking the snapshots. The schedule is maintained by a scheduler service, VxSchedService.exe, that runs in the background.

Using the VSS COW Snapshot wizard

Creating a snapshot is a two-step process. The first step, create a shadow storage area for the snapshot, creates a differences area to store blocks of data before they are changed. The second step uses the VSS Snapshot wizard to create on-host snapshot volumes as well as an XML file to store the database and snapshot volume metadata. The VSS Snapshot wizard integrates with VSS to quiesce the database and then simultaneously snapshot the volumes in the database. This snapshot is done while the database is online and without disrupting processing.

**Note:** You must create a shadow storage area before running the VSS COW Snapshot wizard.
Creating the snapshot set

The following is the procedure to create a snapshot set.

**To create the snapshot set**

1. From the VEA console, navigate to the system where the production volumes are located.
2. Expand the system node, the Storage Agent node, Applications node, and SQL node.
3. Right-click the SQL instance node and click **VSS COW Snapshot**.
4. In the wizard, review the Welcome page and click **Next**.

**Note**: After performing COW related operations with the Windows GUI, the VEA GUI may not be updated to reflect the results of the operation. Use the VSS Refresh command to update the VEA GUI.
5 Specify the snapshot set parameters as follows and then click **Next**:

- **Select Component for snapshot operation**
  - Select the database for the snapshot set.

- **Directory**
  - The wizard creates the snapshot set metadata XML file. The XML metadata file is stored by default in the directory shown on the screen.
  - There are two ways to change the XML file location. First, edit the directory path in the Directory field for this wizard screen. Second, change the XML file location. Use a text editor to create a text file named `redirect.txt`. This text file should contain a single text line specifying the full path to the location of the XML file, for example, `G:\BackupSets`. Save the `redirect.txt` file in the default directory `C:\Program Files\Veritas\Veritas Volume Manager\VSSXML`.
  - If SFW/SFW HA is installed on the D drive, then the path will be the same as above, but on the D drive.

- **Snapshot set**
  - Enter a name for the snapshot set, for example, billing or accept the default name. The wizard generates a default snapshot set name that includes the term "SnapshotSet", component name, identification number, date, and time.

- **Select snapshot type**
  - Select the snapshot type.
  - You can specify that snapshots be created as either a Full backup or Copy backup type. Either type can be used to restore a database. However, if you want to replay logs in SQL Server as part of restoring a database, a Full backup needs to have been created earlier. When replaying logs, you can replay from the time of the last Full backup. A Copy backup does not affect this sequence of log replay and therefore is often used as an "out of band" copy for purposes such as testing or data mining.

6 Review the specifications of the snapshot set and click **Finish**.

**Using the VSS COW Snapshot Scheduler wizard**

You can use the VSS COW Snapshot Scheduler wizard to add a snapshot schedule. The scheduling capability automates the process of taking snapshots. At the scheduled time, the specified volumes are automatically snapshotted. Once configured and applied, the schedule is maintained by a scheduler service, `VxSchedService.exe`, that runs in the background. In a clustered server
environment, ensure that the scheduler service is configured on each node with domain administrator privileges so that any node in the cluster can run the schedule after a failover.

Note: Information about the operations performed by the schedule can be found by expanding the nodes under the Scheduled Tasks node in the tree-view of the GUI. Expand the appropriate application node to locate the schedules for that application. Right-click the node and select Job History to view information about the operations performed by the schedule.

Note: You must create a shadow storage area before running the VSS COW Snapshot wizard.

To schedule a snapshot for a selected component

1. From the VEA console, navigate to the system where the production volumes and snapshot mirrors are located.
2. Expand the system node, the Storage Agent node, Applications node, and SQL node.
3. Right-click the SQL instance, and click Schedule VSS COW Snapshot.
4. In the Welcome panel, review the information and click Next.
Specify the snapshot set parameters as follows and then click **Next**:

1. **Select component for snapshot operation**

   Select the database for the snapshot set.

2. **Directory**

   The XML file is stored by default in the directory shown on the screen.

   In a clustered server environment, the XML file must be saved on shared storage to be available from all nodes in the cluster.

   There are two ways to change the XML file location.

   First, edit the directory path in the Directory field for this wizard screen. Second, change the XML file location. Use a text editor to create a text file named `redirect.txt`. This text file should contain a single text line specifying the full path to the location of the XML file, for example `G:\BackupSets`. Save the `redirect.txt` file in the default directory `C:\Program Files\Veritas\Veritas Volume Manager\VSSXML`.

   If SFW/SFW HA is installed on the D drive, then the path will be the same as above, but on the D drive.

   **Note:** When a COW snapshot is scheduled, a snapshot is taken at the specified time and a new xml file is generated for each snapshot.

3. **Snapshot set**

   Enter a name for the snapshot set, for example, billing or accept the default name. The wizard generates a default snapshot set name that includes the term "SnapshotSet", component name, identification number, date, and time.

4. **Select snapshot type**

   Select the snapshot type.

   You can specify that snapshots be created as either a Full backup or Copy backup type. Either type can be used to restore a database. However, if you want to replay logs in SQL Server as part of restoring a database, a Full backup needs to have been created earlier. When replaying logs, you can replay from the time of the last Full backup. A Copy backup does not affect this sequence of log replay and therefore is often used as an "out of band" copy for purposes such as testing or data mining.
In the Schedule Information panel, on the General Options tab, specify the following:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of this schedule</td>
<td>Enter a unique name for the snapshot set schedule. This name identifies the snapshot schedule if you later want to view information about the snapshot status. A default name consists of the application name and a numbered suffix that increments with each schedule.</td>
</tr>
<tr>
<td>Description of this schedule</td>
<td>Optionally, enter a description to help you identify the schedule when you view information about the snapshot status.</td>
</tr>
<tr>
<td>Start Time</td>
<td>The time of the day to begin taking snapshots.</td>
</tr>
<tr>
<td>End Time</td>
<td>The time of day to end taking snapshots. If a snapshot is in progress it is completed but a new one is not started after the end time.</td>
</tr>
<tr>
<td>Schedule takes effect on</td>
<td>The date on which the specified schedule takes effect. The default is the current date.</td>
</tr>
<tr>
<td>Restart task every</td>
<td>The interval between snapshots, in minutes. For example, if the interval is 360 minutes and you schedule a snapshot start time of 12 P.M. and an end time of 7 P.M., the snapshot occurs twice. If no interval is specified the snapshot occurs once.</td>
</tr>
<tr>
<td>Every</td>
<td>Enable the <strong>Every</strong> option to have the snapshot schedule continue to occur. Otherwise the schedule applies only for one day. Specify the number of days before restarting the snapshot schedule. For example, 1 day would mean the schedule takes effect daily, 2 days would mean every other day.</td>
</tr>
<tr>
<td>Start On</td>
<td>If you enable the Every option, specify the starting date.</td>
</tr>
<tr>
<td>Pre Command</td>
<td>Optionally, specify the full path of a command script to run before the scheduled snapshot occurs.</td>
</tr>
<tr>
<td>Post Command</td>
<td>Optionally, specify the full path of a command script to run after the snapshot is complete.</td>
</tr>
</tbody>
</table>
To specify run days for the schedule, make selections on the following tabs:

**Days of Week**
Select one or more days on one or more weeks of the month.
You can click a button at the top of the column to select the entire column or a button to the left of a row to select the entire row. For example, clicking **First** schedules the snapshots to occur on the first occurrence of all the week days for the month.

**Days of Month**
Select one or more days of the month. You can also check the **Last Day** checkbox to schedule the snapshot for the last day of each month.

**Specific Dates**
Select one or more specific dates to include in or to exclude from the schedule.
Excluding a date takes precedence over days scheduled on the other tabs. For example, if you schedule every Monday on the Days of Week tab, and you exclude Monday October 9 on the Specific Dates tab, the snapshots are not taken on October 9.

If two schedules overlap for the same snapshot set, only one snapshot is taken. For example, if you select every Thursday plus the last day of the month, and the last day of the month occurs on Thursday, only one snapshot is taken on Thursday.

Click **Next**.

Review the snapshot set and schedule details and click **Finish**.

**Displaying the status of the scheduled VSS COW snapshot**
If a scheduled snapshot fails for some reason, the scheduler process will attempt to rerun it. You may want to verify that scheduled snapshots completed successfully. From the VEA console, you can view snapshot results.

To view a scheduled snapshot status
1. From the VEA console, navigate to the system where the production volumes and snapshot mirrors are located.
2. Expand the system node and the Storage Agent node.
3. Click **Scheduled Tasks** to view all the applications that have schedules.
4. Select the application for which you scheduled the snapshot.
   The scheduled snapshots are listed in the pane on the right.
   All scheduled snapshots associated with SQL are displayed under the SQL node.
5 Choose one of the following:

- To view the status of all scheduled jobs, right-click the selected application and click **All Job History**.
- To view the status of a particular schedule, right-click the snapshot schedule name and click **Job History**.

6 In the dialog box, view the schedule information.

You can sort listed schedules by clicking the column headings. The Status column shows if the snapshot completed successfully.

**Deleting a schedule for a VSS COW snapshot**

The following is the procedure to delete a schedule.

You can also delete (but not modify) a schedule from the VEA GUI.

**To delete a schedule using the VEA GUI**

1 From the VEA console, navigate to the system where the production volumes are located.

2 Expand the system node and the Storage Agent node.

3 Click **Scheduled Tasks** to view all the applications that have schedules.

4 Select the application for which you scheduled the snapshot.

   The scheduled snapshots are listed in the pane on the right.

5 Right-click the name of the snapshot schedule and click **Delete Schedule**.
Using the VSS COW snapshot wizards with Microsoft SQL
This chapter includes the following topics:

- DMPW overview
- Major features of Symantec Dynamic Multi-Pathing for Windows
- Active/Active and Active/Passive settings
- DMPW DSMs

DMPW overview

The Symantec Dynamic Multi-Pathing for Windows option adds additional fault tolerance to disk storage by making use of multiple paths between a computer and a disk in a storage array. A path is a connection between the computer and the storage array’s disks and consists of a host adapter and a SCSI bus connection to one or more SCSI disks or a fiber optic channel connected to a hub, switch, or array. Thus, multiple paths are made possible by connecting two or more host bus adapters with either SCSI or fiber optic cabling to the storage array. The Symantec Dynamic Multi-Pathing for Windows software manages the multiple paths so that the data on each of the array’s disks is accessible to the host computer. If a path to a disk fails, Symantec Dynamic Multi-Pathing for Windows automatically transmits data to and from the disk over an alternate path.

The paths on an array are set up to work in two ways—either in Active/Active mode, which provides load balancing of the data between multiple paths, or in Active/Passive mode, in which only one path is active and any remaining paths are backups.
SFW offers Symantec Dynamic Multi-Pathing for Windows as DMPW DSMs (Device Specific Modules).

**Note:** Windows Management Instrumentation (WMI) is a required service for the MPIO feature to work. Without this service, the MPIO Provider will not load and MPIO objects are not displayed on the VEA console or CLI command outputs. MPIO operations too cannot be performed in absence of WMI service.

DMPW DSMs are designed to support a multipath disk storage environment set up with the Microsoft Multipath I/O (Microsoft MPIO) solution. DMPW DSMs work effectively with Windows to provide a fault tolerant multipath disk storage environment. DMPW DSMs have the following benefits:

- Fiber Channel StorPort Miniport HBA Driver support
- iSCSI HBA support
- Microsoft iSCSI Software Initiator support
- Boot from SAN support
- Active/Active Symantec Dynamic Multi-Pathing for Windows with clustering support
- DMPW DSMs load balancing support
  
  Load balancing support includes the following:
  
  - Round robin load balancing support (Active/Active)
  - Fail Over Only (Active/Passive)
  - Dynamic Least Queue Depth load balancing support
  - Round robin with Subset load balancing support
  - Least Blocks load balancing support
  - Weighted Paths load balancing support
  - Balanced Path load balancing support

Basic disks are supported if SCSI-3 registry support is not enabled for DMPW DSMs. If SCSI-3 registry is enabled for DMPW DSMs for an attached array, then existing basic disks should be upgraded to dynamic disks before placing them under control of DMPW DSMs.

For DMPW DSMs, Boot and data volumes are supported on the same bus/HBAs for non-clustered servers if the Boot from SAN recommendations from Microsoft are followed. DMPW DSMs are not supported with fibre channel port drivers, fibre channel SCSI Miniport drivers or boot/cluster disks on the same bus/HBAs.
Major features of Symantec Dynamic Multi-Pathing for Windows

The major features of Symantec Dynamic Multi-Pathing for Windows (DMPW) are described in this section.

They include the following:

■ Fault tolerance
  Provides fault tolerance to a disk system by using multiple paths to each disk. If the primary path fails, either at the card level or in the cabling from the card to the disk, a secondary path is automatically utilized.

■ Load balancing in Active/Active configurations
  When a system is configured as Active/Active, Symantec Dynamic Multi-Pathing for Windows makes use of all the paths to a disk for the transfer of I/O to and from the disk.

■ Support for multiple paths
  With DMP DSMs, the maximum number of I/O paths you can have is 16 per array LUN.

■ Dynamic recovery
  If an active path to a disk fails, Symantec Dynamic Multi-Pathing for Windows automatically flags the failed path and no longer attempts to transfer data on it. The failed path is monitored and is automatically restored to service when Symantec Dynamic Multi-Pathing for Windows detects that the path is functioning correctly. Symantec Dynamic Multi-Pathing for Windows automatically updates path status on the user display when a path fails or is restored to service.

■ Dynamic path recognition
  If you add a new path to your Symantec Dynamic Multi-Pathing for Windows configuration, running a rescan or rebooting your system causes Symantec Dynamic Multi-Pathing for Windows to detect the new path and display its status. If a failed or disabled path is restored to service, Symantec Dynamic Multi-Pathing for Windows automatically detects the status change and updates the display.

Active/Active and Active/Passive settings

Symantec Dynamic Multi-Pathing for Windows has two modes of operation for an array’s paths, Active/Active and Active/Passive.

These modes also apply to the array’s disks and are defined as follows:
Active/Active

The mode in which Symantec Dynamic Multi-Pathing for Windows allocates the data transfer across all the possible paths, thus enabling the desirable feature of load balancing. With this mode, Symantec Dynamic Multi-Pathing for Windows implements a round-robin algorithm, selecting each path in sequence for each successive data transfer to or from a disk. For example, if you have two paths active, A and B, the first disk transfer occurs on path A, the next on path B, and the next on path A again.

In addition to the round-robin algorithm, DMPW DSMs offer the following load balancing options:

- **Dynamic Least Queue Depth**
  Selects the path with the least number of I/O requests in its queue for the next data transfer.
  For example, if you have two active paths, path A with one I/O request and path B with none, DMPW DSMs would select the path with the least number of I/O requests in its queue, path B, for the next data transfer.

- **Balanced Path**
  This policy is designed to optimize the use of caching in disk drives and RAID controllers. The size of the cache depends on the characteristics of the particular hardware. Generally, disks and LUNs are logically divided into a number of regions or partitions. I/O to and from a given region is sent on only one of the active paths. Adjusting the region size to be compatible with the size of the cache is beneficial so that all the contiguous blocks of I/O to that region use the same active path. The value of the partition size can be changed by adjusting the value of the tunable parameter, Block Shift.
  Block Shift represents the number of contiguous I/O blocks that are sent along a path to an Active/Active array before switching to the next available path. The Block Shift value is expressed as the integer exponent of a power of 2. For example, the Block Shift value of 11 represents $2^{11}$ or 2048 contiguous blocks of I/O.
  The benefit of this policy is lost if the value is set larger than the cache size. The benefit is also lost when the active path fails. In this situation, the I/O is automatically redistributed across the remaining paths.
  The default value of the Block Shift parameter is set to 11 so that 2048 contiguous blocks (1MB) of I/O are sent over a path before switching to a different path. Depending on your hardware, adjusting this parameter may result in better I/O throughput. Refer to your hardware documentation for more information.
Note: Block Shift only affects the behavior of the balanced path policy. A value of 0 disables multi-pathing for the policy unless the \texttt{vxdmpadm} command is used to specify a different partition size for an array.

- Weighted Paths
  Uses the path with the lowest numerical weight. Each path is assigned a weight by the user to designate which path is favored for data transfer. If two or more paths have the same weight and are the lowest weight of all paths, then these paths are used each in turn, in round-robin fashion, for the data transfer.
  For example, if you have three active paths, path A with weight of 0, path B with weight of 0, and path C with weight of 9, DMPW DSMs would use path A for one data transfer and then use path B for the next. Path C is in standby mode and is used if path A or path B fails.

- Round robin with Subset
  Uses a subset of paths, each in turn, in round-robin fashion. The user specifies the paths for data transfer that make up the subset. The remaining paths are in standby mode.
  For example, if you have three active paths, path A, path B, and path C and you specify the subset to contain path A and path B, then DMPW DSMs would use path A for one data transfer and then use path B for the next. Path C is in standby mode and is used if path A or path B fails.

- Least Blocks
  Selects the path with the least number of blocks of I/O in its queue for the next data transfer.
  For example, if you have two active paths, path A with one block of I/O and path B with none, DMPW DSMs would select the path with the least number of blocks of I/O in its queue, path B, for the next data transfer.

- Active/Passive
  A mode in which a path designated as the "Preferred Path" or "primary path" is always active and the other path or paths act as backups (standby paths) that are called into service if the current operating path fails.

The modes of operation—Active/Active and Active/Passive—are shown as options in the Load Balancing section of the program’s Array Settings and Device Settings windows. The Active/Active mode enables load balancing, but the Active/Passive mode does not provide load balancing except for the Fail Over Only load balancing policy.
Note: If a storage array cannot transfer data on one of the path configurations, the Load Balancing options appear grayed out on the screen and you cannot access these settings.

You configure the load balancing settings for the paths at the array level through the Array Settings screen, or you can accept the default setting. The default setting is dependent on the particular array. Consult the documentation for your storage array to determine the default setting of the array and any additional settings it supports.

After the appropriate array setting is made, all the disks in an array have the same load balancing setting as the array. If the array is set to active/active, you can use the Device Settings screen to change the setting on an individual disk so that it has a different load balancing setting than the array. When an array is set to active/passive, no load balancing is enabled and data transfer is limited to the one preferred or primary path only.

For all Active/Active arrays under control of DMPW DSMs:

- All paths to the disks are current active I/O paths. Each active path is designated by a path icon with a green circle in the VEA GUI.
- For an Active/Passive load balance setting, the primary path is designated by a path icon with a checkmark in a green circle in the GUI.
- The DMPW DSMs are not enabled to indicate which array controller each path is connected to.

For all Active/Passive Concurrent (A/PC) and Asymmetric Logical Unit Access (ALUA) arrays under control of DMPW DSMs, the load balance settings apply only to the current active I/O paths. If all the active I/O paths change or fail, the load balance settings are automatically applied to the new current active I/O paths of the arrays.

In addition, for A/PC and ALUA arrays:

- The current active path is designated by a path icon with a green circle in the VEA GUI.
- For an Active/Passive load balance setting, the primary path is designated by a path icon with a checkmark in a green circle in the VEA GUI.
- DMPW automatically selects the primary path for Active/Passive load balancing.
- Round robin with Subset and Weighted Paths load balance settings are available only at the device level. They are not available at the array level.
- Active paths are connected to the same array controller.
Active/Active and Active/Passive settings in a cluster environment

This section covers information about settings for DMPW DSMs along with information about enabling or disabling SCSI-3 PGR.

**DMPW DSMs**

For DMPW DSMs in a cluster environment, either Active/Active or Active/Passive load balance settings can be used. DMPW DSMs automatically set the load balancing to active/passive for disks under SCSI-2 reservation. For Active/Active load balancing in a cluster environment, the array must be enabled for SCSI-3 Persistent Group Reservations (SCSI-3 PGR).

**Note:** Symantec maintains a Hardware Compatibility List (HCL) for Symantec Storage Foundation and High Availability Solutions 6.0 for Windows Products on the Symantec Support Web site. The HCL gives information on HBAs, firmware, and switches that have been tested with each supported array. Check the HCL for details about your hardware before using DMPW DSMs.

Storage arrays may require additional configuration steps or updates to work with Symantec Storage Foundation for Windows and MPIO. Contact the manufacturer of the storage array for details.

**SCSI-3 PGR technology**

SCSI-3 PGR supports multiple nodes accessing a device while at the same time blocking access to other nodes. SCSI-3 PGR supports multiple paths from a host to a disk and SCSI-3 PGR reservations are persistent across SCSI bus resets.

By contrast, SCSI-2 reservations can only be used by one host, with one path. This means if there is a need to block access for data integrity concerns, only one host and one path remain active. This limits access to the device to only one path and prevents the use of multiple paths even if they are available.

SCSI-3 PGR uses a concept of registration and reservation. Systems accessing a device register a key with a SCSI-3 device. Each system registers its own key. Multiple systems registering keys form a membership. Registered systems can then establish a reservation. The reservation type is set to "Exclusive Access - Registrants Only". This means that only some commands are allowed and there is only one persistent reservation holder. With SCSI-3 PGR technology, blocking write access can be done by removing a registration from a device.

In the Symantec Storage Foundation for Windows implementation, a node registers the same key for all paths to the device.
For DMPW DSMs, the Active/Active setting is implemented by translating SCSI reserve/release commands to SCSI-3 PGR commands.

Enabling SCSI-3 PGR

You must enable SCSI-3 support before using the Active/Active setting for DMPW DSMs. (SCSI-3 support is disabled by default.)

**Note:** Before enabling SCSI-3 PGR support, move any cluster disk groups to another node or deport the cluster disk groups.

In SFW 5.1 and later releases, SFW support for clustering environments can be selected to issue SCSI-2 or SCSI-3 reservations with the SFW Control Panel.

- If SCSI-3 is selected in the SFW Control Panel, then there is no need to enable SCSI-3 PGR support for the DMPW DSMs.
  
  After selecting SCSI-3, you must issue the following CLI commands to complete the setting:
  
  - net stop vxsvc
  
  - net start vxsvc

- If SCSI-2 is selected in the SFW Control Panel, then SCSI-3 PGR support can be enabled for the DMPW DSMs by updating the Windows registry by running one of the files listed in the table below, or by using the vxdmpadm CLI command.

  See “vxdmpadm” on page 638.
  
  See “Additional considerations for SFW Microsoft Failover Clustering support” on page 506.
  
  See “Additional considerations for SFW VCS support” on page 520.

  The files in the following table are provided to enable or disable SCSI-3 support for the type of storage array supported. The files are located on the product CD at ..\Tools\storage_foundation_for_windows\DMP_DSM_SCSI3_reg

  Copy the files to your system and run the appropriate .reg for your storage array.

**Note:** You must ensure that your storage array supports SCSI-3 PGR before using the Active/Active setting for DMPW DSMs. Also check to see if your array manufacturer requires any special settings for a LUN to be enabled for SCSI-3 PGR.
### Table 13-1: Files to Enable/Disable SCSI-3 PGR

<table>
<thead>
<tr>
<th>Array Type</th>
<th>Enable SCSI-3 PGR</th>
<th>Disable SCSI-3 PGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ EMC Symmetrix 8000 Series</td>
<td>EnableSupportSCSI3EMC.reg</td>
<td>DisableSupportSCSI3EMC.reg</td>
</tr>
<tr>
<td>■ EMC Symmetrix DMX Series</td>
<td>EnableSupportSCSI3EMC.reg</td>
<td>DisableSupportSCSI3EMC.reg</td>
</tr>
<tr>
<td>■ IBM TotalStorage™ ESS800/ESS750</td>
<td>EnableSupportSCSI3IBMDS.reg</td>
<td>DisableSupportSCSI3IBMDS.reg</td>
</tr>
<tr>
<td>■ IBM TotalStorage™ DS8000</td>
<td>EnableSupportSCSI3IBMDS.reg</td>
<td>DisableSupportSCSI3IBMDS.reg</td>
</tr>
</tbody>
</table>
Table 13-1 Files to Enable/Disable SCSI-3 PGR (continued)

<table>
<thead>
<tr>
<th>Array Type</th>
<th>Enable SCSI-3 PGR</th>
<th>Disable SCSI-3 PGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ Hitachi TagmaStore Universal Storage Platform (USP100, USP600, and USP1100)</td>
<td>EnableSupportSCSI3HDS.reg</td>
<td>DisableSupportSCSI3HDS.reg</td>
</tr>
<tr>
<td>■ Hitachi TagmaStore Network Storage Controller (NSC55)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Hitachi TagmaStore Adaptable Modular Storage (AMS200 and AMS500)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Hitachi TagmaStore Workgroup Modular Storage (WMS100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Hitachi Hitachi 9900 Lightning Series (9900 and 9900V)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Sun StorEdge SE9900 Series (SE9910, SE9960, SE9970V, SE9980V, and SE9990)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 13-1  Files to Enable/Disable SCSI-3 PGR (continued)

<table>
<thead>
<tr>
<th>Array Type</th>
<th>Enable SCSI-3 PGR</th>
<th>Disable SCSI-3 PGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP StorageWorks XP128 Disk Array</td>
<td>EnableSupportSCSI3HPXP.reg</td>
<td>DisableSupportSCSI3HPXP.reg</td>
</tr>
<tr>
<td>HP StorageWorks XP1024 Disk Array</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HP StorageWorks XP10000/XP12000 Disk Array</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HP StorageWorks Enterprise Virtual Array (EVA4000, EVA6000, and EVA8000)</td>
<td>EnableSupportSCSI3HPEVA.reg</td>
<td>DisableSupportSCSI3HPEVA.reg</td>
</tr>
</tbody>
</table>

Dynamic multi-pathing software

Active/Active and Active/Passive settings
### Table 13-1
Files to Enable/Disable SCSI-3 PGR (continued)

<table>
<thead>
<tr>
<th>Array Type</th>
<th>Enable SCSI-3 PGR</th>
<th>Disable SCSI-3 PGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network Appliance F800 Series</td>
<td>EnableSupportSCSI3NETAPP.reg</td>
<td>DisableSupportSCSI3NETAPP.reg</td>
</tr>
<tr>
<td>Network Appliance FAS200 Series (FAS250 and FAS270)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Appliance FAS900 Series (FAS920, FAS940, FAS960, and FAS980)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Appliance FAS3000 Series (FAS3020 and FAS3050)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Appliance NearStore Series</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NetApp V-Series (GF980c, GF960c, V3050c, V3020c, and GF270c)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** The only Network Appliance arrays that are supported are those that are configured as an active/active hardware type (cfmode: standby for each Network Appliance filer).
DMPW DSMs

This section describes support for the Microsoft multipath input/output solution (Microsoft MPIO). The support is provided by DMPW DSMs.

This section covers the following topics:

■ See “DMPW DSMs menus” on page 437.
■ See “Add and remove paths” on page 442.
■ See “Specify load balancing settings and the primary path” on page 443.
■ See “View array, disk, and path status” on page 452.

DMPW DSMs menus

This section describes DMPW DSMs menus.

They include the following:

■ See “Displaying the menu for arrays” on page 437.
■ See “Commands for arrays” on page 438.
■ See “Displaying the menu for disks” on page 440.
■ See “Commands for paths of a disk” on page 440.

Displaying the menu for arrays

There is a context menu for arrays that are under the control of DMPW DSMs that let you access the settings and properties of the array. It is available when you select an array in the VEA GUI.
To display the menu for arrays

1. Open the DMPW DSMs folder in the VEA GUI.
2. Select the array that you are interested in and the array context menu appears.

Commands for arrays

This section describes the DMPW DSMs menu commands.

The menu commands are the following:

Array settings

Properties
Array settings

The Array Settings command launches the Array Settings wizard.

It lets you select the setting for the operational modes for the array’s paths in the Load Balance Policy section. The Control Timer Settings is a section of tunable parameters for testing the status or health of a path.

At the bottom of the screen there is an option for applying all the settings to all the arrays under control of DMPW DSMs. This option applies all the settings to all arrays under control of a specific DMPW DSMs driver. When you select this option, the current settings for this array are applied to all the arrays controlled by this specific DMPW DSMs driver.

**Note:** There are specific DMPW DSMs that work with specific families of hardware arrays. If your environment has more than one family of hardware arrays under control of DMPW DSMs, then each family of hardware arrays would work with specific DMPW DSMs. When you select the option for applying all the settings to all the arrays under control of the DSM, you are applying the settings to only those arrays that work with that specific DMPW DSMs.

See the Symantec Web site for more information about which hardware arrays are supported by specific DMPW DSMs.

http://www.symantec.com/business/support/index.jsp

Additional information about array settings is available.

See “Array status” on page 453.

**Note:** If the Fail Over Only (Active/Passive) array load balancing setting is selected and a primary path has not been set, DMPW DSMs set the primary path. Generally, DMPW DSMs set the primary path to the first path that is able to transfer data. You can manually set the primary path with the Set primary path command.

Properties

The Properties command brings up the Properties screen, which displays information about the selected array, including array name, array type, load balance policy, and a list of the devices contained in the array.

Additional information about the array, disk, and path settings is available.

See “View array, disk, and path status” on page 452.
Displaying the menu for disks

The context menu for a disk is available when you highlight a path that is connected to the disk. The menu requires the DMPW DSMs tab to be active.

To display the disk context menu

1. Open the DMPW DSMs folder in the tree view.
2. Select the disk that you are interested in.
   - Note that opening the Disks folder and clicking a disk that is under DMPW DSMs control is an alternative way to select a disk.
3. Select the DMPW DSMs tab in the right pane. This tab displays the paths to the selected disk.
   - Each path is displayed with its properties. Some of the attributes displayed are Port, Channel, Target ID, LUN, and Load Balance Policy.
   - The name of the path is derived from a combination of properties of the path. For example, if the path has properties of Port Number = 2, Channel = 1, and Target ID = 1, then the name of the path is 2-1-1.
4. Right-click on a path and the context menu appears.

Commands for paths of a disk

This section describes the DMPW DSMs menu commands.

The menu commands are the following:

- Statistics monitoring
- Clear performance statistics
- Device settings
- Set primary path
- Properties
Statistics monitoring

The Statistics Monitoring command brings up the Path Statistics screen, which displays the I/O statistics of the selected path.

The I/O statistics for the selected path are the following:

- Number of read operations per second
- Number of write operations per second
- Number of bytes read per second
- Number of bytes written per second

The statistics are updated and displayed at a specified polling interval. The range of values for the polling interval is 2 to 900 seconds. You can set the polling interval by entering the number of seconds in the Polling Interval field and clicking Set Polling Interval.

Clear performance statistics

The Clear Performance Statistics command brings up the Clear Performance Statistics screen, which lets you clear the performance statistics that are being monitored for a single device, an array, or for all the arrays under control of a DMPW DSMs. After selecting which performance statistics to clear, click OK to complete the operation.

Device settings

The Device Settings command brings up the Device Settings screen, which displays the DMPW DSMs characteristics of the disk whose path is selected on the DMPW DSMs tab. It has a Load Balance Policy section to set the operational mode that applies to the selected disk.

See “Device status” on page 454.

Note: If the Fail Over Only (Active/Passive) device load balancing setting is selected and a primary path has not been set, DMPW DSMs set the primary path. Generally, DMPW DSMs set the primary path to the first path that is able to transfer data. You can manually set the primary path with the Set primary path command.

Set primary path

The Set primary path command on the DMPW DSMs menu can be used to specify the currently selected path as the primary path to the disk or the array.

The following options are available:
Set primary path for device
This menu option is available only when the operational mode for the path to the disk is specified as Fail Over Only (Active/Passive) and the currently selected path is not the primary path. The primary path is the only path that is used to transfer data to and from the disk. Clicking this menu selection makes the selected path the primary path to the disk. See “Specifying the primary path for an array or disk” on page 450.

Set primary path for array
This lets you specify the currently selected path as the primary path to the array. The primary path is the only path that is used to transfer data to and from the array.

The array’s primary path can be set regardless of the array’s current load balance setting. This means that if a disk in the array is set to Fail Over Only (Active/Passive), the primary path for the array becomes the primary path for the disk. If the setting is set to any other load balance option, then the primary path setting for the array is not used. However, if a disk in the array is set to Fail Over Only (Active/Passive), the primary path for the array becomes the primary path for the disk.

For example, if an array has a load balance setting of round robin (Active/Active) and the primary path for the array is set to path 2-1-1, then any disk in the array that has the load balance setting of Fail Over Only (Active/Passive) will have its primary path set to path 2-1-1.

See “Specifying the primary path for an array or disk” on page 450.

Properties
The Properties command brings up the Properties screen, which displays information about the selected path, including path name, status, and SCSI address. See “Path status” on page 455.

Add and remove paths
This section describes how to add and remove paths.

After you have been using DMPW DSMs for a while, you might want to add a path to an array if you are adding more disks to the array or if you want additional fault tolerance for the array by having another path. In addition, you may want to remove a path if you are reconfiguring your system.

This section covers the following topics:
Adding a path
Removing a path
Adding a path
You might want to add a path when you add more disks to an array or to increase fault tolerance for the array.

To add a path to an array
1. Add the path by physically connecting a new cable.
2. To view the screen changes caused by the additional path, open the Disks folder in the tree view and select a disk. Then select the DMPW DSMs tab in the right-hand pane.
3. Select Actions > Rescan from VEA. DMPW DSMs scans for paths and updates the screen, reflecting any changes you have made in the physical installation.

Note: If a disk shares a path with another disk, then it must share all the same paths with the other disk. If a disk in the array is not sharing a path with any other disk in the array, then all the paths of the disk must not be shared with any other disk in the array.

Removing a path
Remove a path by physically disconnecting the cable. The system monitors existing paths and detects that the disconnected path is no longer functioning properly. The SFW display is updated to indicate this, and data transfers fail over to the next path in the sequence.

Note: You may need to perform a rescan to update the screen after removing a path from an array that was under control of DMPW DSMs. Select Actions > Rescan from VEA to display the change you have made to the configuration.

Specify load balancing settings and the primary path
This section gives the step-by-step directions for specifying the load balancing settings for the paths in an array and for individual disks.

A general discussion of these load balancing settings is available. See “Active/Active and Active/Passive settings” on page 427.

The primary path setting is only available when you select the Fail Over Only (Active/Passive) load balancing setting for an array or disk.
When you first set up an array under DMPW DSMs, you must make sure you have the load balancing setting you want for the paths in the array. After that is done, all of the disks in the array by default have the same load balancing setting. Then, if desired, you can change this setting for individual disks. The load balancing settings are located in the Load Balance Policy section of the Array Settings wizard and the Device Settings screen.

All of the load balancing settings, except for Fail Over Only (Active/Passive), enable load balancing among the active paths. The Fail Over Only (Active/Passive) setting does not provide load balancing because data transfer only occurs on the one active path, the primary path.

Note: The type of array or disk determines which load balancing settings are available. Load balance settings that are not supported are grayed-out in the VEA GUI. Refer to the documentation for your array or disk for more information about supported load balance settings.

This section covers the following topics:
Specifying load balancing settings for an array
Specifying load balancing settings for a disk
Specifying the primary path for an array or disk

Specifying load balancing settings for an array

The way to specify load balancing settings using the Array Settings wizard follows.

To specify load balancing settings for an array

1 To launch the Array Settings wizard, open the DMPW DSMs folder in the tree view.
2 Right-click the array that you are interested in and the array context menu appears.
3 Select Array Settings from the context menu.
4 The Array Settings welcome screen appears. Click Next to continue.
5 The Select Array Settings parameters screen appears.
   Select the load balancing option by clicking the appropriate radio button.
   SCSI-3 reservation support is required for all load balancing settings, except for Fail Over Only (Active/Passive). Refer to your array documentation to determine if your array supports SCSI-3 reservations before selecting any of these load balancing settings.
■ Round robin (Active/Active)
This option ensures that load balancing is used for data transfers to and from an array. With this setting, DMPW DSMs configures all paths in the array as active and I/O transfers occur on the paths each in turn, in a round-robin fashion.

■ Dynamic Least Queue Depth
This option ensures that load balancing is used for data transfers to and from an array. With this setting, DMPW DSMs configures all paths to the array as active and selects the path with the least number of I/O requests in its queue for a data transfer.

■ Balanced Path
This policy is designed to optimize the use of caching in disk drives and RAID controllers. The size of the cache depends on the characteristics of the particular hardware. Generally, disks and LUNs are logically divided into a number of regions or partitions. I/O to and from a given region is sent on only one of the active paths. Adjusting the region size to be compatible with the size of the cache is beneficial so that all the contiguous blocks of I/O to that region use the same active path. The value of the partition size can be changed by adjusting the value of the tunable parameter, Block Shift.
More details about this option are available.
See “Active/Active and Active/Passive settings” on page 427.

■ Weighted Paths
This option ensures that load balancing is used for data transfers to and from an array. With this setting, DMPW DSMs configures all paths to the array as active and selects the path with the lowest weight for data transfer. Weights are assigned by the user to designate which path is favored. If two or more paths have the same weight and are the lowest weight of all paths, then these paths are used each in turn, in round-robin fashion, for the data transfer.

**Note:** This setting is available for A/PC and ALUA arrays only at the device level. It is not available at the array level.

■ Round robin with Subset
This option ensures that load balancing is used for data transfers to and from an array. With this setting, DMPW DSMs configures all paths to the array as active and uses a subset of paths. These paths are used each in turn, in round-robin fashion, for data transfer. The subset of paths are specified by the user. The remaining paths are in standby mode.
Note: This setting is available for A/PC and ALUA arrays only at the device level. It is not available at the array level.

- Least Blocks
  This option ensures that load balancing is used for data transfers to and from an array. With this setting, DMPW DSMs configures all paths to the array as active and selects the path with the least number of blocks of I/O in its queue for data transfer.

- Fail Over Only (Active/Passive)
  This option has one primary path with the remaining path or paths on standby (backups) in case the primary path fails. The primary path is the only path that is used to transfer data. This option does not provide load balancing among paths. DMPW DSMs sets a path to be the primary path. However, you may choose a specific path to be the primary path.
  See “Specifying the primary path for an array or disk” on page 450.

If you want the selected load balancing setting to be the setting for all the arrays controlled by this specific DMPW DSMs driver, check the checkbox for All arrays under the DSM. This option means that the current load balancing setting and the other settings for this array are applied to all the arrays controlled by this specific DMPW DSMs driver.

There are specific DMPW DSMs that work with specific families of hardware arrays. If your environment has more than one family of hardware arrays under control of DMPW DSMs, then each family of hardware arrays would work with specific DMPW DSMs. When you select the option for applying all the settings to all the arrays under control of the DSM, you are applying the settings to only those arrays that work with that specific DMPW DSMs.

See the Symantec Web site for more information about which hardware arrays are supported by specific DMPW DSMs.

http://www.symantec.com/business/support/index.jsp

The default load balancing setting of an array is dependent on the particular array. Consult the documentation for your storage array to determine the default setting and any additional settings it supports.

In the sample screen shown below, the round robin (Active/Active) setting is selected.
Click Next to continue.

6 The Array Settings summary screen appears displaying the settings for the array. Review the settings and click Finish to apply the settings and exit the wizard.

For some load balance policies, such as round robin with Subset, additional specifications are required. The Array Settings wizard displays a screen before the summary screen to collect these specifications. Click Next after setting these specifications to continue to the summary screen.

**Specifying load balancing settings for a disk**

If a setting has not been specified for an individual disk, the disk assumes the same load balancing setting as the one used by the array. However, by using the Device Settings screen, you can change the load balancing option for an individual disk and make it different than the setting of the array.

DMPW DSMs automatically set the load balancing to Fail Over Only (Active/Passive) for disks under SCSI-2 reservation. The Fail Over Only (Active/Passive) setting is always used on disks under SCSI-2 reservation and the system ignores other load balance settings that may be set.

Disks under SCSI-2 reservation are:

Disks that may be in a clustering environment.
Disks with Private Disk Group Protection.

To specify load balancing settings for a disk

1. Open the DMPW DSMs folder in the VEA console’s tree view.
2. Select the disk that has the load balancing settings you want to change.
   Note that opening the Disks folder and clicking a disk that is under DMPW DSMs control is an alternate way to select a disk.
3. Make sure the DMPW DSMs tab is selected in the right pane, right-click one of the displayed paths, and then select Device Settings from the path context menu.
4. The Device Settings welcome screen appears. Click Next to continue.
5. The Select Device Settings parameters screen appears.

![Device Settings Wizard](image)

Select one of the following load balancing options:

- **Round robin (Active/Active)**
  This option ensures that load balancing is used for data transfers to and from a disk. With this setting, DMPW DSMs configures all paths to the disk as active and enables paths, each in turn, in a round-robin fashion for data transfer.

- **Dynamic Least Queue Depth**
This option ensures that load balancing is used for data transfers to and from an array. With this setting, DMPW DSMs configures all paths to the array as active and selects the path with the least number of I/O requests in its queue for a data transfer.

■ Balanced Path
This policy is designed to optimize the use of caching in disk drives and RAID controllers. The size of the cache depends on the characteristics of the particular hardware. Generally, disks and LUNs are logically divided into a number of regions or partitions. I/O to and from a given region is sent on only one of the active paths. Adjusting the region size to be compatible with the size of the cache is beneficial so that all the contiguous blocks of I/O to that region use the same active path. The value of the partition size can be changed by adjusting the value of the tunable parameter, Block Shift.

More details about this option are available.
See “Active/Active and Active/Passive settings” on page 427.

■ Weighted Paths
This option ensures that load balancing is used for data transfers to and from an array. With this setting, DMPW DSMs configures all paths to the array as active and selects the path with the lowest weight for data transfer. Weights are assigned by the user to designate which path is favored. If two or more paths have the same weight and are the lowest weight of all paths, then these paths are used each in turn, in round-robin fashion, for the data transfer.

■ Round robin with Subset
This option ensures that load balancing is used for data transfers to and from an array. With this setting, DMPW DSMs configures all paths to the array as active and uses a subset of paths each in turn, in round-robin fashion, for data transfer. The subset of paths are specified by the user. The remaining paths are in standby mode.

■ Least Blocks
This option ensures that load balancing is used for data transfers to and from an array. With this setting, DMPW DSMs configures all paths to the array as active and selects the path with the least number of blocks of I/O in its queue for data transfer.

■ Fail Over Only (Active/Passive)
This option has one primary path with the remaining path or paths on standby (backups) that are used when the current primary path fails. The primary path is the only path that is used to transfer data. This option does not provide load balancing among paths. DMPW DSMs chooses a
path to be the primary path. However, you may choose a specific path to be the primary path.

See “Specifying the primary path for an array or disk” on page 450.

Click Next to continue.

6 The Device Settings summary screen appears displaying the settings for the array. Review the settings and click Finish to apply the settings and exit the wizard.

For some load balance policies, such as round robin with Subset, additional specifications are required. The Array Settings wizard displays a screen before the summary screen to collect these specifications. Click Next after setting these specifications to continue to the summary screen.

**Specifying the primary path for an array or disk**

When an array is configured for Fail Over Only (Active/Passive) operation, you can specify the path that is used for data transfer. The specified path, called the primary path, is the only path used for data transfer.

**To specify the primary path for an array or disk**

1 Display the Set primary path screen by doing the following:

- Make sure the DMPW DSMs tab is selected in the right pane.
  To display the DMPW DSMs tab, use the tree view in the left pane to select a disk under the DMPW DSMs folder, or a disk under the Disks folder that has DMPW DSMs enabled, and then click the DMPW DSMs tab that appears in the right pane.

- In the DMPW DSMs tab, right-click on the path you want to be the primary path for the array, and select Set Primary Path from the path context menu.

The Set primary path screen appears.
2 Select to set the primary path for the device or for the array, as follows:

- **Primary path for device**
  The primary path for the device is available only when the operational mode for the path to the disk is specified as Fail Over Only (Active/Passive) and the currently selected path is not the primary path. The primary path is the only path that is used to transfer data to and from the disk. Clicking this menu selection makes the selected path the primary path to the disk. The other paths to the disk are placed on standby and available for failover.

- **Primary path for array**
  This lets you specify the currently selected path as the primary path to the array. The primary path is the only path that is used to transfer data to and from the array.
  The array's primary path can be set regardless of the array's current load balance setting. This means that if the load balance setting for the array is set to round robin (Active/Active) or other Active/Active load balance setting, then the primary path setting for the array is not used. However, if a disk in the array is set to Fail Over Only (Active/Passive), the primary path for the array becomes the primary path for the disk.
  For example, if an array has a load balance setting of round robin (Active/Active) and the primary path for the array is set to path 2-1-1, then any disk in the array that has the load balance setting of Fail Over Only (Active/Passive) will have its primary path set to path 2-1-1.

3 Click **OK** to save your setting and exit the screen.

The primary path is identified by a blue checkmark icon.

**Specifying control timer settings for an array**

Control Timer Settings for an array are a set of tunable parameters that affect the testing of a path’s status or health.
To specify control timer settings for an array

1. To launch the Array Settings wizard, open the DMPW DSMs folder in the tree view.
2. Right-click the array that you are interested in and the array context menu appears.
3. Select **Array Settings** from the path context menu.
4. The Array Settings welcome screen appears. Click **Next** to continue.
5. The Select Array Settings parameters screen appears. Edit the values for the parameters. Click **Next** to continue.

The Control Timer Settings parameters are as follows:

- **Test Path Retry Count**
  - The number of times DMPW DSMs test a path to determine if it has recovered from an error condition. The default value is 0. The maximum value is 50.

- **SCSI Command Timeout**
  - The amount of time a SCSI command waits for a device to respond to it. The default value is 30 seconds. The maximum value is 120 seconds.

- **Kernel Sleep Time**
  - The interval of time the DMPW DSMs kernel waits between attempts to recover a path from an error condition. The default value is 200 milliseconds. The maximum value is 10000 milliseconds.

- **Failover Retry Count**
  - The number of times DMPW DSMs attempt a failover to another path when the current path fails. The default value is 0. The maximum value is 50.

6. The Array Settings summary screen appears displaying the settings for the array. Review the settings and click Finish to apply the settings and exit the wizard.

For some load balance policies, such as round robin with Subset, additional specifications are required. The Array Settings wizard displays a screen before the summary screen to collect these specifications. Click **Next** after setting these specifications to continue to the summary screen.

View array, disk, and path status

DMPW DSMs provide status information for arrays, disks, and paths to the disks. Status displays are accessed through the path context menu.
This section covers the following topics:

Array status
Device status
Path status

**Array status**

To view array status with Array Properties, perform the following steps:

**To view array status**

1. Open the DMPW DSMs folder in the tree view.
2. Right-click the array that you are interested in and the array context menu appears.
3. Select **Properties** from the context menu.
4. The Properties screen appears.

The Properties screen contains the following:

<table>
<thead>
<tr>
<th>Array Name</th>
<th>Displays the name of the array. The name is fixed by the array and is not user definable.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Array Type</td>
<td>Displays the type of load balance policy in effect for the array.</td>
</tr>
<tr>
<td>Control Timer Settings</td>
<td>A set of the following tunable parameters that affect the testing of a path’s status or health.</td>
</tr>
</tbody>
</table>

- **Test Path Retry Count** — The number of times DMPW DSMs test a path to determine if it has recovered from an error condition. The default value is 0. The maximum value is 50.
- **SCSI Command Timeout** — The amount of time a SCSI command waits for a device to respond to it. The default value is 30 seconds. The maximum value is 120 seconds.
- **Kernel Sleep Time** — The interval of time the DMPW DSMs kernel waits between attempts to recover a path from an error condition. The default value is 200 milliseconds. The maximum value is 10 seconds.
- **Failover Retry Count** — The number of times DMPW DSMs attempt a failover to another path when the current path fails. The default value is 0. The maximum value is 50. Click OK to exit.
Load Balance Policy  Displays the load balancing setting in effect. There is one option, Fail Over Only (Active/Passive), that does not provide load balancing. All other options provide load balancing.
Option descriptions are available.
See “Active/Active and Active/Passive settings” on page 427.
The procedure to specify settings is described also.
See “Specifying load balancing settings for an array” on page 444.

Devices in the Array  Displays the number of disks in the array and lists them by name.

Device status
The way to view device status is as follows.

To view device status

1  In the tree view under the DMPW DSMs folder, select a disk whose status you want to view.

2  In the right pane, click the DMPW DSMs tab for the disk.

3  Right-click the path and select Device Settings from the path context menu that comes up.
4  The Device Settings welcome screen appears. Click **Next** to continue.

The Device Settings screen appears.

![Device Settings Wizard](image)

The Device Settings screen contains the setting for the **Load Balance Policy** for the disk.

**Load Balance Policy** — Indicates the setting in effect for the individual disk. The Fail Over Only (Active/Passive) option provides no load balancing. The other options provide load balancing.

Option descriptions are available.

See “Active/Active and Active/Passive settings” on page 427.

The procedure to specify settings is also described.

See “Specifying load balancing settings for a disk” on page 447.

5  Click **Cancel** to exit.

**Path status**

The way to view path status is as follows.
To view path status

1. Make sure that the path you want to view the status for is displayed in the DMPW DSMs tab in the right pane of the VEA console.

   If the DMPW DSMs tab is not showing, select a disk that uses that path in the tree view under the Disks folder. Then, in the right pane, click the DMPW DSMs tab for the disk.

2. Select the path in the DMPW DSMs tab.

   Select **Properties** from the path context menu that comes up.

   The Path Properties screen appears.

   The screen displays the following information for the selected path:

   - **Name**: The name of the selected path.
   - **Status**: DMPW DSMs have two path state indicators:
     - Healthy — The path is operational.
     - Unhealthy — The path is not operational.
   - **Primary**: Whether the path is primary or not.
   - **Port Number**: The number of the physical port on the storage array that the selected path is connected to.
   - **Channel**: The channel that is associated with the path.
   - **Target ID**: The number that, when combined with the LUN, uniquely identifies a disk on the port.
   - **LUN**: Logical Unit Number, the number that, when combined with the Target ID, uniquely identifies a disk on the port.
   - **Load Balancing Policy**: Current load balance policy in effect.

3. Click **OK** to close the screen.
Administering site-aware allocation for campus clusters

This chapter includes the following topics:

■ Overview
■ Administering hosts for site-based allocation
■ Administering disks for site-based allocation
■ Administering volumes for site-based allocation
■ Administering mirrored plexes for site-based allocation

Overview

In a campus cluster or remote mirror configuration, the hosts and storage of a cluster are allocated between two or more sites. These sites are typically connected through a redundant high-capacity network or fibre channel that provides access to the storage and communication between the cluster nodes.

If a disk group is configured with storage at multiple sites and if inter-site communication is disrupted, then a serious split-brain condition may occur. This happens when each site continues to update the local disk group configuration copies without being aware of site disruption. For service(s) to come up on a site while other sites are down, a complete (at least one complete plex for each volume) copy of data is needed. Currently, there is no mechanism to ensure that all volumes have a complete data plex at each site. Data plex keeps getting changed when a volume is resized, a disk is relocated, or when a new volume is added.
Site-aware allocation feature is included with the Symantec Storage Foundation for Windows (SFW) 6.0 release. This feature enables applications and services to function properly at a site when other sites become inaccessible. It means that even during site disruption at least one complete plex of a volume is available at each site. Such type of allocation is known as site-based allocation. Users can specify sites when creating volumes or mirrors, and site boundary limits are maintained for operations like volume grow, subdisk move, and disk relocation. Site boundary limit is crossed when a plex is not totally within a site and allocation of the plex crosses the available site boundary.

Site-aware allocation facilitates following types of site-based allocation:

- Site Confined allocation
- Site Separated allocation

Terms and definition for site-aware allocation is explained in the table below. Refer to Table 14-1 for details.

**Table 14-1** Site-aware allocation and related terminology

<table>
<thead>
<tr>
<th>Terminology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>Logical representation of a set of hosts and set of arrays or enclosures.</td>
</tr>
<tr>
<td>Site Separated</td>
<td>Storage for a volume can be taken from a site or sites specified during volume creation. Storage from multiple sites is supported for such type of allocation. Storage for a volume is allocated so that each plex of the volume resides completely on the same site, i.e., if a Site Separated volume has two plexes on two sites A and B, each plex will reside completely on a separate site. Volume Resize, relocation, relayout, or any such operation keeps each plex on its own site. Multiple plexes can reside on the same site</td>
</tr>
</tbody>
</table>
### Table 14-1  Site-aware allocation and related terminology (continued)

<table>
<thead>
<tr>
<th>Terminology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Confined</td>
<td>Storage for a volume can be taken from only a site that is specified while creating a volume. Multiple sites cannot be allocated for such type of volume allocation. The volume resides entirely on the same site. Resize, relocation, relayout, or any such operation will only use storage from the same site.</td>
</tr>
<tr>
<td>Siteless</td>
<td>Refers to a volume that is not tagged with any site information or site properties. By default, all volumes are Siteless. <strong>Note:</strong> On upgrading SFW 6.0 from previous release versions, all volume types will be “Siteless” by default. You can manually change the property of volumes after upgrading to either Site Confined or Site Separated provided that conditions like “volume need to be entirely on the same site” or “each plex of the volume resides entirely on a site” are met.</td>
</tr>
<tr>
<td>Site boundary</td>
<td>Site boundary limit is said to be crossed when a plex is not totally within a site and allocation of the plex crosses the available site boundary. Automatic operations like hot relocation, volume auto grow does not adhere to site boundary restrictions and storage that is configured with such auto operations become Siteless once site boundary limits is crossed. When a volume becomes siteless, user is notified and Event Viewer logs will display logs to verify the same.</td>
</tr>
</tbody>
</table>

**Pre-requisites for enabling site-aware allocation on a campus cluster setup**

The following prerequisites are listed below for configuring a campus cluster setup with site aware allocation:
Each host that is part of a campus cluster setup can be assigned a site name (optional requirement).
You can add a host to a site using the Veritas Enterprise Administrator (VEA) GUI or `vxassist` command line options.
See “Administering hosts for site-based allocation” on page 460.

SFW dynamic disks must be tagged with a site name to be able to use the site aware allocation feature. You can add a dynamic disk to a site through the VEA GUI or `vxdisk` command line options.
See “Administering disks for site-based allocation” on page 461.

### Administering hosts for site-based allocation

For site-based allocation, hosts can be added or removed from a site through the Veritas Enterprise Administrator (VEA) or command line options.

**Note:** Site name can take any alphanumeric values from 0 to 9, a...z, A....Z and valid characters like period (.), dash (-), and underscore ( _ ). It can be of maximum 31 characters long. Site names are case insensitive and saved in registry in small case even if user specifies the site names in upper case.

See “Administering hosts for site-aware allocation through GUI” on page 460.
See “Administering hosts for site-aware allocation through CLI” on page 461.

**Note:** If storage is tagged with site information but host is not tagged with any site name, site aware allocation feature can still be used for such storage. However, if the storage is not tagged with any site information, it cannot be used for site-based allocation.

### Administering hosts for site-aware allocation through GUI

A host can be tagged with a site name using the Veritas Enterprise Administrator (VEA) GUI.

**Adding a host to a site**

To add a host to a site through VEA, perform the following steps:
To add a host to a site through GUI

1. From the VEA console, select localhost and click Actions > Add Host to Site from the Menu.

   Additionally, you can also right-click localhost and select Site > Add Host to Site from the context menu.

2. On the Add Host to Site dialog box, enter the name of the site to which you want to add a host. Say for example, enter the name of site as site1. Click Ok.

   This adds the host to site site1.

Removing a host from a site

To remove a host from a site, perform the following through VEA console:

To remove a host from a site through GUI

1. From the VEA GUI, right-click the local host and select Site > Remove Host from Site option.

   Additionally, you can also select Menu option Actions > Remove Host from Site.

2. A message is displayed to confirm deletion of the host from the site. Click Yes to remove a host.

Administering hosts for site-aware allocation through CLI

Use the vxassist command options for adding, removing, or displaying the site for a host.

See “vxassist (Windows-specific)” on page 624.

Run the `vxassist taghost site=<sitename>` to add a host to a site named site1

See “vxassist taghost” on page 627.

Use `vxassist showtag` to list the site name to which a host belongs.

See “vxassist showtag” on page 627.

Use the `vxassist untaghost` to remove the site name for a host.

See “vxassist untaghost” on page 628.

Administering disks for site-based allocation

For site-based allocation, SFW dynamic disks can be added or removed from a site using the Veritas Enterprise Administrator (VEA) GUI or command line options.
Note: Site name can take any alphanumeric values from 0 to 9, a...z, A....Z and valid characters like period (.), dash (-), and underscore ( _ ). It can be of maximum 31 characters long. Site names are case insensitive and disk is tagged with small case even if user specifies the site names in upper case.

See “Administering disks for sites through GUI” on page 462.
See “Administering disks for sites through CLI” on page 464.
See “View disk properties” on page 131.

Administering disks for sites through GUI

SFW dynamic disks can be added to or removed from the site using the VEA GUI.

Adding a disk to a site

Perform the following steps to add a disk or multiple disks to a site through the VEA console:
To add a disk to a site

1  From the VEA console, select a disk and click **Actions > Add Disk to Site** from the Menu.

   Additionally, right-click a disk that needs to be added to a site and select the **Add Disk to Site** from the context menu.

   Select the site from a list of sites seen by a host or specify a new sitename.

2  On **Add Disk to a Site** complete the following:

   - **Available Sites**: Enable this option if you want to select a site from the drop-down list. This list contains list of sites to which a host or disk has already been added.
   - **Select a new site**: Enable this option if you want to specify a new site name, for example, **site2**.
   - **Available Disks**: From this column, select the disk or disks that you want to add to a site. Click **Select >** or **Select All >>** to add the selected disk or disks respectively to a site.

   To deselect, click **Unselect** or **Unselect All** option.

   Click **OK** to confirm disk selection.

Removing a disk from a site

Note that removing a disk from a site fails when any Site Confined or Site Separated volume resides on the disk.

Perform the following steps to remove a disk from a site through the VEA GUI:

To remove a disk from a site

1  From the VEA console, right-click disk or disks that need to be removed from a site. Select **Remove disk from Site** option from the context menu.

2  From **Remove disk from Site** window, select the disk or disks and click **Select >** or **Select All >>** respectively.

   Click **OK** to confirm selection and remove the selected disk or disks from a site.
Administering disks for sites through CLI

Disk or disks can be added to or removed from a site using the `vxdisk` command options.

You can use the following `vxdisk` command options:

- To tag a SFW dynamic disk with a sitename run the command:
  ```
  vxdisk setsite site=<sitename> <disklist>
  ```
  where sitename is the name of the site and disklist is the number of disks that are tagged.
  See “vxdisk setsite” on page 588.

- To display site information or properties of a disk, run the following command:
  ```
  vxdisk diskinfo
  ```
  See “vxdisk diskinfo” on page 577.

- `vxdisk list`
  See “vxdisk list” on page 579.

- To remove a disk from a site, run the command:
  ```
  vxdisk rmsite
  ```

**Note:** `vxdisk rmsite` command will fail on a disk if it has Site Confined or Site Separated volumes resides on the disk.

See “vxdisk rmsite” on page 589.

Administering volumes for site-based allocation

You can reset or set Sitetype property of a SFW dynamic volume either through Veritas Enterprise Administrator (VEA) GUI or command line options.

When performing operations like subdisk move & disk evacuation for site-based volumes, storage must come from the same site as the one to which the volume belongs; otherwise, the operation fails. If you are mirroring a Site-Confined volume or trying to grow a site-based volume (Site-Confined or Site Separated), then also storage should come from the same site as the original volume.
**Note:** The hot relocation operation does not adhere to site boundary restrictions. If hot relocation causes the site boundary to be crossed, then the Site Separated property of the volumes is changed to Siteless. This is done so as not to disable hot relocation. To restore site boundaries later, you can relocate the data that crossed the site boundary back to a disk on the original site and then change back the properties of the affected volumes.

See “Expand a dynamic volume” on page 146.

See “Hot relocation” on page 244.

### Setting or resetting volume Sitetype property for site allocation

A new property "Sitetype" has been added to SFW dynamic volumes.

See “Check partition or volume properties” on page 144.

The Sitetype volume property can take the following values:

- Siteless
- Site Confined
- Site Separated

See Table 14-1 on page 458.

### Setting or resetting volume Sitetype property through GUI

To set or reset the volume property through VEA, perform the following steps:
To set or reset volume property through GUI

1. From the VEA console, select a volume from the tree view to select **Actions > Change Volume Sitetype** from Menu.

   Additionally, you can also right-click a volume and select **Change Volume Sitetype** from the context menu to set the volume Sitetype property.

   Select the following options from the Change Volume Sitetype properties dialog box:

   - **Siteless to Site Separated**
     - All volumes are Siteless by default. You can set the Sitetype property of such volumes to Site Separated.
     - A Siteless volume will successfully get converted to Site Separated provided that each plex of that volume resides entirely on a site.

   - **Siteless to Site Confined**
     - You can reset the Sitetype property of a Siteless volume to Site Confined.
     - A Siteless volume will successfully get converted to Site Confined provided that all plexes of that volume reside on the same site.

2. After selecting the required option, click **OK**.

   Additionally, you can also reset the volume Sitetype property of a Site Confined or Site Separated volume to Siteless by right-clicking such a volume and selecting the required option from the context menu.

**Setting or resetting volume Sitetype property through CLI**

To set or reset volume Sitetype property through the CLI, you can use the following command options:

Use **vxassist set sitetype** command for setting the Sitetype volume property of a Siteless volume to either Site Confined or Site Separated.

```
vxassist -g<DynamicDiskGroupName> set <VolumeName|DriveLetter|VmName|DrivePath> sitetype={confined | separated}
```

Use **vxassist resetsitetype** to convert a Site Confined or Site Separated volume to Siteless volume.
Creating a dynamic volume

For creating site-based volumes (Site Confined or Site Separated), it is a prerequisite that your storage must be site tagged.

See “Administering disks for site-based allocation” on page 461.

Create SFW dynamic volumes for site-based allocation using the VEA GUI or CLI options:

Creating a volume through GUI

Creating a volume through CLI

Creating a volume through GUI

For information about creating a site-aware volume with site properties through the Veritas Enterprise Administrator (VEA) console or GUI,

Creating a volume through CLI

You can use the vxassist make command to create a volume for site-based allocation.

```
vxassist [-b] [-o notrackalign] -g<DynamicDiskGroupName> make
<VolumeName> [length][type{mirror|raid5|stripe}[[,log]]
[<alloc_attributes...>][Column=N] [StripeUnit=<width>]
[Site=<sitename1>[,<sitename2>,...]]
[DriveLetter={A|B..|Z}|DrivePath=<DrivePath>][<!]diskname | p#c|t#l#> ...
```

See “vxassist make” on page 591.

For example run the following command:

```
vxassist -g testdg make testvol1 100M Site=s1
```

The above command will create a Site Confined volume (testvol1) on disks belonging to site (s1)

For example, run the following command:

```
vxassist -g testdg make testvol1 100M type=mirror mirror=3 Site=s1
```
The above command will create a Site Confined volume (`testvol1`) with all three plexes residing on disks belonging to site (s1.)

For example, run the following command:

```
vxassist -g testdg make testvol1 100M type=mirror mirror=3 Site=s1,s2,s3
```

The above command will create a Site Separated volume (`testvol1`) with each of the three plexes residing on disks belonging to sites (s1, s2, and s3) respectively.

### Administering mirrored plexes for site-based allocation

If you create more than one mirror at a time, you may see inconsistent information on the progress bar. Also, the generation of multiple mirrors does affect system resources. After creating a mirror, you may want to wait until it has finished generating before creating another mirror.

See “Dynamic volume types” on page 59.

---

**Note:** Adding mirrors to a volume involves a certain amount of time for mirror resynchronization. Take care not to perform actions on the volume until the command is complete. Also, if you inadvertently shut down the server or deport the disk group containing the volume before mirror resynchronization completes, any mirrors that were being added to the volume will be deleted when the disk group with the volume comes online again.

---

### Adding a mirror to a site-based volume through GUI

If you want to add a mirrored plex to a disk or storage that is not site tagged, then you should change the volume Sitetype property to Siteless.

In case of a Site Confined volume, mirrors can be added within the same site only, say for example **Site1**. If you want to add a mirrored plex to a different site, say **Site2**, then you should change the volume Sitetype property to Site Separated or Siteless.

In case of a Site Separated volume, mirrors can be added to a different site. All volumes that are required for an application to come up must have a complete plex at all the specified sites. Writes are written to the specified sites as done in case of a normal mirrored volume.

See “Setting or resetting volume Sitetype property for site allocation” on page 465.
Perform the following steps to add a mirror:
To add a mirror for a site-based volume

1. Right-click the volume you want to mirror.
2 Select **Mirror > Add** from the context menu.

The Add Mirror wizard appears. Specify how many mirrors you want to add to the volume, and, if required, manually assign the destination disks for the mirrors.

Complete the following on this screen:

- **Name of the Volume**
  - Default name of the volume to which you want to add a mirror is displayed

- **Number of mirrors to add**
  - Select the number of mirrors you want to add from this drop-down list.
Select site from

If the volume is site Separated, then this list is displayed. Select sites as per your requirement. Disks are displayed in Available disks as per specified sites.

If volume is Siteless, then this list is grayed out and all available disks are displayed for selection.

If the volume is Site Confined, then this site selection list is grayed out and disks from the same site as volume are displayed.

Auto select disks

Enable this option, if you want to assign disks automatically.

Manually select disks

Enable this option, if you want to manually assign disks.

The volume site type, whether Site Confined or Site Separated, is displayed based on system auto-selection.

Select disk or disks from the Available disk list and click Select or Select All respectively.

Click Next.

3 In the Specify the attributes dialog box, select the Concatenated or Striped volume layout type. If you are creating a striped mirror, the Columns and Stripe unit size boxes need to have entries. Defaults are provided.

You may also specify a mirror that mirrors across disks with the following attributes:

- Connected by port
- Identified by target
- Contained in an enclosure
- Connected by channel

In addition for a striped layout, you may specify to have the stripe across disks done by the following:

- Port
- Target
- Enclosure
The operation to create a new dynamic volume fails if the appropriate resources are not available to support the selected attributes to mirror across disks.

4 On the summary page, click Finish to add the mirror.

Adding a mirror to a site-based volume through CLI

Use the vxassist mirror command to add a mirror to an existing site-based volume.

```
vxassist [-b] [-o notrackalign] [-g<DynamicDiskGroupName>] mirror
<VolumeName|DriveLetter|VmName|DrivePath> [type=stripe]
[<alloc_attributes ...>] [Column=N] [StripeUnit=<width>]
[Site=<sitename1>[,<sitename2>,...]] [<!|]diskname | p#c#t#l#> ...
```

For example, run the following command:

```
vxassist -g testdg mirror testvol Site=s1
```

Here, testvol is a Site Confined volume residing on site s1. This creates a mirror of volume (testvol) on disks belonging to site (s1).

For example, run the following command:

```
vxassist -g testdg mirror testvol mirror=2 Site=s2,s3
```

Here, testvol is a Site Separated volume residing on site s1. This creates two mirrors of volume (testvol) with one plex on disks belonging to site (s2) and other on disks belonging to site (s3).
Administering site-aware allocation for campus clusters
Administering mirrored plexes for site-based allocation
Chapter 15

Administering storage migration for SFW and Hyper-V virtual machine volumes

This chapter includes the following topics:

■ About storage migration
■ About performance tunables for storage migration
■ Setting performance tunables for storage migration
■ About performing online storage migration
■ Storage migration limitations
■ About changing the layout while performing volume migration
■ Migrating volumes belonging to SFW dynamic disk groups
■ Migrating volumes belonging to Hyper-V virtual machines
■ Migrating data from SFW dynamic disks of one enclosure to another
■ Converting your existing Hyper-V configuration to live migration supported configuration
About storage migration

SFW provides the ability to move volumes to new storage locations via the Storage Migration Wizard. The storage migration feature facilitates moving multiple volumes to different sets of disks while the volumes are still online. Volumes associated with a Hyper-V virtual machine (VM) or an SFW disk group can be moved in a single administrative operation while the volumes are online without stopping the applications or Hyper-V VMs.

Storage migration provides administrators great flexibility when deploying new arrays or moving to LUNs that are configured for better performance.

**Note:** Volume layout and site boundary constraints are preserved during storage migration.

See “Administering volumes for site-based allocation ” on page 464.

About performance tunables for storage migration

Performance tunables are provided to optimize the time taken for the storage migration operation. Using them, you can enhance the storage migration performance, in migrating data from source disks to target disks. These new performance tunables gives you the flexibility to trade between storage migration performance and application performance.

Usage of performance tunables is limited to storage migration operation only. The following new performance tunables are introduced:

- I/O size
- Task Threads

You can access these tunables from VEA > Control Panel > Task Settings > Configuration Task Performance Tuning tab.

For more details about these tunables, see “Setting performance tunables for storage migration” on page 476.

Setting performance tunables for storage migration

The performance tunables are set at default values. However you can define these values, to optimize the storage migration performance:
I/O size  
To read or write data to the disks during migration.
To trade off between application performance and storage migration performance.
The I/O size tuning is not applicable for migration of striped volumes, if you do not change the layout.
IO size, default value (in sectors) = 4096, Lower Bound = 128, Upper Bound = 16384

Task threads  
To perform the subdisk move
Can be specified separately for storage migration tasks
Operations initiated from array migration and storage migration wizards, use task threads value, specified under storage migration tunables.
Task threads, default value = 1, Lower Bound = 1, Upper Bound = 20

Perform the following steps from the system where the storage (disk group volumes or array enclosure disks) is mounted and online.

To set the storage migration performance tunables

1  Launch VEA from Start > Programs > Symantec > Symantec Storage Foundation > Veritas Enterprise Administrator or, on Windows 2012 operating systems, from the Apps menu in the Start screen.
   Connect to the local system.

2  Click Control Panel in the left panel and then double-click Task Settings in the right pane.
3  On the localhost - Task Settings window, click the **Configuration task performance tuning** tab to view the new performance tunables.

4  In the Storage migration tunable box, define appropriate values for the new tunables, I/O size and Task threads, and then click **OK**.

   The attribute values take effect immediately and apply to all the storage migration operations run subsequently.

   These settings do not apply to storage migration operations that are already in progress.

**About performing online storage migration**

The storage migration wizard migrates data on the disks from one enclosure to another, by moving volumes and optionally changing their layout. This is achieved in a single administrative operation, while the volumes are online, and without stopping the applications.

The following operations are available to perform online storage migration:

- Migrate volumes belonging to SFW dynamic disk groups.
  See “Migrating volumes belonging to SFW dynamic disk groups” on page 479.
- Migrate volumes belonging to Hyper-V virtual machines.
See “Migrating volumes belonging to Hyper-V virtual machines” on page 482.

- Migrate data from SFW dynamic disks of one enclosure to another.
  See “Migrating data from SFW dynamic disks of one enclosure to another” on page 484.

Storage migration limitations

The limitations while performing storage migration are as follows:

- For migrating volumes, the target disks selected for migration must belong to the same disk group.

- If the Hyper-V virtual machine configuration spans across multiple disk groups, then storage migration should be performed on a per disk group basis.

- RAID-5 volumes are not supported for migration.

About changing the layout while performing volume migration

You can change the volume layout while migrating it, from concatenated to striped or vice versa. In addition, you can also change the number of columns or stripe unit size of a stripe volume.

For a mirrored volume, the specified target layout applies to all the plexes of that particular volume, except the snap ready plexes.

Migrating volumes belonging to SFW dynamic disk groups

Use this procedure to perform storage migration for SFW dynamic disk groups.

Ensure that the disk groups that you want to migrate are imported on the system where you run this procedure.
To migrate volumes belonging to SFW dynamic disk groups

1. Launch VEA from Start > Programs > Symantec > Symantec Storage Foundation > Veritas Enterprise Administrator or, on Windows 2012 operating systems, from the Apps menu in the Start screen.

Connect to the local system.

2. In the left panel expand Disk Groups and then either right-click and select Migrate Storage or from the menu bar click Actions > Migrate Storage to start the Storage Migration Wizard.

3. Review the prerequisites on the Welcome panel and then click Next.

4. On the Storage Component Selection panel, Select Migrate disk group volumes, and then select the desired disk group from the drop-down list and click Next.

5. On the Disk Group Volume Selection panel, you can select one or more volumes for online migration. The Select all volumes option is selected by default. Clear the Select all volumes option and press Ctrl+click if you want to select one or more volumes for online migration. Click Next.

6. On the Disk Group Volume Target Selection panel, you can select the source volumes and the corresponding target disks to migrate volumes. The Select all volumes checkbox is selected by default. Clear the Select all volumes
checkbox to map target disks to individual volumes and **Change layout** if desired. Press Ctrl+click to select multiple target disks.

- All selected source volumes can migrate to any target disks if the **Select all volumes** option is selected.
- If you select the **Select all volumes** option, you will not have the option to change the layout. The layout can be changed only on selecting individual volumes.
- If you select the **Change layout** checkbox and opt to change the layout of the volume, the target layout column gets populated with the selected layout, otherwise **Unchanged** will be displayed.

Click **Next** to go to the Summary panel.

Unless the validation status of all the volumes shows **Success**, the GUI will not navigate to the next panel. The validation status column will be populated when you click **Next** on the Disk Group Volume Target Selection panel.

7 On the Summary panel, the mapping of the source volumes and target disks is shown based on the selection done on the previous panel. The Storage migration summary panel displays the name of the disk group, the source volumes, target layout and the target disks.

If the select all option is selected then the summary is shown in the form of a grouping of source volumes and target disks. If the select all option is unchecked, the individual selected volumes and assigned target disks will be displayed on the summary panel, according to the selection made by you.

The **Save Summary** button on the Summary panel lets you to save user selection summary in an HTML file.

The default summary file name is `StorageMigration_Summary_yyyy_MM_dd_HH_mm_ss.html`.

The default location of the file is `%allusersprofile%\veritas`.

8 **Click Finish** to begin the volume migration.

9 Now check the storage migration status (whether successful or failed) by completing the following on the VEA:

- Click the **Console** tab on the bottom panel of the VEA.
- Verify that separate Subdisk move tasks are created per subdisk.
- Click the **Tasks** tab on the VEA to check the tasks progress in the bottom panel of the console.
- Wait for all Subdisk move tasks to complete.
From the Disk View tab verify that all selected volumes are now migrated to the selected destination disks.

Migrating volumes belonging to Hyper-V virtual machines

Use this procedure to migrate volumes belonging to Hyper-V virtual machines.

Ensure that the disk groups that you want to migrate are imported on the system where you run this procedure.

To migrate volumes belonging to Hyper-V virtual machines

1. Launch VEA from Start > Programs > Symantec > Symantec Storage Foundation > Veritas Enterprise Administrator or, on Windows 2012 operating systems, from the Apps menu in the Start screen.
   Connect to the local system.

2. Launch the Storage Migration Wizard.
   Right-click localhost and then click Migrate Storage.
   Or, select localhost and then on the menu bar, click Actions > Migrate Storage.

3. Review the prerequisites on the welcome panel and then click Next.

4. On the Storage Component Selection panel, select Migrate volumes used by Microsoft Hyper-V virtual machines, and select the desired virtual machine from the drop-down list.
5 Click **Next** to navigate to the Disk Group Volume Selection panel. You can select one or more volumes for online migration. The **Select all volumes** option is selected by default. Clear the **Select all volumes** option and press Ctrl+click if you want to select one or more volumes for online migration. Click **Next**.

6 On the Disk Group Volume Target Selection panel, you can select the source volumes and the corresponding target disks to migrate volumes. The **Select all volumes** checkbox is selected by default. Clear the **Select all volumes** checkbox to map target disks to individual volumes and **Change layout** if desired. Press Ctrl+click to select multiple target disks.

- All selected source volumes can migrate to any target disks if the **Select all volumes** option is selected.
- If you select the **Select all volumes** option, you will not have the option to change the layout. The layout can be changed only on selecting individual volumes.
- If you select the **Change layout** checkbox and opt to change the layout of the volume, the target layout column gets populated with the selected layout, otherwise **Unchanged** will be displayed.

Click **Next** to go to the Summary panel.
Unless the validation status of all the volumes shows Success, the GUI will not navigate to the next panel. The validation status column will be populated when you click Next on the Disk Group Volume Target Selection panel.

7. On the Summary panel, the mapping of the source volumes and target disks is shown based on the selection done on the previous panel. The Storage migration summary panel displays the name of the disk group, the source volumes, target layout and the target disks.

If the select all option is selected then the summary is shown in the form of a grouping of source volumes and target disks. If the select all option is unchecked, the individual selected volumes and assigned target disks will be displayed on the summary panel, according to the selection made by you.

The Save Summary button on the Summary panel lets you save the selection summary in an HTML file.

The default summary file name is StorageMigration_Summary_yyyy_MM_dd_HH_mm_ss.html.

The default location of the file is %allusersprofile%\veritas.

8. Click Finish to begin the volume migration.

9. Now check the storage migration status (whether successful or failed) by completing the following on the VEA:
   ■ Click the Console tab on the bottom panel of the VEA.
   ■ Verify that separate Subdisk move tasks are created per subdisk.
   ■ Click the Tasks tab on the VEA to check the tasks progress in the bottom panel of the console.
   ■ Wait for all Subdisk move tasks to complete.
   ■ From the Disk View tab verify that all selected volumes are now migrated to the selected destination disks.

Migrating data from SFW dynamic disks of one enclosure to another

Use this procedure to migrate data from SFW dynamic disks of one enclosure to another.
To migrate data from SFW dynamic disks of one enclosure to another

1. Launch VEA from **Start** > **Programs** > **Symantec** > **Symantec Storage Foundation** > **Veritas Enterprise Administrator** or, on Windows 2012 operating systems, from the **Apps** menu in the **Start** screen.

   Connect to the local system.

2. Launch the Storage Migration Wizard.

   Right-click the **Enclosures node**, and then on the menu bar click **Actions** > **Migrate Storage**.

   Or, right-click **Enclosures Node** or an individual enclosure and then select **Migrate Storage**.

3. Review the prerequisites on the Welcome panel and then click **Next**.

4. On the Storage Component Selection panel, select **Migrate data from an array** and then from the drop-down list choose the source array enclosure.

5. Click **Next** to navigate to the Enclosure Disk Selection panel.

   The disks may lie on different disk groups. Select the number of required source disks either by manually selecting one or more source disks for migration or by selecting the **Select all disks** option.

   **Note:** Only SFW dynamic disks are available for selection as source disks.

   After selecting the source disks click **Next** to continue.

6. On the Enclosure Disk Target Selection panel, select the target enclosure, as well as map source disk to the destination disk.
Two options for target disk selection mode are available: **Automatic** and **Manual**.

- In the **Automatic** mode, the source, and target disks are mapped automatically.
- In the **Manual** mode, you can map source disk to target disk manually. Here there is a 1:1 mapping from source to target disk.

Click **Next** to continue after selecting the desired option.

7 The Summary panel shows the summary of the mapping.

The **Save Summary** button on the Summary panel lets you save the selection summary in an HTML file.

The following details are given in the summary:

- **Automatic** mode: Source Enclosure, Target Enclosure, and Source Disks: Target Disks. Here the disk grouping by automatic disk selection is shown.

- **Manual** mode: Source Enclosure, Target Enclosure, and Source Disks: Target Disks. Here the 1:1 mapping of source and target disks is shown.

The default summary file name is `StorageMigration_Summary_yyyy_MM_dd_HH_mm_ss.html`.

The default location of the file is `%allusersprofile%\veritas`. 
8  Review the summary and click **Finish** to begin the enclosure migration operation.

9  Now check the storage migration status (whether successful or failed) by completing the following on the VEA:

   - Click the **Console** tab on the bottom panel of the VEA.
   - Verify that separate Subdisk move tasks are created per subdisk.
   - Click the **Tasks** tab on the VEA to check the tasks progress in the bottom panel of the console.
   - Wait for all Subdisk move tasks to complete.
   - From the **Disk View** tab verify that all selected volumes are now migrated to the selected destination disks.

**Converting your existing Hyper-V configuration to live migration supported configuration**

Through the storage migration wizard, it is possible to convert your existing Hyper-V virtual machine (VM) configuration to a live migration supported configuration (one Hyper-V virtual machine per disk group).

Before you convert or change the existing Hyper-V virtual machine configuration to a live migration supported configuration, it is presumed here that you have completed the following procedures already:

- Create disk groups and dynamic volumes  
  See “Create dynamic disk groups” on page 47.  
  See “Create dynamic volumes” on page 52.
- Copy Virtual Hard Disks (VHDs) to volumes
- Create at least two Hyper-V virtual machines (VMs)

**To convert a Hyper-V configuration to a live migration supported configuration**

1  To migrate volumes that belong to a Hyper-V virtual machine to empty disks, make sure that you have completed migrating volumes belonging to Hyper-V virtual machines.

   See “Migrating volumes belonging to Hyper-V virtual machines” on page 482.

2  Now check storage migration status (whether successful or failed) by completing the following on the VEA:

   - Click the **Console** tab on the bottom panel of the VEA.
   - Verify that separate Subdisk move tasks are created per subdisk.
Click the **Tasks** tab on the VEA to check the tasks progress in the bottom panel of the console.

- Wait for all Subdisk move tasks to complete.

- From the **Disk View** tab verify that all selected volumes are now migrated to the selected destination disks.

**3** After storage migration completes successfully, split the disk group into two disk groups by selecting the dynamic disk group created by you already in the preceding sections. Right-click the disk group to launch the split dynamic disk group wizard

OR

On the VEA, right-click a disk group to select the split dynamic disk group option.

See “Dynamic Disk Group Split and Join” on page 365.

See “Create dynamic disk groups” on page 47.

Click **Next**.
4 Specify the **New dynamic disk group name** (Say DG2).

Select **Split dynamic disk group by disks** option.

Select the disks to which Hyper-V volumes are migrated.

Click **Next**.

5 The Summary page is displayed. Click **Finish** to exit the wizard.

Now the configuration is changed to one virtual machine per disk group.
Administering storage migration for SFW and Hyper-V virtual machine volumes

Converting your existing Hyper-V configuration to live migration supported configuration
Microsoft Failover Clustering support

This chapter includes the following topics:

■ Overview
■ How SFW works with Microsoft Failover Clustering
■ Create a cluster dynamic disk group
■ Making the cluster disk group a cluster resource in Windows Server operating systems
■ Displaying the cluster disk group resource properties on Windows Server operating systems
■ Create a dynamic mirrored quorum resource
■ Microsoft Failover Cluster quorum arbitration time settings
■ Additional considerations for SFW Microsoft Failover Clustering support

Overview

You can use Symantec Storage Foundation for Windows (SFW) to manage the Microsoft Failover Clustering feature.

Symantec Storage Foundation for Windows supports a Microsoft Failover Clustering configuration. A cluster consists of two or more nodes, which are linked servers that support a set of common resources and provide an image of a single system to the client. Microsoft Failover Clustering has failover functionality so that if one of the nodes fails or is taken offline, another node gains access to all
resources held by the failed node, thus providing minimum downtime for applications using these resources.

With Symantec Storage Foundation for Windows, you can create mirrored, RAID-5, and other advanced dynamic volumes on clustered storage.

To use Symantec Storage Foundation for Windows with Microsoft Failover Clustering, perform the following main tasks:

- Set up the cluster environment.
  The minimum requirement is two servers connected by a network. The servers must be on a shared SCSI or Fibre Channel bus. You need to install and configure Microsoft Failover Clustering on each computer that is to be a member of the new cluster.

- Install SFW and create one or more cluster disk groups.
  The process is almost identical to creating a regular dynamic disk group in SFW, except that when you create a cluster disk group, the program sets up the group so that it can be accessed by a Microsoft failover cluster and be used as a resource in the cluster. You create the desired dynamic volumes in the cluster disk group in exactly the same way as in a regular dynamic disk group. See “Create a cluster dynamic disk group” on page 496.

- Use the Windows Server's Failover Cluster Manager snap-in to add the cluster disk group as a resource to the cluster.
  After this step is done, the storage is part of the cluster and is associated with a specific node of the cluster. If the node fails or goes offline, the clustered storage on the node is transferred to another node in the cluster. If you are using an application, you may want to set up a separate resource group for the application.

**Note:** For detailed instructions on setting up SFW and Microsoft Failover Clustering with an application and also for integrating it with Symantec Storage Foundation Volume Replicator (Volume Replicator), see the procedures in the *Symantec Storage Foundation and High Availability Solutions Solutions Guide*. The Solutions Guide also has instructions for setting up SFW and Microsoft Failover Clustering with Volume Replicator.

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**How SFW works with Microsoft Failover Clustering**

Microsoft Failover Clustering provides a set of standard resources, such as physical disks, file and print shares, and network addresses and names. Each resource is accessed using a resource DLL and an extension DLL. The resource DLL provides
communication between Microsoft Failover Clustering and the resource. The extension DLL allows the user to set the resource properties.

Microsoft also allows vendors to integrate product-specific resources into Microsoft Failover Clustering through the use of custom resource and extension DLLs. SFW’s product-specific resource is the Symantec Storage Foundation for Windows disk group resource with its two DLLs, Disk Group resource DLL and Cluster Administrator extension DLL.

The block diagram below shows the relationship between Symantec Storage Foundation for Windows cluster components and the Microsoft Cluster Service.

The initial install program for Symantec Storage Foundation for Windows will install both the Symantec Storage Foundation for Windows disk group resource DLL and the Cluster Administrator extension DLL, provided that you select the Microsoft Failover Clustering feature option and the installer detects that Microsoft Failover Clustering is already installed and running on the server.

In the situation where you want to add Microsoft Failover Clustering, SFW is enabled to install these resources and the extension DLLs.

See "Installing Microsoft Failover Clustering after SFW is already installed" on page 493.

If you are installing the client version of Symantec Storage Foundation for Windows, you can choose the client install and the Microsoft Failover Clustering feature option. This combination installs remote cluster support on the client computer and does not require Microsoft Failover Clustering to be installed on that computer. However, Symantec Storage Foundation for Windows and SFW Microsoft Failover Clustering support must be installed on any servers that the client manages.

### Installing Microsoft Failover Clustering after SFW is already installed

This section describes the steps needed to install Microsoft Failover Clustering support on a server if Symantec Storage Foundation for Windows is already installed. You will need to do a "rolling install," in which you install the SFW Microsoft Failover Clustering support option on the inactive node or nodes of the cluster first. Then you make the active cluster node inactive by moving the cluster resources to another node and install on that node.

**Note:** After completing the steps provided below, you must ensure that the Volume Manager Disk Group (VMDg) resource has been registered. If not, then you need to register it manually. For information about registering the resource manually, refer to the *Symantec Storage Foundation and High Availability Solutions Installation and Upgrade Guide.*
To install Microsoft Failover Clustering option when SFW is installed

1 First, you must have a Microsoft failover cluster set up and have failover clusters running on each server where you want to install the SFW Microsoft Failover Clustering option. SFW also must be running on each server in the cluster.

2 On the inactive node of the cluster, select Add or Remove Programs in the Windows Control Panel.

3 From the menu located on the left side of the Add or Remove Programs window, select Change or Remove Programs.

4 Highlight the SFW Server Components entry and click Change.

5 The installer window appears. Select Add or Remove to add or remove features. Click Next to continue.

6 The Option Selection window appears. Check the Cluster Option for Microsoft Failover Cluster.

   If the option is grayed out, add its license key with the following:

   ■ Click the Add License link located at the far right of the window to add a license key for an option.

   ■ In the pop-up window that appears, enter the license key for the option and click OK. Click the checkbox to add the option.

   Click Next to continue.

7 The Validation window appears. The installer checks for prerequisites for the selected systems and displays the results. Review the information and click Next to continue.

8 The Summary window appears. Review the information and click Update to begin the product update.

   The Update Status window appears. Status messages and the progress of the update are displayed. At the completion of the update, click Next to continue.

9 A report summarizing the update appears. Review the information and click Next to continue.

10 The Thank You window appears when the feature has been added or removed. Click Finish to complete the process.
11 A message box appears. Click Yes to restart your system and complete the update.

12 Complete the installation by repeating the sequence on any remaining nodes. For the active node, use the Move command with Windows Server's Failover Cluster Manager snap-in to move the cluster resources to another node before installing.

**To enable the Failover Cluster Command Interface feature in Windows Server 2012 after installing SFW**

In Windows Server 2012, the Failover Cluster Command Interface feature is disabled by default. However, if you are working on a Microsoft Failover Clustering environment, then this feature needs to be enabled before installing SFW. The SFW installation uses cluster.exe to register its resources, such as Volume Manager Disk Group (VMDg), with Microsoft Failover Clustering so that they are displayed in the Failover Cluster Manager GUI. Therefore, if the mentioned feature is not enabled, then these resources are not registered and will not appear in Failover Cluster Manager.

To enable the Failover Cluster Command Interface feature in Windows Server 2012 for a Microsoft Failover Clustering environment, using Server Manager's Add Roles and Features Wizard, select the Failover Cluster Command Interface option under **Features > Remote Server Administration Tools > Feature Administration Tools > Failover Clustering Tools**. For more information, refer to the Microsoft documentation.

In case you did not enable the Failover Cluster Command Interface feature before installing SFW, you can do so after installing SFW using one of the following methods:
Using Windows Powershell cmdlets:

1 To import the FailoverClusters module, type the following cmdlet:

```
Import-module failoverclusters
```

2 To register the VMDG resource type, type the following cmdlet:

```
Add-ClusterResourceType "Volume Manager Disk Group"
C:\Windows\Cluster\vxres.dll -DisplayName "Volume Manager Disk Group"
```

3 To register the (Replicated Volume Group) RVG resource type, type the following cmdlet:

```
Add-ClusterResourceType "Replicated Volume Group"
C:\Windows\Cluster\mscsrvgresource.dll -DisplayName "Replicated Volume Group"
```

Using commands:

1 Enable the Failover Cluster Command Interface feature as mentioned above.

2 Run the following cluster commands to manually register SFW resources with Microsoft Failover Clustering:

- To register the VMDG resource type:
  
  ```
  cluster RESTYPE "Volume Manager Disk Group" /CREATE /DLL:vxres.dll /TYPE:"Volume Manager Disk Group"
  ```

- To register the RVG resource type:
  
  ```
  cluster RESTYPE "Replicated Volume Group" /CREATE /DLL:mscsrvgresource.dll /TYPE:"Replicated Volume Group"
  ```

Create a cluster dynamic disk group

This section contains a summary of the steps necessary to create a cluster disk group.

To create a cluster disk group, follow the steps for creating a new dynamic disk group here at:

See “Create dynamic disk groups” on page 47.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support cluster disk groups.
In the step for defining the attributes, be sure to check the Create cluster group checkbox.

Please note the following considerations in this process:

- When creating a cluster disk group for use as a Volume Manager Disk Group resource, make sure that the disk group name is unique across the cluster. If the cluster software attempts to fail over a disk group to another node that has a disk group with the same name or if you move a disk group to another node that has a disk group with the same name, unpredictable results can occur.

- When assigning a drive letter to a new volume that is going to be part of a Symantec Storage Foundation for Windows disk group resource, make sure the drive letter assigned is available on all other nodes. Failure to do so may result in drive letter changes when the resource is moved or failed over to another node.

- SFW normally does not let you create a cluster dynamic disk group with disks that are on the same bus as the cluster node's system or boot disk, but you can now remove this limitation by running a `vxclus` command from the SFW command line interface. Users have requested this change to facilitate booting from a SAN. If you plan to set up your system to boot from a SAN, proceed with caution to make sure that you are following the correct procedure. See “vxclus” on page 572.

- Setting up the cluster disk group on a Windows Server operating system creates physical disk resources for all the basic disks on the shared bus. Later, you create resources for the SFW cluster disk groups. Before doing so, you must remove any physical disk group resources for disks used in the cluster disk groups. Otherwise, a reservation conflict occurs.

After creating the cluster disk group, create the necessary dynamic volumes on the cluster disks.

### Making the cluster disk group a cluster resource in Windows Server operating systems

The following steps describe how to make a Symantec Storage Foundation for Windows cluster disk group a resource in a cluster.
To make the cluster disk group a cluster resource

1. From the **Start** menu (the **Start** screen on Windows 2012 operating systems), click **Administrative Tools**.

   Launch the Failover Cluster Manager snap-in by clicking **Failover Cluster Manager**.

2. Expand the cluster from the tree view in the left pane to display **Roles**.

3. Right-click **Roles**, and then select **Create Empty Role** from the context menu.

   The new role is created under the **Roles** pane in the center.

4. Right-click the role that you just created, and then select **Properties** from the context menu.

   The New Role Properties window appears.

![New Role Properties window](image)

5. Enter a name for the new role in the **Name** field, and then click **OK** to continue.

6. To add a Volume Manager Disk Group (VMDg) resource, right-click the role, and then select **Add Resource** > **More Resources** > **Volume Manager Disk Group**.

   In the pane below the **Roles** pane, click the **Resources** tab to see information about the new VMDg resource.
7 In the pane below the Roles pane, click the Resources tab, right-click New Volume Manager Disk Group, and then select Properties from the context menu.

The New Volume Manager Disk Group Properties window appears.

8 Under the General tab, enter a name for this new resource in the Name field, and then click OK to continue.
9 Under the **Properties** tab, view and modify the private properties of this resource.

The table in the properties panel gives the following details:

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DiskRunChkDsk</td>
<td>Specify whether SFW should perform a file system check on the disks each time the cluster resource is brought online. If enabled, SFW automatically cleans the file system by running the <code>chkdsk /x /f</code> command on the volume that is being brought online, if dirty bit is set on that volume. The value 1 (enabled) indicates that SFW performs the file system check and the value 0 (disabled) indicates that it does not. The default is 0 (disabled).</td>
</tr>
<tr>
<td>FastFailover</td>
<td>Specify whether the VMDg resource should be enabled for fast failover. Specify &quot;true&quot; for enabling it and &quot;false&quot; for disabling it. The default value is &quot;true&quot;.</td>
</tr>
<tr>
<td>DiskGroupName</td>
<td>Specify the name of the SFW cluster disk group that you want to configure as a cluster resource.</td>
</tr>
</tbody>
</table>
Note: A VMDg resource is not marked as online until all volumes in it are verified using chkdsk utility, if the value is set to 1.

10 The Summary tab displays the new cluster resource. The cluster resource's status should be online. If it's not, then right-click it, and then select Bring Online to bring the resource online.

11 In the tree-view of Failover Cluster Manager, expand the Storage node to review the attributes of the new cluster resource.

Notes:

■ SFW uses the Windows temporary folder (typically C:\Windows\temp) to store the output of the chkdsk command.
  If there is not enough disk space or if the logged-on user does not have write access to the temporary directory, the Volume Manager Disk Group (VMDg) resource may fail due to a chkdsk error.
  The cluster log shows the following message:
  ERR [RES] Volume Manager Disk Group <FORCHKDSK>: RunChkDsk: Failed to get the temporary file.
  You need to run chkdsk manually to bring the resource online.

■ chkdsk fails to execute on a disk group under replication and does not come online.
  If chkdsk is run on a volume that is under replication, cluster logs display the following error message:
  Windows cannot run disk checking on this volume because it is write protected.
  In such a scenario, replication locks the volume, as a result chkdsk cannot be executed, and the VMDg resource is marked as failed because chkdsk has failed.
  Therefore the VMDg will not come online.
  Do not enable chkdsk on a disk group that is under replication.
  Remove a disk group out of replication and run chkdsk manually.

■ If the VMDg resource has a dirty volume, then Windows shows a pop-up while the volume mounts. Set the chkdsk property of the VMDg resource under Microsoft Failover Clustering to '1' to perform automatic verification of that volume.
Displaying the cluster disk group resource properties on Windows Server operating systems

The following displays the cluster disk group resource properties.
To display cluster disk group resource properties

1. From the **Start** menu (the **Start** screen on Windows 2012 operating systems), click **Administrative Tools**.
   
   Launch the Failover Cluster Manager snap-in by clicking **Failover Cluster Manager**.

2. Expand the tree view in the left pane to display the **Storage** node.

   Expand the **Storage** node, and then select **Disks**. The cluster disk group resource is displayed in the **Disks** pane.

   The Summary of Storage window appears displaying the cluster disk group resource.
3 Right-click the cluster disk group resource and select Properties from the context menu.

The Properties window appears where you can view the properties of the cluster disk group resource.

Create a dynamic mirrored quorum resource

When you install the first node of a cluster, you specify a basic disk volume for a physical disk resource known as the quorum resource. This resource contains the
cluster log and is also used for determining which node in a cluster has control over the cluster. If the physical disk quorum resource fails or becomes corrupted, the cluster becomes unusable.

A quorum resource failure can be avoided by using a dynamic mirrored quorum resource instead of a physical disk quorum resource. Unlike a physical disk quorum resource, which contains a single disk, a dynamic mirrored quorum resource will provide a high level of redundancy by allowing the mirroring of the quorum disk. It is strongly recommended that a dynamic mirrored quorum contain three disks because a cluster disk resource cannot be brought online unless a majority of disks are available. With the quorum volume in a two-disk group, loss of one disk will prevent the quorum volume from coming online and make the cluster unavailable.

If you are using a system running SQL Server, a problem can occur when migrating to a dynamic mirrored quorum volume.

**Microsoft Failover Cluster quorum arbitration time settings**

When the SFW Microsoft Failover Clustering support option is selected during installation, a message appears to remind you that the maximum quorum arbitration time can be adjusted to ensure optimal functioning of SFW dynamic volumes with Microsoft Failover Clustering.

The quorum arbitration time setting is used to set the limit of the time period that is allowed for quorum arbitration. Quorum arbitration is the process that occurs when the controlling node of the cluster is no longer active and other nodes of the cluster attempt to gain control of the quorum resource and thus control of the cluster.

You may want to set up a dynamic quorum resource.

The advantage of a dynamic quorum is that it can be mirrored to provide fault tolerance for the quorum resource.

---

_**Note:**_ In Windows Server 2012, to use the Failover Cluster Command Interface (cluster.exe) feature for Microsoft Failover Clustering, you must select the **Failover Cluster Command Interface** option under the **Failover Clustering Tools** feature during Windows Server 2012 installation. For more information, refer to the Microsoft documentation.

The optimal quorum arbitration time setting for a dynamic quorum is:

Maximum time - 120 seconds
To specify this setting, type the following command in the command line:

```
cluster.exe /prop QuorumArbitrationTimeMax=120
```

If you do not plan to use a dynamic quorum and instead want to retain the quorum resource on a basic disk, then you may want to specify the default settings that Windows server recommends for a basic quorum.

The Windows server quorum arbitration time setting for a basic quorum is:

Maximum time - 60 seconds

To reset the setting, type the following command in the command line:

```
cluster.exe /prop QuorumArbitrationTimeMax=60
```

The advantage of changing the setting back is that it speeds up the quorum arbitration process.

### Additional considerations for SFW Microsoft Failover Clustering support

This section contains additional information that is important in working with Microsoft Failover Clustering and Symantec Storage Foundation for Windows.

Note the following considerations:

- When a cluster disk group resource is offline or a cluster disk group that is not a failover cluster resource is in a Deported state, it is not protected from access by other computers. For maximum data protection, keep Volume Manager Disk Group resources online. Note that the SFW disk group resources still retain the "Volume Manager" name.

- When using the Windows Server's Failover Cluster Manager snap-in to create a disk group resource, the Volume Manager Disk Group Parameters screen might not list all the available Symantec Storage Foundation for Windows cluster disk groups in the drop-down list. If this happens, exit the New Resource wizard and use the Windows Server's Failover Cluster Manager snap-in to select the cluster group to which the resource is to be assigned. Next, move the cluster group to the cluster node where the Symantec Storage Foundation for Windows cluster disk group is currently online. Then create the Symantec Storage Foundation for Windows disk group resource.

- Under the following circumstances, the VEA Disk View may not reflect the latest state of the disk(s) until a refresh is performed:
  - When you change the state of a cluster disk resource on one node and try to view the disks under this resource from another node on the same cluster.
- When you change the state of a cluster disk resource on one node and try
to view the disks under this resource from a remote computer.

- SFW support of the Microsoft Failover Clustering environment allows the
selection of SCSI-2 reservation mode or SCSI-3 reservation mode. Selecting
the type of SCSI support for the Microsoft Failover Clustering environment is
done by using the System Settings portion of the SFW Control Panel.
When selecting the type of SCSI support in a Microsoft Failover Clustering
environment, it is important to know if your storage arrays support SCSI-3.
SFW SCSI-3 clustering support does not let you mix storage arrays that support
SCSI-3 with storage arrays that cannot. In a situation of mixed storage arrays,
you must use SFW SCSI-2 clustering support. Refer to the HCL for arrays that
support SCSI-3.

**Note:** Symantec maintains a hardware compatibility list (HCL) for Symantec
Storage Foundation and High Availability Solutions 6.0 for Windows products
on the Symantec support Web site. Check the HCL for details about your storage
arrays before selecting the type of SCSI support in a Microsoft Failover
Clustering environment.

After selecting the type of SCSI support, you must issue the following CLI
commands to complete the setting on your system:

- `net stop vxsvc`
- `net start vxsvc`

**Note:** If a cluster disk group is imported on the system, you must deport or
move the cluster disk group to another system before issuing these CLI
commands.

If SFW SCSI-2 clustering support is selected and Active/Active load balancing
is desired, the SCSI-3 Persistent Group Reservations (SCSI-3 PGR) support
mode must be enabled for the DMPW DSM.

- A cluster dynamic disk group that is part of the cluster resources cannot be a
source disk group for a join command. However, it can be a target disk group
for the command.

- Change in Bringing a Two-Disk Cluster Group Online
  In earlier versions of Volume Manager for Windows, it was possible to bring
  a two-disk cluster disk group online when only one disk was available. If a
  cluster were to lose all network communication, this allowed the disk group
to be brought online on two cluster nodes simultaneously, with each node
owning a single disk, possibly resulting in data loss or a partitioned cluster. Though the likelihood of this situation occurring is slim for most customers, the consequences if it does happen may be severe. However, this is no longer supported with recent versions of Volume Manager and it is not possible to bring a two-disk cluster disk group online in Volume Manager unless it complies with the normal majority algorithm which means both disks must be available. The normal majority algorithm is \((n/2 + 1)\).

- You are not allowed to deport a cluster disk group that is also a Volume Manager disk group resource for Microsoft Failover Clustering.

- Connecting to a Cluster Node

If you connect to a computer from the VEA GUI using the virtual name or the virtual IP address, the VEA GUI will display the computer name of the cluster node that currently owns the virtual name and IP resources. Therefore, it is not recommended to use the virtual name or virtual IP address when connecting and administrating a cluster node through SFW HA. Instead, use the actual computer name or the IP address of the cluster node.

- Symantec Dynamic Multi-Pathing for Windows (DMPW) does not support using a basic disk as a cluster resource under Microsoft Failover Clustering. Failover may not function properly when using Symantec Dynamic Multi-Pathing for Windows with a Microsoft Failover Clustering basic disk cluster resource. Refer to Tech Note 251662 on the Symantec Support site for details.

If you want to use Symantec Dynamic Multi-Pathing for Windows with SFW and Microsoft Failover Clustering, you must convert any Microsoft Failover Clustering basic disk cluster resources to dynamic disk cluster resources before activating Symantec Dynamic Multi-Pathing for Windows. The initial setup of Microsoft Failover Clustering requires that you use a basic disk as the quorum disk. Once SFW is installed, you should upgrade the basic disk to dynamic by including it in a dynamic cluster disk group and then convert the quorum resource from a basic disk resource to a dynamic disk resource.

**Note:** DMP DSMs do not support an Active/Active setting in a Microsoft Failover Clustering environment when a quorum disk is a basic disk.

- Cluster dynamic disk groups that contain iSCSI disks are not set up for persistent login on all nodes in the cluster. SFW ensures that the iSCSI targets of cluster dynamic disk groups that contain iSCSI disks are configured for persistent login. If the persistent login is not configured for the target, SFW automatically configures it.
Cluster dynamic disk groups that contain iSCSI disks are only automatically configured for persistent login on the node where they were created. The other nodes in the cluster are not enabled for persistent login. You need to manually set up the persistent login for each of the other nodes in the cluster.

■ Copying the Policy File, VxVolPolicies.xml, to Another Node
If the second node is configured the same as the first and if the first node’s policy settings for Automatic Volume Growth are to be maintained on the second node, you need to copy the VxVolPolicies.xml file of the first node to the second node. Copy the VxVolPolicies.xml file to the same path location on the second node as its location on the first node. The default path of the VxVolPolicies.xml file is Documents and Settings\All Users\Application Data\Veritas.

More information about the Policy File is available.
See “Configuring Automatic volume growth” on page 224.

■ More information about using SFW and Microsoft Failover Clustering in a shared cluster environment with the FlashSnap off-host backup procedure is available.
See “Using Dynamic Disk Group Split and Join with a cluster on shared storage” on page 375.

■ If you are installing the Microsoft Failover Clustering feature on a server on which Symantec Storage Foundation for Windows is already installed, then you must manually restart Veritas Enterprise Administrator Service (VxSVC) by running the following commands:

- net stop vxsvc
- net start vxsvc
Microsoft Failover Clustering support

Additional considerations for SFW Microsoft Failover Clustering support
VCS support in SFW HA

This chapter includes the following topics:

■ Overview
■ How SFW HA works with VCS
■ Integration steps
■ Additional considerations for SFW VCS support

Overview

Symantec Storage Foundation and High Availability Solutions (SFW HA) provides built-in Symantec Cluster Server (VCS) support to set up cluster disk groups for a VCS cluster on a Windows Server operating system.

Symantec Cluster Server (VCS) is a high-availability solution for clustered environments. It monitors systems and services on a cluster and fails over services to a different system in case of a system crash or a service failure. VCS provides policy-based, application-focused failover management, which enables applications to be failed over to any server in the cluster or SAN environment and to consecutive servers as necessary. VCS supports up to 32-node clusters in SAN and traditional client-server environments.

With SFW HA, you can create mirrored, RAID-5, and other advanced dynamic volumes on VCS clustered storage.

This chapter gives a high-level overview of how you can set up Symantec Storage Foundation and High Availability Solutions to manage storage for a cluster with the VCS software. Please refer to the VCS documentation and the SFW HA Solutions Guides for detailed step-by-step information on setting up various SFW HA configurations.
For full details on clustering steps with SFW HA, see the *Symantec Storage Foundation and High Availability Solutions Solutions Guide*. You can refer to application-specific Solutions guide for more details on they work with SFW HA. For example, if you are using SQL Server with SFW HA, refer to the *Symantec Storage Foundation and High Availability Solutions HA and Disaster Recovery Solutions Guide for Microsoft SQL*.

### How SFW HA works with VCS

VCS uses application-specific programs called agents to manage hardware and software entities within a highly available cluster environment. The entities being managed are called resources. Resources with similar characteristics are collectively known as a resource type. Resources can be grouped together to be part of a service group, which is an organizational grouping for related resources.

VCS provides the Volume Manager Disk Group (VMDg) and MountV agents to manage cluster disk groups and mounts created on cluster disk groups.

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**Note:** Even though the name of the Volume Manager program has changed to Symantec Storage Foundation for Windows, the Volume Manager Disk Group (VMDg) name remains in effect.

### About the Volume Manager disk group agent

The VMDg agent imports, monitors, and deports a cluster disk group configured with SFW HA. The agent makes the disk group highly available. The VMDg agent supports Symantec Dynamic Multi-Pathing for Windows (DMPW) and works in a SAN environment.

The agent is represented by the VMDg resource type.

### About the MountV agent

The MountV agent mounts, monitors, and unmounts volumes on cluster disk groups imported using SFW HA. The agent supports NTFS, FAT, and FAT32 formatted volumes. When a cluster disk group fails over to another system, the MountV agent ensures that the new system accesses the disk group from the same path it was accessed from before failover. The MountV agent ensures a consistent device path by mounting the disk group with the same mount point (drive letter) on the new system. It also dismounts the disk group from a failed system when a resource or group is taken offline. The agent supports mounting disk groups as NTFS folders.

The agent is represented by the MountV resource type.
Refer to the VCS documentation for more information about the agents, their resource types, and attributes.

Integration steps

To use SFW HA with VCS, you must perform the following tasks.

For detailed step-by-step procedures for installing and configuring a cluster with SFW HA, see the Symantec Storage Foundation and High Availability Solutions Solutions Guide.

Setting up the cluster hardware

Set up the hardware for VCS according to the recommendations in the VCS documentation. Refer to instructions from the hardware manufacturers for specific hardware installation details.

Installing and configuring Windows

Install the Windows operating system on all cluster nodes and configure the necessary network settings. See Symantec Storage Foundation and High Availability Solutions Solutions Guide for specific recommendations.

Installing SFW HA

The SFW HA installer lets you install the software for Symantec products for Symantec Storage Foundation and High Availability Solutions for Windows on multiple nodes simultaneously. The SFW HA installer automatically installs SFW, VCS, and the Symantec Cluster Server Enterprise Agent.

For instructions, see Symantec Storage Foundation and High Availability Solutions Installation and Upgrade Guide.

Setting up a VCS cluster

Use the VCS Configuration Wizard (VCW) to set up the VCS cluster.

Launch the wizard from Start > Programs > Symantec > Symantec Cluster Server > Configuration Wizards > Cluster Configuration Wizard or, on Windows 2012 operating systems, from the Apps menu in the Start screen.

Full steps for this wizard are given in the Symantec Storage Foundation and High Availability Solutions Solutions Guide.
Creating cluster dynamic disk groups and volumes

At this point, you will use Symantec Storage Foundation for Windows to create disk groups and dynamic volumes for the application on the shared storage.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support cluster disk groups.

**To create cluster dynamic disk groups and volumes**

1. Create one or more cluster disk groups in SFW as follows:
   - Create a separate cluster disk group with a unique name for each application to be clustered.
   - Make sure that the device path to each disk group is recognized by all systems sharing the disk.
   - In the step for defining the attributes, be sure to select the checkbox **Create cluster group**.

   See “Create dynamic disk groups” on page 47.

   When creating a cluster disk group for use as a Volume Manager disk group resource, make sure that the disk group name is unique across the cluster. If the cluster software attempts to fail over a disk group to another node that has a disk group with the same name or if you move a disk group to another node that has a disk group with the same name, unpredictable results can occur.

2. In SFW, create one or more dynamic volumes for each cluster disk group.

   See “Create dynamic volumes” on page 52.

**Installing the application on cluster nodes**

If you are installing an application on the cluster nodes, this is the point in the process where that task will be done. VCS requires that the application program files be installed on the same local drive of all the cluster nodes and that the application data and log files or other files related to the application data be installed on the shared storage, using the cluster disk groups and dynamic volumes that were set up in the previous task.

Applications may have built-in procedures for running on a cluster. Consult the application documentation to determine whether these procedures are available. Make sure that the disk groups and volumes are imported and thus mounted on the server before you install the application.
Configuring cluster disk groups and volumes as VCS resources

This section describes the procedures for configuring cluster disk groups and volumes as VCS resources through a VCS service group. You can create a new service group for these resources or add these resources to an existing service group. The disk groups must be configured as resources of type VMDg and volumes as resources of type MountV. You must create a resource dependency such that the MountV resources depend on the VMDg resources.

Once the cluster disk groups are configured as VCS resources, VCS will take over the tasks of importing and deporting disk groups and mounting and unmounting volumes.

Please note that VCS provides multiple ways to create service groups. For example, if you are using Microsoft SQL Server with VCS, you need to use the VCS service group wizard for SQL. There are also separate wizards for setting up file shares and for setting up print shares, as well as a generic application wizard, a Web GUI wizard, and the Cluster Manager Java Console. You can also use the command line to configure the VCS service group. Please refer to the VCS documentation to determine which wizard is most appropriate to configure the service group for your situation. This section describes how to create and configure a service group with the Cluster Manager Java Console. All the different methods for creating a service group cover similar steps.

This section covers the following topics:

Creating a service group

Adding resources to a service group

Editing resource attributes

Creating the resource dependency

Bringing resources online

Creating a service group

A service group is a collection of resources working together to provide application services to clients. It typically includes multiple hardware and software resources working together to produce a single service. For example, a database service group may include a logical network (IP) address, the database management system software (DBMS), underlying file systems, logical volumes, and a set of physical disks managed by SFW HA. If this service group migrates to another node for recovery purposes, all of its resources must migrate together to recreate the group on another node without affecting other service groups.

This section describes the procedure for creating a new service group.
You can also add resources to an existing service group.
See “Adding resources to a service group” on page 517.

To create a new service group

1. Start Cluster Manager (Java Console) and log on to the cluster.
2. On the Edit menu, click Add, and then click Service Group. The Add Service Group window appears.

3. Enter the name of the service group.
4. In the Available Systems box, click the systems to which the service group will be added.
5. Click the right arrow to move the selected systems to the Systems for Service Group box.
6. To add a new service group based on a template, click Templates.
7. Click the appropriate template name in the Templates dialog box that comes up.
8. Click the appropriate service group type. A failover service group runs on only one system at a time; a parallel service group runs concurrently on multiple systems.
9. Click OK.

You can see the newly created service group in the Cluster Explorer configuration tree.
Adding resources to a service group

Do the following to add resources to a service group.

To add resources of the MountV and VMDg resource type to the service group

1. If you have not already done so, start Cluster Manager (Java Console) and log on to the cluster.
2. From the Cluster Explorer configuration tree, select the service group to which the resources will be added.
3. From the Cluster Explorer Edit menu, choose Add>Resource.
4. In the Add Resource dialog box, enter a unique name for the resource.
5. From the Resource Type list, select the MountV resource type.
6. Select the Critical and Enabled checkboxes and click OK.
7. Repeat steps 3 to 6 to add a resource of the VMDg resource type.

After adding the resources, you must define attribute values for the resources according to your configuration.

See “Editing resource attributes” on page 517.

Editing resource attributes

This section describes the attributes that need to be defined to configure the MountV and VMDg resources and the procedure for defining these attributes.
Attributes for resources of type MountV

MountV resources have a few attributes. They include the following:

- **MountPath** – The drive letter or path to an empty NTFS folder that will be assigned to the volume being mounted. VCS will mount the volume at this path. The attribute can be specified as X, X:, X:\, X:\Directory, or X:\Directory\.

- **VolumeName** – The name of the volume to be mounted. For example, the name could be Raid1, Stripe2, Volume01, and so on.

- **VMDgResName** – The name of the Volume Manager disk group (VMDg) resource on which the MountV resource depends.

Attributes for resources of type VMDg

**DiskGroupName** – The name of the cluster disk group. The disk group name can be retrieved from the VEA console by running the command vxdg list, or by using the VCS VMGetDrive utility.

Before defining resources of type MountV and VMDg, take the following precautions:

- Do not configure a system drive as a resource of type Mount or MountV.

- When using the Mount or MountV agents to configure a resource as a folder mount, you must also configure the root folder as a VCS resource.

- If you remove the EVERYONE=READ permission from the volume to be configured as a Mount/MountV resource, make sure that the system account has READ permissions (SYSTEM=READ) to the volume.

To edit resource attributes

1. In the Cluster Explorer configuration tree, click the object whose attributes you want to edit.

2. In the View panel, click the **Properties** tab. If the attribute does not appear in the Properties View, click **Show All Attributes**. This opens the Properties View.
3 In the Properties View, click the icon in the Edit column of the Key Attributes or Type Specific Attributes table. In the Attributes View, click the **Edit** icon in the Edit column of the attribute table.

4 In the Edit Attribute dialog box, enter changes to the attribute values and click **OK**.

Repeat these instructions for all MountV and VMDg attributes.

See “Editing resource attributes” on page 517.

**Creating the resource dependency**

VCS requires that you create a dependency between resources of type MountV and those of type VMDg.

**To create the resource dependency**

1 In the Cluster Explorer configuration tree, click the **Service Groups** tab.

2 Click the service group to which the MountV and VMDg resources belong.

3 In the view panel, click the **Resources** tab. This opens the resource dependency graph.

4 Click the **MountV** resource.

5 Drag the yellow line to the **VMDg** resource and click the resource.

6 In the Confirmation dialog box, click **Yes**.

You can now bring the resources online.

See “Bringing resources online” on page 520.
Bringing resources online

When you bring resources of type MountV and VMDg online, VCS imports the disk group on the active system in the cluster and mounts the volumes at the specified mount paths.

To bring resources online

1. In the Service Groups tab of the Cluster Explorer configuration tree, right-click the resource of type MountV.

2. From the pop-up menu, click Online, and click the system on which to bring the resource online.

Once the command is completed, the resources should come online on the selected system. You can view the status of the resources in the Cluster Explorer’s View panel.

Testing the cluster

You can verify your installation by switching nodes in the VCS Cluster Manager (Java Console). For the most complete test of the cluster’s failover capability, shut down the computer that is currently online. Bring it back up again after the cluster fails over.

Additional considerations for SFW VCS support

This section describes additional information that is important in working with VCS and Symantec Storage Foundation for Windows.

It includes the following:

- A cluster dynamic disk group that is part of the cluster resources cannot be a source disk group for a join command. However, it can be a target disk group for the command.

- Connecting to a Cluster Node through the VEA GUI

  If you connect to a computer from the VEA GUI using the virtual name or the virtual IP address, the VEA GUI will display the computer name of the cluster node that currently owns the virtual name and IP resources. Therefore, it is not recommended to use the virtual name or virtual IP address when connecting and administering a cluster node through SFW HA. Instead, use the actual computer name or the IP address of the cluster node.

- Cluster dynamic disk groups that contain iSCSI disks are not set up for persistent login on all nodes in the cluster.
SFW ensures that the iSCSI targets of cluster dynamic disk groups that contain iSCSI disks are configured for persistent login. If the persistent login is not configured for the target, SFW automatically configures it. Cluster dynamic disk groups that contain iSCSI disks are only automatically configured for persistent login on the node where they were created. The other nodes in the cluster are not enabled for persistent login. You need to manually set up the persistent login for each of the other nodes in the cluster.

■ Copying the Policy File, VxVolPolicies.xml, to Another Node
If the second node is configured the same as the first and if the first node's policy settings for Automatic Volume Growth are to be maintained on the second node, then you need to copy the VxVolPolicies.xml file of the first node to the second node. Copy the VxVolPolicies.xml file to the same path location on the second node as its location on the first node. The default path of the VxVolPolicies.xml file is Documents and Settings\All Users\Application Data\Veritas.
More information is available about the policy file.
See “Configuring Automatic volume growth” on page 224.

■ SFW support of the VCS environment allows the selection of SCSI-2 reservation mode or SCSI-3 reservation mode. Selecting the type of SCSI support for the VCS environment is done by using the System Settings portion of the SFW Control Panel.
When selecting the type of SCSI support in a VCS environment, it is important to know if your storage arrays support SCSI-3. SFW SCSI-3 clustering support does not let you mix storage arrays that support SCSI-3 with storage arrays that cannot. In a situation of mixed storage arrays, you must use SFW SCSI-2 clustering support. Refer to the HCL for arrays that support SCSI-3.

**Note:** Symantec maintains a hardware compatibility list (HCL) for Symantec Storage Foundation and High Availability Solutions for Windows Products on the Symantec support Website. Check the HCL for details about your storage arrays before selecting the type of SCSI support in a VCS environment.

After selecting the type of SCSI support, you must issue the following CLI commands to complete the setting on your system:

- `net stop vxsvc`
- `net start vxsvc`
**Note:** If a cluster disk group is imported on the system, you must deport or move the cluster disk group to another system before issuing these CLI commands.

If SFW SCSI-2 clustering support is selected and active/active load balancing is desired, the SCSI-3 Persistent Group Reservations (SCSI-3 PGR) support mode must be enabled for the DMPW DSM.
Implementing disaster recovery with VVR

This chapter includes the following topics:

- Overview
- Summary of the steps for setting up a disaster recovery solution with Volume Replicator
- Volume Replicator terms

Overview

Symantec Storage Foundation Volume Replicator (Volume Replicator) option is a data replication tool designed to maintain a consistent copy of application data at a remote site as part of an effective disaster recovery plan. In the event that the datacenter is down, the application data is immediately available at the remote site, and the application can be restarted at the remote site.

Volume Replicator works as a fully integrated component of SFW or SFW HA. Volume Replicator benefits from the robustness, ease of use, and high performance of SFW or SFW HA and, at the same time, adds replication capability. Volume Replicator can use existing SFW or SFW HA configurations, with some restrictions. Any application, even with existing data, can be configured to use SFW transparently.

For detailed information about Volume Replicator, refer to the Symantec Storage Foundation Volume Replicator Administrator's Guide.

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support Volume Replicator.
Volume Replicator feature highlights

Volume Replicator has many feature highlights. They include the following:

■ Supports replication of data over any IP network, LAN or WAN.
■ Runs on all storage hardware supported by Symantec Storage Foundation for Windows.
■ Supports replication over a firewall.
■ Provides volume-level replication of application or file system data, including support of commercial database management systems.
■ Replicates the data in asynchronous or synchronous mode, ensuring complete data integrity and consistency in either mode.

How Volume Replicator works

Volume Replicator’s purpose is to replicate data from a primary site to one or more secondary sites. It does this by using a replicated volume group (RVG) within an SFW disk group as the unit of replication.

The following is a summary of how Volume Replicator works:

■ Through the Volume Replicator software, the volumes to be replicated on the primary site are identified as part of an RVG, which consists of one or more volumes in a SFW disk group. If you have multiple disk groups with volumes to be replicated, each disk group must have a separate RVG. It is possible to have more than one RVG per disk group.

■ With each RVG, a Replicator Log volume is also set up. The Replicator Log volume at the primary site holds the writes that are to be sent to the secondary site.

■ A corresponding RVG and Replicator Log volume at the secondary site are also set up.

An identical disk group and volume setup is created on the secondary site. The disk groups and volumes must be of the same size and have the same names as those on the primary site. The volumes do not have to be the same volume type.

The Replicator Log volume on the secondary site must have the same name as on the primary site, but its size can differ. However, Symantec recommends that the two log volumes be the same size.

The secondary site Replicator Log is held in reserve so that it can be used if the primary site goes down or has to be migrated and the secondary site needs to become the new primary site.
The RVG at the primary site and the corresponding RVG at the secondary site are called a Replicated Data Set (RDS). Most Volume Replicator commands operate on an RDS. Normally, you can perform Volume Replicator operations from any host in an RDS.

Once the Volume Replicator components are properly installed and configured, replication starts. Volume Replicator uses the Replicator Log volume on the primary site to track all the writes to the application or file system in the order that they were received and then transmits the writes to the secondary site. Each write to a data volume under an RVG on the primary site generates two writes: the first one is sent to the Replicator Log, and when that is complete, the other is sent to the application data volumes and to the secondary site at the same time. When the secondary system receives a write, it sends an initial acknowledgment of the receipt back to the primary site, even before the write is committed to disk. This is called the "Network Acknowledgment." Once the secondary commits the write to disk, a second acknowledgment, called the "Data Acknowledgment," is sent to the primary system. The Replicator Log volume on the primary system discards the write when it receives the Data Acknowledgment.

Replication is a unidirectional process. The updates on the primary host are sent to the secondary host, but access to the data at the secondary host or hosts is read-only on the replication volumes.

The three modes of replication — synchronous, asynchronous, and synchronous override — work as follows:

- The synchronous mode waits until the Network Acknowledgment has been received from the secondary host before it completes the write to the application. Thus, the primary and the secondary have the same data.

- The asynchronous mode completes the application write after it has been written to the primary Replicator Log volume. If the primary site goes down, there may still be some writes that were not yet received at the secondary site. This mode has better performance but with a risk of some data loss.

- The synchronous override is a mode of replication that is synchronous as long as the network is available, but when the network becomes unavailable, the replication is continued in the asynchronous mode.

- If a disaster occurs on the primary site and its data is destroyed, a secondary host can take over the role of the primary host to make the data accessible. You can then restart the application on that host.
You can also manually migrate the role of a healthy primary host to a secondary host when the application involved in replication is inactive. You may want to do this for maintenance purposes.

Summary of the steps for setting up a disaster recovery solution with Volume Replicator

This section provides a high-level summary of the steps for setting up a Volume Replicator disaster recovery solution with SFW. For more detailed information, refer to the Symantec Storage Foundation Volume Replicator Administrator’s Guide.

These instructions do not give all the steps for setting up a cluster with Volume Replicator. For full details on clustering steps with SFW HA, see the Symantec Storage Foundation and High Availability Solutions Solutions Guide. You can refer to application-specific Solutions guide for more details on how they work with SFW HA. For example, if you are using SQL Server with SFW HA, refer to the Symantec Storage Foundation and High Availability Solutions HA and Disaster Recovery Solutions Guide for Microsoft SQL.

All the guides are included on the product disc.

To set up a cluster with Volume Replicator:

1. Set up and configure the hardware at each site.

   For Volume Replicator, installation requires at least two servers running SFW with a network connection between them: one as the primary at the main site and the other as the secondary at a second site. Optionally, you can have additional secondary sites.

   If you plan to use clustering with SFW HA or SFW and Microsoft Failover Clustering, you have several configuration choices. Probably the most common one is to have four servers, two each clustered together at each site. You can also have a cluster with two servers, one node at the primary site and the other at the secondary. Another variation is for the primary site to have a two-node cluster while the secondary site has a standalone server for replication.

2. Install the operating system and configure the network.

3. Install SFW or SFW HA.

   Be sure to select the Volume Replicator option.

   With SFW HA, it is recommended that you purchase and install the Global Cluster Option (GCO) as well. GCO facilitates replication support after a site failure.
4 After the installation completes, the Volume Replicator Security Service Configuration Wizard (VxSAS) will be launched.

Follow the instructions in the Volume Replicator documentation to configure this service, which is required for Volume Replicator commands to work properly.

5 Create one or more disk groups in SFW or SFW HA on your primary system. Then create the volumes within each disk group.

See “Create dynamic disk groups” on page 47.

See “Create dynamic volumes” on page 52.

You are creating the volumes to be replicated. You can create the volume for the Volume Replicator Replicator Log now or wait until you run the Volume Replicator wizard for setting up the Replicated data sets on the system.

The wizard lets you either identify an existing volume for the log volume or to have the wizard bring up the screen for creating the volume so you can create the volume at that time.

6 If you plan to use an application on your system, you need to install and configure the application at this point.

7 On your secondary system, create a duplicate of the disk groups and volumes that are on the primary system. You can do this step in one of the two following ways:

- Repeat the same manual procedures to set up the disk groups and volumes that you used previously on the primary system.

- Wait until you run the Volume Replicator RDS Wizard and allow Volume Replicator to make a duplicate of the disk groups and volumes for you.

The secondary disk groups and volumes should have the same names as the primary disk groups and volumes. The data volumes on the secondary site should be the same size as the corresponding data volumes on the primary site. The log volume on the secondary can be a different size, but Symantec recommends that the sizes be the same.

If you have installed an application on the primary site, it also needs to be installed on the secondary site.
8 If you have VCS or Microsoft Failover Clustering clusters, create virtual IP resources for replication.

You will need to create a virtual IP resource that will be used for replication for each replicated disk group. In addition, if you are using VCS, you need to specify a NIC resource. This NIC resource is not needed for a Microsoft failover cluster. Create the IP resource on both the primary and secondary sites. Each site needs its own IP address. This virtual IP should be linked to the NIC that is used for the server at each site.

9 Set up the Replicated data sets for Volume Replicator.

Refer to the Symantec Storage Foundation Volume Replicator Administrator's Guide or the Symantec Storage Foundation Solutions guides for detailed instructions.

Volume Replicator terms

This section provides the definitions of the most commonly used Volume Replicator terms for reference purposes.

Replicated Volume Group (RVG)

An RVG is made up of one or more volumes in an SFW disk group. The updates made on the RVG on the primary host are sent to a configured secondary host. Thus, there is a corresponding RVG with a disk group of the same name and volumes with the same names. The data volumes should be the same size, but Replicator Log volume sizes can differ. Optionally, to add more redundancy, you can have multiple secondary hosts, all with the same corresponding copy of the RVG on the primary host.

An RVG within a disk group is the container for replication, so if you have multiple disk groups, you will need to create a separate RVG for each disk group. It is possible to have more than one RVG in a disk group; however, the RVG cannot span across disk groups.

Replicated Data Set (RDS)

An RVG on the primary host and the corresponding duplicate RVG on the secondary host or hosts make up a Replicated Data Set (RDS).

Replicator Log

Each RVG must have a Replicator Log associated with it. The Replicator Log volume at the primary site holds a copy of any data writes that are sent to the secondary
site. The Replicator Log on the secondary site is held in reserve so that it can be used if the primary site becomes nonfunctional and the secondary site takes over the role of primary site. The logs at the two sites must have the same name; however, the sizes of the logs can differ. Symantec recommends having Replicator Log volumes of the same size at the primary site and the secondary site.

Replication Modes

The three modes of replication — synchronous, asynchronous, and synchronous override — work as follows:

- The synchronous mode waits until the Network Acknowledgment has been received from the secondary host before it completes the write to the application. Thus, the primary and the secondary have the same data.

- The asynchronous mode completes the application write after it has been written to the primary Replicator Log volume. If the primary site goes down, there may still be some writes that were not yet received at the secondary site. This mode has better performance but with a risk of some data loss.

- The synchronous override is a mode of replication that is synchronous as long as the network is available, but when the network becomes unavailable, the replication is continued in the asynchronous mode.
Implementing disaster recovery with VVR

**Volume Replicator terms**
Command line interface

This appendix includes the following topics:

- Overview of the command line interface
- vxvol
- vxdg
- vxclus
- vxdisk
- vxassist
- vxassist (Windows-specific)
- vxevac
- vxsd
- vxstat
- vxtask
- vxedit
- vxunreloc
- vxdmpadm
- vxcb
- vxsnap
- vxfsync
- vxscrub
Overview of the command line interface

This section is an overview of the command line interface.

SFW commands available from the command line

This section describes the command line interface (CLI) commands available with Symantec Storage Foundation for Windows. The key SFW commands can be executed from the command line as well as from the GUI.

The utilities are available in the Symantec Storage Foundation for Windows installation directory, typically C:\Program Files\Veritas\Veritas Volume Manager. You can run the commands from any directory in the command prompt window.

Note: The CLI commands run only on the server. They will not run on the Symantec Storage Foundation for Windows client.

Note: The CLI commands are not supported by Storage Foundation Manager.

Note: If User Access Control (UAC) is enabled, then run the CLI commands in the "Run as administrator" mode even if the logged-on user belongs to the local administrators group. Alternatively, log on as an Administrator (default administrator account) to perform the tasks.

The available commands are the following:

- **vxvol**
  Displays volume information, repairs a RAID-5 or mirrored volume, turns Fast Resynchronization on and off, and reactivates a volume. See “vxvol” on page 538.

- **vxdg**
  Lets you create a dynamic disk group and perform other functions related to dynamic disk groups. See “vxdg” on page 550.

- **vxclus**
  Enables and disables the capability of forcing the import of a disk group on a cluster controlled by Microsoft Failover Clustering. The command also has
keywords that allow the cluster disk group to reside on the same bus as the cluster node’s system and boot disk. See “vxclus” on page 572.

- **vxdisk**
  Provides information on dynamic disks, lets you reactivate a dynamic disk, and enables track alignment for the disk. See “vxdisk” on page 576.

- **vxassist**
  Lets you create a dynamic volume and perform other operations related to dynamic volumes such as shrinking the size of the volume. See “vxassist” on page 589.

- **vxvac**
  Evacuates (moves) subdisks from the disk specified to a specified destination disk. See “vxvac” on page 628.

- **vxunreloc**
  Reverses the process of hot relocation.

- **vxsd**
  Provides commands for moving and splitting a subdisk and joining two subdisks. See “vxsd” on page 629.

- **vxstat**
  Provides commands for displaying statistics for disks, volumes, and subdisks. See “vxstat” on page 631.

- **vxtask**
  Provides commands for displaying percentage completion information for tasks. See “vxtask” on page 634.

- **vxedit**
  Provides commands to rename or add comments to a dynamic disk group, a disk, a volume, a plex, and a subdisk. See “vxedit” on page 635.

- **vxdmpadm**
  Provides commands for Symantec Dynamic Multi-Pathing for Windows (DMPW DSMs). See “vxdmpadm” on page 638.

- **vxcbr**
  Provides commands for backing up and restore the Symantec Storage Foundation for Windows configuration information. See “vxcbr” on page 656.

- **vxsnap**
  Performs multiple snapshots simultaneously. The utility integrates with the Windows Volume Shadow Copy Service (VSS) as a VSS Requester. This allows for the simultaneous snapshot of all volumes associated with an Exchange Server database or an SQL Server database. See “vxsnap” on page 658.
- **vxfsync**
  Resynchronize a single file in a snapshotted volume back to the original volume. It is designed to restore one or more corrupt files in a database application that has volumes with multiple database files. See “vxfsync” on page 676.

- **vxscrub**
  Removes unneeded entries in the registry that are a result of adding and deleting volumes. The command is designed to shrink the size of the registry by purging the system hive. See “vxscrub” on page 676.

- **vxygen**
  Determines if there are any differences between plexes of mirrored volumes. See “vxygen” on page 679.

- **vxprint**
  Displays information about SFW and Volume Replicator objects. See “vxprint” on page 680.

**Command line log**

SFW provides support for a log that captures commands issued through the CLI. The command line log also captures the system response to each command. The log file, vxcli.log, is typically located at \Program Files\Veritas\Veritas Volume Manager\logs.

Each entry in the log is prefixed with the date and time of the command or system response, followed by the process identification and thread identification. Each CLI command is a separate entry in the log and each is identified by "---------- Command : ". Each system response is also a separate entry in the log and follows the CLI command.

**Note:** Help messages are not recorded in the command line log.

As an example of a log’s content, the following was recorded as a result of entering vxgd list

```
03/28/06 22:59:37 [5376,2024] ---------- Command : vxgdlist
03/28/06 22:59:38 [5376,2024] Disk groups are....
03/28/06 22:59:38 [5376,2024] Name : BasicGroup
03/28/06 22:59:38 [5376,2024] Disk Group Type : Basic
03/28/06 22:59:38 [5376,2024] DiskGroup ID : No ID
03/28/06 22:59:38 [5376,2024] Status : Imported
03/28/06 23:00:08 [4212,5760] ---------- Command : vxdisklist
03/28/06 23:00:09 [4212,5760] Name MediaName DiskgroupDiskStyle Size(MB) FreeSpace(MB) Status
```
Conventions for command line syntax

This topic describes the typographical conventions used for the command line syntax in this CLI section.

The conventions are as follows:

- Any parameter that is optional for the command syntax has square brackets ([ ]) around it. For example:
  
  [-b] or [-o keeplex]

- Required command words and parameters for the command do not have square brackets around them. For example:
  
  vxvol volinfo or <VolumeName>

- Command words and parameters that are typed as shown in the command syntax are displayed in the Courier bold font. For example:
  
  vxvol volinfo or [-b]

- Parameters that require the user to enter something in their place are displayed in Helvetica Italic font and have angle brackets around them. They are placeholders for information the user enters. For example:
  
  <VolumeName>

  If a parameter is enclosed by both angle brackets and square brackets, it is an optional parameter for the command. For example:

  [<DiskName>]

- The | character is a separator that allows two or more choices for a given parameter. The user can use any one of the choices for the command. For example:

  <VolumeName | DriveLetter>
Ellipses (...) after a parameter indicate more items. For example, the parameter `<DiskName>...` means to enter one or more disk names. The parameter `[DriveLetter={A|B|...|Z}]` means to enter `DriveLetter=` and a drive letter in the range of A to Z.

The parameter `!<DiskName>` is used with three commands—`vxassist break`, `vxassist remove`, and `vxassist snapshot`. The exclamation mark is needed to make these commands consistent with the Volume Manager for UNIX versions of these commands.

About Volume Names

Assigning a Volume Name

When you are creating a volume with `vxassist make`, the `<VolumeName>` parameter is a name you assign to the volume.

Note: A volume name is limited to 18 ASCII characters. It cannot contain spaces, slash mark (/), backslash (\), exclamation point (!), angle brackets (< >), or equal sign (=). Also, a period cannot be the first character in the name.

The volume name you assign in either the command line or the GUI is the internal name of the volume. SFW will make that internal volume name into the operating system volume label. However, if you later change the volume label through the operating system, the internal SFW volume name will not change.

Note: The name you assign for the `<VolumeName>` parameter when creating a volume in the CLI is equivalent to the volume name that is specified in creating a volume with the New Volume command in the VEA GUI.

The internal volume name supplies an identifier for the volume that will stay the same. The operating system may reassign drive letters. A persistent name is especially important in scripts. If you want to use the internal volume name in the command line to refer to the volume, you must precede it with its disk group parameter, `-g<DynamicDiskGroupName>`, for example, `-gDG1 Salesvolume`.

If you do not assign a volume name, SFW will assign the name, in the form of `volume1`, `volume2`, etc. The internal volume name is assigned by the program only to dynamic volumes.

Other Ways to Designate a New Volume
A basic or dynamic volume can also be indicated by a drive letter, `<DriveLetter>`. If the volume has been mounted at an NTFS folder, the volume name is indicated by the drive path parameter `<DrivePath>`, which is the path to the folder.

- **Referring to an Existing Volume**

There are four methods for referring to an existing volume in the CLI:

- The full path name of the volume, which has the following syntax:
  ```plaintext
  \Device\HarddiskDmVolumes\<DynamicDiskGroupName>\<VolumeName>
  ```

  For example:
  ```plaintext
  \Device\HarddiskDmVolumes\DynDskGrp1\Volume1
  ```

- With a drive letter, such as D:

- With its internal volume name, which requires the disk group option
  ```plaintext
  -gDG1 Salesvolume or -gDG1 Volume1
  ```

- With a `<DrivePath>` parameter if the volume is mounted on an NTFS folder, such as `D:\Sales`.

  **Note:** In commands that involve existing volumes, the internal volume name is referred to as `<VmName>` in the command line syntax.

  You can identify the internal volume name through the `vxvolinfo` command, or you can see the internal volume name in the right pane of the GUI when a volume is selected.

- **About Disk Names**

  A disk can be specified in the command line in different ways:

  - With the device name, such as `Harddisk2`
  
  - With a path name, such as `\Device\Harddisk2`
  
  - With the internal disk name assigned by the SFW program, such as `Disk2`
  
  - With `p#c#t#l#`, where the #’s correspond to port, channel, target, and LUN

  The internal disk name is a persistent name that remains even when the operating system changes the disk name, and thus it is useful in scripts. It requires a disk group parameter whenever it is used (for example, `-gDG1 Disk2`). You cannot assign this name. You can identify a disk’s internal name
by using the `vxdisk diskinfo` command. An internal disk name is assigned only to dynamic disks, not basic disks.
You can also see the device name and the internal disk name on the right pane of the VEA GUI when a disk or disks are selected.

**vxvol**

- **volinfo** Displays information on a dynamic volume.
- **repair** Repairs a RAID-5 volume.
- **set fastresync=on|off** Turns Fast Resynchronization on and off.
- **reactivate** Reactivates the volume (restarts the volume).
- **rdpol prefer** Sets the volume read policy on a volume with multiple mirrors to designate one specific plex to be used whenever possible for reading from the volume.
- **rdpol round** Sets the volume read policy on a volume with multiple mirrors so that plexes are read sequentially in a "round-robin" fashion.
- **growfs** Grow the file system.
- **access** Sets the volume to read only or read/write access mode.
- **reclaim** Reclaim storage space from a volume. (Portion of volume must reside on a thin provisioned disk.)
- **reclamcancel** Immediately cancels reclaim operation
- **capacitymonitor** Set threshold on dynamic volume so that when the used disk space on a volume reaches the specified threshold, an alert message is logged.
- **autogrow** Allows an individual volume to grow (increase capacity) automatically by a specified amount when the used disk space on the volume reaches a certain threshold. The threshold is set by Capacity Monitoring.

Each keyword is followed by the volume name or drive letter. Typing the following sequence for each keyword brings up a description of its syntax:
vxvol <Keyword> -?

**vxvol volinfo**

```
vxvol [-v] [-g<DynamicDiskGroupName>] volinfo <VolumeName | DriveLetter | VmName|DrivePath>
```

Returns information about the volume.

The following attributes apply:

- **[-v]**
  - The verbose option displays the size and offset of the subdisks as well as the other information provided by the main command.

- **-g<DynamicDiskGroupName>**
  - Needed only if you are using the internal volume name.

- **<VolumeName>**
  - The path name of the volume, such as \Device\HarddiskDmVolumes\DGI\Volume1.

- **<DriveLetter>**
  - The drive letter of the volume.

- **<VmName>**
  - Internal name of the volume; requires the use of the -g option, such as -gDGI Volume1.

- **<DrivePath>**
  - A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

The possible information categories are name, dynamic disk group name, size, volume type, whether it is a boot or system volume, whether it contains the page file (pagefile.sys), volume status, and access mode (read only or read/write access mode). If the volume is a dynamic volume, the command can return additional information on any mirror plexes or DCO volumes associated with the volume.

**Example**

```
vxvol volinfo E:
```

This returns a list with specified information as described above for volume E.

**vxvol repair**

```
vxvol [-o notrackalign] [-g<DynamicDiskGroupName>] repair <VolumeName | DriveLetter | VmName|DrivePath>
```

Repairs a RAID-5 or mirrored volume if its status is Degraded and there is unallocated space on another dynamic disk. The command repairs the damaged
part of the volume by placing a functional replacement of that subdisk on another
disk. The following attributes apply:

-o notrackalign Disable track alignment on the destination disk.
-g<DynamicDiskGroupName> Needed only if you are using the internal
volume name.

<VolumeName> The path name of the volume, such as
\Device\HarddiskDmVolumes\DG1\Volume1.

<DriveLetter> The drive letter of the volume.

<VmName> Internal name of the volume; requires the use
of the -g option, such as -gDG1 Volume1.

<DrivePath> A volume that is mounted on an NTFS folder;
it is indicated by a path to that folder.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do
not support track alignment.

**Example**

vxvol repair J:

This command repairs a RAID-5 volume (designated as J:) after a disk that belongs
to the RAID set has failed.

**vxvol set fastresync=on|off**

vxvol [-o notrackalign] [-g<DynamicDiskGroupName>] set
fastresync=on|off <VolumeName | DriveLetter |<VmName|DrivePath>

Turns FastResync on or off for the specified mirrored volume. The following
attributes apply:

-o notrackalign Disable track alignment on the disk where the
log resides. Applicable when fastresync=on.

-g<DynamicDiskGroupName> Needed only if you are using the internal
volume name.

<VolumeName> The path name of the volume, such as
\Device\HarddiskDmVolumes\DG1\Volume1.

<DriveLetter> The drive letter of the volume.
Internal name of the volume; requires the use of the -g option, such as -gDG1 Volume1.

A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

FastResync is not supported on RAID-5 volumes. If you have initiated a snapshot operation on a volume, you cannot turn FastResync off for that volume. If you try to do so, the command line interface returns an error message.

When you turn FastResync on, a DCO (disk change object) log volume is created. When you turn FastResync off, the DCO log volume is deleted. You can perform a limited number of operations on a DCO log volume.

The following topics provide more information:

See “FastResync” on page 336.
See “Disk Change Object (DCO) volume” on page 340.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support track alignment.

Examples

vxvol set fastresync=on J:

This command turns on the FastResync feature on the volume with drive letter J.

vxvol set fastresync=on\Device\HarddiskDMVolumes\DynDskGrp1\Volume1

This command turns on the FastResync feature for Volume 1, which belongs to DynDskGrp1.

**vxvol reactivate**

vxvol [-g<DynamicDiskGroupName>] reactivate <VolumeName | DriveLetter |<VmName|DrivePath>

Manually restarts the volume. You need to rescan and then reactivate the disk before attempting to reactivate the volume.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the vxvol reactivate command.
The following attributes apply:

- **-g<DynamicDiskGroupName>**
  Needed only if you are using the internal volume name parameter.

- **<VolumeName>**
  The path name of the volume, such as \Device\HarddiskDmVolumes\DG1\Volume1.

- **<DriveLetter>**
  The drive letter of the volume.

- **<VmName>**
  Internal name of the volume; requires the use of the -g option, such as -gDG1 Volume1.

- **<DrivePath>**
  A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

More information about the CLI version of the Rescan command and the Reactivate (a disk) command is available.

- See “vxassist” on page 589.
- See “vxdisk” on page 576.

**Example**

vxvol reactivate J:

This command reactivates the volume with drive letter J.

**vxvol rdpol prefer**

vxvol [-g<DynamicDiskGroupName>] rdpol prefer <VolumeName | DriveLetter | <VmName|DrivePath><PlexName>

Sets the volume read policy on a volume with multiple mirrors to designate a specific plex to be used for reads. This plex is referred to the "preferred plex."

---

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the vxvol rdpol prefer command.

The following attributes apply:

- **-g<DynamicDiskGroupName>**
  Needed only if you are using the internal volume name parameter.
Designating a plex as preferred can improve your system’s read performance if the drive used for the target mirror is a high-performance drive or if the target mirror is located on a drive that is physically closer.

**Note:** When a preferred plex has an error, the read operation is completed by another plex. This happens automatically, as if there were no preferred plex.

Example

```
vxvol rdpol prefer J: Volume1-01
```

This command designates plex Volume1-01 as the preferred plex on mirrored volume J.

**vxvol rdpol round**

```
vxvol [-g DynamicDiskGroupName] rdpol round <VolumeName | DriveLetter | <VmName | DrivePath>
```

Sets the volume read policy on a volume with multiple mirrors to read from each plex sequentially in a "round-robin" fashion. Sequential access causes only one plex to be accessed at a time. This takes advantage of the drive or controller read-ahead caching. The following attributes apply:
-g<DynamicDiskGroupName>  Needed only if you are using the internal volume name parameter.

<VolumeName>  The path name of the volume, such as \Device\HarddiskDmVolumes\DG1\Volume1.

<DriveLetter>  The drive letter of the volume.

<VmName>  Internal name of the volume; requires the use of the -g option, such as -gDG1 Volume1.

<DrivePath>  A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

Example

vxvol rdpol round J:

This command sets up the mirrors of volume J to be read in a round-robin fashion.

vxvol growfs

vxvol [-g<DynamicDiskGroupName>] growfs <VolumeName | DriveLetter | <VmName | DrivePath> [<length>]

Grows the file system if a volume is resized but the file system fails to resize correctly. If the optional parameter [<length>] is not used, the command would try to grow the file system size to the full volume size.

The following attributes apply:

- -g<DynamicDiskGroupName>  Needed only if you are using the internal volume name parameter.

<VolumeName>  The path name of the volume, such as \Device\HarddiskDmVolumes\DG1\Volume1.

<DriveLetter>  The drive letter of the volume.

<VmName>  Internal name of the volume; requires the use of the -g option, such as -gDG1 Volume1.

<DrivePath>  A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

<length>  Size of the volume in MB. If no size is indicated, the volume is grown to the maximum size.
Note: Any growth is limited to a maximum of 2 TB every time this command is run. The file system usable space is in general somewhat smaller than the raw volume size, since the file system itself occupies space. Only use this command when you see a large difference between the volume size and the file system capacity.

Example

vxvol growfs J: 1000

This command would grow the file system size of volume J by 1 GB.

vxvol growfs J:

This command would grow the file system size of volume J to the full volume size.

vxvol access

vxvol [-g<DynamicDiskGroupName>] [-f ]

access readonly|readwrite <VolumeName | DriveLetter |<VmName|DrivePath>>

Sets the read/write access mode of a volume. The following attributes apply:

-g<DynamicDiskGroupName> Name of dynamic disk group. (Needed only if you are using the internal volume name parameter.)

[-f] The force option forces the volume to the specified access mode.

<VolumeName> The path name of the volume, such as \Device\HarddiskDmVolumes\DG1\Volume1.

<DriveLetter> The drive letter of the volume.

<VmName> Internal name of the volume; requires the use of the -g option, such as -gDG1 Volume1.

<DrivePath> A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

Example

vxvol access readwrite E:

This command sets volume E to read/write access.
vxvol reclaim

vxvol [-g<DynamicDiskGroupName>] [-b]
reclaim<VolumeName|DriveLetter|VmName|DrivePath>

Reclaim storage space from a volume. (Portion of volume must reside on a thin provisioned disk.)

The following attributes apply:

- `-g<DynamicDiskGroupName>` Name of dynamic disk group. (Needed only if you are using the internal disk name of the volume.)
- `-b` Run the command in the background.
- `VolumeName` The path name of the volume, such as \Device\HarddiskDmVolumes\DG1\Volume1
- `DriveLetter` Drive letter of the volume.
- `VmName` The internal disk name of the volume, which requires the `-g` option (for example, `-gDG1 Volume2`).
- `DrivePath` Drive path that the volume is mounted on. (Must be an empty folder on a local NTFS volume.)

**Note:** The operation to reclaim storage from thin provisioned disks is not supported for RAID-5 volumes.

**Note:** The reclaim storage operation is disabled during a shrink volume operation. The reclaim storage operation is enabled when the shrink volume operation has completed.

**Example**

vxvol -gDG1 reclaim Volume1

This command recclaims space from volume with internal name Volume1.

vxvol reclaimcancel

vxvol [-g<DynamicDiskGroupName>]
reclaimcancel<VolumeName|DriveLetter|VmName|DrivePath>
Immediately cancels the reclaim operation. Only a portion of the storage space of the volume may have been reclaimed.

The following attributes apply:

- `g<DynamicDiskGroupName>` Name of dynamic disk group. (Needed only if you are using the internal disk name of the volume.)

`VolumeName` The path name of the volume, such as `\Device\HarddiskDmVolumes\DG1\Volume1`

`DriveLetter` Drive letter of the volume.

`VmName` The internal disk name of the volume, which requires the `-g` option (for example, `-gDG1 Volume2`).

`DrivePath` Drive path that the volume is mounted on. (Must be an empty folder on a local NTFS volume.)

Example

vxvol reclaimcancel F:

This command immediately cancels the reclaim operation on volume associated with drive letter F:

**vxvol capacitymonitor**

vxvol [-g<DynamicDiskGroupName>]
capacitymonitor<VolumeName|DriveLetter|VmName|DrivePath>
enable=<yes|no> [critical=<# of volume capacity>] [warning=<# of volume capacity>] [pollinginterval=<# of seconds>] [messageinterval=<# of seconds>] [email=<email address>] [-A APPLYPOLICYTOFAILOVER]

Set threshold on dynamic volume so that when the used disk space on a volume reaches the specified threshold, an alert message is logged.

The following attributes apply:

- `g<DynamicDiskGroupName>` Name of dynamic disk group. (Needed only if you are using the internal disk name of the volume.)
### vxvol autogrow

```
vxvol [-g<DynamicDiskGroupName>]
autogrow<VolumeName|DriveLetter|VmName|DrivePath> enable=<yes|no>
[growby=<length>] [-t tpdiskonly] [maxvolumesize=<#size>]
```
Allows an individual volume to grow (increase capacity) automatically by a specified amount when the used disk space on the volume reaches a certain threshold. The threshold is set by Capacity Monitoring.

The following attributes apply:

- `-g <DynamicDiskGroupName>` Name of dynamic disk group. (Needed only if you are using the internal disk name of the volume.)

  **VolumeName** The path name of the volume, such as `\Device\HarddiskDmVolumes\DG1\Volume1`

  **DriveLetter** Drive letter of the volume.

  **VmName** The internal disk name of the volume, which requires the `-g` option (for example, `-g DG1 Volume2`).

  **DrivePath** Drive path that the volume is mounted on. (Must be an empty folder on a local NTFS volume.)

  **Enable** Enable or disable automatic volume growth.

  **growby** Amount of space that volume is to be expanded each time the growth threshold is reached. Amount of space can be specified in terms of S for Sectors, K for KBs, M for MBs, G for GBs, T for TBs. The default unit of measurement is MBs.

  **-t tpdiskonly** Specify for only thin provisioned disks.

  **maxvolumesize** Maximum volume size. Limit volume growth to a maximum volume size. Maximum volume size can be specified in terms of S for Sectors, K for KBs, M for MBs, G for GBs, T for TBs. The default is unrestricted volume growth.

  **email** Notification email address when volume capacity has reached warning/critical threshold.
<alloc_attributes...>

Specify allocation attributes for mirror/stripe volumes. Attributes are of the form:
- mirror={diskclass}
- wantmirror={diskclass}
- stripe={diskclass}
- wantstripe={diskclass}

Mirror

Specify the diskclass to use for mirroring.

WantMirror

Specify the diskclass to use for mirroring. This specification is ignored if allocations are not available.

Stripe

Specify that volumes are to be striped across instances of a diskclass.

WantStripe

Specify that volumes are to be striped across instances of a diskclass. This specification is ignored if allocations are not available.

diskclass

Type of disk grouping to be used for mirror/stripe. Available types are channel, enclosure, port, or target.

diskname

Name of the disk, e.g., Harddisk2; or internal disk name (requires use of -g option), e.g., -g MyDg Disk2

p#c#t#l#

Corresponds to the Port, Channel, Target, LUN of a disk.

-A APPLYPOLICYTOFAILOVER

Make capacity monitoring policy available to another cluster node after a failover.

vxdg

list

Displays a list of the dynamic disk groups on the computer.

dginfo

Displays information about a specified dynamic disk group.

init

Creates a dynamic disk group.

adddisk

Adds a basic disk to a dynamic disk group.
rmdisk  
Removes a disk from a dynamic disk group and reverts it back to a basic disk.

import  
Imports the specified dynamic disk group on the computer.

deport  
Deports the specified dynamic disk group on the computer.

destroy  
Deletes the specified dynamic disk group on the computer.

protect  
Adds private dynamic disk group protection.

release  
Removes private dynamic disk group protection.

upgrade  
Upgrades the disk group version to the current version (the default) or earlier version of Volume Manager.

repldisk  
Replaces the specified disk by moving all the subdisks to a spare disk.

split  
Splits the specified dynamic disk group into two dynamic disk groups.

recover  
Recovers a dynamic disk group that fails because of a system crash or other problem during a dynamic disk group split operation.

join  
Joins two dynamic disk groups into one larger dynamic disk group.

latestart  
Imports diskgroups after system starts up to allow more time for storage to become available for applications.

reclaim  
Reclaim storage space from thin provisioned disks in a dynamic disk group.

reclaimcancel  
Immediately cancel reclaim operation

refreshff  
Refreshes the disk group state on the system to support the new Deported Read-Only state for fast failover.

A dynamic disk group is identified by `-g<DynamicDiskGroupName>`, such as DynDskGrp1 or by its dynamic disk group ID (DgID). The DgID is an internal number assigned to the disk group. It can be viewed through the `vxdg list` or `vxdg dginfo` command.
A disk that is being added or removed is identified by its `<DiskName>` or by p#c#t#l# (where the #s corresponds to the port, channel, target, and LUN of a disk).

In early releases of Volume Manager for Windows, using `vxdg adddisk` to add the first basic disk to a dynamic disk group automatically created the first dynamic disk group (known as the primary dynamic disk group). If you then used `vxdg adddisk` to specify adding a disk to a dynamic disk group with a new name, a secondary dynamic disk group was formed. You must use the `vxdg init` command to create a dynamic disk group. The `vxdg adddisk` command now only adds disks to dynamic disk groups that have already been created.

**Note:** In Symantec Storage Foundation for Windows, the primary dynamic disk group is the dynamic disk group that contains the boot or system disk. It is not necessarily the first dynamic disk group that is created.

**Note:** In all versions of Volume Manager, occasionally if volumes arrived after commands like import, init, adddisk, and join are completed, subsequent commands like associating a drive letter might fail. However, in the Symantec Storage Foundation for Windows, these commands will wait until the volumes are ready to be used. If the volumes take a very long time to arrive (a rare case), the command may timeout so that the script will not hang. Users can use `-o timeout=<n>` to override the default timeout.

Typing the following sequence for each keyword brings up a description of its syntax:

`vxdg <keyword> -?`

**vxdg list**

`vxdg list`

Returns a list of the dynamic disk groups that are on the current system. The list includes the disk groups’ names, their types, whether each disk group is imported or deported, and the DgID. The dynamic disk group ID (DgID) is an internal number assigned to the disk group. It can be used in place of the dynamic disk group name.

**vxdg dginfo**

`vxdg -g<DynamicDiskGroupName> dginfo`
Returns information about the dynamic disk group that is referenced in
-g<DynamicDiskGroupName>. Gives the names and numbers of the volumes and
the disks in the dynamic disk group. It also includes the dynamic disk group name,
its state (either Imported or Deported), its Access level (whether Read/Write or
Read-Only) and its dynamic disk group ID. The dynamic disk group ID (DgID) is
an internal number assigned to the disk group. It can be used in place of the
dynamic disk group name.

Example

vxdg -gSalesDynDskGrp dginfo

Lists the names and numbers of the volumes and disks in the disk group named
"SalesDynDskGrp."

Example of an output for vxdg dginfo, when a disk group is set for FastFailover
for the disk group QDG1:

On active node

C:\vxtool>vxdg -gQDG1 dginfo

Disk group information for the disk group QDG1

Name : QDG1

DiskGroup ID : cc33237e-266b-4b6e-84f6-455191dabdd9

Disk Group Type : Dynamic (Cluster)

Status : Imported

Access : Read/Write

:

Names of the Volumes are....
\Device\HarddiskDmVolumes\QDG1\QVol1 (Q:)

Names of the Disk are....
Harddisk4

On passive node

C:\>vxdg -g qdg1 dginfo

Disk group information for the disk group qdg1

Name : QDG1

Command line interface
DiskGroup ID : cc33237e-266b-4b6e-84f6-455191dabdd9
Disk Group Type : Dynamic (Cluster)

Status : Deported
Access : Read-Only

Names of the Volumes are....
\Device\HarddiskDmVolumes\QDG1\QVol1
Names of the Disk are....
Harddisk4

vxdg init

vxdg -g<DynamicDiskGroupName> [-f] [-s | -R] [-TLDM] [-o timeout=<n>]
init [<medianame>=]<DiskName>... | <p#c#t#l# >...
[basename=<seedname>]

Creates a new dynamic disk group with the specified disks.

-g<DynamicDiskGroupName>  Identifies the dynamic disk group name. A
dynamic disk group name is limited to 18
ASCII characters. It should not have any
spaces.

-f  Force the operation.

-s  Creates a cluster dynamic disk group.

-R  Creates a private dynamic disk group, that
is a disk group with private dynamic disk
group protection.
On Windows Server operating systems:

Creates a Microsoft Disk Management Disk Group.

**Note:** Windows Server OS allows only one Microsoft Disk Management Disk Group and automatically assigns the name of the disk group when it is created. Specifying the `-TLDM` option with the name of the disk group with the `-g <diskgroupname>` attribute results in an error.

`-TLDM` allows the operation to timeout in `<n>` seconds.

`-o timeout=<n>`

Internal disk name specified by user.

**Note:** Only ASCII characters are allowed.

`<medianame>`

The name of the disk or disks, which can be specified by the device name (such as `Harddisk2`).

`<DiskName>...`

Another way to indicate a disk name; the #s correspond to port, channel, target, and LUN of the disk.

`<p#c#t#l#>...`

A name that when appended with a system-generated number becomes the internal identifier of the disk.

**Note:** Only ASCII characters are allowed.

There can be one or more disks in a dynamic disk group. Disks within a dynamic disk group share a common configuration. Dynamic volumes are created within a dynamic disk group and are restricted to using disks within that group.

You can use this command to create a cluster dynamic disk group, a private dynamic disk group, a Windows Disk Management compatible dynamic disk group, or a Microsoft Disk Management Disk Group.

See “Disk groups overview” on page 171.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support cluster disk groups.

Examples
vxdg -gSharedDg1 init -s -TLDM Harddisk0 Harddisk1

vxdg init -TLDM Harddisk5

On Windows Server operating systems, this command creates a Microsoft Disk Management Disk Group. The dynamic disk group includes Harddisk5.

vxdg -gDG1 init mediaName1=Harddisk1 mediaName2=Harddisk2 Harddisk3 Harddisk4

This command creates a new dynamic disk group called "DG1". The dynamic disk group includes Harddisk1, Harddisk2, Harddisk3, and Harddisk4 and the names mediaName1 and mediaName2 are assigned to Harddisk1 and Harddisk2 respectively.

vxdg adddisk

vxdg -g<DynamicDiskGroupName> [-o timeout=<n>] adddisk
[<medianame>=]<DiskName>... | <p#c#t#l#>... [basename=<seedname>]

Adds one or more basic disks that are referenced in <DiskName>... | <p#c#t#l#>... to the dynamic disk group referenced in -g<DynamicDiskGroupName>.

The following attributes apply:

-g<DynamicDiskGroupName>

The name of the disk group that the disk is being added to.

-o timeout=<n>

Allow the operation to timeout in <n> seconds.

<medianame>

Internal disk name specified by user.

Note: Only ASCII characters are allowed.

<DiskName>...

The name of the disk or disks, which can be specified by the device name (such as Harddisk2).

<p#c#t#l#>...

Another way to indicate a disk name; the #s correspond to port, channel, target, and LUN of the disk.

<seedname>

A name that when appended with a system-generated number becomes the internal identifier of the disk.

Note: Only ASCII characters are allowed.
The ellipses indicate that you can specify more than one disk.

You can no longer create a dynamic disk group implicitly by using a different dynamic disk group name. Dynamic disk group creation and all the options associated with the operation are now done through `vxdg init` instead.

Examples

```
vxdg -gSalesDynDskGrp adddisk Harddisk4
```

Adds Harddisk4 to SalesDynDskGrp.

```
vxdg -gclustr_dyndskgrp1 adddisk Harddisk5
```

Adds Harddisk5 to the cluster dynamic disk group clustr_dyndskgrp1.

```
vxdg rmdisk
vxdg [-g<DynamicDiskGroupName>] [-f] rmdisk <DiskName> | p#c#t#l#>
```

Reverts a disk that is referenced in `<DiskName>` or `<DiskName>` from a dynamic disk to a basic disk. `<DiskName>` can be the disk name or path name of the device, such as Harddisk2 or `\Device\Harddisk2`. The disk must not contain any volumes when it is reverted.

The following attributes apply:

```
-g<DynamicDiskGroupName>  The name of disk group that the disk is being removed from.
-f                       Forces the command; use this option with caution.

<DiskName>                The disk name of the disk being reverted, which can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the `-g` option (for example, `-gDG2 Disk2`).

p#c#t#l#                  Another way to indicate a disk name; the #s correspond to port, channel, target, and LUN of the disk.
```

Example

```
vxdg rmdisk Harddisk2
```

Reverts Harddisk2 to a basic disk.
vxdg import

vxdg -g<DynamicDiskGroupName> [-n<NewDynamicDiskGroupName>] [-s | -d] [-f] [-C] [-o] timeout=<n> import

Imports the dynamic disk group referenced in -g<DynamicDiskGroupName> for use on this computer. You can use its name from the original computer or rename it with -n<NewDynamicDiskGroupName>.

Note: Microsoft Disk Management Disk Groups do not support the vxdg import command.

The following attributes apply:

- **-g<DynamicDiskGroupName>**  
The name of the disk group that is being imported.

- **-s**  
Imports the disk group as a cluster disk group. Using this command with the -s option is the only way you can convert a regular secondary disk group to a cluster disk group.

  With SFW, it is only required to use the -s the first time you create the cluster disk group.

- **-d**  
Converts a cluster disk group to a regular disk group.

- **-f**  
Forces the command; use this option with caution. The -f option can be used to force the import of a cluster disk group when a minority of disks in the disk group are available.

  See “Unable to bring a cluster disk group online when a minority of the disks in the disk group are available” on page 294.

- **-C**  
Clears the disk group’s host ID. See more about the host ID below.

- **-o timeout=<n>**  
The -o timeout=<n> option will allow the operation to timeout in <n> seconds. This is useful for scripting purposes.

About a disk group host ID:
When a dynamic disk group is created or imported, all disks in the dynamic disk group are stamped with the computer's host id. Typically, a dynamic disk group cannot be imported if any of its disks are stamped with a non-matching host id. This mechanism provides a check in cases when disks can be accessed from more than one host.

In Symantec Storage Foundation for Windows, if a dynamic disk group is in use by one computer when another computer attempts to import this dynamic disk group again, the import will fail because the host IDs of these two computers are different.

If a dynamic disk group is successfully deported, the host id is cleared and the group can be safely imported to another computer. With SFW, you do not need the -s option. A cluster disk group remains a cluster disk group when it is imported. If you want to change a cluster disk group back to an ordinary disk group, you deport it and then import it with the -d option.

To move a dynamic disk group from one computer to another when the dynamic disk group was not cleanly deported (for example, if the host computer crashed), you must specify the -c option to clear the original host id and stamp a new host id onto the dynamic disk group.

Example

```
vxdg -gDynDskGrp1 -nAcctgDynDskGrp import
```

Imports the dynamic disk group previously known as "DynDskGrp1" and renames it "AcctgDynDskGrp."

---

**vxdg deport**

```
vxdg -g<DynamicDiskGroupName> [-f] deport
```

Deports the dynamic disk group referenced in -g<DynamicDiskGroupName> in preparation for its being imported to another computer. Disks and volumes cannot be accessed until the dynamic disk group is imported. The -f option forces the deport of the disk group if one or more of its volumes are still in use. Symantec Storage Foundation for Windows does not let you deport a cluster disk group that is a VCS or Microsoft Failover Clustering disk group resource.

**Note:** Microsoft Disk Management Disk Groups do not support the **vxdg deport** command.

Example

```
vxdg -gDynDskGrp1 deport
```
Deports the dynamic disk group named "DynDskGrp1."

**vxdg destroy**

vxdg -g<DynamicDiskGroupName> [-f] destroy

Deletes the dynamic disk group referenced in `-g<DynamicDiskGroupName>`. The `-f` option forces the delete of the disk group.

Example

vxdg -gDynDskGrp1 destroy

Deletes the dynamic disk group named "DynDskGrp1."

**vxdg protect**

vxdg -g<DynamicDiskGroupName> protect

 Adds private dynamic disk group protection to a secondary dynamic disk group on the current host. Private dynamic disk group protection allows administrators to partition storage and assign exclusive ownership in a SAN or shared disk array.

**Note:** Microsoft Disk Management Disk Groups do not support the `vxdg protect` command.

Private dynamic disk group protection uses hardware locking techniques to protect a secondary dynamic disk group located on shared storage from access by other hosts connected to the shared storage pool. The hardware locking is implemented by using a SCSI reservation thread to maintain a current reservation for each disk in a protected group.

If disks are being added to a dynamic disk group that has a SCSI reservation, they will get a reservation automatically.

As long as the dynamic disk group remains on the same host, the protection will be enabled, even through restarts. If the dynamic disk group is deported and imported on another host, the private dynamic disk group protection is removed and the command must be redone to restore the protection.

Also, if you uninstall Symantec Storage Foundation for Windows, the dynamic disk group protection information is removed. If you then reinstall Symantec Storage Foundation for Windows and want to restore the dynamic disk group protection, you must redo the command.

See “Partitioned shared storage with private dynamic disk group protection” on page 185.
Example

vxdg -gDynDskGrp2 protect

Adds private dynamic disk group protection to DynDskGrp2.

vxdg release

vxdg -g<DynamicDiskGroupName> release

Removes private dynamic disk group protection.

Note: Microsoft Disk Management Disk Groups do not support the vxdg release command.

Example

vxdg -gDynDskGrp2 release

Removes private dynamic disk group protection from DynDskGrp2.

vxdg upgrade

vxdg -g<DynamicDiskGroupName> [-T <version>] upgrade

Upgrades a dynamic disk group that was originally created on an earlier version of Volume Manager or its related programs to the current Symantec Storage Foundation for Windows dynamic disk group version. The optional -T <version> parameter lets you upgrade a disk group created under Disk Management or earlier versions of Volume Manager for Windows to the Volume Manager disk group version.

In most cases, you'll want to upgrade an existing disk group so that it can take advantage of the dynamic disk group capabilities of Symantec Storage Foundation for Windows.

If you don't plan to make changes to these existing disk groups, you do not have to upgrade them; upgrading them lets you use additional features that affect a disk group, such as SFW's support for VSS, the Volume Shadow Copy Service feature. SFW incorporates VSS support into FlashSnap. If you plan to use the FlashSnap option with these existing disk groups, then you should upgrade them to the current disk group type.
Note: If you upgrade a disk group to SFW, you will not be able to import it on another server that is running earlier versions of Volume Manager or Disk Management. Once a disk group version is upgraded, it cannot be changed back to an earlier disk group version.

For information about the supported disk group versions, See “Dynamic disk group properties” on page 189.

Note: SFW does not let you upgrade a dynamic disk group that contains a boot or system volume. It must remain at the Disk Management disk group version level to allow for the fact that the program could be uninstalled and that a system and boot disk group would become inaccessible if it were a higher disk group version.

Examples

vxdg -gDynDskGrp1 upgrade

This command upgrades Symantec Storage Foundation for Windows dynamic disk group DynDskGrp1 to the latest version.

vxdg -gDynDskGrp2 -T60 upgrade

This command upgrades Symantec Storage Foundation for Windows dynamic disk group DynDskGrp2 to the version 60.

vxdg -gDynDskGrp2 -TSFW upgrade

This command can be used to convert Microsoft Disk Management Disk Group into SFW dynamic disk group. If you convert the disk group, it will no longer be managed by Windows Disk Management. It will only be accessible and managed by SFW. The conversion cannot be undone.

Note: Converting a Microsoft Disk Management Disk Group that was created using iSCSI disks to an SFW dynamic disk group is currently not supported.

You need to complete the conversion procedure with the following:

- Restart the server.
- Import the converted disk group using the vxdg import command. Specify the –c option in the command to clear the host ID.
If advanced disk group features are needed, upgrade the disk group version using the `vxdg upgrade` command.

**vxdg repldisk**

```bash
vxdg [-g<DynamicDiskGroupName>] repldisk "Missing Disk (disk#)" | DiskName | p#c#t#l# > <SpareDiskName>
```

Replaces a missing disk specified by "Missing Disk (disk#)" | DiskName | p#c#t#l# > moving all the subdisks to the disk specified by <SpareDiskName>. The disk specified by <SpareDiskName> must be a basic blank disk.

---

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxdg repldisk` command.

The following attributes apply:

- `-g<DynamicDiskGroupName>`: This parameter is required only if the internal disk name is used to identify the missing disk.
- "Missing Disk (disk#)" : Specifies the missing disk. This string represents how the missing disk is identified by the program. Because the string "Missing Disk (disk#)" has spaces, you must use quotation marks around it. The program specifies the (disk#), such as(disk2).
- `DiskName`: The internal disk name of the missing disk. Requires the use of the `-g` option (for example, `-gDG1 Disk2`).
- `p#c#t#l#` : Another way to indicate a disk name; the #s correspond to port, channel, target, and LUN.
- `<SpareDiskName>` : The name of the replacement disk.

This command is listed under dynamic disk group commands because it applies only to dynamic disks.

**Example**

```bash
vxdg repldisk "Missing Disk (disk2)"=Harddisk3
```

This command moves the contents of a missing dynamic disk designated as "Missing Disk (disk2)" to a basic disk, which in this case is Harddisk3. In the process, Harddisk3 becomes a dynamic disk. Active redundant volumes (mirrored
and RAID-5) on the replaced disk will be resynchronized automatically after disk replacement.

```
vxdg -gDG1 repldisk Disk2=Harddisk3
```

This is an example of the same command using the internal disk name parameter.

**vxdg split**

```
vxdg -g<SourceDynamicDiskGroupName> -n(TargetDynamicDiskGroupName)
```

Splits a dynamic disk group into two dynamic disk groups. The disks and volumes that will be in the split-off disk group must be healthy. Also, the volumes that will be in the new disk group must be complete for the command to succeed.

Microsoft Disk Management Disk Groups do not support the `vxdg split` command.

See “Dynamic disk group split” on page 367.

**-g<SourceDynamicDiskGroupName>**

Name of the current dynamic disk group.

**-n<TargetDynamicDiskGroupName>**

Name of the new dynamic disk group.

**-i**

Makes the new dynamic disk group to be in the Imported state.

**-f**

Forces the split. Use this command with care.

**-s**

Makes the new dynamic disk group a cluster dynamic disk group.

**-d**

Changes the target disk group from a cluster disk group to a regular disk group.

**-y**

Query for the split closure. See the first example below.

**-v**

Splits all disks in the dynamic disk group that contain snapshot volumes. Do not use the `<Object>` parameter when you use this option.
Name of a disk or volume, or a drive letter. You can split by either disks or volumes. This option is not needed when using the \(-v\) option.

The internal volume and disk name can be used. The \(<\text{DrivePath}>\) parameter is supported for a volume name. Also, a disk can be indicated by the \(p\#c\#t\#l\#\) parameter; the \#s correspond to port, channel, target, and LUN.

A primary dynamic disk group created in Symantec Storage Foundation for Windows cannot be split because it contains a boot or system drive. If you have dynamic disk groups created in an early release of Volume Manager, you will need to upgrade them to be compatible with Symantec Storage Foundation for Windows dynamic disk groups before you can use the \(\text{vxdg split and join commands}\). To do this you use the \(\text{vxdg upgrade}\) command.

By default, the new dynamic disk group is in the Deported state after the split. You can use the \(-i\) option to have it be in the Imported state. The source dynamic disk group remains in the Imported state.

With the VEA GUI split command, if the source disk group is a cluster disk group or a disk group with private dynamic disk group protection, the resulting target disk group will be of the same disk group type. With a CLI split command for either of these two disk group types, you must use the \(-i\) switch. In a CLI split operation with either of these disk group types, the target disk group does not assume the disk group type of the source disk group until after the target disk group is imported.

See “Dynamic Disk Group Split and Join” on page 365.

\textbf{Note:} In earlier versions of Volume Manager, it was necessary to designate the \(-s\) switch with every command involving a cluster disk group. However, in SFW, you use the \(-s\) switch only the first time you designate a cluster disk group. The \(-d\) switch has been added to allow changing a cluster disk group to an ordinary disk group.

Before using dynamic disk group split and join commands with a cluster on shared storage, you should review the considerations for doing so.
See “Using Dynamic Disk Group Split and Join with a cluster on shared storage” on page 375.

Examples

vxdg -gDynDskGrp1 -y -nDynDskGrp2 split Harddisk5 Harddisk7

This command makes a query to determine whether Harddisk5 and Harddisk7 in a dynamic disk group named "DynDskGrp1" comprise the total disks that are needed to have a dynamic disk group split where all the volumes in the split-off dynamic disk group are complete. Here is the output from the command:

Following is the Closure for the requested Splitoperation.
Names of the Disks are....
Harddisk7
Harddisk5
Harddisk6
Names of the Volumes are....
\Device\HarddiskDmVolumes\DynDskGrp1\Volume1
\Device\HarddiskDmVolumes\DynDskGrp1\Stripe1

The output indicates that to have a successful split, or what is called "split closure," Harddisk6 must be added. The example of the command to perform the actual split is as follows:

vxdg -gDynDskGrp1 -i -nDynDskGrp2 split Harddisk5 Harddisk6 Harddisk7

This command results in successfully splitting the dynamic disk group DynDskGrp1 with the target dynamic disk group DynDskGrp2 in the Imported state. The new dynamic disk group has the disks Harddisk5, Harddisk6, and Harddisk7.

The example that follows designates the volumes to be included in a new target disk group. Note the path name that is needed for volumes.

vxdg -gDynDskGrp1 -i -nDynDskGrp2 split
\Device\HarddiskDmVolumes\DynDskGrp1\mirrorvol1
\Device\HarddiskDmVolumes\DynDskGrp1\mirrorvol2

This command results in successfully splitting the dynamic disk group DynDskGrp1 with the target dynamic disk group DynDskGrp2 in the Imported state. The new dynamic disk group contains the volumes
\Device\HarddiskDmVolumes
\DynDskGrp2\mirrorvol1 and \Device\HarddiskDmVolumes
\DynDskGrp2\mirrorvol2.
vxdg -gtest -nnew split p1c0t110 p1c0t210

This command performs the split operation. The name of the new disk group is "new." This command shows an example of the use of the p#c#t#l# with the <Object> parameter.

vxdg -gtest -nnew split Disk1 Disk2

This command performs the split operation. This example shows the use of the internal disk name with the <Object> parameter.

vxdg -gtest -nnew split Volume1 Volume2

This command performs the split operation. This example shows the use of the internal volume name with the <Object> parameter.

vxdg -gtest -nnew split L:\Folder

This command performs the split operation. This example shows the use of <DrivePath> with the <Object> parameter.

vxdg -gtest -nnew split Volume1 Volume2 -f

This command performs the split operation. This example shows the use of the -f force option.

vxdg recover

vxdg -g<DynamicDiskGroupName> [-s|-d] recover

Recovers a dynamic disk group that fails because of a system crash or other problem during a dynamic disk group split operation. This command is used for manual recovery of a disk group when the disk group requires such recovery. The -s option recovers the disk group as a cluster disk group in the Imported state. The -d parameter is used to change a cluster disk group to a regular disk group.

More information is available about automatic and manual modes of recovery. See “Recovery for the split command” on page 371.

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support cluster disk groups.

Example

vxdg -gDynDskGrp2 recover
Recovers DynDskGrp2 after it failed because of a system crash during a dynamic disk group split operation.

**vxdg join**

```
/oracle/vxdg join -g<SourceDynamicDiskGroupName> -n<TargetDynamicDiskGroupName> 
[-C] [-P] [-o timeout=<n>] join
```

Joins two dynamic disk groups together. If some disks are missing or are not functioning, the join command will fail.

**Note:** Microsoft Disk Management Disk Groups do not support the vxdg join command.

- `-g<SourceDynamicDiskGroupName>`
  - Name of the source dynamic disk group, the dynamic disk group that will be added to the target dynamic disk group. The source dynamic disk group ceases to exist after the join.

- `-n<TargetDynamicDiskGroupName>`
  - Name of the target dynamic disk group, the dynamic disk group that will exist after the join.

- `-C`
  - Clear host id. This parameter should be used when you want to import a disk group from another node and that disk group was not properly deported. A host id might not be cleared, for example, if the host computer became nonfunctional. When a host id has not been cleared, SFW will not permit the join without the Clear host id override. Use this override with care.

- `-P`
  - Allow Partial Join.
    - See the explanation of the PartialJoin command:
      - See “About partial disk group join” on page 374.
Allow the operation to timeout in <n> seconds. This parameter is useful for scripting.

The disk group type after the join will be the type of the target disk group. For example, if the target disk group before the join had private dynamic disk group protection, the resulting disk group will have private dynamic disk group protection after the join. Also, a cluster dynamic disk group will not be allowed to be the source group for a join command if the disk group is being monitored by cluster software, such as VCS or Microsoft Failover Clustering. However, a cluster disk group can be a target dynamic disk group in a join command.

See “Dynamic Disk Group Split and Join” on page 365.

Example

vxdg -gDynDskGrp2 -nDynDskGrp1 join

This command will join DynDskGrp2 back into DynDskGrp1. You can also join dynamic disk groups together that were not originally split apart.

vxdg join -gddg -ncdg -o timeout=200 join

This command joins the dynamic disk group ddg to dynamic disk group cdg. The example shows the use of the -o timeout=<n> parameter.

vxdg reclaim

Reclaim storage space from thin provisioned disks in a dynamic disk group. The following attributes apply:

-g<DynamicDiskGroupName> Name of dynamic disk group.
-b Run the command in the background.
-volumes Reclaim storage space from volumes.
-freespaces Reclaim freespace from disks.
-all Reclaim storage space from volumes and freespace from disks. (Default option.)
**Note:** The operation to reclaim storage from thin provisioned disks is not supported for RAID-5, DCO, or Volume Replicator DCM volumes.

**Note:** The reclaim storage operation is disabled during a shrink volume operation. The reclaim storage operation is enabled when the shrink volume operation has completed.

Example

```bash
vxdg -gDG1 reclaim option=freespaces
```

This command reclaims only the freespace of the thin provisioned disks in the DG1 dynamic disk group.

**vxdg reclaimcancel**

```bash
vxdg [-g<DynamicDiskGroupName>] reclaimcancel
option=<volumes|freespaces|all>
```

Immediately cancels the reclaim operation. Only a portion of the storage space of the dynamic disk group may have been reclaimed.

The following attributes apply:

- `-g<DynamicDiskGroupName>`: Name of dynamic disk group.
- `volumes`: Reclaim storage space from volumes.
- `freespaces`: Reclaim freespace from disks.
- `all`: Reclaim storage space from volumes and freespace from disks. (Default option.)

Example

```bash
vxdg -gDG1 reclaimcancel
```

This command immediately cancels the reclaim operation for volumes and freespace of the thin provisioned disks in the DG1 dynamic disk group. (No option is specified, so the default option of volumes and freespace is used.)
vxdg latestart

vxdg -g<DynamicDiskGroupName> latestart on|off

The following attributes are:

-g<DynamicDiskGroupName> Name of the dynamic disk group that is made available after system startup.

on Enables the specified dynamic disk group to be imported after system startup.

off Disables the specified dynamic disk group from being imported after system startup.

Generally, dynamic (non-cluster) disk groups are automatically imported during system startup. However, some types of storage are not available during system startup which would cause the import to fail. In a clustered environment, disk groups are imported by the cluster application and do not need to have vxdg latestart enabled.

Specifying on in the vxdg latestart command enables the dynamic disk group that is referenced in -g<DynamicDiskGroupName> to be imported after system startup by the Veritas DG Delayed Import Service (VxDgDI). VxDgDI can import the dynamic disk group after it is made dependent on the service that controls the storage. This allows the required time for the storage to become available. Applications that rely on storage imported by the VxDgDI service may also need to be made dependent on VxDgDI so that they may proceed when their storage is available. Making the VxDGDI service startup type automatic allows the service to run every time the system is started.

Note: To configure a dependency for iSCSI, use VxDgDI to import the dynamic disk group after it is made dependent on the iSCSI service (MSiSCSI) that controls the storage.

As long as the dynamic disk group remains on the same host, vxdg latestart is enabled, even through restarts. If the dynamic disk group is deported and imported on another host, vxdg latestart must be reenabled on the new host.
For SFW, newly created dynamic disk groups that contain iSCSI disks, or existing dynamic disk groups that have iSCSI disks added to them, are automatically configured to be imported after system startup. Using the `vxdg latestart` command is not required for these dynamic disk groups.

**To setup vxdg latestart:**

1. Edit the Windows registry to make VxDgDI dependent on the service that controls the storage.
2. Enter the `vxdg latestart` command at the command line.
   
   For example
   
   ```
   vxdg -g DynDskGrp2 latestart on
   ```
   
   enables the dynamic disk group "DynDskGrp2" to be imported after system startup.
3. Applications that rely on storage imported by the VxDgDI service will have their storage available automatically after the Veritas DG Delayed Import Service completes its startup process. However, applications that start as a Windows service need to be made dependent on the Veritas DG Delayed Import Service with the Windows Registry Editor before their storage is available.

**vxdg refreshff**

```
vxdg -g <diskgroupname> refreshff
```

This command refreshes the state of the disk groups on a system to support the new Deported Read-Only disk group state of fast failover.

Sometimes, the disk groups on passive nodes do not reflect the new Read-Only state, even though FastFailover is enabled for the VMDg resources. This typically occurs in cases where a new node is added to a service group where FastFailover is already enabled. This command must be run on the newly added node for it to support the fast failover disk group state.

**vxclus**

The `vxclus` utility makes it possible to bring a Microsoft Failover Clustering disk group online on a node with a minority of the disks in the disk group. The `vxclus` utility creates an entry in the Registry that enables the cluster resource to be brought online. Once `vxclus enable` is executed, you can bring the resource online with the Windows Server's Failover Cluster Manager snap-in.
With SFW, the `vxclus` utility has added keywords that allow a cluster disk group to reside on the same bus as the cluster node’s system and boot disk. These keywords are necessary to support booting from a SAN. Also your hardware array must also have support for booting from a SAN. Refer to your hardware array manufacturer’s instructions and the Microsoft Web site for more information about booting from a SAN.

**Note:** The `vxclus` commands are needed only with Microsoft Failover Clustering.

Bringing cluster disk groups online on a node with a minority of the disk group’s disks is described in more detail in the following topic:

See “Unable to bring a cluster disk group online when a minority of the disks in the disk group are available” on page 294.

- **enable**
  - Allows a cluster disk group to be brought online when a minority of disks in the disk group is available.

- **disable**
  - Disables the capability to bring a cluster disk group online when a minority of disks in the disk group are available.

- **cleanup**
  - Disables for all cluster disk groups on a node the capability to bring the disk group online when a minority of disks in the disk group is available. The cleanup option is not applicable to the `UseSystemBus` support.

- **UseSystemBus ON**
  - Sets up the conditions to allow a cluster disk group to be created that can reside on the same bus as the cluster node’s system or boot disk.

- **UseSystemBus OFF**
  - Removes the capability of a creating a cluster disk group that can reside on the same bus as the cluster node’s system or boot disk.

Typing the following sequence for each keyword brings up a description of its syntax:

```
vxclus <Keyword> -?
```
**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxclus` command.

---

**vxclus enable**

```
vxclus enable -g<DynamicDiskGroupName> [-p]
```

Enables a designated cluster disk group for force import so that it may be brought online when a minority of disks in the disk group are available. The `vxclus` utility creates an entry in the Windows registry that enables the cluster resource for force import. Once `vxclus enable` is executed, you can bring the resource online with Windows Server's Failover Cluster Manager snap-in. After the resource is brought online, the `vxclus` force import functionality is disabled. However if `-p` is specified, the entry made in the Windows registry is such that the `vxclus` force import functionality remains enabled. This allows persistent force import of the designated cluster disk group so that this resource can always be brought online with the Failover Cluster Manager snap-in.

The following attributes apply:

- `-g<SourceDynamicDiskGroupName>`
  
  Name of the cluster disk group to be enabled for force import.

- `-P`

  Enables persistent force import of the cluster disk group.

**Example**

```
vxclus enable -gDG2 -p
```

Enables the DG2 cluster disk group to be brought online on a node when a minority of disks in the disk group are available. Also the DG2 cluster disk group is enabled so that it is always ready to be brought online with Windows Server's Failover Cluster Manager snap-in.

---

**vxclus disable**

```
vxclus disable -g<DynamicDiskGroupName>
```

Disables the capability to bring the designated cluster disk group online on a node when a minority of disks in the disk group are available. This command is necessary only if you have executed the `vxclus enable` command but have not yet brought the disk group online with Windows Server's Failover Cluster Manager snap-in and later decide that you do not want to bring the disk group online if there are not many disks available in a disk group.
Example

vxclus disable -gDG2

Removes from the DG2 cluster disk group the capability to be brought online when a minority of disks in the disk group are available.

vxclus cleanup

vxclus cleanup

Disables for all cluster disk groups on a node the capability to bring a disk group online when a minority of disks in the disk group are available. This command is necessary only if you have executed the vxclus enable command on multiple cluster disk groups but you have not yet brought the cluster disk groups online with Windows Server's Failover Cluster Manager snap-in and you decide that you do not want to bring these disk groups online.

Example

vxclus cleanup

On the current cluster node, this command turns off the vxclus capability for any cluster disk groups that had this capability enabled.

vxclus UseSystemBus ON

vxclus UseSystemBus ON

This command makes the registry changes necessary to allow a dynamic cluster disk group to be created on the same bus as the cluster node's system or boot disk. In previous versions of Volume Manager, the program did not allow this to happen. The reason for making this command available is for users who want to have the boot or system disk and the cluster disk group located on a SAN in order to boot from the SAN.

**Warning:** If you decide that you want to have a cluster disk group on the same bus as the computer node's system or boot disk and you want to boot from a SAN, then you need to follow the specific instructions of your array manufacturer for booting from a SAN. See the Microsoft Windows Server Knowledge Base article 305547 for details of the considerations involved when booting from a SAN.

Example

vxclus UseSystemBus ON
Makes it possible to create a cluster disk group on the same bus as the cluster node’s system or boot disk.

**vxclus UseSystemBus OFF**

**vxclus UseSystemBus OFF**

Reverses the `vxclus UseSystemBus ON` command, removing the Registry changes that make it possible to create a cluster disk group that can reside on the same bus as the cluster node’s system or boot disk.

**Example**

**vxclus UseSystemBus OFF**

Removes the capability of creating a cluster disk group on the same bus as the cluster node’s system or boot disk.

**vxdisk**

The `vxdisk` utility has commands relating to disks.

- **diskinfo**
  
  Gives information about a disk.

- **attach**
  
  Connects the disk and enables access to the disk.

- **detach**
  
  Stops disk access and disconnects the disk.

- **list**
  
  Gives information about all disks on a managed server or on a specified disk group.

- **merge**
  
  Merges a foreign disk.

- **reactivate**
  
  Reactivates a disk (restarts a disk).

- **sig**
  
  Places a disk signature on a disk.

- **convertdisk**
  
  Converts the partitioning scheme of a disk to MBR or GPT.

- **set track**
  
  Sets track alignment offset for data storage.

- **trackaligninfo**
  
  Displays track alignment setting for host and track alignment offset and settings for all arrays.

- **set hotreloc**
  
  This option sets hot relocation at the host or disk level.

- **setsite**
  
  This option is used to add disks to a particular site.

- **rmsite**
  
  This option is used to remove disk or disk from a site.
ping
Identifies a physical disk.

offline

online

reclaim
Reclaim storage space from a thin provisioned disk.

reclaimcancel
Immediately cancel reclaim operation

Each keyword is followed by <DiskName>, the name of the disk, which can be indicated by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g disk group option (for example, -gDG1 Disk2). Another way to specify a disk is with the p#c#t#l# parameter. The #s correspond to port, channel, target, and LUN of the disk.

Typing the following sequence for each keyword brings up a description of its syntax:

vxdisk <Keyword> -?

vxdisk diskinfo

Provides information on the disk referenced in <DiskName>. The information includes the disk name, the dynamic disk group with which the disk is associated, capacity (indicated as Length), disk partition style, free space, device type, port, channel, target ID, LUN, the disk signature, serial number, track alignment settings, Thin Provisioning type (ThinNoReclaim or ThinReclaim for thin provisioned disks), etc. If the disk has subdisks associated with it, they will be listed.

vxdisk [-g <DynamicDiskGroupName>] diskinfo [-e] <DiskName>

The following attributes apply:

-e
Is an optional parameter.

Use the -e option if you want to display extended attribute information for arrays in addition to the basic disk information. Extended attribute information available for display depends on the array type. It can include vendor ID, product ID, revision ID, cabinet serial number, array volume ID, array LUN type, array RAID level, array snapshot LUN, array replication LUN, array media type, array transport protocol, array port WWN number, array port serial number, array controller ID and array hardware mirror.
DiskName
Name of the disk, e.g., Harddisk2; or internal disk name (requires use of -g option), e.g., -g MyDg Disk2

The –g option is needed only if you use the internal disk name to indicate the disk name (for example, -gDG1 Disk2).

If the disk is site tagged, then it will display the site information if the disk name is specified.

See “Administering disks for site-based allocation” on page 461.

p#c#t#l# Corresponds to the Port, Channel, Target, LUN of a disk.

Note: Not all manufacturers of thin provisioned disks enable the display of the current provisioned size.

Example

vxdisk diskinfo Harddisk2

Gives information on Harddisk2.

vxdisk attach

vxdisk [-g<DynamicDiskGroupName>] attach <DiskName | p#c#t#l#>

Attaches a disk that was detached.

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the vxdisk attach command.

The following attributes apply:

-\ g<DynamicDiskGroupName>
This parameter is required only if the internal disk name is used.

<DiskName>
The internal disk name of the missing disk, which requires the –g option (for example, -gDG1 Disk2).

p#c#t#l# Another way to indicate a disk; the #s correspond to port, channel, target and LUN of a disk.

Example
vxdisk -gDG1 attach Disk2

Attaches a disk, Disk2, to disk group DG1, that was previously detached.

vxdisk detach

vxdisk [-g<DynamicDiskGroupName>] detach <DiskName | p#c#t#l# >

Detaches a disk.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the vxdisk detach command.

The following attributes apply:

- **-g**<DynamicDiskGroupName>
  This parameter is required only if the internal disk name is used.

- **<DiskName>**
  The internal disk name of the missing disk, which requires the -g option (for example, -gDG1 Disk2).

- **p#c#t#l#**
  Another way to indicate a disk; the #s correspond to port, channel, target and LUN of a disk.

Example

vxdisk -gDG1 detach Disk2

Detaches a disk, -gDG1 Disk2, that was attached earlier.

vxdisk list

Lists device name, internal disk name, disk group, disk partition style, size, free space, LUN, status, serial number, ThinProvisioningType (ThinNoReclaim or ThinReclaim for thin provisioned disks), ProvisionedSize (current size of thin provisioned disks), Site, etc. for all the disks on the managed server.

See “Administering disks for site-based allocation” on page 461.

vxdisk [-g <DynamicDiskGroupName>] [-v] list

The following attributes apply:

- **-g**
  The -g option limits the list of disks to the specified disk group.
-v  The -v (verbose) option displays signature, status, bus type, port, target, channel, LUN, track alignment offset, and track alignment setting information for the disks in the list.

**Note:** Not all manufacturers of thin provisioned disks enable the display of the current provisioned size.

**Example**

vxdisk -gDB1 -v list

Gives information on all the disks in the DB1 disk group. The -v option includes the signature, status, bus type, port, channel, target, and LUN information.

**vxdisk merge**

vxdisk -g<DynamicDiskGroupName> merge <DiskName | p#c#t#l#>

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the vxdisk merge command.

In the GUI, this command is called Merge Foreign Disk. If you remove a disk from the server and also remove it in Symantec Storage Foundation for Windows and then decide to reattach it to the server as a member of the same dynamic disk group, you will need to use this command. The command will reinstate the disk to its old status as a member of its former dynamic disk group on that server.

You will also need to use this command if you remove a disk without taking its disk group offline, move the disk to another server, and then attempt to reinstall it in the original server. The command is necessary in this case because the disk has the other server’s disk group ID.

See “Merge foreign disk command” on page 276.

The following attributes apply:

- **-g<DynamicDiskGroupName>**  Name of the dynamic disk group.

- **<DiskName>**  The designated hard disk, which can be specified by the device name (such as Harddisk2).

- **p#c#t#l#**  The #s corresponds to the port, channel, target, and LUN of the disk.
Example

vxdisk -gDB1 merge Harddisk3

Merges Harddisk3 back into its former disk group, DB1.

**vxdisk reactivate**

vxdisk [-g<DynamicDiskGroupName>] reactivate <"Missing Disk (disk#)"| DiskName |p#c#t#l#>

Reactivates a disk that has gone offline.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxdisk reactivate` command.

The following attributes apply:

- `-g<DynamicDiskGroupName>` This parameter is required only if the internal disk name is used.
- "Missing Disk (disk#)" Specifies the missing disk. This string represents how the missing disk is identified by the program. Because the string "Missing Disk (disk#)" has spaces, you must use quotation marks around it. The program specifies the (disk#), such as(disk2).
- `<DiskName>` The internal disk name of the missing disk, which requires the `-g` option (for example, -gDG1 Disk2).
- `p#c#t#l#` Another way to indicate a disk; the #s correspond to port, channel, target and LUN of a disk.

Example

vxdisk reactivate "Missing Disk (disk2)"

Reactivates a disk shown as "Missing Disk (disk2)" that has gone offline. This assumes that the disk was offline and has now come back online.
vxdisk set hotreloc

vxdisk [-g<DynamicDiskGroupName>] set hotreloc
<mode=<enable|disable|on|off>>

| <usage=<preferred|secondary|nohotuse|reserved> <diskname>>

Set hot relocation at the host or disk level.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxdisk set hotreloc` command.

**Note:** Dynamic disks belonging to a SAN Disk Group do not support the `vxdisk set hotreloc` command.

The following attributes apply:

- `-g <DynamicDiskGroupName>` Specifies the dynamic disk group name.

- `mode=<enable|disable|on|off>` Specifies the mode to set the hot relocation.
  - `enable`: Enable hot relocation at the host level.
  - `disable`: Disable hot relocation at the host level.
  - `on`: Enable hot relocation at the disk level.
  - `off`: Disable hot relocation at the disk level.

- `usage=<preferred|secondary|nohotuse|reserved>` Hot relocation setting at the disk level.
  - `preferred`: Preferred target disk in case of I/O failure.
  - `secondary`: Target disk used in case of I/O failure if no preferred disk is specified, or no free space available on preferred disks.
  - `nohotuse`: Does not allow disk to be used for hot relocation.
  - `reserved`: Does not allow disk to be used for hot relocation or other automatic selection operations.
Specifies disk name for hot relocation. (Requires the -g option; for example, -gDG1 Disk2.)

Example

vxdisk set hotreloc usage reserved disk2

Does not allow disk2 to be used for hot relocation.

vxdisk hotrelocinfo

vxdisk [-g<DynamicDiskGroupName>] hotrelocinfo [<diskname>]

The vxdisk hotrelocinfo CLI displays hot relocation settings for a given hard disk.

Example:

vxdisk hotrelocinfo harddisk1

Provides information regarding harddisk1 whether it is reserved for manual use or can be used as a hot relocation target. If the disk can be used as a hot relocation target, it provides information regarding its Hot Relocation usage.

The following attributes apply:

-g<DynamicDiskGroupName> Specifies the dynamic disk group name.

<DiskName> Specifies disk name for hot relocation. (Requires the -g option; for example, -gDG1 Disk2.)

vxdisk sig

vxdisk sig "<DiskName> (no signature)
|p#c#t#l#> [diskstyle=<MBR|GPT>]

Adds a disk signature to a new disk. Because the string "<DiskName> (no signature)" has spaces, you must use quotation marks around it.

The following attributes apply:

<DiskName> The internal disk name of the disk.

p#c#t#l# Another way to indicate a disk; the #s correspond to port, channel, target and LUN of a disk.
diskstyle=<MBR|GPT>  Specifies the disk partitioning scheme. The default is MBR.

Example

vxdisk sig "Harddisk5 (no signature)"

Adds a signature to Harddisk5 with a diskstyle of MBR.

**vxdisk set track**

vxdisk [-g<DynamicDiskGroupName>] set track align= <enable | disable | yes | no> offset=offset# <[vid=<vendor id> pid=<product id>] | <DiskName> | <p#c#t#l#>>

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support track alignment.

Sets track alignment offset of data storage for disks connected to the host. When a disk is specified by name or by p#c#t#l#, the track alignment is set for all the disks that match the vendor ID and product ID of the disk. When the vendor ID and the product ID is specified, the track alignment is set for all the disks that match the specified vendor ID and product ID.

This command sets track alignment for all disks connected to the host if no disk or no vendor ID and product ID are specified.

The following attributes apply:

- **-g<DynamicDiskGroupName>**  This parameter is required only if the internal disk name is used.

  **align**  Enable or Disable track alignment.
  
  *(Yes to enable or No to disable track alignment.)*

  **vid**  Vendor ID of storage device.

  **pid**  Product ID of storage device.

  **offset**  Track alignment offset of storage device
  *(Range: 64 - 4096).*

  **<DiskName>**  Name of disk (for example, Harddisk2) or internal disk name (requires the -g option, for example, -gDG1 Disk2).
Another way to indicate a disk; the #s correspond to port, channel, target and LUN of a disk.

Examples

vxdisk set track align=enable vid=DGC pid=EMC offset=128

Enables track alignment and sets offset to 128 for all disks connected to the host with vendor ID matching 'DGC' and product ID matching 'EMC'.

vxdisk set track align=enable vid=default pid=default offset=64

Enables track alignment and sets offset to 64 for all disks connected to the host with vendor ID matching 'default' and product ID matching 'default'. (The 'default' specification refers to those disks that are not explicitly supported by the track alignment feature of SFW. Use the vxdisk trackaligninfo command to display which disks are supported by SFW.)

vxdisk set track align=enable offset=67 harddisk6

Enables track alignment and sets offset to 67 for all disks connected to the host with vendor ID and product ID that match the vendor ID and product ID of harddisk6.

vxdisk -gdg1 set track align=enable offset=67 disk6

Enables track alignment and sets offset to 67 for all disks connected to the host with vendor ID and product ID that match the vendor ID and product ID of disk6 in diskgroup dg1.

vxdisk set track align=enable

Enables track alignment for all disks connected to the host.

vxdisk trackaligninfo

vxdisk trackaligninfo

Displays the track alignment setting for the host and track alignment offset and settings for all arrays (including VID and PID).

Examples

vxdisk trackaligninfo
Displays the track alignment settings at the host level. Also displays the track alignment offset and track alignment setting for all arrays (identified by vendor ID and product ID).

**vxdisk ping**

```
vxdisk [-g<DynamicDiskGroupName>] ping <DiskName | p#c#t#l# >
```

Identifies a physical disk. This command flashes the fault light till a ping duration of 5 minutes is completed.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxdisk ping` command.

The following attributes apply:

- `-g <DynamicDiskGroupName>`: This parameter is required only if the internal disk name is used.
- `<DiskName>`: The internal disk name of the disk, which requires the `-g` option (for example, `-g DG1 Disk2`).
- `p#c#t#l#`: Another way to indicate a disk; the #s correspond to port, channel, target and LUN of a disk.

**Example**

```
vxdisk ping -gDG1 Disk2
```

Identifies Disk2 that belongs to disk group DG1.

**vxdisk reclaim**

```
vxdisk [-g<DynamicDiskGroupName>] [-b] reclaim<DiskName | p#c#t#l# >
```

Reclaims storage space from a thin provisioned disk. The `-b` (background) option runs the reclaim operation in the background.

The following attributes apply:
-g <DynamicDiskGroupName> Name of dynamic disk group. (Needed only if you are using the internal disk name of the disk.)

-b Run the command in the background.

<DiskName> The DiskName can be the external name or the internal name.

- The external name of the disk (for example, Harddisk2.
- The internal disk name of the disk, which requires the -g option (for example, -gDG1 Disk2).

p#c#t#l# Another way to indicate a disk; the #s correspond to port, channel, target and LUN of a disk.

Note: The operation to reclaim storage from thin provisioned disks is not supported for RAID-5, DCO, or Volume Replicator DCM volumes.

Note: The reclaim storage operation is disabled during a shrink volume operation. The reclaim storage operation is enabled when the shrink volume operation has completed.

Example

vxdisk reclaim Harddisk2 Harddisk3

This command reclaims space on the disks with the external names of Harddisk2 and Harddisk3.

vxdisk reclaimcancel

vxdisk [-g DynamicDiskGroupName] reclaimcancel <DiskName | p#c#t#l#>

Immediately cancels the reclaim operation. Only a portion of the storage space of the disk may have been reclaimed.

The following attributes apply:
vxdisk

Example

vxdisk reclaimcancel Harddisk2 Harddisk3

This command immediately cancels the reclaim operation on the disks with the external names of Harddisk2 and Harddisk3.

vxdisk setsite

To add an SFW dynamic disk to a site run the following command:

vxdisk [-g<DynamicDiskGroupName>] setsite site=<sitename> <diskname(s)| p#c#t#l#>

See “Administering disks for sites through CLI” on page 464.

The following attributes apply:

-g<DynamicDiskGroupName>  Specifies the dynamic disk group name. For DG1

site=<sitename>            Where site is the name of the site, for example, site1.
                            Sitename can take any alphanumeric values and can be maximum 31 characters long.

<diskname(s)>               The name of the disk or disks that is selected for tagging. For example, Harddisk1, Harddisk2, etc.

p#c#t#l#                    Another way to indicate a disk; this corresponds to port, channel, target, and LUN of a disk.

Example:
vxdisk site1 Harddisk1 Harddisk2

This command will add disks Hard disk 1, Hard disk 2 to site1.

vxdisk rmsite

Use vxdisk rmsite to remove a disk from the site.

Note: The vxdisk rmsite command fails on a disk that has Site Confined or Site Separated volumes associated with it.

vxdisk [-g<DynamicDiskGroupName>] rmsite <diskname(s) | p#c#t#l#>

See “Administering disks for sites through CLI” on page 464.

The following attributes apply:

-g<DynamicDiskGroupName>  This parameter is required only if the internal disk name is used.

<DiskName>  The internal disk name of the missing disk, which requires the -g option (for example, -gDG1 Disk2).

rmsite  Specifies the remove site or untag site option for disk names entered.

For example, rmsite Disk2.

<p#c#t#l#>  Another way to indicate a disk; this corresponds to port, channel, target, and LUN of a disk.

Example:

vxdisk -gDG1 rmsite Disk2

This command will remove Disk2 from its site.

vxassist

The vxassist utility has keywords or operands for creating and changing a volume and for doing operations related to a volume.

make  Creates a dynamic volume.

growby  Extends an NTFS dynamic volume or an unformatted dynamic volume.

querymax  Queries maximum number of reclaimable bytes from the current volume.
Decreases the size of an NTFS dynamic volume or an unformatted dynamic volume.

Adds a mirror to an existing volume.

Breaks a mirror from an existing volume.

Removes a volume, a mirror, or a log.

Deletes a partition or volume.

Shreds and deletes a volume.

Adds a log plex to a volume.

Prepares a volume for a snapshot by adding a mirror to the volume.

**Note:** Either the `prepare` or `snapstart` keyword may be used in the CLI, however `prepare` is recommended.

Creates a separate volume from the snapshot mirror.

Joins the snapshot mirror back to the original volume.

Clears the association between the original volume and the snapshot volume, making them separate volumes.

Aborts the operation to prepare the snapshot on the original volume.

Rescans all the storage objects on the computer.

Refreshes volume, drive letter, and system information.

Performs a SCSI bus reset on all SCSI buses.

Displays installed version of SFW and the build number.

### Windows-Specific Commands

Assigns or changes a drive letter or drive path.

Removes a drive letter or drive path.

Creates a primary partition.

Creates an extended partition.

Creates a logical drive.

Deletes an extended partition.
Typing the following sequence for each keyword brings up a description of its syntax.

vxassist <Keyword> -?

**vxassist make**

**Use the vxassist make command to create a volume.**

```
vxassist [-b] [-o notrackalign] -g<DynamicDiskGroupName> make
[<VolumeName>] <length>[type={mirror|raid5|stripe}[,log]]
[<alloc_attributes...>] [Column=N] [StripeUnit=<width>]
[Site=<sitename1>[,<sitename2>,...]]
[DriveLetter={A|B|..|Z}|DrivePath=<DrivePath>] [<![diskname | p#c#t#l#> ...
```

The following attributes apply:

- **-b**
  Option to run the command in the background. This option is useful for operations that take an extended amount of time, such as adding a mirror or extending a volume.

- **-o notrackalign**
  Disable track alignment on the disk where the volume resides.

- **-g<DynamicDiskGroupName>**
  Name of the dynamic disk group.

- **<VolumeName>**
  Name of the volume. This is a Symantec Storage Foundation for Windows specific name that is used for internal processing.

  The name is limited to 18 ASCII characters. It cannot contain spaces, slash mark (/), backslash (/), exclamation point (!), angle brackets (< >), or equal sign (=). Also, a period cannot be the first character in the name.

- **<Length>**
  Size of the volume; megabytes is the default. To indicate KB, add K to the number (500K); similarly, add G for GB and T for TB.

- **type={mirror|raid5|stripe} [,log]**
  Type of volume to be created. Default is a spanned volume. The [, log] argument in type will add a RAID-5 log for a RAID-5 volume or a dirty region logging (DRL) log for a mirrored volume during volume creation.
**<alloc_attributes>**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation attributes for mirroring and striping volumes.</td>
<td><strong>Attributes are:</strong></td>
</tr>
<tr>
<td></td>
<td>■ Mirror=n[, diskclass {[!]}diskclass:instance}]</td>
</tr>
<tr>
<td></td>
<td>■ Wantmirror=diskclass {[!]}diskclass:instance]</td>
</tr>
<tr>
<td></td>
<td>■ Stripe=diskclass {[!]}diskclass:instance}]</td>
</tr>
<tr>
<td></td>
<td>■ Wantstripe=diskclass {[!]}diskclass:instance}]</td>
</tr>
</tbody>
</table>

**Mirror=<n>**

Number of mirrors to be created for mirrored volumes. (Default is 2.)

**or**

**Mirror=<n>, diskclass**

Optionally specify a diskclass to use in mirroring. For example, *Mirror=2, target* specifies that volumes are mirrored between SCSI target addresses. Each mirror can contain disks from any number of instances of the diskclass, but different mirrors cannot use disks from the same instance of the diskclass.

**Stripe=diskclass**

Volumes are striped across instances of a particular diskclass. For example, *Stripe=target* specifies that volumes are striped between SCSI target addresses. Each column stripe can contain disks from any number of instances of the diskclass, but different columns cannot use disks from the same instance of the diskclass.

**Wantmirror=diskclass**

Specifies a diskclass to use in mirroring. However this constraint is ignored if the requested allocation cannot be satisfied.

**Wantstripe=diskclass**

Volumes are striped across instances of a particular disk class. However this constraint is ignored if the requested allocation cannot be satisfied.
diskclass

{[!]diskclass:instance}

Diskclass specifies (or excludes) a particular type of disk grouping. For example, port specifies a group of disks on a port.

Instance specifies which grouping. For example, pl specifies a particular grouping of disks.

Each type of diskclass has a particular format for specifying instances of the class. Multiple diskclass instances can be specified separated by a space.

Diskclass can be one of the following:
- target or t
  Specifies disks that have the same SCSI target address of the same port. The target is specified in the form p#t#
- enclr, e, or enclosure
  Specifies disks belonging to a particular enclosure.
- port or p
  Specifies disks connected to a particular port.
- channel or ch
  Specifies disks connected to a particular channel.

Column=<n>

Number of columns. Required for RAID-5 and striped volumes.

StripeUnit=<Width>

Stripe width of RAID-5(striped) volumes in blocks (512 Kbytes). Allows the user to specify the stripe unit for RAID-5 and striped volumes.

Site

Name of the site on which a site based volume is to be created or mirrored.

DriveLetter={A|B|...|Z}

The default is no assignment of a drive letter to the volume.

DrivePath=<DrivePath>

Used when you want to mount the new volume at a folder on a local NTFS volume. You can use this attribute as an alternative to the drive letter.
Name of a disk or disks to include or exclude, such as Harddisk2. Parameters will be used to specify disks for volume creation, mirroring, and extension.

The disk name can also be indicated by the internal disk name or by \texttt{p#c#t#l#}, where the \#s correspond to port, channel, target, and LUN of a disk.

If disks are not specified, SFW will select the disks automatically within the specified disk group.

\textbf{Note:} This attribute is required when working with a Microsoft Disk Management Disk Group.

\textbf{Note:} The default volume type is a concatenated volume. The created volume is not formatted (no file system is created on the volume). You need to use the operating system format command to format the volume.

\textbf{Note:} Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support track alignment.

\textbf{Examples}

\texttt{vxassist -gDG2 make 100 DriveLetter=E Harddisk1}

The above command line sequence creates a simple 100-MB volume in dynamic disk group DG2. The volume's drive letter is E. The volume would be created on Harddisk1.

\texttt{vxassist -gDG2 make 100 type=mirror,log DriveLetter=F}

The above command line sequence makes a mirrored 100-MB volume with a DRL log. The volume is assigned the drive letter F.

\texttt{vxassist -gDG2 make 120 type=raid5 DriveLetter=X Column=3 Harddisk2 Harddisk3 Harddisk5}

The above command line sequence creates a 120-MB RAID-5 volume with the drive letter X. The volume is striped across Harddisk2, Harddisk3, and Harddisk5. All RAID-5 volumes require at least three columns. If you do not indicate a column number for a RAID-5 volume, the command will fail.

\texttt{vxassist -b -gDG2 make 100 type=stripe DriveLetter=X Column=3}
The above command line sequence makes a striped volume that is assigned drive letter X. The \-b option allows the command to run in the background.

`vxassist -gDG2 make DbVolume 100`

The resulting path name for the volume is:

`\Device\HarddiskDmVolumes\DG2\DbVolume`.

`vxassist -gDG2 make Vol1 100m mirror=2, port`

The above command line sequence makes a two mirrored 100-MB volumes connected to the same port.

`vxassist -gDG2 make Vol1 100m mirror=2, port port:p2 port:p3`

The above command line sequence makes two mirrored 100-MB volumes connected to port:p2 and port:p3.

To create a volume for a site that uses the site-aware allocation feature, refer to:

See “Creating a volume through CLI” on page 467.

See “Administering volumes for site-based allocation” on page 464.

**vxassist growby**

```
vxassist [-b] [-o notrackalign] [-g<DynamicDiskGroupName>] growby
<VolumeName | DriveLetter | VmName|DrivePath> <Length> 
[[<alloc_attributes...>]] [[!]<DiskName|p#c#t#l#>...]
```

Extends the usable space of an NTFS or unformatted volume by the amount specified in `<Length>`.

The following attributes apply:

- `-b` runs the command in the background.
- `-o notrackalign` disable track alignment on the disk where the volume resides.
- `-g<DynamicDiskGroupName>` required only if the internal volume name or internal disk name is used.
- `<VolumeName>` the path name of the volume, such as
  `\Device\HarddiskDmVolumes\DG1\Volume1`.
- `<DriveLetter>` the drive letter of the volume.
<VmName> Internal name of the volume; requires the use of the -g option, such as -gDG1 Volume1.

<DrivePath> A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

<Length> The size of the volume; megabytes is the default. To indicate KB, add K to the number (500K); similarly, add G for GB and T for TB.

<alloc_attributes> Allocation attributes for mirroring and striping volumes.

Attributes are:

- Mirror={diskclass ![diskclass:instance]}
- Wantmirror={diskclass ![diskclass:instance]}
- Stripe={diskclass ![diskclass:instance]}
- Wantstripe={diskclass ![diskclass:instance]}

Mirror=diskclass Specifies a diskclass to use in mirroring. For example, Mirror=target specifies that volumes are mirrored between SCSI target addresses. Each mirror can contain disks from any number of instances of the diskclass, but different mirrors cannot use disks from the same instance of the diskclass.

Stripe=diskclass Volumes are striped across instances of a particular diskclass. For example, Stripe=target specifies that volumes are striped between SCSI target addresses. Each column stripe can contain disks from any number of instances of the diskclass, but different columns cannot use disks from the same instance of the diskclass.

Wantmirror=diskclass Specifies a diskclass to use in mirroring. However this constraint is ignored if the requested allocation cannot be satisfied.

Wantstripe=diskclass Volumes are striped across instances of a particular disk class. However this constraint is ignored if the requested allocation cannot be satisfied.
Diskclass specifies (or excludes) a particular type of disk grouping. For example, `port` specifies a group of disks on a port.

Instance specifies which grouping. For example, `p1` specifies a particular grouping of disks.

Each type of diskclass has a particular format for specifying instances of the class. Multiple diskclass instances can be specified separated by a space.

Diskclass can be one of the following:
- `target` or `t`
  Specifies disks that have the same SCSI target address of the same port. The target is specified in the form `p#t#`
- `enclr`, `e`, or `enclosure`
  Specifies disks belonging to a particular enclosure.
- `port` or `p`
  Specifies disks connected to a particular port.
- `channel` or `ch`
  Specifies disks connected to a particular channel.

Column=⟨n⟩
Number of columns. Required for RAID-5 and striped volumes.

StripeUnit=⟨Width⟩
Stripe width of RAID-5/striped volumes in blocks (512 Kbytes). Allows the user to specify the stripe unit for RAID-5 and striped volumes.

[!]〈DiskName>...
The name of the disk or disks to include or exclude on which the volume will be extended. The disk name can be specified by the device name (such as `Harddisk2`) or the internal disk name (such as `Disk2`). The internal disk name must be preceded by the `-g` option (for example, `-gDG1 Disk2`).

[!]〈p#c#t#l#〉
Another way to indicate a disk to include or exclude; the #s correspond to port, channel, target, and LUN of the disk.
Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support track alignment.

Examples

vxassist growby J: 100

The above command extends volume J by 100 MB. Only NTFS or unformatted volumes can be extended. An unformatted volume's file system type is shown as "RAW."

vxassist -g mydg growby vol1 100M port:p3 !Harddisk2

The above command extends vol1 by 100 MB on disks connected to port p3 excluding Harddisk2.

vxassist querymax

vxassist [-g<DynamicDiskGroupName>] querymax <VolumeName | DriveLetter | VmName | DrivePath>

Queries maximum number of reclaimable bytes from the current volume. Only NTFS or unformatted volumes are supported by this command. An unformatted volume's file system type is shown as "RAW."

The following attributes apply:

-g<DynamicDiskGroupName> Required only if the internal volume name or internal disk name is used.

<VolumeName> the path name of the volume, such as \Device\HarddiskDmVolumes\DG1\Volume1.

<DriveLetter> The drive letter of the volume.

<VmName> Internal name of the volume; requires the use of the -g option, such as -gDG1 Volume1.

<DrivePath> A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

Examples

vxassist querymax J:

The above command queries volume J maximum number of reclaimable bytes. The output will be the number of reclaimable bytes that can be reclaimed.
The output of `vxassist querymax` may not be accurate. The command internally uses the Microsoft API to query the volumes. These APIs can sometimes return more reclaimable bytes than the actual available bytes.

See www.support.microsoft.com/kb/976436

**vxassist shrinkby**

```
vxassist [-g<DynamicDiskGroupName>] shrinkby <VolumeName | DriveLetter | VmName | DrivePath> [<Length>]
```

Decreases an NTFS or unformatted volume (RAW) by the amount specified in `<Length>`. If the optional parameter `<Length>` is not used, then the command decreases the volume by maximum reclaimable bytes. Before using the command, review the prerequisites for shrinking a dynamic volume.

See “Before shrinking a dynamic volume” on page 152.

The following attributes apply:

- `-g<DynamicDiskGroupName>` Required only if the internal volume name or internal disk name is used.
- `<VolumeName>` the path name of the volume, such as \Device\HarddiskDmVolumes\DG1\Volume1.
- `<DriveLetter>` The drive letter of the volume.
- `<VmName>` Internal name of the volume; requires the use of the `-g` option, such as -gDG1 Volume1.
- `<DrivePath>` A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.
<Length>

The size by which you want to shrink the volume. Acceptable units are “S” for Sectors, “K” for KBs, “M” for MBs, “G” for GBs, “T” for TBs. Default unit is MB. For example, to reduce a 30 GB volume to 20 GB, provide 10G.

If not specified, then vxassist querymax is used to obtain maximum reclaimable bytes for a given volume.

vxassist querymax internally uses Microsoft APIs to query a volume. These APIs can sometimes return more reclaimable bytes than the actual available bytes.

See www.support.microsoft.com/kb/976436

In such a case the shrinkby operation may fail with the following error: V-76-42261-7777: Shrink volume Failed: No room to shrink.

To resolve this issue, run the shrinkby operation again or specify a size that is lower than the value obtained from the vxassist querymax command.

**Note:** The shrink volume operation is disabled during a reclaim storage operation for thin provisioned disks. The shrink volume operation is enabled when the reclaim storage operation has completed.

**Note:** During the volume shrink operation, if the deport disk group operation is performed, either by the user or because of a failover, then the volume shrink operation is canceled.

**Examples**

vxassist shrinkby J: 100

The above command shrinks volume J by 100 MB. Only NTFS or unformatted volumes are supported by this command. An unformatted volume's file system type is shown as "RAW."

vxassist shrinkabort

vxassist [-g<DynamicDiskGroupName>] shrinkabort
The vxassist shrinkabort cancels the shrink operation on the given volume. The following attributes apply:

- **DynamicDiskGroupName**: Name of the dynamic disk group.
- **VolumeName**: Name of the volume. Example: `\Device\HarddiskDmVolumes\DynamicGroup\Volume1`
- **DriveLetter**: Drive letter of the volume. Example: `C:`
- **VmName**: Internal name of volume. (Requires use of `-g<DynamicDiskGroupName>` option). Example: `-g MyDg Volume1`
- **DrivePath**: Drive Path on which the volume is mounted on. Example: `C:\TEMP`. Must be an empty folder on a local NTFS volume.

**Example**

```
vxassist shrinkabort z:
```

The shrink volume operation is performed in two stages, where the filesystem shrink operation is performed after which `volumeshrink` follows.

If the filesystem shrink operation has progressed too far to cancel, then it commits the changes made during the filesystem shrink operation after which `volumeshrink` operation will be aborted.

In such a case, use `vxvol growfs` to extend file system to volume size.

**vxassist mirror**

Use the `vxassist mirror` command to add a mirror to an existing volume.

```
vxassist [-b] [-o notrackalign] [-g<DynamicDiskGroupName>] mirror <VolumeName|DriveLetter|VmName|DrivePath> [type=<typename>]
```
The following attributes apply:

- **-b** Runs the command in the background.

- **-o notrackalign** Disable track alignment on the disk where the volume resides.

- **-g<DynamicDiskGroupName>** Required only if the internal volume name or internal disk name is used.

- **<VolumeName>** the path name of the volume, such as \Device\HarddiskDmVolumes\DG1\Volume1.

- **<DriveLetter>** The drive letter of the volume.

- **<VmName>** Internal name of the volume; requires the use of the -g option (for example, -gDG1 Volume1).

- **<DrivePath>** A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

- **Type=<Type>** Type of volume layout.

Types are:
- Stripe
- Concatenate

- **<alloc_attributes>** Allocation attributes for mirroring and striping volumes.

Attributes are:
- **Mirror=n,[diskclass {[!diskclass:instance]}**
- **Wantmirror=[diskclass {[!diskclass:instance]}**
- **Stripe=[diskclass {[!diskclass:instance]}**
- **Wantstripe=[diskclass {[!diskclass:instance]}**
Mirror=<n>  
Number of mirrors to be created for mirrored volumes. (Default is 2.)

or

Mirror=<n>, diskclass  
Optionally specify a diskclass to use in mirroring. For example, Mirror=2, target specifies that volumes are mirrored between SCSI target addresses. Each mirror can contain disks from any number of instances of the diskclass, but different mirrors cannot use disks from the same instance of the diskclass.

Stripe=diskclass  
Volumes are striped across instances of a particular diskclass. For example, Stripe=target specifies that volumes are striped between SCSI target addresses. Each column stripe can contain disks from any number of instances of the diskclass, but different columns cannot use disks from the same instance of the diskclass.

Wantmirror=diskclass  
Specifies a diskclass to use in mirroring. However this constraint is ignored if the requested allocation cannot be satisfied.

Wantstripe=diskclass  
Volumes are striped across instances of a particular disk class. However this constraint is ignored if the requested allocation cannot be satisfied.
<table>
<thead>
<tr>
<th><strong>diskclass</strong></th>
<th>Diskclass specifies (or excludes) a particular type of disk grouping. For example, <code>port</code> specifies a group of disks on a port.</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>{[!]diskclass:instance}</code></td>
<td>Instance specifies which grouping. For example, <code>p1</code> specifies a particular grouping of disks.</td>
</tr>
<tr>
<td>Each type of diskclass has a particular format for specifying instances of the class. Multiple diskclass instances can be specified separated by a space.</td>
<td></td>
</tr>
<tr>
<td>Diskclass can be one of the following:</td>
<td></td>
</tr>
<tr>
<td><code>- target</code> or <code>t</code></td>
<td>Specifies disks that have the same SCSI target address of the same port. The target is specified in the form <code>p#t#</code></td>
</tr>
<tr>
<td><code>- enclr</code>, <code>e</code>, or <code>enclosure</code></td>
<td>Specifies disks belonging to a particular enclosure.</td>
</tr>
<tr>
<td><code>- port</code> or <code>p</code></td>
<td>Specifies disks connected to a particular port.</td>
</tr>
<tr>
<td><code>- channel</code> or <code>ch</code></td>
<td>Specifies disks connected to a particular channel.</td>
</tr>
</tbody>
</table>

| **Column=<n>** | Number of columns. Required for RAID-5 and striped volumes. |
| **StripeUnit=<Width>** | Stripe width of RAID-5(striped volumes in blocks (512 Kbytes). Allows the user to specify the stripe unit for RAID-5 and striped volumes. |
| **Site** | Specifies the name of the site on which a site-based volume is to be created or mirrored. |
| `[!]<DiskName>...` | The name of the disk or disks (such as `Harddisk2`) on which the mirror or mirrors are to be created. |
| The disk name can also be indicated by the internal disk name, which requires the `-g` option (for example, `-gDG1 Disk2`). |
Another way to indicate a disk; the #s correspond to port, channel, target, and LUN of a disk.

Warning: Adding mirrors to a volume involves a certain amount of time for mirror resynchronization. Take care not to perform actions on the volume until the command is complete. Also, if you inadvertently shut down the server or deport the disk group containing the volume before mirror resynchronization completes, any mirrors that were being added to the volume will be deleted when the disk group with the volume comes online again.

The SmartMove feature can help reduce mirror resynchronization time. See “SmartMove” on page 112.

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support track alignment.

Example

vxassist mirror -b Z: Mirror=2 Harddisk4 Harddisk5

The above command line sequence adds two mirrors to volume Z. Harddisk4 and Harddisk5 will be used to create the mirrors. The process of adding the two mirrors will run in the background. Instead of using the drive letter Z, you could provide a path name, such as:

\Device\HarddiskDmVolumes\DynDskGrp1\Volume1

To create a mirror for a site-based volume using the site-aware allocation feature, refer to:

See “Adding a mirror to a site-based volume through CLI” on page 473.

See “Administering mirrored plexes for site-based allocation” on page 468.

vxassist break

vxassist [-g<DynamicDiskGroupName>] break <VolumeName |DriveLetter> <plex=PLEXName>|<!Diskname |!p#c#t#l#>] [DriveLetter={A|B|...|Z}|DrivePath=<DrivePath>]

Breaks a mirror from an existing volume. When a mirror is broken, it becomes a separate volume and you will lose the fault tolerance that mirroring provides.
The following attributes apply:

- `-g<DynamicDiskGroupName>` Required only if the internal volume name or internal disk name is used.

  `<VolumeName>` The path name of the volume, such as \Device\HarddiskDmVolumes\DG1\Volume1.

  `<DriveLetter>` The drive letter of the volume.

  `<VmName>` Internal name of the volume; requires the use of the `-g` option (for example, `-gDG1 Volume1`).

  `plex=<PlexName>` The mirror or plex to be broken off. It can be the plex name (such as `Volume2-01`) or the GUID of the mirror plex. A GUID is a unique internal number assigned to the plex. To determine the GUID for a given plex, use the command `vxvol volinfo` for the mirrored volume that contains the plex. If you are using a script and have multiple snapshot plexes, then the GUID can distinguish the different snapshot plexes.

  `<!DiskName>` The name of the disk, such as `Harddisk2`, or the internal disk name, which requires the use of the `-g` option (for example, `!-gDG1 Disk2`). You can use this attribute as an alternative to the plex name. See the note on the exclamation mark that follows this table.

  `<!p#c#t#l#>` Another way to indicate a disk; the #s correspond to port, channel, target, and LUN of the disk. It also requires the `!`.

  `DriveLetter={A|B|...|Z}` Used to assign a specific drive letter to the new volume that is created from the broken-off plex. The drive letter is not automatically assigned.

  `DrivePath=<DrivePath>` Used when you want to mount the new volume that is created from the broken-off plex at a folder on a local NTFS volume. You can use this attribute as an alternative to the drive letter.

**Note:** The exclamation mark in front of the `DiskName` attribute is necessary to make the command compatible with the Volume Manager for UNIX version of the command.
If you do not remember the plex name, you can determine what it is by using the `vxvol volinfo` command. Alternatively, if you know which disk the plex resides on, you can use the `<!DiskName>` syntax, for example, `!Harddisk2`, to specify the plex.

**Note:** If you want to delete the mirror instead of breaking it off, see the `vxremove` command in the section.

**Examples**

`vxassist break H: plex=Volume1-01 DriveLetter=Z`

The above command line sequence breaks a mirror from a volume that has been assigned the drive letter H. The specified plex becomes a new volume and receives the drive letter Z. The drive letter H is retained by the original volume.

`vxassist break \Device\HarddiskDmVolumes\DynDskGrp1\Volume1 plex=Volume1-01 DriveLetter=Z`

The above command line sequence is the same as the previous command sequence except that a path name, instead of a drive letter, is used to indicate the volume from which the mirror will be broken.

`vxassist break L: !Harddisk3 DriveLetter=M`

This breaks off the mirror that resides on Harddisk3 from volume L and assigns drive letter M to the newly created volume.

**vxassist remove**

```
vxassist [-f] [-g<DynamicDiskGroupName>] remove [volume|mirror|log] <VolumeName | DriveLetter | VmName|DrivePath> [LogType=<DRL|DCM |DCO>] [nlog=<#>] [plex=<PlexName>|<!Diskname |!p#c#t#l#>]
```

Removes (deletes) either a volume, a mirror from an existing volume, or a DRL or RAID-5 log from an existing volume. When you specify removing a volume, the command works the same as `vxassist delete`. If no volume, mirror, or log is specified, the command assumes a mirror plex for backward compatibility because the command formerly removed only a mirror plex.

The following attributes apply:

- `-f` Force the operation.
-g<DynamicDiskGroupName> Required only if the internal volume name or internal disk name is used.

volume|mirror|log Specifies what is to be removed from an existing volume. If you do not use this parameter, a mirror will be removed. If you want to remove a volume or a log, you will have to put the volume or log keyword in.

<VolumeName> The path name of the volume, such as \Device\HarddiskDmVolumes\DG1\Volume1.

<DriveLetter> The drive letter of the volume to be operated on.

<VmName> Internal name of the volume; requires the use of the -g option (for example, -gDG1 Volume1).

<DrivePath> A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

LogType Specify the type of log when removing a log (DCM, DRL or DCO type).

nlog=<n> Specify the number of logs when removing a log. Number of logs. (n>0)

plex=<PlexName> The mirror or plex to be removed. It can be the plex name (such as Volume2-01) or the GUID of the mirror plex. A GUID is a unique internal number assigned to the plex. To determine the GUID for a given plex, use the command vxvol volinfo for the mirrored volume that contains the plex. If you are using a script and have multiple snapshot plexes, then the GUID can distinguish the different snapshot plexes.

<!DiskName> The name of the disk, such as Harddisk2, or the internal disk name, which requires the use of the -g option (for example, !-gDG1 Disk2). You can use this attribute as an alternative to the plex name. See the note on the exclamation mark that follows this table. If there is more than one mirror or log associated with the volume, you need to indicate either the mirror plex name or log plex name or the disk name.

<!p#c#t#l#> Another way to indicate a disk; the #s correspond to port, channel, target, and LUN of the disk. It also requires the !.
**Note:** The exclamation mark in front of the `DiskName` attribute is necessary to make the command compatible with the Volume Manager for UNIX version of the command.

If you do not remember the plex name, you can determine what it is by using the `vxvol volinfo` command. Alternatively, if you know which disk the plex resides on, you can use the `<!DiskName>` syntax, for example, `!Harddisk2`, to specify the plex.

The logs can be either DRL or RAID-5 logs. If you have more than one log, you will need to identify the log plex. You cannot remove a DCO log with this command. A DCO log is added with the command `vxvol set fastresync=on` and deleted with the command `vxvol set fastresync=off`.

See “vxvol” on page 538.

**Examples**

`vxassist remove Z: plex=Volume1-01`

The above command line sequence removes a mirror from volume Z. The data on the specified plex will be destroyed and is not recoverable.

`vxassist remove volume F:`

The above command line sequence removes volume F. The data on the volume will be destroyed and is not recoverable.

`vxassist remove log H:`

The above command line sequence removes a log from volume H.

**vxassist delete**

```
vxassist [-f] [-g<DynamicDiskGroupName>] delete
<VolumeName | DriveLetter | VmName|DrivePath>
```

Deletes a volume or partition. The following attributes apply:

- `-f` Force the operation.
- `-g<DynamicDiskGroupName>` Required only if the `<VmName>` parameter is used.
<VolumeName> The path name of the volume, such as \Device\HarddiskDmVolumes\DG1\Volume1.

<DiveLetter> The drive letter of the volume to be operated on.

<VmName> Internal name of the volume; requires the use of the \-g option (for example, \-gDG1 Volume1).

<DrivePath> A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

Examples

vxassist delete J:

The above command deletes volume J. The command will destroy all data on the volume.

vxassist delete\Device\HarddiskDmVolumes\DynDskGrp1\volume1

The above command deletes a volume with the path name:

\Device\HarddiskDmVolumes\DynDskGrp1\volume1.

vxassist shred

vxassist [-f] [-g<DynamicDiskGroupName>] shred [shredtype=<0|1|2>]
<VolumeName | DriveLetter | VmName|DrivePath>

Overwrites the entire volume with zeroes and then deletes the volume.

SFW provides the following methods for overwriting the volume:

■ 1 Pass algorithm
  Overwrites the volume with a pattern of zeroes.
  Specified by shredtype=0.

■ 3 Pass algorithm
  The volume is overwritten a total of 3 times. The volume is first overwritten with a pre-selected digital pattern, then overwritten with the binary complement of the pattern. In the last pass, the volume is overwritten with a randomly selected digital pattern. This 3 pass approach is based on the specifications in the US Department of Defense standard 5220.22-M (3). Specified by shredtype=1.

■ 7 Pass algorithm
  The volume is overwritten a total of 7 times. Each pass consists of overwriting the volume with a randomly selected digital pattern or with the binary
complement of the previous pattern. This 7 pass approach is based on the specifications in the US Department of Defense standard 5200.28-STD (7). Specified by shredtype=2.

SFW defaults to the 1 Pass algorithm when shredtype is not specified.

**Warning:** All data in the volume will be lost when you shred it. Make sure that the information has been backed up onto another storage medium and verified, or that it is no longer needed.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the vxassist shred command.

The following attributes apply:

- **-f** Force the operation.
- **-g<DynamicDiskGroupName>** Required only if the <VmName> parameter is used.
- **-shredtype=<0|1|2>** Specifies the method to overwrite the volume.
  - 0 specifies the 1 Pass algorithm
  - 1 specifies the 3 Pass algorithm
  - 2 specifies the 7 Pass algorithm

- **<VolumeName>** The path name of the volume, such as \Device\HarddiskDmVolumes\DG1\Volume1.
- **<DriveLetter>** The drive letter of the volume to be operated on.
- **<VmName>** Internal name of the volume; requires the use of the –g option (for example, –gDG1 Volume1).
- **<DrivePath>** A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

**Examples**

vxassist shred J:

The above command shreds volume J.

vxassist shred\Device\HarddiskDmVolumes\DynDskGrp1\Volume1

The above command shreds a volume with the path name:
vxassist addlog

vxassist [-o notrackalign] [-g<DynamicDiskGroupName>] addlog
<VolumeName | DriveLetter | VmName | DrivePath> [LogType=<DRL | DCM | DCO>] [nlog=<n>] [!]diskclass:instance] [!]<DiskName|p#c#t#l#>...

Adds a DRL, DCM, DCO, or RAID-5 log plex to the volume.

RAID-5 logging is used to prevent bad volumes during system crash or failure. If more than one log is added, then the logs are just mirrored. DRL logs for RAID volumes are called RAID-5 logs and provide the same functionality.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxassist addlog` command.

The following attributes apply:

- `-o notrackalign` Disable track alignment on the disk where the log resides.
- `-g<DynamicDiskGroupName>` Required only if the internal volume name or internal disk name is used.
- `<VolumeName>` The path name of the volume, such as `\Device\HarddiskDmVolumes\DG1\Volume1`.
- `<DriveLetter>` The drive letter of the volume to be operated on.
- `<VmName>` Internal name of the volume; requires the use of the `-g` option (for example, `-gDG1 Volume1`).
- `<DrivePath>` A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.
- `LogType` Type of log to add (DCM, DRL or DCO type).
- `nlog=<n>` Number of logs to add.
[!]diskclass:instance Specify (or exclude) a set of disks.

Diskclass specifies a particular type of disk grouping. For example, port specifies a group of disks on a port.

Instance specifies which grouping. For example, p1 specifies a particular grouping of disks.

Each type of diskclass has a particular format for specifying instances of the class. Multiple diskclass instances can be specified separated by a space.

diskclass

Diskclass can be one of the following:

- target or t
  Specifies disks that have the same SCSI target address of the same port. The target is specified in the form p#t#
- enclr, e, or enclosure
  Specifies disks belonging to a particular enclosure.
- port or p
  Specifies disks connected to a particular port.
- channel or ch
  Specifies disks connected to a particular channel.

[!]<DiskName>... Specifies the disk or disks to include or exclude. If you do not use this parameter, the program selects the disks.

The DiskName parameter can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG1 Disk2).

[!]<p#c#t#l#> Another way to indicate a disk; the #s correspond to port, channel, target, and LUN of a disk.

For descriptions of the advanced features of DRL and RAID-5 logging, see the following topic:

See “Dirty region logging (DRL) and RAID-5 logging” on page 250.

Example

vxassist -g mydg addlog vol1 logtype=DRL port:p2 !harddisk3

Adds a DRL log to vol1 on a disk that is not harddisk3 and is connected to port p2.
vxassist prepare

vxassist [-b] [-o notrackalign] [-g<DynamicDiskGroupName>] prepare
<VolumeName | DriveLetter | VmName|DrivePath>
[Type=stripe][<alloc_attributes...>] [Column=<n>]
[StripeUnit=<Width>][Plex=<MirrorPlexName> | ![]<Diskname> | p#c#t#l#>
...

Adds a snapshot mirror to the volume. It is a mirrored plex of the original volume that is broken off in the snapshot process. You can either add a new snapshot mirror or convert a mirror of the volume that already exists. A snapshot mirror is also referred to as a "snap plex."

---

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxassist prepare` command.

---

**Note:** Either the `prepare` or `snapstart` keyword may be used in the CLI, however `prepare` is recommended.

---

The following attributes apply:

- `-b` Runs the command in the background.
- `-o notrackalign` Disable track alignment on the disk where the mirror resides.
- `-g<DynamicDiskGroupName>` Needed only if you are using the internal volume name or internal disk name.
- `<VolumeName>` The path name of the volume, such as `\Device\HarddiskDmVolumes\DynDskGrp1\Volume1`.
- `<DriveLetter>` The drive letter of the existing volume.
- `<VmName>` Internal name of the volume; requires the use of the `-g` option (for example, `-gDG1 Volume1`).
- `<DrivePath>` A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.
- `Type=<Type>` Type of volume layout.

Types are:
- Stripe
- Spanned (Spanned is the default.)
<alloc_attributes> Allocation attributes for mirroring and striping volumes. Attributes are:

- Mirror={diskclass {![diskclass:instance]}}
- Wantmirror={diskclass {![diskclass:instance]}}
- Stripe={diskclass {![diskclass:instance]}}
- Wantstripe={diskclass {![diskclass:instance]}}

**Mirror=diskclass** Specifies a diskclass to use in mirroring. For example, Mirror=target specifies that volumes are mirrored between SCSI target addresses. Each mirror can contain disks from any number of instances of the diskclass, but different mirrors cannot use disks from the same instance of the diskclass.

**Stripe=diskclass** Volumes are striped across instances of a particular diskclass. For example, Stripe=target specifies that volumes are striped between SCSI target addresses. Each column stripe can contain disks from any number of instances of the diskclass, but different columns cannot use disks from the same instance of the diskclass.

**Wantmirror=diskclass** Specifies a diskclass to use in mirroring. However this constraint is ignored if the requested allocation cannot be satisfied.

**Wantstripe=diskclass** Volumes are striped across instances of a particular disk class. However this constraint is ignored if the requested allocation cannot be satisfied.
Diskclass specifies (or excludes) a particular type of disk grouping. For example, `port` specifies a group of disks on a port.

Instance specifies which grouping. For example, `p1` specifies a particular grouping of disks.

Each type of diskclass has a particular format for specifying instances of the class. Multiple diskclass instances can be specified separated by a space.

Diskclass can be one of the following:

- `target` or `-t` Specifies disks that have the same SCSI target address of the same port. The target is specified in the form `p#t#`
- `enclr`, `e`, or `enclosure` Specifies disks belonging to a particular enclosure.
- `port` or `-p` Specifies disks connected to a particular port.
- `channel` or `-ch` Specifies disks connected to a particular channel.

`Column=<n>` Number of columns. Required for RAID-5 and striped volumes.

`StripeUnit=<Width>` Stripe width of RAID-5/striped volumes in blocks (512 Kbytes). Allows the user to specify the stripe unit for RAID-5 and striped volumes.

`plex=<MirrorPlexName>` Converts a specified mirror plex to a snap plex. It can be the plex name (such as `Volume1-01`) or the GUID of the mirror plex. A GUID is a unique internal number assigned to the plex. To determine the GUID for a given plex, use the command `vxvol -v volinfo` for the mirrored volume that contains the plex.

`[!]<DiskName>` The designated hard disk to include or exclude, which can be specified by the device name (such as `Harddisk2`) or the internal disk name (such as `Disk2`). The internal disk name must be preceded by the `-g` option (for example, `-gDG1 Disk2`).

`[!]<p#c#t#l#>` Another way to indicate a disk; the #s correspond to port, channel, target, and LUN of a disk.
If you do not remember the plex name, you can determine what it is by using the
vxvol volinfo command.

When the snapshot mirror is synchronized with the volume, its state changes to Snap Ready and the prepare the volume for snapshot task exits.

More information is available on Snap Shot commands.

See “Snapshot commands” on page 344.

Examples

vxassist -b prepare E:

Runs the prepare the volume for snapshot process on volume E in the background.

vxassist prepare E: plex=Volume2-01

Runs the prepare the volume for snapshot process on volume E, converting the existing mirror plex Volume to a snap plex.

vxassist prepare e: plex=volume1-02

This command converts the plex named "volume1-02" from a regular mirror to a snapshot plex.

vxassist prepare e: harddisk2 harddisk3

This command creates a new snap plex on harddisk2 and/or harddisk3. You can indicate more than one disk to be used for the snap plex.

vxassist prepare d:\mount1

This command adds a snap plex to the volume that is mounted on folder d:\mount1.

---

Note: Either the prepare or snapstart keyword may be used in the CLI, however prepare is recommended.

---

Note: You should not use the vxassist break command to break off a snapshot mirror from its associated volume or the vxassist remove command to delete a snapshot mirror. Instead use vxassist snapshot to break off a snapshot mirror from the associated volume or use vxassist snapabort to delete it.

vxassist snapshot

vxassist [-g<DynamicDiskGroupName>] snapshot
Detaches the snapshot mirror (also called the "snap plex") and creates a separate volume that is associated with the snapshot mirror.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxassist` snapshot command.

The following attributes apply:

- `-g <DynamicDiskGroupName>` Needed only if you are using the internal volume name or internal disk name parameter.
- `<VolumeName>` The path name of the original volume, such as `\Device\HarddiskDmVolumes\DynDskGrp1\Volume1`.
- `<DriveLetter>` The drive letter of the volume.
- `<VmName>` Internal name of the volume; requires the use of the `-g` option (for example, `-gDG1 Volume1`).
- `<DrivePath>` A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.
- `plex=<SnapPlexName>` Name of the snapshot mirror. It can be the plex name (such as `Volume1-01`) or the GUID of the mirror plex. A GUID is a unique internal number assigned to the plex. To determine the GUID for a given plex, use the command `vxvol -v volinfo` for the mirrored volume that contains the plex. You need to specify this attribute only when there is more than one snap plex.
- `<!DiskName>` The name of the disk, such as `Harddisk2`, or the internal disk name, which requires the use of the `-g` option (for example, `!-gDG1 Disk2`). See the note below this table on the exclamation mark. You can use `!DiskName` as an alternative to the plex name.
- `<!p#c#t#l#>` Another way to indicate a disk; the #s correspond to port, channel, target, and LUN of the disk. It also requires the `!`.
- `access=readonly` Sets the new volume to read only access.
DriveLetter={A|B|...|Z}  Used to assign a specific drive letter to the new volume.

DrivePath=<DrivePath>  Used to assign a drive path to the new volume.

<NewVolumeName>  The name of the volume that is created when the snapshot mirror is broken off. This is also referred to as the SnapVolumeName parameter.

Examples

vxassist snapshot E: access=readonly DriveLetter=H

This command detaches a snapshot mirror from volume E. The snapshot volume will be volume H with read only access.

vxassist snapshot E: plex=volume1-02 DrivePath=C:\ABC BackupVolume

This command detaches the snapshot mirror, volume1-02, from volume E, and mounts the new volume called "BackupVolume" to an empty folder called "ABC" on the C drive. The device path of the new volume is:
\Device\HarddiskDMVolumes\DynDskGrp1\BackupVolume.

vxassist snapshot d:\mp1 snap

This will snapshot the volume which is mounted at the d:\mp1 folder and assigns the "snap" name to the snapshot.

vxassist snapback

vxassist [-o resyncfromreplica] [-b] [-f] [-g<DynamicDiskGroupName>]
  snapback <SnapVolumeName | DriveLetter |VmName |DrivePath>

Joins the broken plex back to the original volume and resynchronizes the two volumes. By default, the synchronization is done from the original volume to the snapshot mirror.

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the vxassist snapback command.

The following attributes apply:

-o resyncfromreplica  Reverses the resynchronization, copying data from the snapshot mirror to the original volume
Performs the command in the background.

-Performs the command in the background.

-\f\n\- \forces the snapback. Use this option with care. Make sure the volume is not in use.

-\g\n\<DynamicDiskGroupName>\n\- Needed only if you are using an internal volume name.

\<SnapVolumeName>\n\- The name of the volume associated with the snapshot plex.

\<DriveLetter>\n\- The drive letter of the snapshot volume.

\<VmName>\n\- Internal name of the volume; requires the use of the \-g option, such as \-gDG1 Volume1.

\<DrivePath>\n\- A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

**Example**

vxassist snapback H:

This command joins the snapshot volume H back to the original volume.

vxassist snapback d:\mount1

This command will snapback the plex associated with the volume that is mounted on the d:\mount1 folder.

**vxassist snapclear**

vxassist -g\n\<DynamicDiskGroupName>\n\> \-g\n\<DynamicDiskGroupName>\n\> \-g\n\<DynamicDiskGroupName>\n\> snapclear

\<VolumeName | SnapVolumeName | DriveLetter | VmName | DrivePath\n\[plex=\<SnapPlexName>] [\<SnapshotName>]\n
Clears the association between the original volume and the snapshot volume and makes the snapshot volume and original volume two independent volumes. The vxassist snapclear command can be specified only after the vxassist snapshot command has been issued. After the vxassist snapclear command runs, the snapshot volume becomes an ordinary volume and cannot be snapped back to the original volume.

With SFW, it is possible to do a snapclear operation on the original volume. You might want to clear the original volume in two situations: 1) A snapshot volume is deported to a second host and then deleted on that host, and 2) A snapclear is
done on the snap volume but the original volume is offline and later this volume comes online.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxassist snapclear` command.

The following attributes apply:

- `-g <DynamicDiskGroupName>`
  Needed if you are using the internal volume name or original volume name.

- `<VolumeName>`
  The name of the original volume.

- `<SnapVolumeName>`
  The name of the volume associated with the snapshot plex, the volume that is broken off through the `vxassist snapshot` command.

- `<DriveLetter>`
  The drive letter of the snapshot volume.

- `<VmName>`
  Internal name of the volume; requires the use of the `-g` option, such as `-gDG1 Volume1`.

- `<DrivePath>`
  A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.

- `plex=<SnapPlexName>`
  Name or GUID of the mirror plex.

- `<SnapshotName>`
  Optional name assigned to the snapshot volume.

**Examples**

`vxassist snapclear H:`

This command clears the association between the snapshot volume H and the original volume.

`vxassist snapclear e: plex=volume1-01`

This will clear the association of e: (the snapshot volume) with its master volume.

`vxassist snapclear F: snapvolume01`

This command will clear the association of master volume (F:) with its snapshot volume named "snapvolume01."
Note: When you are using the snapback command to clear the association of the master volume, you must use the `<SnapPlexName>` or the `<Snapshot name>` when referring to the snapshot volume.

vxassist snapabort

```
vxassist [-o keeplex] [-g<DynamicDiskGroupName>] snapabort
<VolumeName | DriveLetter> | VmName | DrivePath> [plex=<SnapPlexName>]
```

Aborts a snapshot mirror plex that has been attached to a volume through a prepare the volume for snapshot operation or a snapback operation by either deleting it or converting it to an ordinary mirror. In cases where the deleted snap plex is the last snap plex and the resulting volume is simple or striped, the vxassist snapabort command deletes the DCO log volume also.

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the vxassist snapabort command.

The following attributes apply:

- `-o keeplex` Converts the snap plex to a mirror plex instead of deleting it.
- `-g<DynamicDiskGroupName>` Needed only if you are using the internal volume name.
- `<VolumeName>` The path name of the original volume, such as `\Device\HarddiskDmVolumes\DynDskGrp1\volume1`.
- `<DriveLetter>` The drive letter of the volume.
- `<VmName>` Internal name of the volume; requires the use of the `-g` option (for example, `-gDG1 Volume1`).
- `<DrivePath>` A volume that is mounted on an NTFS folder; it is indicated by a path to that folder.
plex=<SnapPlexName>  Name of a mirror plex that was created when a prepare the volume for snapshot process began. You would need this only if you already prepared the volume for snapshot previously and you prepare the volume for snapshot again, and thus you have multiple snap plexes and want to abort one of them.

A <SnapPlexName> can be the plex name (such as Volume2-01) or the GUID of the mirror plex. A GUID is a unique internal number assigned to the plex. To determine the GUID for a given plex, use the command vxvol -v volinfo for the mirrored volume that contains the plex.

Examples

vxassist snapabort E:

This command aborts the prepare the volume for snapshot operation on volume E.

vxassist -o keepplex snapabort H: plex=Concatvol1-03

This command aborts the prepare the volume for snapshot operation on volume H, but it converts the plex Concatvol1-03 to a volume of the same type as the original volume. The reason the SnapPlexName had to be specified is that there were two snap plexes, because the vxassist prepare command had been invoked twice on volume H.

vxassist snapabort E: plex=volume1-0

This command aborts the prepare the volume for snapshot operation on volume E with the designated plex.

vxassist rescan

vxassist [-b] rescan

Rescans all the storage system objects on the computer, including disks, volumes, and file systems. The -b option runs the command in the background.

vxassist refresh

vxassist [-b] refresh

Refreshes volume, drive letter, and system information. The -b option runs the command in the background.
vxassist

vxassist resetbus

vxassist resetbus

Performs a SCSI bus reset on all SCSI buses.

vxassist version

vxassist version

Displays installed version of SFW and the build number.

vxassist (Windows-specific)

Assigns or changes a drive letter or drive path for a volume. In the command line interface, if you want a drive letter, you must always assign it.

vxassist assign

vxassist [-f] [-g<DynamicDiskGroupName>] assign <VolumeName> DriveLetter |VmName|DrivePath>DriveLetter={A|B|...|Z}|DrivePath=<DrivePath>

-f Forces the command. Use this option with caution.

-g<DynamicDiskGroupName> Required only if the internal volume name or the internal disk name is used.

<VolumeName> The path name of the original volume, such as \Device\Harddisk0\Volumes\DynDskGrp1\Volume1.

<DriveLetter> The current drive letter of the volume.

<VmName> Internal name of the volume; requires the use of the -g option (for example, -gDG1 Volume1).

<DrivePath> Existing drive path for the volume.

DriveLetter={A|B|...|Z} The drive letter to be assigned.

DrivePath=<DrivePath> The drive path to be assigned.

For more information on assigning a drive letter or drive path:
See “Add, change, or remove a drive letter or path” on page 138.
See “Mount a volume at an empty folder (Drive path)” on page 141.
If the volume already has a drive letter, assigning a drive letter will replace the existing drive letter. In addition, if you assign a drive path to a volume that already has an existing drive letter, the existing drive letter will remain.

Example

vxassist assign\Device\HarddiskDmVolumes\DynDskGrp2\volume1
DriveLetter=E:

This command assigns drive letter E to \Device\HarddiskDmVolumes\DynDskGrp2\volume1.

vxassist unassign

vxassist [-f] [-g<DynamicDiskGroupName>] unassign <VolumeName | DriveLetter | VmName> [DrivePath=<DrivePath>]

Removes a drive letter or drive path for a volume. The following attributes apply:

- **-f** Forces the command. Use this option with caution.
- **-g<DynamicDiskGroupName>** Required only if the internal volume name is used.
- **<VolumeName>** The path name of the original volume, such as \Device\HarddiskDmVolumes\DynDskGrp1\Volume1.
- **<DriveLetter>** The current drive letter of the volume.
- **<VmName>** Internal name of the volume; requires the use of the -g option (for example, -gDG1 Volume1).
- **DrivePath=<DrivePath>** The drive path to be unassigned.

More information on unassigning a drive letter or drive path is available at the following:

See “Add, change, or remove a drive letter or path” on page 138.

See “Mount a volume at an empty folder (Drive path)” on page 141.

If a drive path and a drive letter are not specified, the command will remove the drive letter. If you want to remove the drive path, you must specify it.

Example

vxassist unassign E:
This command removes drive letter E from the volume.

**vxassist create_part**

```
vxassist create_part <DiskName |p#c#t#l#> <Length>
[DriveLetter={A|B|...|Z}|DrivePath=<DrivePath>]
```

Creates a primary partition of `<Length>` megabytes on `<DiskName>` and optionally assigns either a drive letter or drive path to it. To specify the partition size in KB, add K to the number (500K); similarly, add G for GB and T for TB.

See “Create primary and extended partitions ” on page 156.

The disk name can also be replaced by the `p#c#t#l#` parameter, where the `#`s correspond to port, channel, target, and LUN of the disk. Note that there is no internal disk name for a basic disk.

Example

```
vxassist create_part Harddisk0 100 DriveLetter=E
```

Creates a primary partition of 100 MB with drive letter E on Harddisk0.

**vxassist create_ext**

```
vxassist create_ext <DiskName |p#c#t#l#> <Length>
```

Creates an extended partition of `<Length>` megabytes on `<DiskName>`. To specify the extended partition size in KB, add K to the number (500K); similarly, add G for GB and T for TB. The disk name can be replaced by the `p#c#t#l#` parameter, where the `#`s correspond to port, channel, target, and LUN of the disk.

Example

```
vxassist create_ext Harddisk0 100
```

Creates an extended partition of 100 MB on Harddisk0.

**vxassist delete_ext**

```
vxassist delete_ext <DiskName |p#c#t#l#>
```

Deletes the extended partition on `<DiskName>`. In addition, the disk name can be replaced by the `p#c#t#l#` parameter, where the `#`s correspond to port, channel, target, and LUN of the disk.

Example

```
vxassist delete_ext Harddisk0
```
Deletes the extended partition on Harddisk0.

**vxassist create_drive**

```
vxassist create_drive <DiskName |p#c#t#l#> <Length> [DriveLetter={A|B|...|Z}]
```

Creates a logical drive of `<Length>` megabytes in the extended partition on `<DiskName>`. To specify the logical drive size in KB, add K to the number (500K); similarly, add G for GB and T for TB. The extended partition must have been created first.

See “New logical drives” on page 161.

The disk name can also be replaced by the `p#c#t#l#` parameter, where the `#`s correspond to port, channel, target, and LUN of the disk.

**Example**

```
vxassist create_drive Harddisk0 100 DriveLetter=E
```

Creates a logical drive of 100 MB on Harddisk0. The logical drive has the drive letter E.

There is no separate `delete_part` command. The `vxassist delete` command, which removes a volume, can be used to delete primary partitions or logical drives. The `delete_ext` command is needed since an extended partition does not have a name to be used in the `vxassist delete` command.

**vxassist taghost**

Run the command `vxassist taghost site=<sitename>` to add a host to a site

```
vxassist taghost site=site1
```

This command will tag localhost to site `site1`.

See “Administering hosts for site-aware allocation through CLI” on page 461.

**vxassist showtag**

Run the `vxassist showtag` command to display the site name to which a host belongs:

```
vxassist showtag
```

The host is tagged to site `site1`.

See “Administering hosts for site-aware allocation through CLI” on page 461.
vxassist untaghost

Use the vxassist untaghost command to remove a host from the site.

For example, run the command vxassist untaghost on a host to display:

vxassist untaghost

Successfully untagged host from its site.

See “Administering hosts for site-aware allocation through CLI” on page 461.

vxassist set sitetype

Use vxassist set sitetype command for setting the Sitetype volume property of a Siteless volume to either Site Confined or Site Separated.

vxassist -g<DynamicDiskGroupName> set <VolumeName|DriveLetter|VmName|DrivePath> sitetype={confined | separated}

See “Administering volumes for site-based allocation ” on page 464.

vxassist resetsitetype

Use the vxassist resetsitetype to convert a Site Confined or Site Separated volume to Siteless volume.

vxassist -g<DynamicDiskGroupName> resetsitetype <VolumeName|DriveLetter|VmName|DrivePath>

See “Administering volumes for site-based allocation ” on page 464.

vxevac

The vxevac utility moves subdisks from the disk specified by <DiskName> to one specified destination disk <NewDiskName>. If no <NewDiskName> argument is specified, any nonvolatile, nonreserved disk in the same dynamic disk group can be used as a destination disk. The destination disk must be in the same dynamic disk group.

vxevac [-o notrackalign>] [-g<DynamicDiskGroupName>] <DiskName|p#c#t#l#> [NewDiskName]

Note: Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the vxevac command.
-o notrackalign  Disable track alignment when moving to destination disk.

-g<DynamicDiskGroupName>  Required only if the internal disk name is used.

<DiskName>  The name of the disk, which can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG1 Disk2).

p#c#t#l#  Another way to indicate a disk; the #s correspond to port, channel, target, and LUN of the disk.

NewDiskName  Name of the disk to which the subdisks will be moved.

Example

vxevac Harddisk0 Harddisk3

Moves all the subdisks from Harddisk0 to Harddisk3.

vxsd

Command for moving, splitting, and joining a subdisk.

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxsd` command.

mv  Moves a subdisk.

split  Splits a subdisk.

join  Joins a subdisk.

Typing the following sequence for each keyword brings up a description of its syntax.

vxsd <Keyword> -?

Use `vxvol volinfo` to display the subdisk names. Use `vxvol -v volinfo` to display the size and offset of the subdisks. The `-g<DynamicDiskGroupName>` option needs to be specified since `<SubDiskName>` is not distinct among different dynamic disk groups.
vxsd mv

vxsd [-o notrackalign] -g<DynamicDiskGroupName> [-f] [-b] mv
<SubDiskName> [<DiskName | p#c#t#l#>]

This command moves the named subdisk to the disk specified by <DiskName | p#c#t#l#>. If a disk is not specified, the move operation tries to find free space within the dynamic disk group. The Move Subdisk function can be used for load balancing by moving a subdisk from a heavily accessed disk to a more lightly loaded one.

This command can also be used to move the part of a volume that is on a failed or missing disk to a healthy one. Moving a subdisk for redundant volumes (mirrored or RAID-5) will use the redundant data to recreate the subdisk on the healthy disk. However, for nonredundant volumes (concatenated or striped), the data cannot be recreated and doing a subdisk move will therefore lose data, which could be recovered if the disk can be repaired. Because of this possibility of data loss, Symantec Storage Foundation for Windows normally does not let you move the subdisk for nonredundant volumes.

You can disable track alignment for the operation by using the -o notrackalign option. You can also force the operation by using the -f option if you don't need the data any more or you can no longer recover the data. By doing so, you will retain the volume structure, but there is no guarantee that the data will be recoverable. The -b option performs the command in the background.

Moving a subdisk from one disk to another involves a certain amount of time. The SmartMove feature can help reduce the time for this operation.

See “SmartMove” on page 112.

Example

vxsd -gDynDskGrp1 mv Disk1-01 Harddisk2

This command moves subdisk Disk1-01 to Harddisk2 (belonging to the DynDskGrp1 dynamic disk group).

vxsd -gDynDskGrp1 -f mv Disk1-01

This command forces the move of subdisk Disk1-01 (which is on a failed disk) to another disk with enough free space.

vxsd split

vxsd -g<DynamicDiskGroupName> -s<Size> split <SubDiskName>

Splits a subdisk into two separate subdisks.
The \(-s\) option is required to specify the \(<Size>\) in MB of the first of the two subdisks to be created. The second subdisk occupies the remaining space used by the original subdisk.

Example

```
vxsd -gDynDskGrp1 -s100 split Disk3-03
```

This command will split subdisk Disk3-03 into two subdisks, the first of which is 100 MB.

---

**vxsd join**

```
vxsd -g<DynamicDiskGroupName> join <SubDiskName>...
```

Combines two or more existing subdisks into one subdisk. To join subdisks, the subdisks must be contiguous on the same disk.

Example

```
vxsd -gDynDskGrp1 join Disk3-03 Disk3-04
```

In this example, the command joins the two subdisks Disk3-03 and Disk3-04 into a new subdisk called Disk3-05.

---

**vxstat**

The **vxstat** utility has keywords and operands for displaying statistics for dynamic disks, dynamic volumes, and subdisks of dynamic volumes. It can also display statistics at specified intervals and for specified numbers of times.

Typing the following sequence brings up a description of its syntax:

```
vxstat <Keyword> -?
```

```
vxstat [-g<DynamicDiskGroupName>] [-s] [-d] [-v] [-i<Interval>] [-c<Count>] [<Object>...]
```

The following attributes apply:

- \(-g<DynamicDiskGroupName>\) Name of the dynamic disk group from which the records will be selected. For example, \(-gDynDskGrp1\).
An object can be a disk or a volume (specified by the volume name or drive letter). If no object is specified, the statistics apply to all the volumes on the managed server. Multiple objects are separated by a space.

[-s] Displays statistics for subdisks on the objects specified. If the object specified is a disk, all subdisks on that disk will be selected. If the object specified is a volume, all subdisks on that volume will be selected.

[-d] Displays statistics for disks on the objects specified.

[-v] Displays statistics for volumes on the objects specified.

[-i<Interval>] Displays statistics every <Interval> seconds. The default and minimum interval is 5 seconds between instances that the statistics are displayed.

[-c<Count>] Stops displaying interval statistics after <Count> times.

If the -i<Interval> option is specified without the -c<Count> option, the statistics will run continuously with the interval specified. If neither the -i<Interval> option nor the -c<Count> option is specified, the statistics display once.

Summary statistics for each object are displayed in one-line output records, preceded by two header lines. The output line consists of blank-separated fields for the object type and object name.

Statistics Types
The statistics types are as follows:

- Read Requests/Second
  The number of read requests per second for selected storage objects.

- Write Requests/Second
  The number of write requests per second for selected storage objects.

- Read Blocks/Second
  The amount of read request data (in blocks per second) that is processed for selected storage objects. It is the throughput on the read requests made.

- Write Blocks/Second
The amount of write request data (in blocks per second) that is processed for selected storage objects. It is the throughput on the write requests made.

- **Average Time/Read Block**
  The average time in microseconds that it takes to process a read block from the time a request is made until the data is returned.

- **Average Time/Write Block**
  The average time in microseconds that it takes to process a write block from the time a request is made until the data is returned.

- **Queue Depth**
  The current number of read and write requests in the queue for selected disks. It does not apply to volumes and subdisks.

You can use these statistics to improve performance on your system. See “Statistics overview” on page 301.

**Examples**

```bash
vxstat -s
```
Displays statistics for all subdisks on a managed server.

```bash
vxstat -d Harddisk5 Harddisk6
```
Displays statistics for Harddisk5 and Harddisk6

```bash
vxstat -s E:
```
Displays statistics for the subdisks of volume E.

```bash
vxstat -i 1 0 -c 5 -d
```
Displays 5 sets of statistics at 10-second intervals for all the disks on the managed server.

```bash
vxstat -d F:
```
Displays statistics for the disks that are associated with volume F.

```bash
vxstat -v Harddisk5
```
Displays statistics for the volumes that are associated with Harddisk5.

```bash
vxstat -gDynDskGrp1 -v
```
Displays statistics for all volumes in DynDskGrp1.
vxtask

The vxtask utility has keywords and operands to give percentage completion information on a task running on a managed server. Disk group and volume options let you specify a disk group or volume.

Typing the following sequence brings up a description of its syntax:

```
vxtask <Keyword> -?
vxtask [-g<DynamicDiskGroupName>] [-v.VolumeName | Driveletter | VmName>] list
```

The following attributes can apply:

- `-g<DynamicDiskGroupName>`
  Name of the dynamic disk group for which the task information will be displayed. For example, `-gDynDskGrp1`.

- `[-v.VolumeName | Driveletter | VmName>]`
  Displays task information for the specified volume. The `<VolumeName>` is the path name of the volume. The `<VmName>` parameter requires the use of the `-g` option, such as `-gDG1 Volume1`.

By default the information on all the tasks running on the managed server will be displayed unless the `-g` or `-v` options is specified.

Examples

```
vxtask list
vxtask -gDynDskGrp1 list
```

Displays percentage completion information on all the tasks running on a managed server.

Displays percentage completion information on the tasks relating to the disk group DynDskGrp1.
The `vxedit` command has keywords to associate a comment with a dynamic diskgroup, disk, volume, plex, or subdisk, or to set an alias for an enclosure.

### set comment
Associates a comment with a dynamic diskgroup, disk, volume, plex, or subdisk.

### set alias
Set alias for an enclosure.

### rename
Changes the name of a volume, plex, or disk media.

Typing the following sequence brings up a description of its syntax:

```
vxedit <Keyword> -?
```

---

**vxedit set comment**

```
vxedit [-g<DynamicDiskGroupName>] set comment=<comment>[<Object>]```

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxedit set comment` command.

The following attributes apply:

- `-g<DynamicDiskGroupName>` Name of the dynamic disk group for which the task information will be displayed. For example, `−gDynDskGrp1`.

- `<comment>` The comment text. The maximum size of comment is 40 bytes.

- `<Object>` Can be a dynamic volume, disk, plex, disk media, subdisk, or enclosure. Plex and subdisk require use of the `−g` option. If no object is specified, the command defaults to dynamic disk group (requires use of the `−g` option).

This command allows the user to add comments to any dynamic disk group, disk, volume, plex, or subdisk.

**Example**

```
vxedit set comment=BootDisk Harddisk0
```

Set the comment field of Harddisk0 to "BootDisk."
**vxedit set alias**

```
vxedit [-g<DynamicDiskGroupName>] set alias=<EnclosureNewAlias><EnclosureName | EnclosureOldAlias>
```

The following attributes apply:

- `-g<DynamicDiskGroupName>` Name of the dynamic disk group for which the task information will be displayed. For example, `-gDynDskGrp1`.
- `<EnclosureNewAlias>` New alias name for enclosure.
- `<EnclosureName | EnclosureOldAlias>` Name of enclosure or old alias of enclosure.

This command allows the user to set an alias for an enclosure.

**Example**

```
vxedit set alias=ABC1 DEC0
```

Set the alias for enclosure DEC0 to ABC1.

**vxedit rename**

```
vxedit [-g<DynamicDiskGroupName>] rename <OldVolumeName><NewVolumeName> [-f] | <OldPlexName><NewPlexName>| <OldDMName><NewDMName>
```

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxedit rename` command.

The following attributes apply:

- `-g<DynamicDiskGroupName>` Name of the dynamic disk group for which the task information will be displayed. For example, `-gDynDskGrp1`.
- `<OldVolumeName>` Old name for volume.
- `<NewVolumeName>` New name for volume.
- `-f` Forces the rename of the volume.
- `<OldPlexName>` Old name for plex.
- `<NewPlexName>` New name for plex.
<OldDMName> Old name for disk media.

<NewDMName> New name for disk media.

This command allows the user to change the name of a volume, plex, or disk media to a new name.

Example

vxedit rename Volume1 VolumeABC

Rename Volume1 to VolumeABC.

vxunreloc

Reverses the process of hot relocation or evacuation and moves the hot-relocated subdisks back onto the disk that was replaced after a disk failure.

vxunreloc [-g<DynamicDiskGroupName>] [-f] <DiskName |p#c#t#l#>

**Note:** Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the vxunreloc command.

**Note:** Dynamic disks belonging to a SAN Disk Group do not support the vxunreloc command.

-g<DynamicDiskGroupName> Required only if the internal disk name is used.

-f Unrelocates a subdisk to a different offset if unrelocating to the original offset is not possible.

**DiskName** Name of the disk that was relocated to another disk.

For example, *device name* such as Harddisk2, or *internal disk name* such as Disk2 (requires use of -g option, for example, -gDG1 Disk2).

p#c#t#l# Another way to indicate a disk name; the #s correspond to port, channel, target, and LUN of the disk.

All disks involved in the process must be in the same dynamic disk group.

Example
vxunreloc Harddisk0

This command unrelocates Harddisk0, which had been previously relocated to another hard disk.
See “Hot relocation” on page 244.

vxdmpadm

The vxdmpadm utility provides commands for Symantec Dynamic Multi-Pathing for Windows (DMPW DSMs).

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<td>setdsmscsi3</td>
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</tr>
<tr>
<td>setarrayscsi3</td>
<td>Enables or disables SCSI3 support in the registry of the array that contains the specified disk.</td>
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**setattr dsm**  
Sets DSM attributes.

**setattr array**  
Sets array attributes.

**setattr device**  
Sets device attributes.

**setattr path**  
Sets path attributes.

**set isislog**  
Alters trace level of the VEA/ISIS log dynamically.

**rescan**  
Rescans all the storage system objects on the computer.

**disk list**  
Lists details of all the disks on the managed server.

**getdsmattrib**  
Displays information for installed Symantec DSMs with no storage connection.

**getmpioparam**  
Displays MPIO parameters for installed Symantec DSMs

**setmpioparam**  
Sets MPIO parameters for installed Symantec DSMs

A full explanation of the DMP DSMs software and commands is available.  
See “DMPW overview” on page 425.

Each keyword is followed by the volume name or drive letter. Typing the following sequence for each keyword brings up a description of its syntax:

```
vxdmpadm<Keyword> -?
```

**vxdmpadm dsminfo**

```
vxdmpadm [-g<DynamicDiskGroupName>] dsminfo <DiskName> | p#c#t#l#>
```

This command displays the DSM name, arrays in the DSM, and the array load balance policy. The `DiskName` parameter can be specified by the device name (such as `Harddisk2`) or the internal disk name (such as `Disk2`). The internal disk name must be preceded by the `-g` option (for example, `-gDG1 Disk2`). The `#s` in the `p#c#t#l#` parameter correspond to the port, channel, target, and LUN of a disk.

**Example**

```
vxdmpadm dsminfo Harddisk5
```

Displays the DSM information in which Harddisk5 participates.
vxdmpadm arrayinfo

vxdmpadm [-g<DynamicDiskGroupName>] arrayinfo <DiskName> | p#c#t#l#>

This command displays the array name, the devices in the array, and the array load balance policy. It also displays the tunable parameters (control timer settings) that affect the testing and failover of paths. The DiskName parameter can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG1 Disk2). The #s in the p#c#t#l# parameter correspond to the port, channel, target, and LUN of a disk.

Example

vxdmpadm arrayinfo Harddisk5

Displays the array information for the array in which Harddisk5 participates.

vxdmpadm deviceinfo

vxdmpadm [-g<DynamicDiskGroupName>] deviceinfo <DiskName> | p#c#t#l#>...

This command displays the device name, the internal disk name, number of paths, status, and load balance policy. The DiskName parameter can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG1 Disk2). The p#c#t#l# parameter corresponds to the port, channel, target, and LUN of a disk.

Example

vxdmpadm deviceinfo Harddisk5 Harddisk6

Displays DMP DSMs related information about Harddisk5 and Harddisk 6.

vxdmpadm pathinfo

vxdmpadm [-g<DynamicDiskGroupName>] pathinfo <DiskName> | p#c#t#l#>...

This command displays path status, load balance policy, port, target, and LUN along with device name, internal disk name, and number of paths. The DiskName parameter can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG1 Disk2). The p#c#t#l# parameter corresponds to the port, channel, target, and LUN of a disk.
Example

vxdmpadm pathinfo Harddisk5 Harddisk6

Displays path information for Harddisk5 and Harddisk6.

**vxdmpadm arrayperf**

vxdmpadm [-g<DynamicDiskGroupName>] arrayperf <DiskName> | p#c#t#l#>

This command displays the date and time of the performance statistics, the array name, all the devices in the array, the paths for each device, and the performance statistics of all the devices in the array. The statistics are grouped by each path that is connected to a device. The DiskName parameter can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG1 Disk2). The #s in the p#c#t#l# parameter corresponds to the port, channel, target, and LUN of a disk.

The performance statistics represent the aggregate workload of the array. It includes the following number of:

- Reads
- Writes
- Bytes read
- Bytes written

Example

vxdmpadm arrayperf Harddisk5

Displays the performance statistics of the devices in the array in which Harddisk5 participates.

**vxdmpadm deviceperf**

vxdmpadm [-g<DynamicDiskGroupName>] deviceperf <DiskName> | p#c#t#l#>

This command displays the date and time of the performance statistics, the device name, the paths for the device, and the performance statistics of the device. The statistics are grouped by each path connected to the device. The DiskName parameter can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g
option (for example, -gDG1 Disk2). The p#c#t#l# parameter corresponds to the port, channel, target, and LUN of a disk.

The performance statistics represent the aggregate workload of the device. It includes the following number of:

- Reads
- Writes
- Bytes read
- Bytes written

Example

vxdmpadm deviceperf Harddisk6

Displays the performance statistics of Harddisk6.

**vxdmpadm pathperf**

vxdmpadm [-gDynamicDiskGroupName] pathperf <DiskName> | p#c#t#l#>...

This command displays the date and time of the performance statistics, the device name, and the performance statistics of the device. The statistics are grouped by each path connected to the device. The DiskName parameter can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG1 Disk2). The p#c#t#l# parameter corresponds to the port, channel, target, and LUN of a disk.

The performance statistics represent the workload of the paths connected to the device. It includes the following number of:

- Reads
- Writes
- Bytes read
- Bytes written

Example

vxdmpadm pathperf Harddisk6

Displays the performance statistics of Harddisk6.
vxdmpadm allperf

This command displays performance information of the paths for all devices. For devices, this includes the following:
- Name of the counter
- Path name
- Device name
- Array name
- Counter value

For path summaries, this includes the following:
- Name of the counter
- Path name
- Array name
- Counter value

vxdmpadm iostat

This command displays the I/O statistics for a single disk, all disks in an array, or all the disks of all the arrays in the host. The statistics can be grouped by device or array. If no groupby is specified, then statistics is shown for all the paths. The statistics can be set to display after a specified number of seconds and for a specified number of times through this CLI option.

The following attributes apply:

- showdevice|showarray
  - showdevice specifies paths of the disk. (Default is showdevice.)
  - showarray specifies all the paths of the array that contains the disk.
**showall**

Displays the I/O statistics for all the paths of all the arrays connected to the host. Diskname should not be specified with this option.

**groupby=device**

The I/O statistics is shown per device.

If no groupby is specified, then statistics is shown for all devices.

**groupby=array**

The I/O statistics is shown per array

**KB**

Data read or written is shown in KiloBytes/Second

**MB**

Data read or written is shown in MegaBytes/Second

**GB**

Data read or written is shown in GigaBytes/Second

**interval=#**

# specifies the amount of time (seconds) between displays of the I/O statistics.

( Default value is 5 seconds between displays.)

**count=#**

# specifies the number of times the I/O statistics are displayed.

( Default is infinite number of displays.)

**<DiskName>**

The designated disk, which can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG2 Disk1).

**p#c#t#l#**

The #s correspond to the port, channel, target, and LUN of a disk.

---

**vxdmpadm cleardeviceperf**

vxdmpadm [-g<DynamicDiskGroupName>] cleardeviceperf

**<DiskName> | p#c#t#l#**
This command resets the performance I/O statistics of a device.
The following attributes apply:

```
<DiskName> The designated disk, which can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG2 Disk1).
```

```
p#c#t#l# The #s correspond to the port, channel, target, and LUN of a disk.
```

**vxdmpadm cleararrayperf**

```
vxdmpadm [-g<DynamicDiskGroupName>] cleararrayperf<DiskName> | p#c#t#l#>
```

This command resets the performance I/O statistics of an array that contains the specified disk.
The following attributes apply:

```
<DiskName> The designated disk, which can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG2 Disk1).
```

```
p#c#t#l# The #s correspond to the port, channel, target, and LUN of a disk.
```

**vxdmpadm clearallperf**

```
vxdmpadm [-g<DynamicDiskGroupName>] clearallperf<DiskName> | p#c#t#l#>
```

This command resets the performance I/O statistics of all arrays under the control of the DMP DSMs that the specified disk belongs to.
The following attributes apply:

```
<DiskName> The designated disk, which can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG2 Disk1).
```

```
p#c#t#l# The #s correspond to the port, channel, target, and LUN of a disk.
```
vxdmpadm setdsmscsi3

vxdmpadm [-g<DynamicDiskGroupName>] setdsmscsi3 scsi3support=0|1 <DiskName> | p#c#t#l#> | [dsmName=ALL | <DsmFileName>]

This command enables or disables SCSI3 support in the registry of the DMP DSMs that controls the specified disk.

The following attributes apply:

- scsi3support=0|1
  - 0 disables SCSI3 support in the DMP DSMs
  - 1 enables SCSI3 support in the DMP DSMs

- <DiskName>
  - The designated disk, which can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG2 Disk1).

- p#c#t#l#
  - The #s correspond to the port, channel, target, and LUN of a disk.

- dsmName=ALL | <DsmFileName>
  - This attribute applies the scsi3support=0|1 selection to enable or disable SCSI3 on installed DSMs before a connection is configured. You can apply to all installed DSMs or to a particular DSM, specified by file name. You can use the vxdmpadm getdsmattrib command to get a list of DSM file names.

vxdmpadm setarrayscsi3

vxdmpadm [-g<DynamicDiskGroupName>] setarrayscsi3 scsi3support=0|1 <DiskName> | p#c#t#l#>

This command enables or disables SCSI3 support in the registry of the array that contains the specified disk.

The following attributes apply:

- scsi3support=0|1
  - 0 disables SCSI3 support in the DMP DSMs
  - 1 enables SCSI3 support in the DMP DSMs

- <DiskName>
  - The designated disk, which can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG2 Disk1).
The #s correspond to the port, channel, target, and LUN of a disk.

**vxdmpadm setattr dsm**

```
vxdmpadm [-g<DynamicDiskGroupName>] setattr dsm
[loadbalancepolicy=FO|RR|LQ|LB|BP [blockshift=#]] [primarypath=#]
[testpathretrycount=# scsicmdtimeout=# kernalsleeptime=#
failoverretrycount=#] <DiskName> | p#c#t#l#> [dsmName=ALL | <DsmFileName>]
```

This command sets the load balance policy and primary path of the DSM to which the designated disk belongs. It also lets you set tunable parameters (control timer settings) that affect the testing and failover of the paths. The following attributes apply:

- **loadbalancepolicy**
  - Specifies the load balance policy for the DSM where:
    - FO specifies Fail Over Only (Active/Passive)
    - RR specifies Round Robin (Active/Active)
    - LQ specifies Dynamic Least Queue Depth
    - LB specifies Least Blocks
    - BP specifies Balanced Path

- **blockshift=#**
  - # specifies the number of contiguous I/O blocks that are sent along a path to an Active/Active array before switching to the next available path.
  - (Default value is 2048 blocks.)

- **primarypath=#**
  - # specifies the primary path of the DSM. For example, primarypath=1-1-1 sets path 1-1-1 as the primary path of the DSM.
  - Range: 0 ~ 50 times. Default: 0.

- **testpathretrycount=#**
  - # specifies the amount of time a SCSI command waits for a device to respond to a SCSI command. Default is 30 seconds. Maximum is 120 seconds.

- **scsicmdtimeout=#**
  - # specifies the interval of time the DMP DSMs kernel waits between attempts to recover a path from an error condition. Default is 200 milliseconds. Maximum is 10000 milliseconds.

- **kernalsleeptime=#**
failoverretrycount=#  # specifies the number of times DMP DSMs attempts
a failover to another path when the current path fails. 
Default is 0. Maximum is 50 times. 

**Note:** For DMP DSMs, Failover Retry Count does not apply to the EMC Symmetrix array.

`<DiskName>`  
The designated disk, which can be specified by the 
device name (such as Hardisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the `-g` option (for example, `-gDG2 Disk1`).

`p#c#t#l#`  
The #s correspond to the port, channel, target, and LUN of a disk.

dsmName = ALL | `<DsmFileName>`  
Specifies whether to apply settings to all installed DSMs or only to the DSM specified by file name. Only the load balance policy settings are applied. If other settings are specified, the command will return an error.

**Note:** This parameter can be applied with or without a storage connection. If the array hasn’t been configured with load balance settings previously, it inherits the load balance settings specified for the DSM once it is connected. However, if the array was previously connected and has been configured with load balance settings in the registry, the previous settings will be maintained when the array is reconnected.

**Example**

```bash
vxdmpadm setattr dsm loadbalancepolicy=FO 
primarypath=1-1-0 scsicmdtimeout=34 Harddisk6
```

Sets the load balance policy of the DSM to Fail Over Only (Active/Passive), the primary path to path 1-1-0, the scsicmdtimeout to 34 seconds.

**vxdmpadm setattr array**

```bash
vxdmpadm [-g<DynamicDiskGroupName>] setattr array
[loadbalancepolicy=FO|RR|RS [path#=state#] |LQ|WP 
[path#=weight#]|LB|BP [blockshift=#]] [primarypath=#]
[testpathretrycount=# scsicmdtimeout=# kernalsleeptime=# 
failoverretrycount=# ]<DiskName> | p#c#t#l#>
```
This command sets the load balance policy and primary path of the array to which
the designated disk belongs. It also lets you set tunable parameters (control timer
settings) that affect the testing and failover of the paths. The following attributes
apply:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
</table>
| `loadbalancepolicy=FO|RR|RS|LQ|WP|LB|BP` | Specifies the load balance policy for the array where:
  - FO specifies Fail Over Only (Active/Passive)
  - RR specifies Round Robin (Active/Active)
  - RS specifies Round Robin with Subset
  - LQ specifies Dynamic Least Queue Depth
  - WP specifies Weighted Paths
  - LB specifies Least Blocks
  - BP specifies Balanced Path

*Note:* Round Robin with Subset and Weighted Paths are available for A/PC and ALUA arrays only at the device level. They are not available at the array level.

| `path#=state#` | `state#` specifies either standby (0) or active (1) state of the specified `path#`. For example, 1-1-1=0 means that path 1-1-1 is assigned a state of standby.
|               | (Default state of a path is active (1).)                                                                                                   |
| `path#=weight#` | `weight#` specifies the weight assigned to the specified `path#`. For example, 1-1-1=10 means that path 1-1-1 is assigned a weight of 10. The path with the lowest weight indicates the most-favored path for I/O.
|               | (Range of values for `weight#`: 0 - 255.)                                                                                                  |
| `blockshift=#` | `#` specifies the number of contiguous I/O blocks that are sent along a path to an Active/Active array before switching to the next available path.
|               | (Default value is 2048 blocks.)                                                                                                            |
| `primarypath=#` | `#` specifies the primary path of the array. For example, `primarypath=1-1-1` sets path 1-1-1 as the primary path of the array.                |
| `testpathretrycount=#` | `#` specifies the number of times the testpath routine will retry to test the health of the path.
|               | Range: 0 - 50 times. Default: 0.                                                                                                           |
| `scsicmdtimeout=#` | `#` specifies the amount of time a SCSI command waits for a device to respond to a SCSI command. Range: 30 - 120 seconds. Default is 30 seconds. |
kernalsleeptime=#  # specifies the interval of time the DMP DSMs kernel
waits between attempts to recover a path from an error
condition. Range: 200 ~ 10000 milliseconds. Default is
200 milliseconds.

failoverretrycount=#  # specifies the number of times the failover routine will
retry to failover the path. Range: 0 ~ 50 times. Default:
0.

Note: For DMP DSMs, Failover Retry Count does not
apply to the EMC Symmetrix array.

<DiskName>  The designated disk, which can be specified by the device
name (such as Harddisk2) or the internal disk name
(such as Disk2). The internal disk name must be
preceded by the -g option (for example, -gDG2 Disk1).

p#c#t#l#  The #s correspond to the port, channel, target, and LUN
of a disk.

Examples

vxdmpadm setattr array loadbalancepolicy=FO primarypath=2-1-0
testpathretrycount=4 Harddisk6

Sets the load balance policy of the array to Fail Over Only (Active/Passive), the
primary path to path 2-1-0, the testpathretrycount to 4 times.

vxdmpadm setattr array loadbalancepolicy=RR Harddisk6

Sets the load balance policy of the array to Round Robin (Active/Active).

vxdmpadm set attr device

vxdmpadm [-g<DynamicDiskGroupName>] set attr device
[loadbalancepolicy=FO|RR|RS [path#=state#] |LQ|WP
[path#=weight#]|LB|BP [blockshift=#]] [primarypath=#] <DiskName> |
p#c#t#l#

This command sets the load balance policy and primary path of the device to
which the designated disk belongs. The following attributes apply:
loadbalancepolicy= Specifies the load balance policy for the device where:

- FO specifies Fail Over Only (Active/Passive)
- RR specifies Round Robin (Active/Active)
- RS specifies Round Robin with Subset
- LQ specifies Dynamic Least Queue Depth
- WP specifies Weighted Paths
- LB specifies Least Blocks
- BP specifies Balanced Path

path#=state# state# specifies either standby (0) or active (1) state of the specified path#. For example, 1-1-1=0 means that path 1-1-1 is assigned a state of standby.
(Default state of a path is active (1)).

path#=weight# weight# specifies the weight assigned to the specified path#. For example, 1-1-1=10 means that path 1-1-1 is assigned a weight of 10. The path with the lowest weight indicates the most-favored path for I/O.
(Range of values for weight#: 0 - 255.)

blockshift=# # specifies the number of contiguous I/O blocks that are sent along a path to an Active/Active array before switching to the next available path.
(Default value is 2048 blocks.)

primarypath=# # specifies the primary path of the device. For example, primarypath=1-1-1 sets path 1-1-1 as the primary path of the device.

<DiskName> The designated disk, which can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG2 Disk1).

p#c#t#l# The #s correspond to the port, channel, target, and LUN of a disk.

Example

vxdmpadmsetattr device loadbalancepolicy=FO primarypath=1-1-0 Harddisk6

Sets the load balance policy of the device to Fail Over Only (Active/Passive) and the primary path to path 1-1-0 for Harddisk6.
vxdmpadm setattr path

vxdmpadm [-g<DynamicDiskGroupName>] setattr path
[loadbalancepolicy=FO|RR|RS [path#=state#] |LQ|WP
[path#=weight#]|LB|BP [blockshift=#]] [primarypath=#] <DiskName> | p#c#t#l#>...

This command sets the load balance policy and primary path of the designated disk. The following attributes apply:

loadbalancepolicy=
  Specifies the load balance policy for the device where:
  ■ FO specifies Fail Over Only (Active/Passive)
  ■ RR specifies Round Robin (Active/Active)
  ■ RS specifies Round Robin with Subset
  ■ LQ specifies Dynamic Least Queue Depth
  ■ WP specifies Weighted Paths
  ■ LB specifies Least Blocks
  ■ BP specifies Balanced Path

path#=state#
  state# specifies either standby (0) or active (1) state of the specified path#. For example, 1-1-1=0 means that path 1-1-1 is assigned a state of standby.
  (Default state of a path is active (1).)

path#=weight#
  weight# specifies the weight assigned to the specified path#. For example, 1-1-1=10 means that path 1-1-1 is assigned a weight of 10. The path with the lowest weight indicates the most-favored path for I/O.
  (Range of values for weight#: 0 - 255.)

blockshift=#
  # specifies the number of contiguous I/O blocks that are sent along a path to an Active/Active array before switching to the next available path.
  (Default value is 2048 blocks.)

primarypath=#
  # specifies the primary path of the device. For example, primarypath=1-1-1 sets path 1-1-1 as the primary path of the device.

<DiskName>
  The designated disk, which can be specified by the device name (such as Harddisk2) or the internal disk name (such as Disk2). The internal disk name must be preceded by the -g option (for example, -gDG2 Disk1).
The #s correspond to the port, channel, target, and LUN of a disk.

Example

```
vxdmpadm setattr path loadbalancepolicy=FO PRIMARYPATH=1-1-0
Harddisk6
```

Sets the load balance policy of the device to Fail Over Only (Active/Passive) and the primary path to path 1-1-0 for Harddisk6.

```
vxdmpadm set isislog
```

```
vxdmpadm set isislog level=<#|default> [reg=<y|n>]
```

This command alters trace level of the VEA/ISIS log dynamically. The following attributes apply:

```
level=#
```

Specifies the trace level to be set as current trace level, where # can be:

- 1 specifies the trace level Info1
- 2 specifies the trace level Info2
- 3 specifies the trace level Info3
- 4 specifies the trace level Info
- 5 specifies the trace level Warning
- 6 specifies the trace level Error (default)

```
reg=y|n
```

Specifies whether to update the trace level in the registry or not.

- Specify reg=y to update the trace level in the registry.
- Specify reg=n to not update the trace level in the registry.

By default, the trace level is not updated in the registry if this attribute is not specified.

Example

```
vxdmpadm set isislog level=default
```

Sets the trace level to 'Error'(6) and does not update the trace level in the registry.

```
vxdmpadm set isislog level=4 reg=y
```

Sets the trace level to 'Info'(4) and updates the trace level in the registry.
**vxdmpadm rescan**

```
vxdmpadm [-b] rescan
```

Rescans all the storage system objects on the computer, including disks, volumes, and file systems. The `-b` option runs the command in the background.

**vxdmpadm disk list**

```
vxdmpadm disk [-g<DynamicDiskGroupName>] [-v] list
```

Lists device name, internal disk name, disk group, disk partition style, size, free space, LUN, status, serial number, ThinProvisioningType (ThinNoReclaim or ThinReclaim for thin provisioned disks), ProvisionedSize (current size of thin provisioned disks), etc. for all the disks on the managed server.

The `-g` option limits the list of disks to the specified disk group. The `-v` (verbose) option displays signature, status, bus type, port, target, channel, LUN, track alignment offset, and track alignment setting information for the disks in the list.

---

**Note:** Not all manufacturers of thin provisioned disks enable the display of the current provisioned size.

**Example**

```
vxdmpadm disk -gDB1 -v list
```

Gives information on all the disks in the DB1 disk group. The `-v` option includes the signature, status, bus type, port, channel, target, and LUN information.

```
vxdmpadm disk [-g<DynamicDiskGroupName>] [-v] list
```

**vxdmpadm getdsmattrib**

```
vxdmpadm getdsmattrib [dsmName=ALL | <DsmFileName>]
```

`ALL` is the default; it gets the information for all installed Symantec DSMs.

`<DsmFileName>`: gets the information only for the DSM with that file name.

This command displays information for Symantec DSMs that have been installed in the system, with no storage connection required, as follows:

- The Symantec DSM file name
- The Symantec DSM full name which has been registered with MPIO
- The current load balance of the Symantec DSM
The SCSI3 support setting of the Symantec DSM

**vxdmpadm getmpioparam**

```bash
vxdmpadm getmpioparam [dsmName=ALL | <DsmFileName>]
```

If a DSM file name is specified, the command will display MPIO parameter settings for the specified DSM. Otherwise, the command will display MPIO parameter settings for all Symantec DSMs that have been installed on a system.

**vxdmpadm setmpioparam**

```bash
vxdmpadm setmpioparam [default] | [PathVerifyEnabled=0|1] [PathVerificationPeriod=#] [PDORemovePeriod=#] [RetryCount=#] [RetryInterval=#] [dsmName=ALL | <DsmFileName>]
```

This command enables changing MPIO timer parameters or restoring default MPIO timer parameters.

---

**Warning:** Symantec DSMs always use the default MPIO timer parameters. Therefore, this command should not be used unless a customer has been advised by Microsoft to change the settings for debugging purposes. Attempting to change these MPIO parameters would affect the behavior of a DSM for I/O error, path failover, and DSM performance.

---

- **default**
  - Restores the default settings of these MPIO parameters

- **PathVerifyEnabled=0|1**
  - Default: 0 (not enabled)
  - If enabled (value 1) MPIO will perform path verification every $N$ seconds where $N$ is the value set in PathVerificationPeriod.

- **PathVerificationPeriod=#**
  - # specifies the amount of time MPIO will perform the path verification, if path verification is enabled. Default: 30 seconds.
  - Maximum value: MAXULONG.

- **PDORemovePeriod=#**
  - # specifies the amount of time an MPIO pseudo LUN, which represents a disk under MPIO control, will stay in memory after all paths of a disk have been removed from the system. It also specifies how long the pending I/O should fail after all paths have been removed from a disk. Default: 20 seconds. Maximum value: MAXULONG.

- **RetryCount=#**
  - # specifies the number of times DSM will ask MPIO to retry the I/O when an I/O error occurs. Default: 3. There is no maximum value.
RetryInterval=# # specifies the amount of time MPIO should retry a failed I/O. Default: 1 second.

dsmName = ALL |<DsmFileName> Specifies whether to apply these settings to all installed DSMs or only to the DSM specified by file name.

**Note:** You can use the `vxdmpadm getdsmattrib` command if you want to find out the file names of installed DSMs.

---

**vxcb**

The `vxcb` utility provides the ability for users to back up and restore their Symantec Storage Foundation configuration. This utility does not back up and restores data, only the Symantec Storage Foundation configuration—that is, the disk group and logical volume layout on a server.

- **backup** Backs up the Symantec Storage Foundation configuration.
- **restore** Restores the Symantec Storage Foundation configuration.
- **write_signature** Manually writes a signature to a disk.

Typing the following sequence for each keyword brings up a description of its syntax:

```
vxcb <Keyword> -?
```

**Note:** The `vxcb` utility does not support Microsoft Disk Management Disk Groups. To back up the configuration of a Microsoft Disk Management Disk Group, use the Windows Server Backup feature of Windows.

---

**vxcb backup**

```
vxcbr [-a] [-p<Path>] backup [<DynamicDiskGroupName>...]```

Backs up the configuration to the directory where the Symantec Storage Foundation for Windows software is installed (normally `C:\Program Files\Veritas\Veritas Volume Manager`) or to a directory indicated in the `-p<Path>` parameter. The configuration files take about one megabyte of space per disk group. The `vxcb` utility will only back up the configurations of disk groups that are online. Any offline or deported disk groups will be skipped by this utility for backup purposes.

The following attributes apply:
[-a] Indicates that all disk groups on the server will be backed up. This option is recommended.

-p<Path> Specifies the path to the directory where the configuration information will be archived. The default path is \%ALLUSERSPROFILE\%Application Data\VERITAS\VXCBR\ManualCBR.

<DynamicDiskGroupName>... Limits the configuration to the disk group or disk groups indicated.

You must specify valid target disk groups.

Example

vxcbr -a backup

This backs up configuration of all online SFW disk groups on the managed server.

vxcbr restore

vxcbr [-i] [-p<Path>] restore [<DynamicDiskGroupName>...]

Restores the configuration. This restore command can only restore disk group configurations to their original disks; that is, the program assumes that you have not changed or replaced any of the ORIGINAL disks. However, if a disk is missing, you can specify the -i parameter to restore a configuration of an incomplete disk group. Probably, the only reason you might want to do an incomplete restore is to be able to access existing disks. An incomplete restore of the configuration is not recommended.

The following attributes apply:

-i Indicates that you want to restore an incomplete configuration—that is, one of the disks in the configuration is missing. It is a forced restore of an incomplete disk group.

-p<Path>> The path to where configuration information is saved.

<DynamicDiskGroupName>... Restores the disk group or groups specified.

Example

vxcbr restore Dg01 Dg02

Restores disk group configurations for Dg01 and Dg02.
vxcbr write_signature

vxcbr [-f<FileName>] write_signature [<<DiskName>=<DiskSignature>>...]

If the signature on a disk is no longer readable, you must manually add the
signature back to the disk, so that the configuration information can be restored
to the disk. You can find the signature information from a backup of the disk. If
you have one or two disks, you can indicate the disk names and signatures in the
command line. However, if you have multiple disks, you may find it easier to create
a separate file with the disk names and the corresponding disk signatures. The
utility will read the information from a specified file.

The following attributes apply:

[-f<FileName>]

Name of the file that has disk
names and signatures for each
disk you want the write
signature to be applied to. Use
the format
DiskName>=<DiskSignature>. For example,
Harddisk3=0x1234
Harddisk4=0xABCD.

[<<DiskName>=<DiskSignature>>...]

Format for indicating the disk
name and signature. See the
example below.

Example

vxcbr write_signature Harddisk3=0x1234Harddisk4=0xABCD

Manually adds the 0x1234 signature to Harddisk3 and 0xABCD signature to
Harddisk4.

vxsnap

The vxsnap CLI utility lets you perform multiple snapshots at the same time. To
use vxsnap, you must have the SFW FlashSnap option installed.

Note: FlashSnap is available only with the Enterprise edition. See the "Licensing"
section in the Symantec Storage Foundation and High Availability Solutions
Installation and Upgrade Guide for details.
Dynamic disks belonging to a Microsoft Disk Management Disk Group do not support the `vxsnap` command.

The `vxsnap` CLI utility makes use of both FlashSnap and Volume Shadow Copy Service (VSS) technology to create high-quality snapshots that can be done when application files are open. VSS can quiesce the application for the moment when the snapshot is created and then resume the application immediately after the snapshot; but a VSS-aware application must be used, such as Microsoft SQL Server. The `vxsnap` CLI utility acts as a VSS requestor, which lets you use SFW to initiate VSS snapshots at any time.

See “Volume Shadow Copy Service (VSS)” on page 383.

The `vxsnap` utility is designed to create and restore multiple snapshot sets.

The `vxsnap` CLI utility lets you name the snapshot volume. You must create the mirror for the volume before using the `vxsnap` CLI utility. The `vxsnap prepare` command can be used to create the mirror for the volume.

The `vxsnap` CLI utility allows a traditional full snapshot or a Microsoft Copy on Write (COW) snapshot. Microsoft COW snapshots have the benefit of being faster than full snapshots and take up less storage space.

A COW snapshot creates a shadow copy that is differential. When a change to the original volume occurs, the block that is about to be modified is read and then written to a “differences area”, which preserves a copy of the data block before it is overwritten with the change. Thus making a copy of the block before it is changed. Using the blocks in the differences area and unchanged blocks in the original volume, a copy of the volume can be constructed that represents the volume in the state before any changes occurred.

The benefit of the COW snapshot is that it creates shadow copies very rapidly because it is only writing changed blocks at a given time. Using the blocks in the differences area and unchanged blocks in the original volume, the initial state of the original volume can be reconstructed.

Either the `prepare` or `start` keyword may be used in the CLI, however `prepare` is recommended.

For step-by-step examples using `vxsnap`, see the application-specific Solutions guide. For example, for Microsoft SQL Server, refer to the *Symantec Storage Foundation and High Availability Solutions Quick Recovery and Microsoft Clustering Solutions Guide for Microsoft SQL*.
**Note:** To use `vxsnap`, the disk group must be a Symantec Storage Foundation for Windows 4.0 or later version. You must upgrade the disk groups created with an earlier version of Volume Manager for Windows before using the `vxsnap` utility.

**Note:** The `vxsnap` commands must be invoked on a local system.

- **prepare**
  Creates snapshot mirrors of the volumes in the specified component. The snapshot mirrors remain attached to and synchronized with the original volumes.
  
  *Note:* Either the `prepare` or `start` keyword may be used in the CLI, however `prepare` is recommended.

- **create**
  Creates simultaneous snapshots of all volumes in the specified component, providing a point-in-time snapshot set.

- **reattach**
  Reattaches and desynchronizes an existing snapshot set to the original database volumes.

- **restore**
  Restores a volume, database, or component from a snapshot set.

- **refresh**
  Refreshes all VSS Writers and component objects.

- **diffarea**
  Manages shadow storage area for COW snapshots. For example, the management of shadow storage area creation, size, and removal.

- **delete**
  Deletes COW snapshots corresponding to the information in the specified snapshot set.

Type the following sequence to view a description of the command syntax:

```
vxsnap <Keyword> -?
```

**vxsnap prepare**

For volume operations:

```
vxsnap prepare component=<ComponentName>/writer=<WriterName>
[-b] [source=<Volume>/harddisk=<Hardisk>...]
```

Creates snapshot mirrors of the volumes in the specified component and eliminates the need for multiple `vxassist prepare` commands. The snapshot mirrors remain attached to and synchronized with the original volumes.
Note: Either the prepare or start keyword may be used in the CLI, however prepare is recommended.

The following attributes apply:

```
component=<ComponentName>                   Name of the component.
writer=<WriterName>                         Unique ID of the VSS writer.
-b                                         Run the process as a background process.
source=<Volume>                             Indicates the source volume for the snapshot mirror specified by a drive letter, drive path (mount point), or volume name of the form "\\?\Volume{GUID}".
harddisk=<Hardisk>                          Name of the disk where the snapshot mirror is created, for example, harddisk2.
```

Example

```
vxsnaps prepare component=SG2/writer="XYZ Writer"
source=L:/harddisk=harddisk2
source=M:/harddisk=harddisk3
```

This command creates snapshot mirrors of all the volumes contained in the mentioned component. The snapshot mirror of the volume mounted on L: is created on disk 2 and the snapshot mirror of the volume mounted on M: is created on disk 3.

For SQL operations:

```
vxsnaps prepare component=<ComponentName>/writer=<WriterName> [server=<ServerName>] [instance=<InstanceName>] [-b]
[source=<Volume>/harddisk=<Hardisk>...]
```

Creates snapshot mirrors of the volumes in the specified component. The snapshot mirrors remain attached to and synchronized with the original volumes.

Note: Either the prepare or start keyword may be used in the CLI, however prepare is recommended.

The following attributes apply:

```
component=<ComponentName>                   Name of the database. The command prepares mirrors for both the database and log volumes of the SQL database.
```
writer=<WriterName>  Unique ID of the VSS writer, for example, SQLServerWriter or the GUID for the writer. Required if you specify the component.

server=ServerName  SQL Server server name.

instance=InstanceName  SQL Server instance name.

-b  Run the process as a background process.

source=<Volume>  Indicates the source volume for the snapshot mirror specified by a drive letter, drive path (mount point), or volume name of the form \\\\Volume\GUID\".

harddisk=<Harddisk>  Name of the disk where the snapshot mirror is created, for example, harddisk2.

**Note:** Any text string that contains spaces must be enclosed in quotation marks.

**Example**

vxsnap prepare component=billing_DB/writer=SQLServerWriter
source=L:/harddisk=harddisk3
source=M:/harddisk=harddisk3

This command will create snapshot mirrors of all the volumes contained in the billing_DB database. The snapshot mirror of the volume mounted on L: will be created on harddisk 3 and the snapshot mirror of the volume mounted on M: will also be created on harddisk 3.

**Note:** Ensure that the [NT AUTHORITY\SYSTEM] account is granted the sysadmin server role (from SQL Management Studio Console) on each node. This is applicable only for SQL Server 2012.

**vxsnap create**

For SQL operations:

vxsnap -x <Filename> create [-g <dynamicdiskgroupname>] source=<Volume>[/DriveLetter=<DriveLetter>][/DrivePath=<DrivePath>][/Newvol=<NewVolName>][/Plex=<PlexName>]... [writer=<WriterName>] [component=<ComponentName>]}
[server=ServerName] [instance=InstanceName] [backuptype=FULL|COPY] [-o] [-c] [secHosts=<SecondaryHosts>]

Creates snapshot(s) of the specified volume(s) or SQL database. Allows volumes to be snapshotted simultaneously.

Separate source volumes and attributes with forward slashes, not spaces. Source and snapshot volume attributes are paired. You must specify the source volume if you choose to specify the snapshot volume plex, drive letter, drive path, label, or volume name.

The following attributes apply:

- `-x <Filename>` Indicates the name to be assigned to the XML metadata file that will be created with the command. The file name must include the "xml" extension. To specify a location other than the default location for the file, you must enter the full path for the file (eg. J:\XML\Image1.xml).

- `-g <DynamicDiskGroupName>` Name of disk group containing source volume. Required when specifying volume name.

- `source=<Volume>` Indicates the source volume for the split-mirror snapshot specified by a drive letter, drive path (mount point), or volume name of the form "\\?\Volume{GUID}". Repeat this parameter for each volume associated with the specified component.

- `[/plex=<PlexName>]` Specifies the name of the mirror or plex that is to be detached. Use this parameter if there are multiple snap plexes available to be snapshotted.

- `[/DriveLetter=<DriveLetter>]` The drive letter to be assigned to the new snapshot volume.
The drive path to be assigned to the new snapshot volume. The drive path must reference an empty local NTFS folder, which was created beforehand. The path must include the drive letter and folder to be mounted, for example, C:\DB1VOL.

`[/DrivePath=<DrivePath>]`

Specifies the name of the new snapshot volume that is created.

If the name is not specified, then the default snapshot volume name begins with “SnapV” followed by a 12 character alphanumeric string. The 12 character alphanumeric string is a coded hexadecimal timestamp based upon the time that the snapshot was taken. For example, a default Snap Volume Name would be “SnapV4A7337AE038A”.

The full device path becomes:

```
\Device\HarddiskDmVolumes<br>\<DiskGroupName><NewVolName>
```

`[/Newvol=<NewVolName>]`

Unique ID of the VSS writer, for example, SQLServerWriter or the GUID for the writer. Required if you specify the component.

`writer=<WriterName>`

Name of the database. The command prepares mirrors for both the database and log volumes of the SQL database.

`component=<ComponentName>`

SQL Server server name.

`sver=ServerName`

SQL Server instance name.

`instance=InstanceName`

Specifies the type of backup, either a Full or Copy. If no option is specified then Copy is the default. To back up logs in SQL Server so that you can restore the database using SQL log replay, at least one Full backup must have been created earlier.

`backupType=FULL|COPY`
-o Allows an existing XML file of the same name to be overwritten. If -o is not specified the vxsnap create command does not overwrite an existing XML file of the same name and the operation fails.

-c Specifies a COW snapshot.

In preparation for a COW snapshot, the vxsnap diffarea command must be used to create the shadow storage volume. The following vxsnap attributes are not compatible with COW snapshots and result in an error:

- /DriveLetter=<driveLetter>
- /DrivePath=<drivePath>
- /Newvol=<newVolName>
- /Plex=<plexName>
- secHosts=<secondary hosts>

secHosts=<SecondaryHosts>

Applies to Symantec Storage Foundation Volume Replicator (Volume Replicator) environment only. Comma separated list of secondary hosts on which a synchronized snapshot is to be taken.

**Note:** Any text string that contains spaces must be enclosed in quotation marks.

**Examples**

vxsnap -x billing_DB.xml create
source=G:/Newvol=billing_data
source=H:/Newvol=billing_log
writer=SQLServerWriter component=billing_DB
backuptype=full

This example creates a snapshot set based on the component billing_DB which contains volume G, the database volume, and volume H, the log volume. The snapshot volumes are named billing_data and billing_log, respectively. The XML file, billing_DB.xml, is used to store the VSS metadata that identifies the snapshot set. This file is used in the command to reattach the snapshot set to resynchronize it and in the command to recover the database using the snapshot set.
vxsnap -x snapdata.xml create
-C writer=sqlserverwriter
component=testDB server=localhost

Creates a COW snapshot of SQL database testDB used in the default instance of the localhost.

For volume operations:

vxsnap -x <Filename> create [-g <dynamicdiskgroupname>]
source=<Volume>[/DriveLetter=<DriveLetter>][/DrivePath=<DrivePath>]
[/Newvol=<NewVolName>][/Plex=<PlexName>]...[-o] [-c]

Creates snapshot(s) of the specified volume(s). Allows volumes to be snapshotted simultaneously.

Separate source volumes and attributes with forward slashes, not spaces. Source and snapshot volume attributes are paired. You must specify the source volume if you choose to specify the snapshot volume plex, drive letter, drive path, label, or volume name.

The following attributes apply:

-x <Filename> Indicates the name to be assigned to the XML metadata file that will be created with the command. The file name must include the "xml" extension.

-g <DynamicDiskGroupName> Name of disk group containing source volume. Required when specifying volume name.

source=<Volume> Indicates the source volume for the split-mirror snapshot specified by a drive letter, drive path (mount point), or volume name of the form "\?\Volume{GUID}". Repeat this parameter for each volume associated with the specified component.

[/plex=<PlexName>] Specifies the name of the mirror or plex that is to be detached. Use this parameter if there are multiple snap plexes available to be snapshotted.

[/DriveLetter=<DriveLetter>] The drive letter to be assigned to the new snapshot volume.
[/DrivePath=<DrivePath>]

The drive path to be assigned to the new snapshot volume. The drive path must reference an empty local NTFS folder, which was created beforehand. The path must include the drive letter and folder to be mounted, for example, C:\DB1VOL.

[/Newvol=<NewVolName>]

Specifies the name of the new snapshot volume that is created.

If the name is not specified, then the default snapshot volume name begins with “SnapV” followed by a 12 character alphanumeric string. The 12 character alphanumeric string is a coded hexadecimal timestamp based upon the time that the snapshot was taken. For example, a default Snap Volume Name would be “SnapV4A7337AE038A”.

The full device path becomes:
\Device\HarddiskDmVolumes
\<DiskGroupName>\<NewVolName>

-o

Allows an existing XML file of the same name to be overwritten. If -o is not specified the vxsnap create command does not overwrite an existing XML file of the same name and the operation fails.

-c

Specifies a COW snapshot.

In preparation for a COW snapshot, the vxsnap diffarea command must be used to create the shadow storage volume. The following vxsnap attributes are not compatible with COW snapshots and result in an error:

- /DriveLetter=<driveLetter>
- /DrivePath=<drivePath>
- /Newvol=<newVolName>
- /Plex=<plexName>
- secHosts=<secondary hosts>
Note: Any text string that contains spaces must be enclosed in quotation marks.

Examples

vxsnap -x snapdata.xml create
source=E:\Data\DB1/DrivePath=E:\Backup\DB1
source=E:\Data\DB2/DrivePath=E:\Backup\DB2

This command does not specify a specific storage group (component) but rather creates snapshots from the volumes mounted on E:\Data\DB1 and E:\Data\DB2. The resulting snapshot volumes are assigned mount points E:\Backup\DB1 and E:\Backup\DB2, respectively. The metadata involved in this operation is stored in snapdata.xml.

vxsnap -x snapdata.xml create
-C source=D:

Creates a COW snapshot of volume D:

vxsnap reattach

For SQL operations:

vxsnap -x <Filename> [-f] [-b] reattach[writer=<WriterName>]
[secHosts=<SecondaryHosts>]

This command reattaches and resynchronizes the snapshot volumes in the snapshot set to the original database volumes.

The following attributes apply:

-x <Filename>  The file created by the vxsnap create command. Each snapshot set must have a unique name for the metadata file.  

Note: This file is deleted after the reattach operation has completed successfully.

-f  Forces the reattach. Make sure the volume is not in use by another application before using this command. Use this option with care.

-b  Resynchronizes the volume in the background. A new snapshot cannot be made until the resynchronization is complete.
writer=<WriterName>  Unique ID of the VSS writer, for example, SQLServerWriter or the GUID for the writer.

sechosts=<SecondaryHosts>  Applies to Symantec Storage Foundation Volume Replicator (Volume Replicator) environment only. Comma separated list of secondary hosts on which a synchronized snapshot is to be taken.

Note: Make sure that the snapshot volumes are not in use before using this command.

Example

vxsnap -x billing_DB.xml reattach writer=SQLServerWriter

This command uses the information in the snapdata.xml file to reattach and resynchronize all the volumes in the snapshot set. This xml file is deleted after the reattach operation has completed successfully. The snapshot volumes remain synchronized with the original volumes until the vxsnap create command is issued.

Note: Any text string that contains spaces must be enclosed in quotation marks.

For volume operations:

vxsnap -x <Filename> [-f] [-b] reattach

This command reattaches and resynchronizes the snapshot volumes in the snapshot set to the original database volumes.

The following attributes apply:

-<Filename>  The file created by the vxsnap create command. Each snapshot set must have a unique name for the metadata file.

Note: This file is deleted after the reattach operation has completed successfully.

-f  Forces the reattach. Make sure the volume is not in use by another application before using this command. Use this option with care.

-b  Resynchronizes the volume in the background. A new snapshot cannot be made until the resynchronization is complete.
**Note:** Make sure that the snapshot volumes are not in use before using this command.

**Example**

```
vxsnap -x snapdata.xml reattach
```

This command uses the information in the snapdata.xml file to reattach and resynchronize all the volumes in the snapshot set. This xml file is deleted after the reattach operation has completed successfully. The snapshot volumes remain synchronized with the original volumes until the `vxsnap create` command is issued.

**vxsnap restore**

For SQL operations:

```
vxsnap -x <Filename> [-f] [-b] [-r] restore
[restoreType=[RECOVERY|NO_RECOVERY]]
[noLogs|logFiles=<tlog1,tlog2,...>] writer=WriterName
```

Uses the snapshot volumes in a snapshot set created by the `vxsnap create` command to recover a corrupted or missing SQL Server database. Exclusive access to the SQL Server database is required for this operation.

(COW snapshots can be used with this command.)

Before using this command verify that the source volumes and the snapshot volumes are not in use.

The following attributes apply:

- `-x <Filename>`
  - The file created by the `vxsnap create` command. Each snapshot set must have a unique name for the metadata file.
  - When the full path for the `<Filename>` is not specified, the `writer=<WriterName>` attribute is required.

- `-f`
  - Forces the snapback. Make sure the volume is not in use by another application before using this command. Use this option with care.

- `-b`
  - Resynchronizes the volume in the background. A new snapshot cannot be made until the resynchronization is complete.
-r

Recover even if original volume is not present. If this option is selected and the original volume is not present, the snapshot volume of the missing volume is changed from a read-only volume to a read-write volume.

Use this option only with Recovery noLogs. After using this option you must explicitly assign the original drive letter/mount path of the missing volume to the snapshot volume in the VEA and then bring the database online.

This option cannot be specified to recover using a COW snapshot.

restoreType=

Specifies the type of database recovery, either recovery or no recovery:

- **RECOVERY** can be used with either the noLogs or logFiles=tlog1,tlog2,... attributes.
- **RECOVERY** leaves the database in an online state.

To back up logs so that you can restore the database using log replay, at least one Full backup must have been created earlier.

- **NO_RECOVERY** restores from the specified snapshot set to the time of the snapshot. No logs are applied and the database is left in a loading state so that you can manually replay backup logs to a specific point in time.

noLogs

Database and transaction log files are restored from the snapshot set. No transaction backup logs are applied. The database is left in an operational state.

logFiles=tlog1,tlog2,...

Transaction log backup files to be applied with the **RECOVERY** option to achieve a point of failure recovery and leave the database in an online state. Each transaction log must have a unique name and be created using the "overwrite existing media" option.

writer=WriterName

The name for the SQL Server VSS Writer; used to locate the default directory to search for the XML metadata file. Specify **SQLServerWriter**.

The following are examples of the command:

- Recovering using snapshots without log replay

```bash
vxsnap -x TestDB.xml restore RestoreType=RECOVERY noLogs
writer=SQLServerWriter
```
This command uses the information in the TestDB.xml file to restore all the volumes in the snapshot set and brings the database online. The database is restored to the time the snapshot set was created or last refreshed. You can use the -r option with the RECOVERY noLogs restore type if a production volume is missing due to hardware failure:

```
vxsnap -x TestDB.xml -r restore RestoreType=RECOVERY noLogs writer=SQLServerWriter
```

■ Recovering using snapshots and log replay

```
vxsnap -x TestDB.xml restore RestoreType=RECOVERY logFiles=c:\backup\tLog1.bak, c:\tLog2.bak writer=SQLServerWriter
```

This command uses the information in the TestDB.xml file to restore all the volumes in the snapshot set and then applies the specified transaction log backups (c:\backup\tLog1.bak and c:\tLog2.bak) and brings the database online.

■ Restoring snapshots and manually applying logs

```
vxsnap -x TestDB.xml restore RestoreType=NO_RECOVERY writer=SQLServerWriter
```

This command uses the information in the TestDB.xml file to restore all the volumes in the snapshot set and leaves the database in a loading state so that backup logs can be manually restored to a specific point in time.

**Note:** For more information about the -r switch, see the *Symantec Storage Foundation and High Availability Solutions Quick Recovery and Microsoft Clustering Solutions Guide for Microsoft SQL*.

For volume operations:

```
vxsnap -x <Filename> [-f] [-b] [-r] restore RestoreType=PIT [<Volumename|Driveletter|DrivePath> ...]
```

Uses the snapshots in a snapshot set created by the `vxsnaps create` command to restore data, for example, after an original volume has become corrupted.

(COW snapshots can be used with this command.)

The following attributes apply:
vxsnap -x <Filename>  The file created by the vxsnap create command. Each snapshot set must have a unique name for the metadata file.

-f  Forces the snapback. Make sure the volume is not in use by another application before using this command. Use this option with care.

-b  Resynchronizes the volume in the background. A new snapshot cannot be made until the resynchronization is complete.

-r  Recover one or more of the original volumes are missing. This option cannot be specified to recover using a COW snapshot.

 PIT specifies a restore to the point in time that the snapshot set was created or last refreshed.

VolumeName  Name of volume. For example, \Device\HarddiskDmVolumes\DynamicGroup\Volume1.

DriveLetter  Drive letter of the volume.

DrivePath  Drive path of the volume.

Examples

vxsnap -x snapdata.xml restore RestoreType=PIT

This command uses the information in the snapdata.xml file to restore all the volumes in the snapshot set to the point in time the snapshot set was created or last refreshed.

vxsnap refresh

For SQL operations:

vxsnap refresh

This command refreshes all VSS Writers and component objects. (SQL operations)
Note: It is observed that when adding or removing the VSS components or when connecting to the VEA console for the first time, the updated VSS components are not displayed on the VEA console. To view the updated VSS components, you must manually refresh the VEA. To manually refresh the console, run either the `vxsnap refresh` command or perform a Refresh operation through the VEA console.

**vxsnap diffarea**

For COW snapshot operations:

```
vxsnap diffarea <-a|-r|-c> source=<driveletter>
/target=<driveletter>[/size=<size>]...
```

Manages creation, deletion, and modification of shadow storage area settings for COW snapshots.

The following attributes apply:

- `-a` Create shadow storage area for volume specified in source. Shadow storage area resides on volume specified in target with specified size. The shadow storage area must reside in the same dynamic disk group as the source. It can reside on the same volume as the source volume.

- `-r` Remove association of shadow storage area specified in target and volume specified in source.

- `-c` Change the shadow storage area settings for an existing shadow storage area specified in the target and the volume specified in source.

**source** Source volume for COW snapshot.

**Note:** A basic volume cannot be used as the source volume.

**target** Volume for storing blocks of source volume before write operation.

**Note:** A basic volume cannot be used as the target volume.

**Note:** Target volume must be an NTFS volume.

**size** Size of volume that is shadow storage area.

If size is set to -1 or if size is not specified, then the size of the shadow storage area is unlimited.

**Note:** Use the VEA GUI to view the settings for shadow storage areas.
Examples

vxsnap diffarea -a source=E:/target=F:/size=500
source=G:/target=H:/size=300

This command creates two shadow storage areas. One is a 500MB shadow storage area on volume F that stores COW snapshots of volume E. The second is a 300MB shadow storage area on volume H that stores COW snapshots of volume G.

vxsnap diffarea -r source=E:/target=F:

This command removes the association between volume E and the shadow storage area on volume F.

vxsnap delete

For COW snapshot operations:

vxsnap -x <Filename> [-f] delete
[writer=WriterName]

Deletes the COW snapshots corresponding to the information in the specified XML file. The XML file is deleted after all the snapshots have been successfully deleted.

The following attributes apply:

-x <Filename> Name of the file that stores the metadata for COW snapshots. The file is created by the vxsnap create command.

-f Forces the delete. Use this option with care.

Use the -f option when one or more snapshots in the snapshot set do not exist. For example, use the -f option when one or more snapshots in the snapshot set no longer exist because Windows has deleted older snapshots to make room for newer snapshots.

writer=WriterName The name for the VSS Writer associated with the snapshots to be deleted.

Examples

vxsnap -x snapdata.xml delete writer=sqlserverwriter

Deletes the SQL COW snapshots corresponding to information in snapdata.xml.

vxsnap -x snapdata.xml delete
Deletes the COW snapshots corresponding to information in snapdata.xml.

\texttt{vxsnap -x cow1.xml -f delete}

Forces the deletion of the COW snapshots corresponding to information in cow1.xml.

\textbf{vxfsync}

The \texttt{vxfsync} utility uses Fast File Resync to resynchronize a single file in a snapshotted volume to the original volume. It is designed to restore a good copy of one corrupt file in a database application that has volumes with multiple database files.

\texttt{vxfsync -g <DynamicDiskGroupName> -m <Mastervolume> -s <Snapvolume> -f <filename>}

See “Fast File Resync” on page 380.

The \texttt{vxfsync} command is only available from the Symantec Storage Foundation folder found at the following path:

\texttt{\%ProgramFiles\%\Veritas\Veritas Volume Manager}

- \texttt{-g <DynamicDiskGroupName>} The name of the disk group containing the original and snapshotted volumes.
- \texttt{-m <Mastervolume>} The original volume.
- \texttt{-s <Snapvolume>} The name of the split-mirror snapshot volume.
- \texttt{-f <filename>} The file name of the file to be resynchronized to the original volume.

Example

\texttt{vxfsync -g test -m voll -s voll_snap01 -f test.dat}

This command will use the snapshot volume (the replica), voll_snap01, to resynchronize or restore the file test.dat on the master or original volume, voll.

\textbf{vxscrub}

\texttt{vxscrub} is a command for removing unneeded entries in the registry that are a result of adding and deleting volumes. The command is designed to shrink the size of the registry by purging the system hive. Shrinking the size of the registry
after adding and deleting volumes avoids problems during system restart. Restarting the system after running `vxscrub` is mandatory.

Warning: The `vxscrub` utility should be used only under the direction of Support. Use of this utility without supervision may cause performance problems when importing disk groups.

```
[-a|-b|-l|-v] Uninstalls all unused volumes, disks, or mounted devices only.
   Does not purge the system hive.
-p Uninstalls all unused volumes, disks, and mounted devices, then
   purges the system hive.
-forcepurge Purges the system hive only. Does not uninstall unused volumes,
   disks, or mounted devices.
```

Typing the following brings up a description of its syntax:

`vxscrub`  

`vxscrub [-a|-b|-l|-v]`  

Uninstalls all unused volumes, disks, or mounted devices only. Does not purge the system hive.

Note: The system hive of the registry does not physically shrink using this command mode. Use the other command modes to physically shrink the system hive of the registry.

The following attributes apply:

- `-a` Uninstalls all unused volumes.
- `-b` Uninstalls all unused BASIC volumes.
- `-l` Uninstalls all unused LDM volumes.
- `-v` Uninstalls all unused SFW volumes.
- `-d` Uninstalls all unused disk instances.
- `-m` Cleans up the database of mounted devices.
-q  Does not display any output.
-c  Tests the uninstall and clean up operation. The uninstall and clean up operation is not performed.

Example
vxscrub -a -d -m
This command uninstalls all unused volumes, disks, and mounted devices.

vxscrub -p

vxscrub -p [-q]
Uninstalls all unused volumes, disks, and mounted devices, then the system hive is purged.

**Note:** You must restart the system after running this command.

The following attributes apply:

-p  Uninstalls all unused volumes, disks, and mounted devices, then the system hive is purged.
-q  Does not display any output.

Example
vxscrub -p
This command uninstalls all unused volumes, disks, and mounted devices; purges the system hive; and shrinks the size of the registry.

vxscrub -forcepurge

vxscrub -forcepurge [-c]
Purges the system hive only. Does not uninstall unused volumes, disks, or mounted devices.

**Note:** You must restart the system after running this command.

The following attributes apply:
Purges the system hive.

Tests the purge operation and reports the new size of the registry. The purge operation is not performed.

Example

vxscrub -forcepurge

This command purges the system hive and shrinks the size of the registry.

vxverify

vxverify is a command that determines if there are any differences between plexes of mirrored volumes. This command compares the volumes on a block by block basis. Blocks that do not match are reported in the output.

Note: For RAID-5 volumes, vxverify also checks the integrity of the parity of the volumes.

Typing the following sequence brings up a description of its syntax:

vxverify -?


The following attributes apply:

-v Enables verbose output. This specifies that in addition to any blocks that do not match, the output includes the mirror volume name, block number, and number of blocks being compared.

-p Enables the utility to process a partial plex for debugging purposes.

-d Enables the utility to dump mismatched blocks.

n|all Specifies the number of mismatched blocks to dump.

- n specifies the number of mismatched blocks.

- "all" specifies the dumping of all mismatched blocks.
<DynamicDiskGroupName> Specifies the dynamic disk group of the volume.

Note: The name of the disk group is case sensitive.

<Volume Name> Specifies the volume to process.

offset Specifies the offset for comparison. Offset is specified as a number of blocks.

length Specifies the length for comparison. Length is specified as a number of blocks.

Note: If no length is specified, then the entire volume is compared.

Example

vxverify -g Accounting test

This command performs a comparison of the volume test of the disk group Accounting and its mirrors.

vxprint

vxprint is a command that displays information about SFW and Volume Replicator objects.

Specifying the name of an object results in a display of information for the object. Hierarchies within record associations are displayed in an orderly fashion so that the structure of records is clear. Dashes (–) are displayed in the output wherever there is no available output value. If no option is specified in the command, the command defaults to the -h option.

The typical output format consists of single-line records, each of which include information such as record type, name, object association, object state, length, and other fields. A header line is also written before the record information.

When no disk group is specified with the command, objects in all the disk group are displayed.

Typing the following sequence brings up a description of its syntax:

vxprint -?


The following attributes apply:
-h  List record hierarchies.
-n  List record names.
-q  Suppress field header in output display.
-l  List record information in verbose format.
-P  List Volume Replicator RLINK records.
-V  List Volume Replicator RVG records.
-v  List volume records.
-p  List plex records.
-d  List disk records.
-s  List subdisk records.
-A  Display all disk groups.
-Q  Suppress diskgroup header.
-G  List disk groups.
-E  List enclosures.

<-gDynamicDiskGroupName>  Specifies dynamic disk group.
<-Name>  Specifies an object to process.

Example
vxprint -gAccounting test
This command displays information for the volume test in the disk group Accounting.

vxprint -v
This command displays information of all the volumes on the system.

vxprint -p
This command displays information of all the plexes on the system.

Tuning SFW

SFW provides the vxtune command to tune SFW tunables.
This command is especially useful if you want to experiment with different values to arrive at an optimum value that suits your requirements.

**Syntax for** `vxtune` **command:**

```
vxtune [ <tunable> [ <value> ] ]
```

**Parameters for** `vxtune` **command:**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunable</td>
<td>Specifies the tunable name whose value you want to display or change.</td>
</tr>
<tr>
<td>Value</td>
<td>Specifies the value that you want to set for the tunable.</td>
</tr>
</tbody>
</table>

A new tunable, `vol_maxkiocount` is applicable for `vxio`. You can tune it as follows:

`vol_maxkiocount`: Specifies the maximum number of parallel I/O operations that SFW can perform.

The maximum permissible value can be 2147483647. The default is 2048.

### Displaying the tunable values

Use the `vxtune` command without any parameters to display the value that is currently assigned to the SFW tunable.

**Syntax for** `vxtune` **command:**

```
vxtune [<tunable>]
```

To display the default values for the tunable use the command:

```
vxtune
```

To display the value for a specific tunable use the command:

```
vxtune <tunable>
```

The output for `vxtune` command resembles the following:

```
vol_maxkiocount=4096
```

### Setting the tunable values

Use the `vxtune` tunable command with the value argument to set the tunable to a new value. After modifying the tunable, the new tunable value will be updated immediately.

```
vxtune <tunable> <value>
```
To set the value of `vol_maxkiocount` to 4096:

```
vxtune vol_maxkiocount 4096
```
Veritas Disk ID (VDID) Details for Arrays

This appendix includes the following topics:

- Format of VDID strings for disks belonging to various arrays

Format of VDID strings for disks belonging to various arrays

The Veritas Disk ID (VDID) is a string that contains information that can identify the array that a disk is contained in. The VDID string is shown in the GUI as a part of the display of information for disks. The VDID string is also shown as a result of the `vxdisk diskinfo` and the `vxdisk list` CLI commands.

The following table describes the format of the VDID strings for disks that belong to various arrays.

<table>
<thead>
<tr>
<th>Array</th>
<th>Model/Type</th>
<th>Format of VDID String</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco</td>
<td>MDS</td>
<td>SCSI Inquiry Page 83 data</td>
</tr>
<tr>
<td>COMPAQ</td>
<td>HSG80/HSG80CCL</td>
<td>SCSI Inquiry Page 83 data</td>
</tr>
<tr>
<td>Default</td>
<td>All models</td>
<td>DevicePath@HostName</td>
</tr>
</tbody>
</table>

Note: For the disks that are discovered by the `ddlprov` provider, the VDID string format for its array is "VID_PID_CabinetSerialNumber_LUNSerialNumber". For the disks that are not discovered by the `ddlprov` provider, the VDID string format for its array is "VID_PID_DISKS_LUNSerialNumber". Note that the following is not a complete list of such arrays.
<table>
<thead>
<tr>
<th>Vendor</th>
<th>Array Model</th>
<th>Format of VDID strings for disks belonging to various arrays</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>Clarion</td>
<td>EMC_DGC_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>EMC</td>
<td>Symmetrix/DMX</td>
<td>EMC_SYMMETRIX_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>Hitachi</td>
<td>9960, 9970, 9980, 9200, 9500, 7700, USP</td>
<td>HITACHI_PID_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>HP-EVA</td>
<td>HSV</td>
<td>HP_PID_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>HP-XP</td>
<td>1024</td>
<td>HP_1024_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>HP-XP</td>
<td>512</td>
<td>HP512_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>HP-XP</td>
<td>128</td>
<td>HP128_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>IBM</td>
<td>DS8000, DS6000</td>
<td>IBM_PID_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>IBM</td>
<td>200, 700, 600, 400, Fast_T</td>
<td>IBM_PID_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>IBM-LSI</td>
<td>All models</td>
<td>SCSI Inquiry Page 83 data</td>
</tr>
<tr>
<td>IBM Shark</td>
<td>F20, ESS 800, F10</td>
<td>IBM_PID_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>JBOD</td>
<td>all models</td>
<td>{WWWN}+{SCSI LUNID}</td>
</tr>
<tr>
<td>NETAPP</td>
<td>F825, FAS900</td>
<td>NETAPPP_LUN_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>SUN-T3</td>
<td>All models</td>
<td>SCSI Inquiry Page 83 data</td>
</tr>
<tr>
<td>3PAR</td>
<td>Inserv Storage Server, E-Class, F-Class, S-Class, T-Class</td>
<td>3PARdata_PID_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>DELL</td>
<td>Equallogic PS5000/PS6000 Series</td>
<td>VID_PID_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>PILLAR</td>
<td>Axiom 300/500/600</td>
<td>VID_PID_CabinetSerialNumber_LUNSerialNumber</td>
</tr>
<tr>
<td>Fujitsu</td>
<td>All models</td>
<td>VID_PID_DISKS_LUNSerialNumber</td>
</tr>
<tr>
<td>Compellent</td>
<td>All models</td>
<td>VID_PID_DISKS_LUNSerialNumber</td>
</tr>
<tr>
<td>EMC</td>
<td>VPLEX</td>
<td>VID_PID_DISKS_LUNSerialNumber</td>
</tr>
<tr>
<td>HP</td>
<td>MSA P2000</td>
<td>VID_PID_DISKS_LUNSerialNumber</td>
</tr>
<tr>
<td>HP</td>
<td>MSA 2040</td>
<td>VID_PID_DISKS_LUNSerialNumber</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Model</td>
<td>VDID String</td>
</tr>
<tr>
<td>-------------</td>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>IBM</td>
<td>DS5020</td>
<td>VID_PID_DISKS_LUNSerialNumber</td>
</tr>
<tr>
<td>IBM</td>
<td>DS3524</td>
<td>VID_PID_DISKS_LUNSerialNumber</td>
</tr>
<tr>
<td>Sun</td>
<td>6540</td>
<td>VID_PID_DISKS_LUNSerialNumber</td>
</tr>
<tr>
<td>Sun</td>
<td>7310</td>
<td>VID_PID_DISKS_LUNSerialNumber</td>
</tr>
</tbody>
</table>
Format of VDID strings for disks belonging to various arrays
In Storage Foundation for Windows, the mode in which DMP allocates the data transfer across the possible paths to and from an array, thus enabling load balancing. With this mode, DMP implements a round-robin algorithm, selecting each path in sequence for each successive data transfer to or from a disk. For example, if paths A and B are active, the first disk transfer occurs on path A, the next on path B, and the next on path A again.

The partition or volume from which the computer starts up. On a basic disk, the active partition must be a primary partition. For a dynamic disk, a dynamic volume cannot be marked active directly. However, a basic disk with a system partition can be upgraded to dynamic. After the disk is upgraded and the computer is restarted, the system partition becomes a system volume, which retains its active status.

Upgrading a basic disk with a system partition to a dynamic disk preserves the partition table information, which is required when reinstalling the Windows operating system.

In Storage Foundation for Windows, the mode in which DMP allocates data transfer to and from an array across the preferred path. This path is always active, and the other path or paths act as backups that are called into service if the current operating path fails. This option does not provide load balancing.

The volume that contains the Windows operating system and its support files. The boot volume can be in the same location as the system volume. In Windows, the system partition or volume is the one the computer starts from, while the boot volume is the one that has the operating system and support files.

In Storage Foundation for Windows, the percentage of volume capacity at which an error is reported. The default is 90 percent.

A physical data storage device attached to a computer.

The process of evacuating or moving the entire contents of a healthy disk to the free space on a dynamic disk in the same dynamic disk group.

Storage Foundation for Windows organizes disks into disk groups. Disk groups provide a way of organizing disks in a system and simplifying storage management for systems with large numbers of disks. They also allow disks to be moved between computers to easily transfer the storage between computers.
disk replacement
In Storage Foundation for Windows, the process of replacing a failed disk with an empty basic disk. The volume configuration is recreated on the new disk. The contents of nonredundant volumes are not guaranteed. Redundant volumes will be automatically resynchronized.

drive path
The path to a local drive that is mounted at an empty folder on an NTFS volume.

dynamic disk
A dynamic disk is a physical disk that can contain dynamic volumes created with Storage Foundation for Windows. A dynamic volume organizes space on one or more physical disks by using a specific type of volume layout. The six types of dynamic volume layouts are simple, spanned, mirrored, striped, RAID-5, and mirrored striped (RAID 0+1). On a dynamic disk, space is organized through volumes rather than partitions. Because a dynamic disk does not have the partitioning scheme used by Windows NT, Windows 95/98, and MS-DOS, dynamic disks cannot be accessed through those operating systems.

Dynamic Multipathing
In Storage Foundation for Windows, the Dynamic Multipathing option adds fault tolerance to disk storage by making use of multiple paths between a computer and individual disks in an attached disk storage system. Disk transfers that would have failed because of a path failure are automatically rerouted to an alternate path. Dynamic Multipathing also improves performance by allowing load balancing between the multiple paths. Two forms of Dynamic Multipathing are available, DMP and MPIO.

dynamic volume
In Storage Foundation for Windows, dynamic volumes are volumes created on dynamic disks in place of partitions. A dynamic volume consists of a portion or portions of one or more physical disks and is organized in one of five volume layout types: concatenated, mirrored, striped, RAID-5, and mirrored striped (RAID 0+1). The size of a dynamic volume can be increased if the volume is formatted with NTFS and there is unallocated space on a dynamic disk within the dynamic disk group onto which the volume can be extended.

extended partition
A portion of a basic disk that can contain logical drives. An extended partition is used to have more than four volumes on a basic disk. A basic disk can contain up to four primary partitions or three primary partitions plus an extended partition. The extended partition can be further divided into up to 32 logical drives.

FR (FastResync)
In Storage Foundation for Windows, FastResync is a part of the FlashSnap feature. FR supports resynchronization of mirrors by copying only changes to the temporarily split mirror by using FR logging. This reduces the time it takes to rejoin a split mirror to the mirror set and also reduces the server CPU cycles needed to complete the resynchronization. FastResync can also be used on ordinary mirrored volumes to speed up resynchronization.

failover
An operation in which the failure of one appliance, program, or security gateway causes another to pick up its workload automatically.
FT (fault tolerant) disk  Refers to a disk that contains fault tolerant volumes that are created in Windows NT Disk Administrator.

FT (fault tolerant) volume  Refers to a RAID volume that was originally created in Windows NT Disk Administrator. These volumes include spanned volumes (volume sets), mirrored volumes (mirror sets), striped volumes (stripe sets), and RAID-5 volumes (stripe sets with parity). The FT refers to fault tolerant, even though some of the volume sets are not fault tolerant. Windows Server 2003 does not support FT volumes.

hot relocation  In Storage Foundation for Windows, when a disk fails, hot relocation automatically moves all subdisks from redundant volumes on the failed disk to hot spare disks, or to free space on other disks if enough space is not available on hot spare disks.

hot spot  In Storage Foundation for Windows, a hot spot is an area of high I/O activity that may cause bottlenecks in I/O throughput.

logical drive  A logical drive is a simple volume that resides on an extended partition on a basic disk. Logical drives are limited to the space on the extended partition. They cannot span multiple disks. A logical drive can be formatted and assigned a drive letter.

An extended partition can be subdivided into as many as 32 logical drives. All or part of the free space in an extended partition can be used when creating logical drives.

LUN (logical unit number)  The number that, when combined with the target ID, uniquely identifies a disk on the port.

monitor interval  In Storage Foundation for Windows, DMP (Dynamic Multipathing) monitors the paths to an array to determine whether they are functioning properly. The monitor interval specifies the time interval for the monitoring of that array.

NTFS (Windows NT file system)  An advanced file system designed for use specifically within Windows operating systems. It supports file system recovery, extremely large storage media, long file and folder names, and file and folder compression.

parity  Redundant information that is associated with a block of information. Parity is a calculated value used to reconstruct data after a failure.

RAID-5 volumes stripe data and parity intermittently across a set of disks. Within each stripe, the data on one disk is parity data and the data on the other disks is normal data. RAID-5 volumes, therefore, require at least three disks to allow for this extra parity information. When a disk fails, the parity information on the good disks can be used to recreate the data on the failed disk.

partition  A portion of a physical disk that functions as though it were a physically separate disk. Partitions can be created only on basic disks. Partitions cannot span disks; they must be contiguous regions. When a basic disk that contains partitions is upgraded to a dynamic disk, the partitions become simple volumes on the dynamic disk.
<table>
<thead>
<tr>
<th>Glossary Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>polling interval</td>
<td>In Storage Foundation for Windows, the polling interval is the interval at which volume capacities are checked.</td>
</tr>
<tr>
<td>primary disk group</td>
<td>The disk group that contains the computer's boot or system disk. All other dynamic disk groups are called secondary disk groups. If none of the dynamic disk groups on a system contain the boot or system disk, then there is not a primary disk group.</td>
</tr>
<tr>
<td>primary partition</td>
<td>A volume that is created by using unallocated space on a basic disk. Microsoft Windows NT and other operating systems can start from a primary partition. Up to four primary partitions can be created on a basic disk, or three primary partitions and an extended partition. Primary partitions can be created only on basic disks and cannot be subpartitioned. However, the extended partition can be further divided into as many as 32 logical drives.</td>
</tr>
<tr>
<td>secondary disk group</td>
<td>Any dynamic disk group that is not primary. A primary disk group is a dynamic disk group that contains the computer’s boot or system disk. All other dynamic disk groups are called secondary disk groups.</td>
</tr>
<tr>
<td>simple dynamic volume</td>
<td>A simple dynamic volume consists of a single contiguous region (or subdisk) on a single physical disk. Simple dynamic volumes can be extended or mirrored. A simple volume can be extended within the same disk or onto additional disks. When a basic disk with a partition is upgraded, the partition becomes a simple volume. An extended partition on a basic disk also becomes a simple volume when the disk is upgraded to dynamic.</td>
</tr>
<tr>
<td>spanned volume</td>
<td>A volume made up of disk space on more than one physical disk. Space can be added to a spanned volume by extending it at any time. Spanned volumes can be created only on dynamic disks. Spanned volumes by themselves are not fault tolerant. However, they can be mirrored to be made fault tolerant.</td>
</tr>
<tr>
<td>statistics threshold</td>
<td>In Storage Foundation for Windows, the statistics threshold is the minimum amount of I/O per second that a disk or subdisk must have to display an I/O status other than the Low I/O activity status.</td>
</tr>
<tr>
<td>striped volume (RAID-0)</td>
<td>A volume that stores data in stripes on two or more physical disks. Data in a striped volume is allocated alternately and evenly (in stripes) to the disks of the striped volume. Striped volumes can be created only on dynamic disks. Striped volumes by themselves are not fault tolerant; however, they can be mirrored to be made fault tolerant. They also can be extended.</td>
</tr>
<tr>
<td>subdisk</td>
<td>Refers to a region of contiguous space on a disk. In Storage Foundation for Windows, subdisks are the basic units in which disk space in a volume is allocated. A disk can be divided into one or more subdisks. Each subdisk represents a specific portion of the volumes on a dynamic disk. A Storage Foundation for Windows disk may contain multiple subdisks, but subdisks cannot overlap or share the same portions of a disk. Any disk space that</td>
</tr>
</tbody>
</table>
is not part of a subdisk is considered to be unallocated space, which can be used to create new volumes.

Subdisks can be moved to improve disk performance.

**system partition or volume**
The partition or volume that has the files needed to load the operating system. It is the same as the active partition or volume. In Windows, the system partition or volume is the one the computer starts from, while the boot volume is the one that has the operating system and support files. The system partition or volume and the boot partition or volume can be the same partition or volume.

**target ID**
The number that, when combined with the LUN, uniquely identifies a disk on the port.

**volume**
A volume is a logical entity that is made up of a portion or portions of one or more physical disks. A volume can be formatted with a file system and can be accessed by a drive letter or a mount path. Like disks, volumes can be basic or dynamic.

**volume read policy**
The volume read policy on a dynamic volume allows an administrator to specify either that a particular mirror be used for reads or that all mirrors be read in turn in round-robin fashion for each nonsequential I/O detected.

**warning threshold**
In Storage Foundation for Windows, the percentage of volume capacity at which a warning message is sent. The default is 80 percent of volume capacity.
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