Veritas Storage Foundation™ and High Availability Solutions Microsoft Clustering Solutions Guide for Microsoft Exchange 2007

Windows Server 2008 (x64), Windows Server 2008 R2 (x64)

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Symantec

Veritas Storage Foundation and HA Solutions Microsoft Clustering Solutions Guide for Microsoft Exchange 2007

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Contents

Chapter 8 Configuring disaster recovery for Exchange Server in a Microsoft cluster

Chapter 1

Introducing SFW solutions for a Microsoft cluster

This chapter covers the following topics:

About Microsoft clustering solutions with SFW

Microsoft clustering may be used with Veritas Storage Foundation for Windows (SFW) to provide the following solutions:

- High availability failover cluster in an active/passive configuration on the same site
- Campus cluster, in a two-node configuration with each node on a separate site
- Disaster recovery with a separate cluster on a secondary site, with replication support using Veritas Volume Replicator (VVR)

The example configurations in this guide do not include Dynamic Multi-pathing (DMP). For instructions on how to add DMP to a clustering configuration, see *Veritas Storage Foundation and High Availability Solutions, Solutions Guide*.

Advantages of using SFW in a Microsoft cluster

One of the key advantages of using SFW with Microsoft clustering is the ability to create a mirrored quorum resource that adds fault tolerance to the quorum and protects the cluster. Microsoft clustering uses the quorum architecture, where the cluster database resides in the quorum resource. The quorum resource maintains the cluster database and critical recovery information in a recovery log.

Adding SFW to the configuration protects the quorum disk from being a single point of failure in the cluster because SFW provides dynamic volumes and software mirroring of the quorum device. If the quorum resource fails, the mirror takes over for the resource.

Using SFW also offers other advantages over using Microsoft clustering alone. SFW lets you add fault tolerance to your data volumes. Mirroring of log volumes is recommended, and a mirrored striped RAID layout is recommended for your data volumes. SFW also offers multiple disk groups, multiple mirrors, capacity management and Automatic Volume Growth, online storage migration, performance tuning, hot relocation, dirty region logging, RAID-5 logging, Dynamic Multi-pathing, and enhanced snapshot capabilities with FlashSnap.

About high availability clusters

A high availability solution maintains continued functioning of applications in the event of computer failure, where data and applications are available using redundant software and hardware. High availability can refer to any software or hardware that provides fault tolerance, but generally it has become associated with clustering.

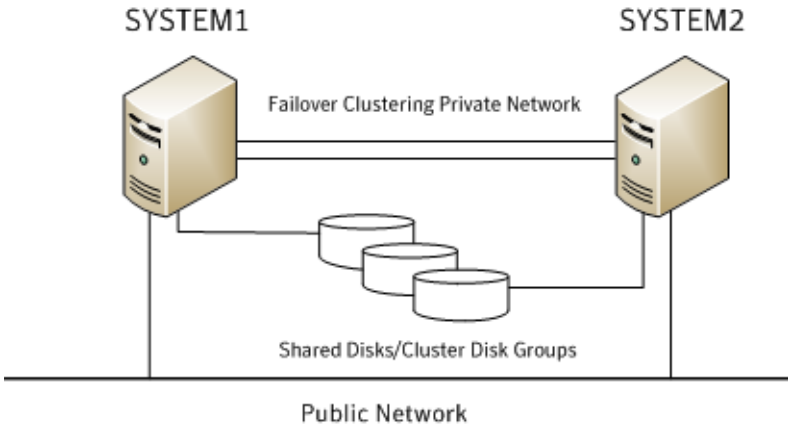
A cluster is a group of independent computers working together as a single system to ensure that mission-critical applications and resources are highly available. The cluster is managed as a single system, shares a common namespace, and is specifically designed to tolerate component failures and to support the addition or removal of components in a way that is transparent to users.

Clustered systems have several advantages, including fault tolerance, high availability, scalability, simplified management, and support for rolling upgrades.

In a high availability cluster with Veritas Storage Foundation for Windows, you configure dynamic cluster disk groups and volumes for the application on shared storage and install the application database and log to the appropriate SFW volumes.

Figure 1-1 shows a two-node high-availability configuration example.

Figure 1-1 High availability active-passive configuration



About campus clusters

Campus clusters are multiple-node clusters that provide protection against disasters. The nodes can be located in separate buildings miles apart. Nodes are located within a single subnet and connected via a Fibre Channel SAN. Each node has its own storage array and contains mirrored data of the storage on the other array.

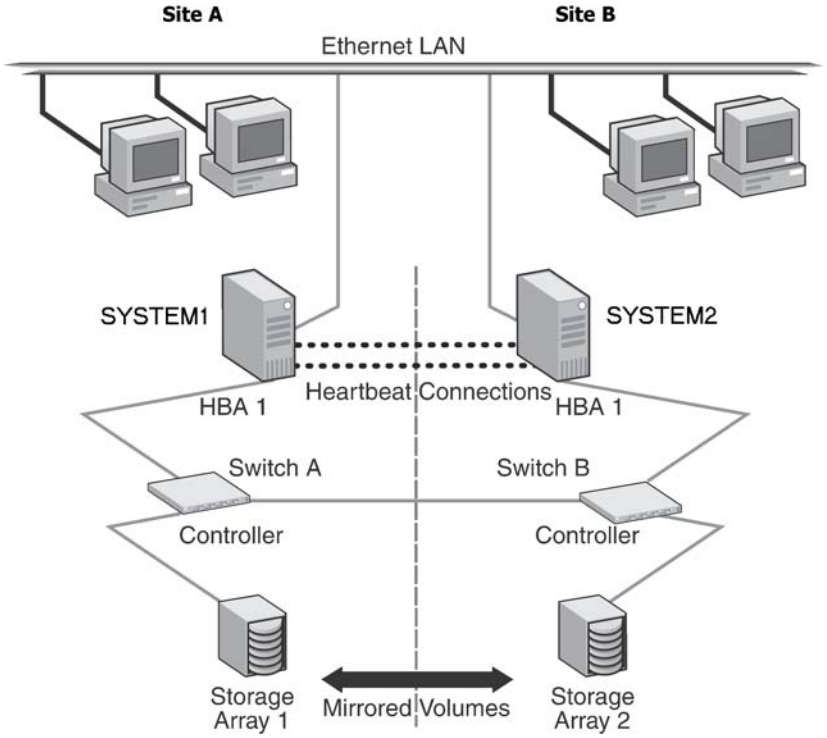
Typical campus clusters involve two sites; you can use more than two sites for additional redundancy.

This environment also provides a simpler solution for disaster recovery than a more elaborate Symantec disaster recovery environment with replication software; however, a campus cluster generally stretches a shorter distance than a replication-based solution depending on the hardware.

Both local clusters and campus clusters have SFW dynamic disk groups and volumes, but the volumes on each campus cluster node are mirrors of one another. Each disk group should contain the same number of disks on each site for the mirrored volumes.

Figure 1-2 shows a two-node campus cluster configuration example.

Figure 1-2 Campus cluster configuration example



About disaster recovery clusters

A typical disaster recovery configuration requires that you have a source host on the primary site and a destination host on the secondary site. The application data is stored on the primary site and replicated to the secondary site by using a tool such as the Veritas Volume Replicator. The primary site provides data and services during normal operation. 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. The application can be restarted on that host.

Using VVR with Microsoft clustering provides a replicated backup of your application data, which can be used for recovery after an outage or disaster. However, this solution does not provide the automated failover capability for disaster recovery that can be achieved using VVR with Veritas Cluster Server (VCS).

In a typical clustered VVR configuration the primary site consists of two nodes, SYSTEM1 and SYSTEM2. Similarly the secondary setup consists of two nodes, SYSTEM3 and SYSTEM4. Each site has a clustered setup with the nodes set up appropriately for failover within the site. In a Microsoft cluster environment, each site has its own quorum volume.

If SYSTEM1 fails, the application comes online on node SYSTEM2 and begins servicing requests. From the user's perspective there might be a small delay as the backup node comes online, but the interruption in effective service is minimal. When a failure occurs (for instance, after an earthquake that destroys the data center in which the primary site resides), the replication solution is activated. If there is a disaster at the primary site, SYSTEM3 at the secondary site takes over. The data that was replicated to the secondary site is used to restore the application services to clients.

Figure 1-3 shows an example disaster recovery configuration before a failure.

Figure 1-3 Disaster recovery example configuration

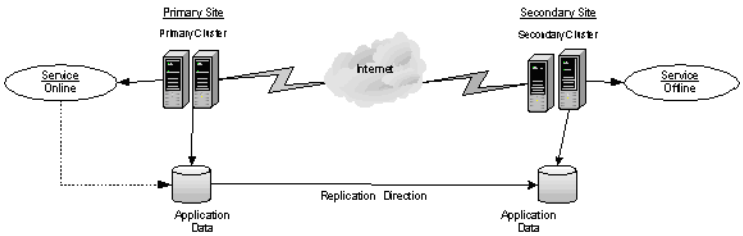
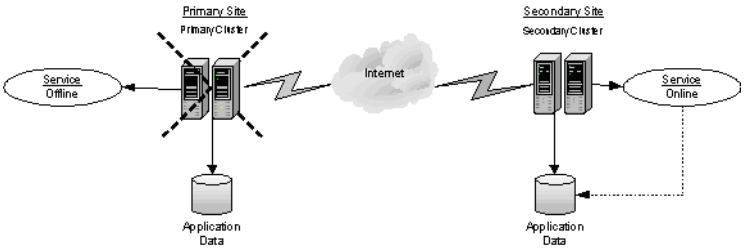


Figure 1-4 shows an example disaster recovery configuration after a failure.

Figure 1-4 Disaster recovery configuration after a failure



About the solutions guides

Table 1-1 shows the available Veritas Storage Foundation and High Availability Solutions solutions guides for Exchange Server. Guides are also available for Microsoft SQL Server, Enterprise Vault, SharePoint Server, and for additional application solutions.

Table 1-1 SFW HA solutions guides for Exchange Server

Title	Description
Veritas Storage Foundation and High Availability Solutions Microsoft Clustering Solutions Guide for Microsoft Exchange 2007	Solutions for Microsoft Exchange Server 2007 and Microsoft clustering with Veritas Storage Foundation for Windows: ■ High availability (HA) ■ Campus clusters ■ Disaster recovery (DR) with Veritas Volume Replicator
Veritas Storage Foundation and High Availability Solutions HA and Disaster Recovery Solutions Guide for Microsoft Exchange 2007	Solutions for Exchange Server 2007 and Veritas Cluster Server clustering with Veritas Storage Foundation HA for Windows ■ High availability (HA) ■ Campus clusters ■ Replicated data clusters ■ Disaster recovery (DR) with Veritas Volume Replicator or hardware array replication
Veritas Storage Foundation and High Availability Solutions HA and Disaster Recovery Solutions Guide for Microsoft Exchange Server 2010	Solutions for Exchange Server 2010 and Veritas Cluster Server clustering with Veritas Storage Foundation HA for Windows ■ High availability (HA) ■ Campus clusters ■ Replicated data clusters ■ Disaster recovery (DR) with Veritas Volume Replicator or hardware array replication
Veritas Storage Foundation and High Availability Solutions Quick Recovery Solutions Guide for Microsoft Exchange 2007	Quick Recovery solutions for Exchange Server 2007 using either Veritas Storage Foundation for Windows or Veritas Storage Foundation HA for Windows.
Veritas Storage Foundation and High Availability Solutions Quick Recovery Solutions Guide for Microsoft Exchange 2010	Quick Recovery solutions for Exchange Server 2010 using either Veritas Storage Foundation for Windows or Veritas Storage Foundation HA for Windows.

Chapter 2

Workflows for deploying Exchange Server with SFW in a Microsoft cluster

This chapter covers the following topics:

Workflow for a high availability (HA) configuration

You can install and configure Storage Foundation for Windows (SFW) and Exchange Server in a Microsoft cluster for high availability on a single site.

Table 2-1 show the process for deploying Exchange Server with SFW in a Microsoft high-availability cluster.

Table 2-1 Process for deploying Exchange Server with SFW in a Microsoft high-availability cluster

Action	Description
Verify hardware and software prerequisites	See "Requirements for deploying Exchange Server 2007 with SFW in a Microsoft cluster" on page 30.
Understand the configuration	See "Planning your high availability configuration" on page 34.
Configure the storage hardware and network	■ Set up the storage hardware for a cluster environment. ■ Verify the DNS entries for the systems on which Exchange will be installed. See "Configuring the storage hardware and network" on page 48.
Establish a Microsoft cluster	Establish the cluster before installing SFW. See "Establishing a Microsoft failover cluster" on page 49.
Install SFW with the Microsoft Failover Cluster option	Perform a rolling installation. See "Installing SFW with Microsoft Failover Cluster option" on page 51. Ensure that you select the following options during installation of SFW: ■ Select the option to install SFW. ■ On the product options screen, select the option to install Cluster Option for Microsoft Failover Cluster. ■ Verify that the Veritas Storage Foundation for Windows (Client Components) check box is checked, to install the client component. ■ If you plan to set up a secondary site for disaster recovery with VVR, install the Veritas Volume Replicator option.

Table 2-1 Process for deploying Exchange Server with SFW in a Microsoft high-availability cluster (Continued)

Action	Description
Configure and manage disk groups and volumes	■ Use the VEA console to create disk groups and volumes for the application and for the quorum resource. See "Tasks for configuring SFW storage" on page 53. **Note:** Setting up a Microsoft failover cluster creates physical disk resources for all the basic disks on the shared bus. To use these disks when you create your SFW cluster disk groups, you must first remove the physical disk resources from the cluster. Otherwise, a reservation conflict occurs.
Implement a dynamic mirrored quorum resource	■ Create a dynamic cluster disk group with a mirrored volume for the quorum disks. ■ Create a Volume Manager Disk Group (VMDG) resource for the quorum disk group. ■ Change the cluster quorum resource to the dynamic mirrored quorum resource. See "Tasks for implementing a dynamic mirrored quorum resource" on page 73.
Add the VMDG resource for the First Storage group to the quorum group	Add the VMDG disk group resource(s) for the First Storage Group. See "Adding a Volume Manager Disk Group resource for Exchange 2007 installation" on page 79.
Install Exchange Server	See "Installing Exchange Server" on page 79.
Add the VMDG resources to the Exchange group	See "Adding the Volume Manager Disk Group resources to the Exchange group" on page 80.
Set the database dependency on the disk group resource	See "Setting the database dependency on the disk group resource" on page 81 .
Move Exchange databases and logs to shared storage.	See "Moving Exchange databases and logs to shared storage" on page 81
Verify the cluster configuration	Move the online Exchange Server cluster group to the second node and back to the first node. See "Verifying the Exchange Server group in the Microsoft cluster" on page 83.

Workflow for a campus cluster configuration

You can install and configure Storage Foundation for Windows (SFW) and Exchange Server in a Microsoft campus cluster.

This configuration workflow describes a two-node campus cluster with each node at a separate site.

The procedures for setting up a campus cluster are nearly the same as those for local clusters, with the following differences:

- A campus cluster has the nodes located in separate buildings. Therefore, the hardware setup requires SAN interconnects that allow these connections.
- In a campus cluster, each node has its own storage array rather than having a shared storage array between the two clusters.
- Both local clusters and campus clusters have SFW dynamic disk groups and volumes, but the volumes on each campus cluster node are mirrors of one another. Each disk group must contain the same number of disks on each site for the mirrored volumes.
- For campus clusters, you enable site allocation, assigning disks to one or the other campus cluster sites.

Table 2-2 shows the process for deploying Exchange Server with SFW in a Microsoft campus cluster.

Table 2-2 Process for deploying Exchange Server with SFW in a Microsoft campus cluster

Action	Description
Verify hardware and software prerequisites	See "Planning your campus cluster configuration" on page 35.
Understand the configuration	See "Planning your campus cluster configuration" on page 35.
Configure the storage hardware and network	■ Set up the storage hardware for a cluster environment. ■ Verify the DNS entries for the systems on which Exchange will be installed. See "Configuring the storage hardware and network" on page 48.

Table 2-2 Process for deploying Exchange Server with SFW in a Microsoft campus cluster (Continued)

Action	Description
Establish a Microsoft cluster	See "Establishing a Microsoft failover cluster" on page 49. Connect the two campus cluster nodes after setting up the Microsoft cluster. See "Establishing a Microsoft failover cluster" on page 49.
Install SFW with the Microsoft Failover Cluster option	Perform a rolling installation. See "Installing SFW with Microsoft Failover Cluster option" on page 51. Ensure that you select the following options during SFW installation: ■ Select the option to install SFW. ■ On the product options screen, select the option to install Cluster Option for Microsoft Failover Cluster. ■ Verify that the Veritas Storage Foundation for Windows (Client Components) check box is checked, to install the client component.
Configure and manage disk groups and volumes	■ Use the VEA console to create disk groups and volumes for the application and for the quorum resource. See "Tasks for configuring SFW storage" on page 53. Ensure that the disk group you configure on each site contains the same number of disks and that you configure mirrored volumes. See "Considerations when creating disk groups and volumes for a campus cluster" on page 57. After creating the disk group, add the disks to a campus cluster site to enable site allocation. **Note:** Setting up a Microsoft failover cluster creates physical disk resources for all the basic disks on the shared bus. To use these disks when you create your SFW cluster disk groups, you must first remove the physical disk resources from the cluster. Otherwise, a reservation conflict occurs.

Table 2-2 Process for deploying Exchange Server with SFW in a Microsoft campus cluster (Continued)

Action	Description
Implement a dynamic mirrored quorum resource	■ Create a dynamic cluster disk group with a mirrored volume for the quorum disks. ■ Create a Volume Manager Disk Group (VMDG) resource for the quorum disk group. ■ Change the cluster quorum resource to the dynamic mirrored quorum resource. See "Tasks for implementing a dynamic mirrored quorum resource" on page 73.
Add the VMDG resource for the First Storage group to the quorum group	Add the VMDG disk group resource(s) for the First Storage Group. See "Adding a Volume Manager Disk Group resource for Exchange 2007 installation" on page 79.
Install Exchange Server	See "Installing Exchange Server" on page 79.
Add the VMDG resources to the Exchange group	See "Adding the Volume Manager Disk Group resources to the Exchange group" on page 80.
Set the database dependency on the disk group resource	See "Setting the database dependency on the disk group resource" on page 81 .
Move Exchange databases and logs to shared storage.	See "Moving Exchange databases and logs to shared storage" on page 81
Verify the cluster configuration	Move the online application cluster group to the second node and back to the first node. See "Verifying the Exchange Server group in the Microsoft cluster" on page 83.

Workflow for a disaster recovery configuration

After creating a high-availability cluster on a primary site, you can install and configure Storage Foundation for Windows (SFW) and Exchange Server on a secondary site cluster for disaster recovery.

This disaster recovery solution requires Veritas Volume Replicator (VVR).

Table 2-3 shows the process for deploying the disaster recover configuration.

Table 2-3 Process for deploying Exchange Server with SFW and VVR for disaster recovery in a Microsoft cluster

Action	Description
Ensure that you have set up the primary site for high availability, including the required options for disaster recovery	For details on setting up high-availability on the primary site, see "Workflow for a high availability (HA) configuration" on page 20. For a disaster recovery configuration, you must install the Veritas Volume Replicator option on the primary as well as the secondary site. Ensure that you are using static IP addresses as required for VVR.
Review the prerequisites and planning information	Verify the prerequisites on the secondary site. See "Requirements for deploying Exchange Server 2007 with SFW in a Microsoft cluster" on page 30. **Note:** If the DR site is on a different network segment, ensure that you allocate two IP addresses for the virtual server, one for the primary site and one for the DR site. Understand the DR configuration. See "Planning your disaster recovery configuration" on page 42.
Review how to create a parallel high availability configuration on the secondary site	Ensure that you follow the secondary site requirements and guidelines for IP addresses, disk groups and volumes, the Exchange Server resource group, and Exchange Server installation. See "Creating a parallel environment on the secondary site" on page 88.
Configure the storage hardware and network	■ Set up the storage hardware for a cluster environment. ■ Verify the DNS entries for the systems on which Exchange will be installed. See "Configuring the storage hardware and network" on page 48.
Establish a Microsoft cluster	Establish the cluster before installing SFW. See "Establishing a Microsoft failover cluster" on page 49.

Table 2-3 Process for deploying Exchange Server with SFW and VVR for disaster recovery in a Microsoft cluster

Action	Description
Install SFW with the Microsoft Failover Cluster option	Perform a rolling installation. See "Installing SFW with Microsoft Failover Cluster option" on page 51. Ensure that you select the following options during SFW installation: ■ Select the option to install SFW. ■ On the product options screen, select the option to install Cluster Option for Microsoft Failover Cluster. ■ On the product options screen, select the option to install Veritas Volume Replicator. ■ Verify that the Veritas Storage Foundation for Windows (Client Components) check box is checked, to install the client component.
Configure and manage disk groups and volumes	■ Use the VEA console to create disk groups and volumes. Make sure the following is exactly the same as the cluster on the primary site: Disk group name Volume names and sizes Drive letters See "Tasks for configuring SFW storage" on page 53. **Note:** Setting up a Microsoft failover cluster creates physical disk resources for all the basic disks on the shared bus. To use these disks when you create your SFW cluster disk groups, you must first remove the physical disk resources from the cluster. Otherwise, a reservation conflict occurs.
Implement a dynamic mirrored quorum resource	■ Create a dynamic cluster disk group with a mirrored volume for the quorum disks. ■ Create a Volume Manager Disk Group (VMDG) resource for the quorum disk group. ■ Change the cluster quorum resource to the dynamic mirrored quorum resource. See "Tasks for implementing a dynamic mirrored quorum resource" on page 73.

Table 2-3 Process for deploying Exchange Server with SFW and VVR for disaster recovery in a Microsoft cluster

Action	Description
Create the parallel Microsoft cluster configuration with SFW and Exchange 2007 on the secondary site	Many procedures are the same as on the primary site. However, there is a different procedure for installing Exchange and setting up the Exchange resource group. See "Creating a parallel environment on the secondary site" on page 88.
Set up security for VVR	Set up the security for VVR on all nodes on both the primary and secondary sites. See "Setting up security for VVR" on page 91.
Understand the VVR components	See "VVR components overview" on page 94.
Create the cluster resources for VVR	■ Create an IP address for the Replicated Volume Group (RVG). ■ Create a Network Name resource for the Replicated Volume Group (RVG). See "Creating resources for VVR" on page 95.
Set up an RDS	Create a replicated data set (RDS) using the VVR wizard. See "Configuring VVR: Setting up an RDS" on page 96.
Create the RVG resource (primary and secondary sites)	Create the RVG resource on both primary and secondary sites. See "Creating the RVG resource" on page 108.
Set up the Exchange Server resource dependencies	Change the Exchange Server resource dependency properties so that it depends on the RVG resource instead of the Volume Manager Disk Group resource. See "Setting the Exchange server resource dependency on the RVG resource" on page 109.

Using the Solutions Configuration Center workflow

The SFW HA product includes a Solutions Configuration Center for various application and configuration solutions.

For Microsoft clustering, the campus cluster configuration solution is available as a workflow on the Configuration Center, with online help linking to the appropriate topics.

To use the Microsoft campus cluster workflow in the Solutions Configuration Center

1. Start the Solutions Configuration Center in one of the following ways:
   - Click **Start > All Programs > Symantec > Veritas Storage Foundation > Solutions Configuration Center**.
   - Click **Start > Run** and type **scc**.
2. Click to expand Solutions for Microsoft Exchange Server.
3. Click to expand the Microsoft Campus Cluster workflow.

Chapter 3

Planning for deploying Exchange Server with SFW in a Microsoft cluster

This chapter covers the following topics:

Requirements for deploying Exchange Server 2007 with SFW in a Microsoft cluster

Verify the requirements for your configuration before starting the Veritas Storage Foundation for Windows installation.

Supported software

Review the SFW HA 6.0 Hardware Compatibility List to confirm supported hardware:

http://www.symantec.com/docs/TECH152806

Review the SFW HA 6.0 Software Compatibility List to confirm supported software:

http://www.symantec.com/docs/TECH153742

The following software is supported for deploying Microsoft Exchange with SFW and Microsoft clustering:

- Veritas Storage Foundation 6.0 for Windows (SFW)
  Include the following option during installation:
  - Cluster Option for Microsoft Failover Cluster

  For a DR configuration with Veritas Volume Replicator, include the following option:
  - Veritas Volume Replicator option

The following table lists the Microsoft Exchange Server versions supported with this release of SFW for a Microsoft clustering solution.

Note: For Exchange 2007, you can only cluster the Mailbox server role. Refer to the Microsoft documentation for other Exchange requirements.

Table 3-1 Supported Microsoft Exchange Server versions

Exchange Server	Windows Servers
Microsoft Exchange Server 2007 SP1, SP2, or SP3 Standard or Enterprise Edition (Mailbox server role required)	■ Windows Server 2008 x64 (for AMD64 or Intel EM64T): Standard, Enterprise, or Datacenter Edition ■ Windows Server 2008 R2 without Hyper-V on Standard, Enterprise, Datacenter Editions ■ Windows Server 2008 R2 on Standard, Enterprise, Datacenter Editions (for physical host or guest, not parent partition/Hyper-V integration) ■ Windows Server 2008 R2 Web Edition ■ Windows Server 2008 x64 on all current editions and architectures Symantec currently supports (SP2 required) ■

Disk space requirements

The following table summarizes disk space requirements for SFW.

Table 3-2 Disk space requirements

Installation options	Required disk space
SFW + all options	1124 MB
Client components	632 MB

System requirements

Refer to Microsoft documentation for Microsoft cluster requirements.

Review the SFW HA 6.0 Hardware Compatibility List to confirm supported hardware:

http://www.symantec.com/docs/TECH152806

Use the following system requirements as a guideline for SFW with Exchange Server in a Microsoft cluster:

- One CD-ROM drive accessible to the system on which you are installing SFW.
- Each system requires 1 GB of RAM for SFW.
- A minimum of 2 GB of RAM per server is required for Exchange 2007; refer to your Microsoft documentation for more information.
- SCSI or Fibre Channel host bus adapters (HBAs) can be used to access shared storage.
- Microsoft clustering requires at least two network adapters per system (one NIC to connect each system to the public network, and one NIC for the private network on each system). Symantec recommends using three network adapters (two NICs exclusively for the private network and one for the public network). Route each private NIC through a separate hub or switch to avoid single points of failure.
- Using static IP addresses for the public network and private network cards is highly recommended and is required for a VVR configuration. You also need a static IP address for the cluster itself. Verify that name resolution is configured for each node.
- Verify that the DNS and Active Directory Services are available. Make sure a reverse lookup zone exists in the DNS. Refer to the Microsoft documentation for instructions on creating a reverse lookup zone.

- Typical configurations require shared disks to support applications that migrate between nodes in the cluster. Symantec recommends two disks for Exchange: one for Exchange database files and one for Exchange log files.
- For a campus cluster configuration, the following applies:
  - The configuration requires two sites with a storage array for each site, with an equal number of disks at each site for the mirrored volumes.
  - Interconnects between the clusters are required for the storage and the network.
- Each system in a Microsoft cluster must be in the same Windows Server domain and must be using the same operating system version.
- For a disaster recovery configuration, the administrator account for the Exchange virtual server (clustered mailbox server) on the primary site must be the same account used for the Exchange virtual server on the secondary site.
- For a disaster recovery configuration, the cluster on the secondary site must reside in the Active Directory domain of the cluster on the primary site.

Additional installation requirements

SFW requires administrator privileges to install the software.

To install SFW, a Microsoft cluster must be running. Before you install SFW, you must set up the hardware and install the operating system and Microsoft clustering feature on all systems and establish the Microsoft cluster.

Installing SFW requires a reboot, but a reboot on the active cluster node causes it to fail over. Therefore, use a "rolling install" procedure to install SFW first on the inactive cluster node. Then move the cluster resources to the other node and install on the now inactive node.

See "Installing SFW with Microsoft Failover Cluster option" on page 51.

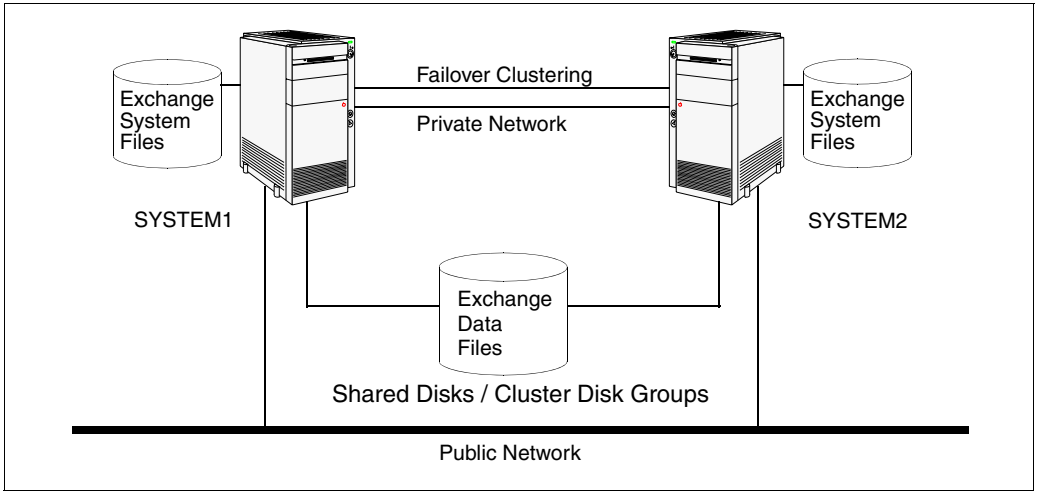
Note: You can install the SFW option for Microsoft Failover Cluster on a machine that is not a member of a Microsoft cluster. However, if that machine becomes the first node in a Microsoft cluster, the Volume Manager Disk Group resource type must be manually registered. For more information, see the *Veritas Storage Foundation and High Availability Solutions Installation and Upgrade Guide.*

Planning your high availability configuration

You can configure Storage Foundation for Windows (SFW) and Exchange Server in a Microsoft cluster for high availability on a single site.

Figure 3-1 illustrates a typical two-node active/passive configuration with Exchange. To set up one to one failover capabilities, the Exchange clustered mailbox server can fail over from SYSTEM1 to SYSTEM2 and vice versa.

Figure 3-1 High availability active/passive configuration



Some key points about the configuration:

- The Exchange clustered mailbox server is configured on the active node (SYSTEM1). If SYSTEM1 fails, SYSTEM2 becomes the active node and the Exchange clustered mailbox server comes online on SYSTEM2.
- One or more application servers can exist in a cluster, but each server must be managed by a separate application group configured with a distinct set of nodes in the cluster.
- The Exchange databases are configured on the shared storage on volumes contained in one or more cluster disk groups.
- SFW enables you to add fault-tolerance to data volumes. Symantec recommends mirroring log volumes and a mirrored striped RAID layout for data volumes.
- SFW enables you to create a dynamic mirrored quorum. If the quorum resource fails, the mirror takes over for the resource.

In this configuration, Symantec recommends creating a three-way mirror for the quorum to provide additional fault tolerance. If possible, do not use the disks assigned to the quorum for any other purpose.

During the configuration process you will create virtual IP addresses for the following:

- Cluster IP address, used by Microsoft cluster
- Exchange clustered server IP address, which should be the same on all nodes

You should have these IP addresses available before you start deploying your environment.

Configuring the quorum device for high availability

The proper configuration of a quorum device is critical to providing the highest availability with SFW storage.

Although a single basic disk used as a physical disk resource can serve as the Microsoft clustering quorum device, this introduces a nonredundant component into an otherwise highly available system.

In general, a disk group containing a dedicated, three-way mirrored volume makes an ideal quorum device. Such a device tolerates two disk failures, because it is mirrored, and server and interconnect failures, because SFW can import it when the disks and at least one server are running.

For a server to take ownership of a disk group containing the cluster quorum device, SFW must successfully import the disk group, and obtain SCSI reservations on more than half of its disks. Disk groups containing odd numbers of disks are best for use as quorum devices because of this behavior.

An SFW cluster disk group containing a volume used as a quorum device should contain that volume only. Any other volumes in that disk group fail over whenever the quorum device changes ownership.

Planning your campus cluster configuration

The procedures for setting up a campus cluster are nearly the same as those for local clusters, with the following differences:

- A campus cluster has the nodes located in separate buildings. Therefore, the hardware setup requires SAN interconnects that allow these connections.
- In a campus cluster, each node has its own storage array rather than having a shared storage array between the two clusters.

- Both local clusters and campus clusters have SFW dynamic disk groups and volumes, but the volumes on each campus cluster node are mirrors of one another.
- Each disk group must contain the same number of disks on each site for the mirrored volumes.

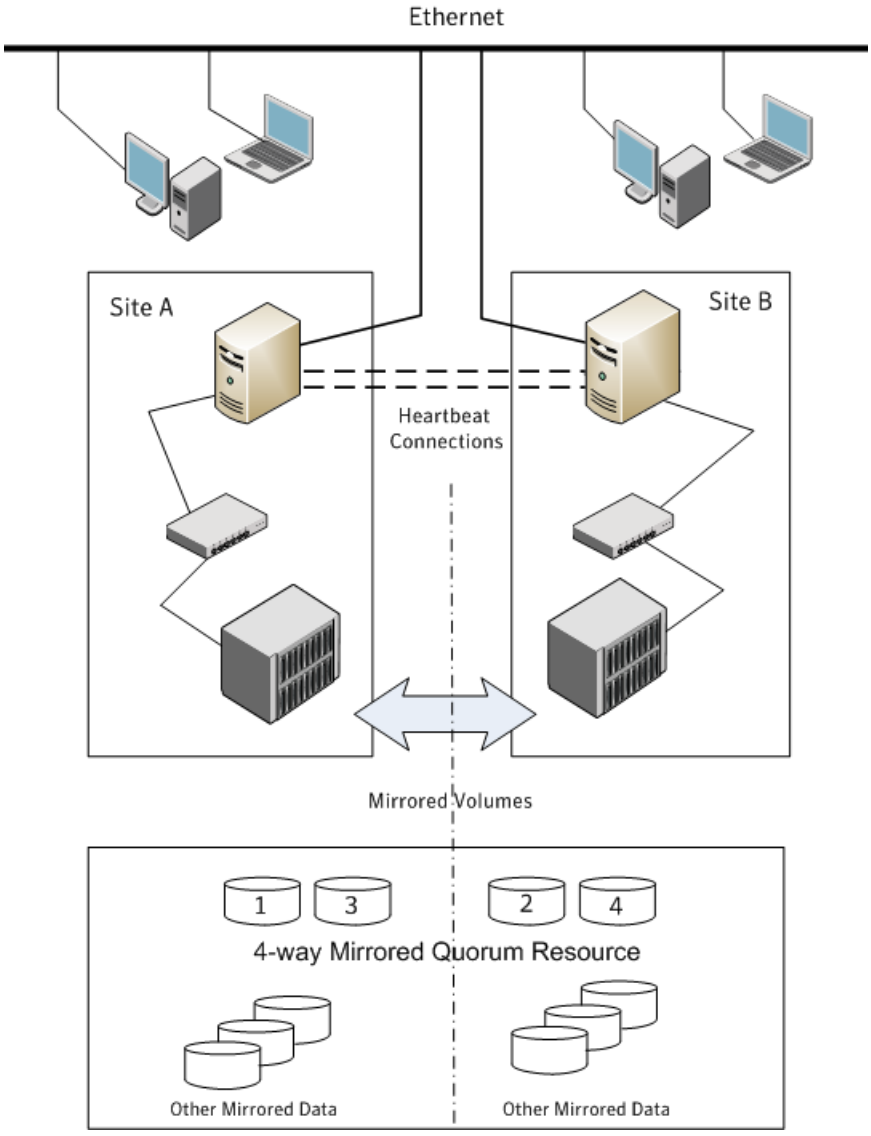
For more information on disk group and volume configuration, see "Planning for SFW cluster disk groups and volumes" on page 54.

Although a campus cluster setup with Microsoft clustering can work without Storage Foundation for Windows, SFW provides key advantages over using Microsoft clustering alone. Through a dynamic mirrored volume that functions on multiple disks across multiple sites, SFW protects the quorum resource in the cluster from being the single point of failure in the cluster.

Most customers use hardware RAID to protect the quorum disk, but that does not work when a natural disaster takes down the primary node and its attached storage. If the quorum resource is lost to the cluster, the cluster fails, because none of the cluster servers can gain control of the quorum resource and ultimately the cluster. Microsoft clustering alone cannot provide fault tolerance to the quorum disk.

Figure 3-2 shows a Microsoft cluster campus cluster configuration with mirrored storage across clusters and a mirrored quorum resource. The 4-way mirrored quorum has an extra set of mirrors for added redundancy.

Figure 3-2 Typical campus clustering configuration



Microsoft campus cluster failure scenarios

Different failure and recovery scenarios can occur with a Microsoft campus cluster and SFW installed. The site scenarios that can occur when there is a cluster server failure include the following:

- If the site not owning the quorum volume and the cluster goes offline, the quorum and data volumes stay online at the other site and other cluster resources stay online or move to that site. Storage Foundation for Windows lets the owning cluster node remain online with 50% ownership of the disks in the quorum group.
- If the site owning the quorum volume goes offline, the remaining site cannot gain control of the quorum volume because it cannot reserve a majority of disks in the quorum group. This is a safeguard to prevent multiple nodes from onlining members of a cluster disk group to which they have access.

Manual failover of a cluster between two sites should be performed only after coordination between the two sites to ensure that the primary server has in fact failed. If the primary server is still active and you manually import a cluster disk group containing the cluster quorum to the secondary (failover) server, a split-brain situation occurs. There may be data loss if the split-brain situation occurs because each plex of the mirrored volume may be updated independently when the same disk group is imported on both nodes.

For additional details on the manual failover scenario, see "Microsoft cluster quorum and quorum arbitration" on page 41.

Table 3-3 lists failure situations and the outcomes that occur.

Table 3-3 List of failure situations and possible outcomes

Failure Situation	Outcome	Comments
Application fault May mean the services stopped for an application, a NIC failed, or a database table went offline.	Failover	If the services stop for an application failure, the application automatically fails over to the other site.
Server failure (Site A) May mean that a power cord was unplugged, a system hang occurred, or another failure caused the system to stop responding.	Failover	Assuming a two-node cluster pair, failing a single node results in a cluster failover. There will be a temporary service interruption for cluster resources that are moved from the failed node to the remaining live node.

Table 3-3 List of failure situations and possible outcomes (Continued)

Failure Situation	Outcome	Comments
Server failure (Site B) May mean that a power cord was unplugged, a system hang occurred, or another failure caused the system to stop responding.	No interruption of service.	Failure of the passive site (Site B) does not interrupt service to the active site (Site A).
Partial SAN network failure May mean that SAN fiber channel cables were disconnected to Site A or Site B Storage.	No interruption of service.	Assuming that each of the cluster nodes has some type of Dynamic Multi-pathing (DMP) solution, removing one SAN fiber cable from a single cluster node should not effect any cluster resources running on that node, because the underlying DMP solution should seamlessly handle the SAN fiber path failover.
Private IP Heartbeat Network Failure May mean that the private NICs or the connecting network cables failed.	No interruption of service.	With the standard two-NIC configuration for a cluster node, one NIC for the public cluster network and one NIC for the private heartbeat network, disabling the NIC for the private heartbeat network should not effect the cluster software and the cluster resources, because the cluster software will simply route the heartbeat packets through the public network.
Public IP Network Failure May mean that the public NIC or LAN network has failed.	Failover. Mirroring continues.	When the public NIC on the active node, or public LAN fails, clients cannot access the active node, and failover occurs.
Public and Private IP or Network Failure May mean that the LAN network, including both private and public NIC connections, has failed.	No interruption of service. No Public LAN access. Mirroring continues.	The site that owned the quorum resource right before the “network partition” remains as owner of the quorum resource, and is the only surviving cluster node. The cluster software running on the other cluster node self-terminates because it has lost the cluster arbitration for the quorum resource.

Table 3-3 List of failure situations and possible outcomes (Continued)

Failure Situation	Outcome	Comments
Lose Network Connection (SAN & LAN), failing both heartbeat and connection to storage May mean that all network and SAN connections are severed, for example if a single pipe is used between buildings for the Ethernet and storage.	No interruption of service. Disks on the same node are functioning. Mirroring is not working.	The node/site that owned the quorum resource right before the "network partition" remains as owner of the quorum resource, and is the only surviving cluster node. The cluster software running on the other cluster node self-terminates because it has lost the cluster arbitration for the quorum resource. By default Microsoft clustering clussvc service will try to auto-start every minute, so after LAN/SAN communication has been re-established, Microsoft clustering clussvc will auto-start and will be able to re-join the existing cluster.
Storage Array failure on Site A, or on Site B May mean that a power cord was unplugged, or a storage array failure caused the array to stop responding.	No interruption of service. Disks on the same node are functioning. Mirroring is not working.	The campus cluster is divided equally between two sites with one array at each site. Completely failing one storage array should not effect on the cluster or any cluster resources that are currently online. However, you will not be able to move any cluster resources between nodes after this storage failure, because neither node will be able to obtain a majority of disks within the cluster disk group.
Site A failure (power) Means that all access to site A, including server and storage, is lost.	Manual failover.	If the failed site contains the cluster node that owned the quorum resource, then the overall cluster would be offline and cannot be onlined on the remaining live site without manual intervention.
Site B failure (power) Means that all access to site B, including server and storage, is lost.	No interruption of service. Disks on the same node are functioning. Mirroring is not working.	If the failed site did not contain the cluster node that owned the quorum resource, then the cluster would still be alive with whatever cluster resources that were online on that node right before the site failure.

Microsoft cluster quorum and quorum arbitration

This section explains the quorum and quorum arbitration in Microsoft clusters.

Quorum

The quorum resource maintains the cluster database, as well as critical recovery information, in a recovery log. The quorum resource must be available to all nodes through a SCSI or Fibre Channel bus. With Microsoft clustering alone, the quorum disk must be located on a single physical disk. However, with SFW, the quorum disk can be a mirrored volume that spans multiple disks and cluster nodes.

The quorum resource also determines ownership of the cluster. When a node that is controlling the cluster goes offline, other nodes use a challenge/defense protocol to determine which node can have control of the quorum resource and the cluster.

Cluster ownership of the quorum resource

The Microsoft clustering challenge/defense protocol uses a low-level bus reset of the SCSI buses between the machines to attempt to gain control of the quorum resource.

After a SCSI bus reset, the reservation that each server had been holding on the quorum disk is lost. Each server has about 10 seconds to re-establish that reservation, which would in turn let the other servers know that it is still functioning, even though the other servers would not necessarily be able to communicate with it.

If the active cluster server does not re-establish the SCSI reservation on the quorum resource within the time limit, the applications that were on the server transfer to the server that establishes the SCSI reservation first. The new server servicing the application may now be a bit slower, but clients still get their applications serviced. The IP (Internet Protocol) address and network names move, applications are reconstituted according to the defined dependencies, and clients are still serviced, without any question as to the state of the cluster.

The challenge/defense protocol is more complex when the quorum device is a volume in a Storage Foundation for Windows disk group. For a server to take ownership of the disk group containing the cluster quorum device, SFW on that server must successfully import the disk group, obtaining SCSI reservations on more than half of its disks.

Because a campus cluster configuration has an even number of disks on each site, failover cannot occur automatically. After a site failure, you must use the manual CLI command `vxclus enable` to bring the cluster disk groups online on the secondary node.

The vxclus utility

Storage Foundation for Windows provides the `vxclus` command line utility to allow forcing a failover to the secondary site. The command `vxclus enable` creates an entry in the Registry that enables the cluster disk group to be brought online on a node with a minority of the disks. After you run `vxclus enable`, you can bring the disk group resource online in the Microsoft cluster. After the cluster disk group is brought online, the `vxclus` functionality is disabled.

Caution: 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.

For more information on the `vxclus` utility, see the "Command Line Interface" chapter of the *Storage Foundation Administrator's Guide*. The `vxclus` utility also provides support for booting from a SAN, but you must have a hardware storage array that supports the capability.

Planning your disaster recovery configuration

After creating a high-availability cluster on a primary site, you can configure a secondary site cluster for disaster recovery.

This disaster recovery solution requires Veritas Volume Replicator (VVR).

In a typical clustered VVR configuration the primary site consists of two nodes, SYSTEM1 and SYSTEM2. Similarly the secondary setup consists of two nodes, SYSTEM3 and SYSTEM4. Each site has a clustered setup with the nodes set up appropriately for failover within the site. At least two disk groups are necessary—one for the application and one for the quorum resource volume. The quorum volume is not replicated from the primary site to the secondary site. Each site has its own quorum volume.

Figure 3-3 illustrates the cluster configuration on the primary site.

Figure 3-3 DR configuration primary site

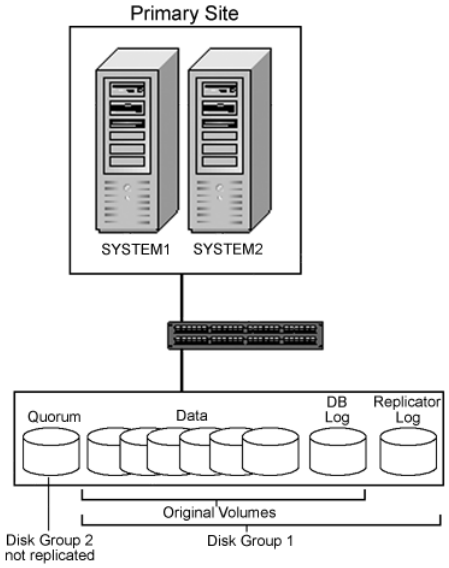


Figure 3-4 shows a typical SFW VVR configuration with Microsoft clustering.

Figure 3-4 DR configuration both sites

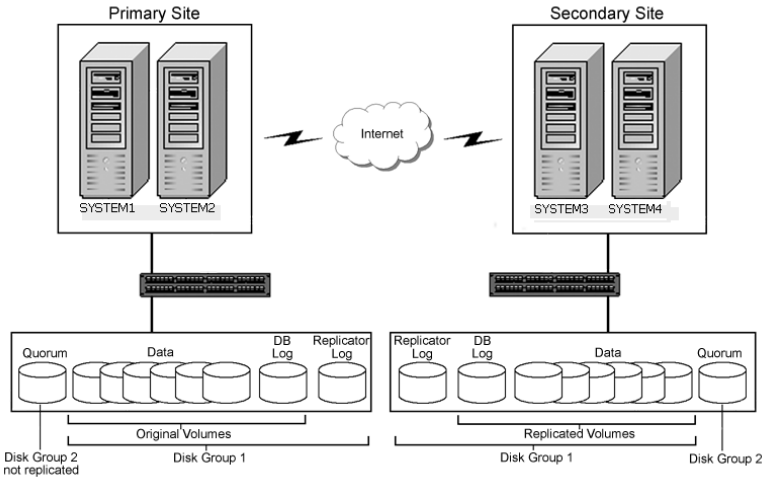
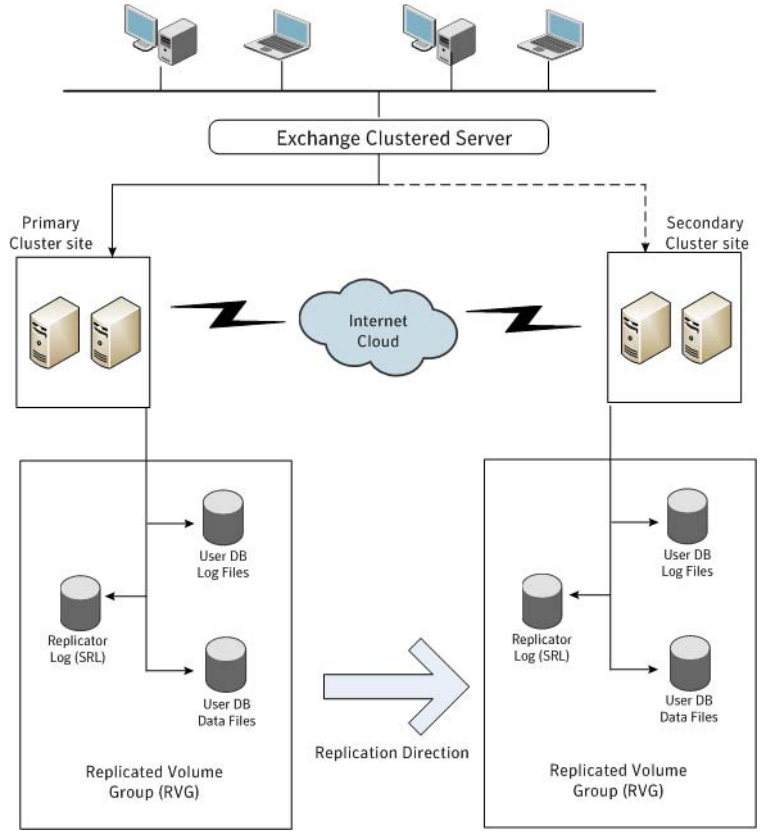


Figure 3-4 shows details on the configuration of the VVR Replicated Volume Group (RVG). The Microsoft Exchange Server application data is stored on the volumes that are under the control of the RVG.

Figure 3-5 Typical VVR RVG configuration



Chapter 4

Installing SFW with Microsoft clustering

This chapter covers the following topics:

Tasks for installing and configuring SFW with Microsoft clustering

Table 4-1 shows the tasks to complete before and during Veritas Storage Foundation for Windows (SFW) installation on a Microsoft cluster.

Table 4-1 Tasks for installing and configuring SFW with Microsoft clustering

Action	Description
Configure the storage hardware and network	■ Set up the storage hardware for a cluster environment, ■ Verify the DNS entries and binding order for the systems on which Exchange will be installed. See "Configuring the storage hardware and network" on page 48.

Table 4-1 Tasks for installing and configuring SFW with Microsoft clustering

Action	Description
Establish a Microsoft cluster	Establish the cluster before installing SFW. See "Establishing a Microsoft failover cluster" on page 49.
For a campus cluster, connect the two nodes	For a campus cluster, connect the two nodes after setting up the cluster. See "Establishing a Microsoft failover cluster" on page 49.
Install SFW with the Microsoft Failover Cluster option	Perform a rolling installation. See "Installing SFW with Microsoft Failover Cluster option" on page 51. Ensure that you select the following options during SFW installation: ■ Select the option to install SFW. ■ On the product options screen, select the option to install Cluster Option for Microsoft Failover Cluster cluster. ■ Leave the client components selected for installation (the default). ■ If you plan to set up a VVR replication environment, select the option to install VVR.

Configuring the storage hardware and network

Use the following procedures to configure the hardware and verify DNS settings. Repeat this procedure for every node in the cluster.

To configure the hardware

1. Install the required network adapters, and SCSI controllers or Fibre Channel HBA.
2. Connect the network adapters on each system.
   To prevent lost heartbeats on the private networks, and to prevent the Microsoft cluster from mistakenly declaring a system down, Symantec recommends disabling the Ethernet autonegotiation options on the private network adapters. Contact the NIC manufacturer for details on this process.
3. Use independent hubs or switches for the private heartbeats. You can use cross-over Ethernet cables for two-node clusters.

4 Verify that each system can access the storage devices. Verify that each system recognizes the attached shared disk and that the attached shared disks are visible.

To verify the DNS settings and binding order

1 From the Control Panel, access the Network Connections window.

2 Ensure the public network adapter is the first bound adapter:
   - From the Advanced menu, click **Advanced Settings**.
   - In the Adapters and Bindings tab, verify the public adapter is the first adapter in the Connections list. If necessary, use the arrow button to move the adapter to the top of the list.

3 Ensure that DNS name resolution is enabled. Make sure that you use the public network adapter, and not those configured for the private network:
   - In the Network Connections window, double-click the adapter for the public network to access its properties.
   - In the Public Status dialog box, on the General tab, click **Properties**.
   - In the Public Properties dialog box, on the General tab, select the **Internet Protocol (TCP/IP)** check box and click **Properties**.
   - Select the **Use the following DNS server addresses** option and verify the correct value for the IP address of the DNS server.
   - Click **Advanced**.
   - In the DNS tab, make sure the **Register this connection's address in DNS** check box is selected. Make sure the correct domain suffix is entered in the **DNS suffix for this connection** field.

Establishing a Microsoft failover cluster

You should establish the Microsoft failover cluster before you install Veritas Storage Foundation for Windows (SFW).

Refer to the Microsoft documentation for details on establishing a failover cluster. In addition, you should be aware of the following SFW related requirement: Setting up a Microsoft failover cluster creates physical disk resources for all the basic disks on the shared bus. In the SFW environment, this means that before you create your SFW cluster disk groups, you must first remove these physical disk resources from the cluster. Otherwise, a reservation conflict occurs. After creating the SFW cluster disk groups, you will add Volume Manager Disk Group resources to the cluster, instead of physical disk resources.

Note: You can install the SFW option for Microsoft Failover Cluster on a machine that is not a member of a Microsoft cluster. However, if that machine becomes the first node in a Microsoft cluster, the Volume Manager Disk Group resource type must be manually registered. For more information, see the *Veritas Storage Foundation and High Availability Solutions Installation and Upgrade Guide*.

Campus cluster: Connecting the two nodes

Make the necessary connections between the two sites after you configure the Microsoft cluster. The cluster is already active on Server A, so Microsoft clustering is now in control of the cluster storage on Server A, and both nodes of the storage cannot be accessed at the same time by the operating system.

To connect the two nodes

1. Connect corresponding cables between the three network cards on the two sites.
2. Connect the two switches at the two sites through the storage interconnect.
3. Test the connectivity between the two sites. Test the IP addresses of all the network adapter cards in the cluster. Bring up the command window and type `ping` *ipaddress*, where the *ipaddress* is the corresponding network adapter in the other node.

Installing SFW with Microsoft Failover Cluster option

This section assumes you have already configured a Microsoft cluster and you are installing SFW on an inactive system that does not own any cluster resources.

Symantec recommends a rolling installation to install SFW. For a rolling installation, you must first install SFW on an inactive system. If your resource groups are on the system where you are installing SFW, you must move the resource groups from the SFW system to another system in the cluster.

After SFW is installed on an inactive system, move the resource groups to this system, and make the other systems inactive. Then install SFW on the other inactive systems in the Microsoft cluster simultaneously.

During SFW installation using the product installer, make the following selections:

- Select **Storage Foundation for Windows** as the product to install.
- When selecting the available options from the server components, ensure that you select the following:
  - Select the **Cluster Option for Microsoft Failover Cluster** option.
  - If you are planning a disaster recovery configuration using Veritas Volume Replicator, select the **Veritas Volume Replicator** option.
- Leave the client components selected (the default).

During installation, the installer will display a message box about Quorum Arbitration. The Quorum Arbitration time settings are adjusted to ensure optimal functionality of a dynamic quorum resource on a mirrored dynamic volume.

The quorum arbitration minimum and maximum time settings are used to set the limits of the time period that Microsoft clustering allows 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. Refer to the *Veritas Storage Foundation Administrator's Guide* for information on the settings.

For additional details on using the product installer or command line installation, see the *SFW HA Solutions Installation and Upgrade Guide*.

Chapter 5

Configuring SFW storage

This chapter covers the following topics:

Tasks for configuring SFW storage

You use Veritas Storage Foundation for Windows to create dynamic cluster disk groups and volumes for a cluster environment.

Table 5-1 shows the tasks for configuring disk groups and volumes.

Table 5-1 Tasks for configuring disk groups and volumes

Action	Description
Plan the disk groups and volumes to create	See "Planning for SFW cluster disk groups and volumes" on page 54. If you are creating a campus cluster or a disaster recovery configuration, review additional information. See "Considerations when creating disk groups and volumes for a campus cluster" on page 57. See "Considerations when creating volumes for a DR configuration using VVR replication" on page 59.
Configure disk groups	Use the VEA console to create disk groups. See "Creating dynamic cluster disk groups" on page 60. **Note:** Setting up a Microsoft failover cluster creates physical disk resources for all the basic disks on the shared bus. To use these disks when you create your SFW cluster disk groups, you must first remove the physical disk resources from the cluster. Otherwise, a reservation conflict occurs.
For campus clusters, add disks to sites	To implement site-based allocation for volumes on campus clusters, you add the disks in the disk group to campus cluster sites. See "Adding disks to campus cluster sites" on page 62.
Configure volumes	Use the VEA console to create volumes. See "Creating dynamic volumes for high availability clusters" on page 62. See "Creating dynamic volumes for campus clusters" on page 66.
Understand how to deport and import disk groups and volumes to cluster nodes	When installing the application, you may need to deport and import disk groups and volumes to the different cluster nodes. See "Managing disk group and volumes" on page 70.

Planning for SFW cluster disk groups and volumes

A dynamic cluster disk group is a collection of one or more disks that behave as a single storage repository and which can potentially be accessed by different

computers. Within each disk group, you can have dynamic volumes with different layouts.

Note: You create a cluster disk group and volumes on only one node of a cluster. The volumes can be accessed by other nodes in a high-availability cluster by first deporting the cluster disk group from the current node and then importing it on the desired node. In a campus cluster, the volumes are mirrored across the storage arrays.

Before creating a disk group, consider the following:

- The type of volume configurations that are required.
- The number of LUNs required for the disk group.
- The implications of backup and restore operations on the disk group setup.
- The size of databases and logs which depend on the traffic load
- The number of disk groups and volumes that are needed for Exchange.
  Typically an SFW disk group corresponds to an Exchange storage group, with a separate volume for each database and for the transaction log.
- For campus clusters, consider the following:
  - The disk groups and number of disks on each site
    For campus clusters, each disk group must contain an equal number of disks on each site.
  - Each volume should be a mirrored volume with one plex of the volume on Site A's storage array and the other plex of the volume on Site B's storage array.
- In a Microsoft cluster, plan to include a disk group for the mirrored quorum resource. If possible, use small disks. Microsoft recommends 500 MB for the quorum disk.
  - In a high-availability configuration, Symantec recommends using at least 3 disks for the mirrored quorum resource.
  - In a campus cluster configuration, because each site must contain an equal number of disks, Symantec recommends a 4-way mirrored quorum, 2 mirrors on each site.

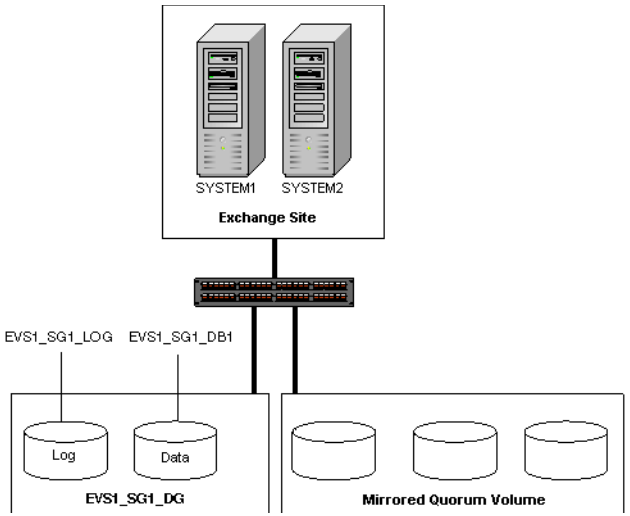
See the following for additional guidelines specific to your configuration:

- "Considerations when creating disk groups and volumes for a campus cluster" on page 57
- "Considerations when creating volumes for a DR configuration using VVR replication" on page 59

Sample high-availability cluster storage configuration

Figure 5-1 shows a detailed view of the disk groups and volumes for Exchange.

Figure 5-1 SFW disk groups and volumes for Exchange clustered mailbox server EVS1 in Microsoft clustering setup



Exchange disk group EVS1_SG1_DG contains two volumes:

- EVS1_SG1_DB1: Contains the Exchange database. Each database in an Exchange storage group typically resides on a separate volume.
- EVS1_SG1_LOG: Contains the transaction log for the storage group.

The general guidelines for disk group and volume setup for EVS1_SG1_DG also apply to additional storage groups.

This configuration is a simple example. The recommended practice for disk groups and volume layout is dependent on your environment.

Sample campus cluster storage configuration

The sample Exchange Server campus cluster storage configuration is similar to the high availability configuration.

See "Sample high-availability cluster storage configuration" on page 56.

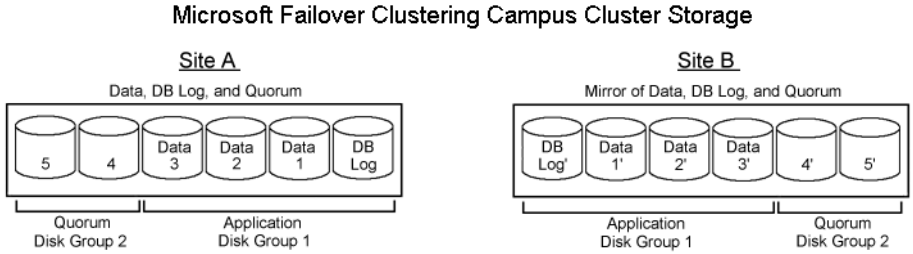
Note that in a campus cluster each disk group spans the storage arrays at both sites. The data and database log on Site A are mirrored to Site B. Each mirrored volume can have more than two disks, but must have an even number, such as four. All the application data could be in one large mirrored volume with

multiple disks, but the same number of disks are required on both sites for the mirroring.

A four-way mirror for the quorum volume provides additional redundancy. The minimum configuration would be a two-way mirror. If possible, use small disks for the quorum volume. Microsoft recommends 500 MB for the quorum volume.

Figure 5-2 shows an example campus cluster storage configuration in a Microsoft cluster environment.

Figure 5-2 SFW disk groups and volumes for in a Microsoft campus cluster



Considerations when creating disk groups and volumes for a campus cluster

When you create the disk groups for a campus cluster, ensure that each disk group has the same number of disks on each physical site. You create each volume as a mirrored volume with one plex of the volume on Site A's storage array and the other plex of the volume on Site B's storage array.

Symantec recommends using the SFW site-aware allocation feature for campus cluster storage. Site-aware allocation can ensure that site boundary limits are maintained for operations like volume grow, subdisk move, and disk relocation.

Enabling site-aware allocation for campus clusters requires the following steps in the VEA:

- After creating the disk groups, you tag the disks with site names to enable site-aware allocation. This is a separate operation, referred to in the VEA as adding disks to a site.

  As an example, say you had a disk group with four disks. Disk1 and Disk2 are physically located on Site A. Disk3 and Disk4 are physically located on

Site B. Therefore, you add Disk1 and Disk2 to “site_a” and add Disk3 and Disk4 to “site_b”.

- During volume creation, you specify the volume site type as Site Separated. This ensures that the volume is restricted to the disks on the selected site.

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.

For more information on site-aware allocation, refer to the *Veritas Storage Foundation Administrator’s Guide*.

When you create the volumes for a campus cluster, consider the following:

- During disk selection, configure the volume as “Site Separated” and select the two sites of the campus cluster from the site list.
- For volume attributes, select the “mirrored” and “mirrored across enclosures” options.
- Symantec recommends using either simple mirrored (concatenated) or striped mirrored options for the new volumes. Striped mirrored gives you better performance compared to concatenated.
  When selecting striped mirrored, select two columns in order to stripe one enclosure that is mirrored to the second enclosure.
- During the volume creation procedure for Site Separated volumes, you can only create as many mirrors as there are sites. However, once volume creation is complete, you can add additional mirrors if desired.
- Choosing “Mirrored” and the “mirrored across” option without having two enclosures that meet requirements causes new volume creation to fail.
- You cannot selecting RAID-5 for mirroring.
- Selecting “stripe across enclosures” is not recommended because then you need four enclosures, instead of two.
- Logging can slow performance.

Considerations when creating volumes for a DR configuration using VVR replication

Before creating a disk group and volumes for a DR configuration using VVR replication, consider the following:

- Do not assign a drive letter to the Replicator Log volume. This will limit access to that volume and avoid potential data corruption. You can create the Replicator Log volume while using the wizard for setting up the replicated data set.
- VVR does not support these types of volumes:
  - Storage Foundation for Windows (software) RAID 5 volumes
  - Volumes with the Dirty Region Log (DRL)
  - Volumes with a comma in their names
  - For the Replicator Log volume, in addition to the above types also make sure that the volume does not have a DCM.

Caution: Do not use volume types that are not supported by VVR.

Viewing the available disk storage

Before creating disk groups and volumes you may want to view available disk storage.

To view the available disk storage

1. Open the VEA console by clicking **Start > All Programs >Symantec> Veritas Storage Foundation >Veritas Enterprise Administrator** and select a profile if prompted.
2. Click **Connect to a Host or Domain**.
3. In the Connect dialog box select the host name from the pull-down menu and click **Connect**.
   To connect to the local system, select **localhost**. Provide the user name, password, and domain if prompted.
4. In the VEA configuration tree, expand **hostname > StorageAgent** and then click **Disks**.
   The internal names for the disks which the current system can access for available storage are displayed, with names Harddisk1, Harddisk2, etc. The

list includes both disks internal to the local system and any external storage that is available.

Creating dynamic cluster disk groups

You create a dynamic cluster disk group with volumes on shared storage so that they can be shared between nodes in the cluster.

Part of the process of creating a dynamic disk group is assigning it a name. You must choose a name that is unique to your environment. Make note of this name, as it will be required later.

To create dynamic cluster disk groups, use the Veritas Enterprise Administrator (VEA). The VEA can be invoked on one of the servers and can be used to connect to all the other servers. However, VEA can also be launched on client system and can be used to manage all the servers remotely.

Note: Setting up a Microsoft failover cluster creates physical disk resources for all the basic disks on the shared bus. To use these disks when you create your SFW cluster disk groups, you must first remove the physical disk resources from the cluster. Otherwise, a reservation conflict occurs. After creating the SFW cluster disk groups, you will add Volume Manager Disk Group resources to the cluster, instead of physical disk resources.

To create a dynamic (cluster) disk group

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

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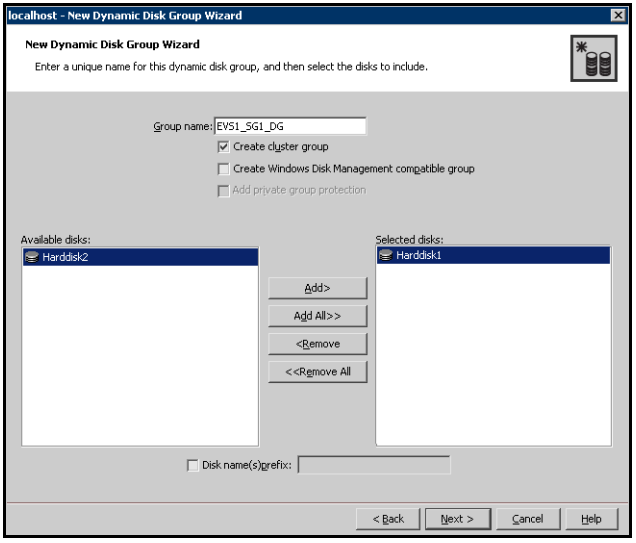
1. Open the VEA console by clicking **Start > All Programs > Symantec > Veritas Storage Foundation > Veritas Enterprise Administrator** (or launch the VEA from the Solutions Configuration Center) and select a profile if prompted.
2. Click **Connect to a Host or Domain**.
3. In the Connect dialog box, select the host name from the pull-down menu and click **Connect**.

   To connect to the local system, select **localhost**. Provide the user name, password, and domain if prompted.
4. To start the New Dynamic Disk Group wizard, expand the tree view under the host node, right click the **Disk Groups** icon, and select **New Dynamic Disk Group** from the context menu.
5. In the Welcome screen of the New Dynamic Disk Group wizard, click **Next**.

6 Provide information about the cluster disk group:



- Enter the name of the disk group (for example, EVS1_SG1_DG).
- Check the **Create cluster group** check box.
- Select the appropriate disks in the **Available disks** list, and use the **Add** button to move them to the **Selected disks** list.

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

Note: For Windows Server 2008, Windows Disk Management Compatible Dynamic Disk Group creates a type of disk group that is created by Windows Disk Management (LDM).

- Click **Next**.

7 Click **Next** to accept the confirmation screen with the selected disks.

8 Click **Finish** to create the new disk group.

Adding disks to campus cluster sites

For campus cluster storage, Symantec recommends using Veritas Storage Foundation for Windows (SFW) site-aware allocation. To enable site-aware allocation, you assign a site name to disks after they are added to a disk group. In the VEA assigning a site name is referred to as adding disks to a site.

For example, Disk1 and Disk2 are physically located on Site A and Disk3 and Disk4 are physically located on Site B. Therefore, you add Disk1 and Disk2 to site_a and add Disk3 and Disk4 to site_b.

To add disks to a site

1. From the VEA console, right-click a disk that needs to be added to a site and select **Add Disk to Site**.
   Disks must be part of a dynamic disk group in order to add them to a site.
2. In the **Add Disk to a Site** screen, choose one of the following:
   - Choose **Select a new site** and specify a new site name.
     The site name can include any alphanumeric value and valid characters like the period (.), dash (-), and underscore (_). It cannot exceed 31 characters. Site names are case insensitive; all names are converted to lowercase.
   - Choose **Available Sites** and select a site from the list.
3. From the **Available Disks** column, select the disk or disks to add to the specified site.
4. Click **OK**.

Creating dynamic volumes for high availability clusters

This section will guide you through the process of creating a volume on a dynamic disk group.

You can use this procedure for volumes in a high availability cluster. For volumes in a campus cluster, see the following:

- "Creating dynamic volumes for campus clusters" on page 66

Before you begin, review the following topic if applicable to your environment:

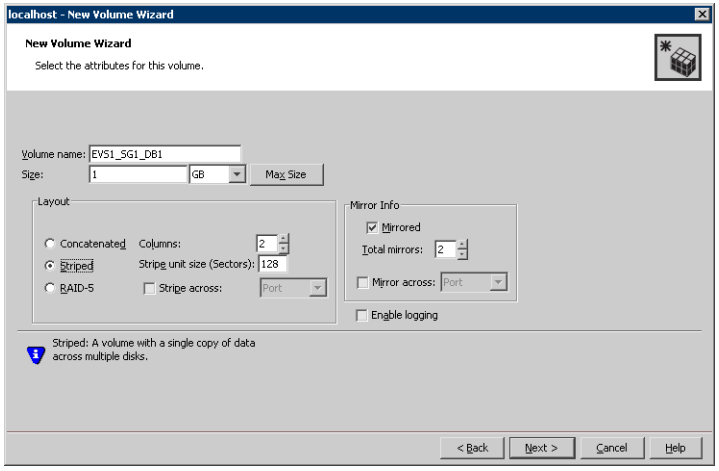
- "Considerations when creating volumes for a DR configuration using VVR replication" on page 59

Note: When assigning drive letters to volumes, ensure that the drive letters that you assign are available on all nodes.

To create dynamic volumes

1. If the VEA console is not already open, click **Start > All Programs > Symantec > Veritas Storage Foundation > Veritas Enterprise Administrator** and select a profile if prompted.
2. Click **Connect to a Host or Domain**.
3. In the Connect dialog box select the host name from the pull-down menu and click **Connect**.
   To connect to the local system, select **localhost**. Provide the user name, password, and domain if prompted.
4. To start the New Volume wizard, expand the tree view under the host node to display all the disk groups. Right click a disk group and select **New Volume** from the context menu.
   You can right-click the disk group you have just created, for example EVS1_SG1_DG.
5. At the New Volume wizard opening screen, click **Next**.
6. Select the disks for the volume.
   - Make sure the appropriate disk group name appears in the Group name drop-down list.
   - For Site Preference, leave the setting as **Siteless** (the default).
   - Automatic disk selection is the default setting. To manually select the disks, click **Manually select disks** and use the **Add** and **Remove** buttons to move the appropriate disks to the **Selected disks** list. Manual selection of disks is recommended.
   - 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.
   - Click **Next**.

7 Specify the volume attributes.

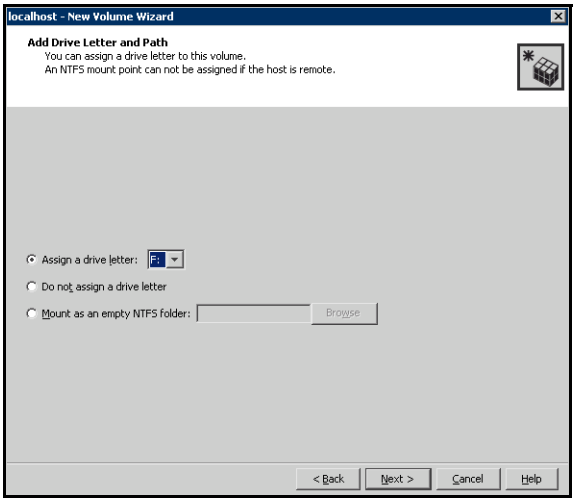


- Enter a volume name. The name is limited to 18 ASCII characters and cannot contain spaces or forward or backward slashes.
- Provide a size for the volume. If you click the **Max Size** button, a size appears in the Size box that represents the maximum possible volume size for that layout in the dynamic disk group.
- Select a layout type.
- If you are creating a striped volume, the **Columns** and **Stripe unit size** boxes need to have entries. Defaults are provided.
- To select mirrored striped, click both the **Mirrored** checkbox and the **Striped** radio button.
- In the Mirror Info area, select the appropriate mirroring options.
- Verify that **Enable logging** is not selected.
- Click **Next**.

8 Assign a drive letter or mount point to the volume. You must use the same drive letter or mount point on all systems in the cluster. Make sure to verify the availability of the drive letter before assigning it.

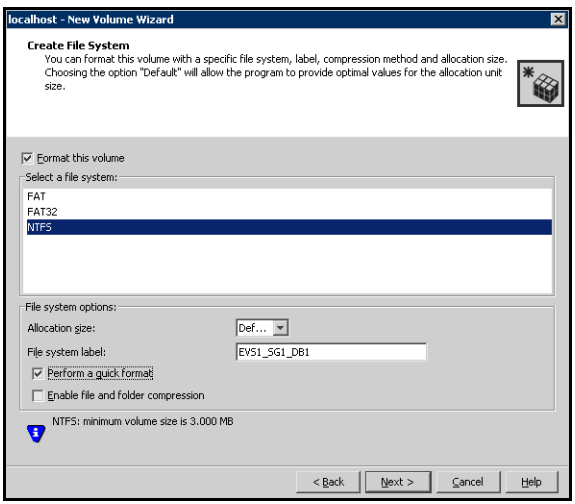
- To assign a drive letter, select **Assign a Drive Letter**, and choose a drive letter.
- To mount the volume as a folder, select **Mount as an empty NTFS folder**, and click **Browse** to locate an empty folder on the shared disk.

- If creating a Replicator Log volume for Veritas Volume Replicator, select **Do not assign a drive letter**.



9 Click **Next**.

10 Create an NTFS file system.



- Make sure the **Format this volume** checkbox is checked and click **NTFS**.
- For a VVR configuration, for the Replicator Log volume only, clear the **Format this volume** check box.
- Select an allocation size or accept the default.

- The file system label is optional. SFW makes the volume name the file system label.
- Select **Perform a quick format** if you want to save time.
- Select **Enable file and folder compression** to save disk space. Note that compression consumes system resources and performs encryption and decryption, which may result in reduced system performance.
- Click **Next**.

11 Click **Finish** to create the new volume.

12 Repeat these steps to create additional volumes.
Create the cluster disk group and volumes on the first node of the cluster only.

Creating dynamic volumes for campus clusters

This section will guide you through the process of creating a volume on a dynamic disk group for a campus cluster.

For creating volumes for other types of clusters, see the following:

- "Creating dynamic volumes for high availability clusters" on page 61

Before you begin, review the following topics:

- "Considerations when creating disk groups and volumes for a campus cluster" on page 57
- "Adding disks to campus cluster sites" on page 62

Note: When assigning drive letters to volumes, ensure that the drive letters that you assign are available on all nodes.

To create dynamic volumes

1 If the VEA console is not already open, click **Start > All Programs > Symantec > Veritas Storage Foundation > Veritas Enterprise Administrator** on the desktop. (Skip to step 4 if VEA is already connected to the appropriate host.)

2 Click **Connect to a Host or Domain**.

3 In the Connect dialog box select the host name and click **Connect**.
To connect to the local system, select **localhost**. Provide the user name, password, and domain if prompted.

4 To start the New Volume wizard, expand the tree view under the host node to display all the disk groups. Right click a disk group and select **New Volume** from the context menu.
You can right-click the disk group you have just created, for example EVS1_SG1_DG.

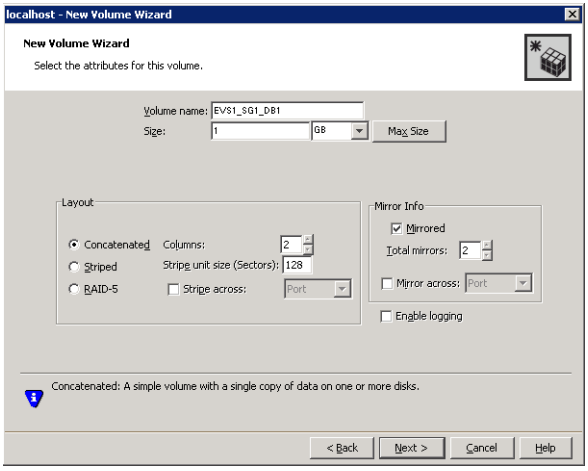
5 At the New Volume wizard opening screen, click **Next**.

6 Select the disks for the volume as follows

Group name	Make sure the appropriate disk group is selected.
Site preference	Select the **Site Separated** option.
Select site from	Select the campus cluster sites. Press **CTRL** to select multiple sites. **Note:** If no sites are listed, the disks have not yet been added to a site.
Auto select disks	Automatic disk selection is recommended for campus clusters. SFW automatically selects the disks based on the following criteria: ■ Their port assignment (disks with two different ports are selected). Note that in the list of available disks, the entry after each disk name starts with the port number. For example, the “P3” in the entry P3C0T2L1 refers to port 3. ■ Amount of available space on the disks. SFW will pick two disks (one from each array) with the most space.
Manually select disks	If you manually select disks, use the **Add** and **Remove** buttons to move the appropriate disks to the **Selected disks** list.
Disable Track Alignment	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.

Click **Next**.

7 Specify the volume attributes as follows:

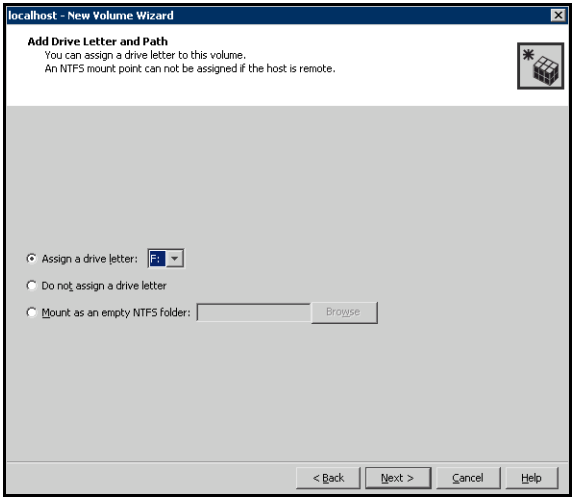


Volume name	Specify a name for the volume. The name is limited to 18 ASCII characters and cannot contain spaces or forward or backward slashes.
Size	Specify a size for the volume. If you click **Max Size**, the **Size** box shows the maximum possible volume size for that layout in the dynamic disk group.
Layout	Ensure that the Mirrored checkbox is selected. Select a layout type as follows: Select either **Concatenated** or **Striped**. If you are creating a striped volume, the **Columns** and **Stripe unit size** boxes need to have entries. Defaults are provided. In addition, click the **Stripe across** checkbox and select **Ports** from the drop-down list.
Mirror Info	Click **Mirror across** and select **Enclosures** from the drop-down list. When creating a site separated volume, as required for campus clusters, the number of mirrors must correspond to the number of sites. If needed, you can add more mirrors after creating the volume.
Enable logging	Verify that this option is not selected.

Click **Next**.

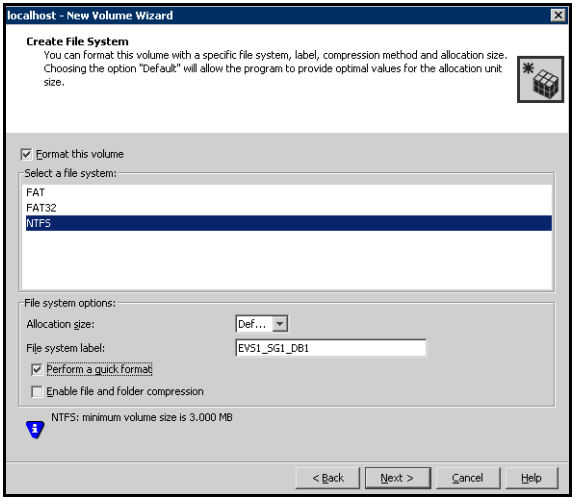
8 In the Add Drive Letter and Path dialog box, assign a drive letter or mount point to the volume. You must use the same drive letter or mount point on all systems in the cluster. Make sure to verify the availability of the drive letter before assigning it.

- To assign a drive letter, select **Assign a Drive Letter**, and choose a drive letter.
- To mount the volume as a folder, select **Mount as an empty NTFS folder**, and click **Browse** to locate an empty folder on the shared disk.



9 Click **Next**.

10 Create an NTFS file system.



- Make sure the **Format this volume** checkbox is checked and select **NTFS**.
- Select an allocation size or accept the Default.
- The file system label is optional. SFW makes the volume name the file system label.
- Select **Perform a quick format** if you want to save time.
- Select **Enable file and folder compression** to save disk space. Note that compression consumes system resources and performs encryption and decryption, which may result in reduced system performance. Click **Next**.

11 Click **Finish** to create the new volume.

12 Repeat these steps to create additional volumes as needed.

Note: Create the cluster disk group and volumes on the first node of the cluster only.

Managing disk group and volumes

During the process of setting up an SFW environment, refer to these general procedures for managing disk groups and volumes:

- When a disk group is initially created, it is imported on the node where it is created.
- A disk group can be imported on only one node at a time.
- To move a disk group from one node to another, unmount the volumes in the disk group, deport the disk group from its current node, import it to a new node and mount the volumes.

Importing a disk group and mounting a volume

Use the VEA Console to import a disk group and mount a volume.

To import a disk group

1. From the VEA Console, right-click a disk name in a disk group or the group name in the Groups tab or tree view.
2. From the menu, click **Import Dynamic Disk Group**.

To mount a volume

1. If the disk group is not imported, import it.
2. To verify if a disk group is imported, from the VEA Console, click the Disks tab and check if the status is imported.
3. Right-click the volume, click **File System**, and click **Change Drive Letter and Path**.
4. Select one of the following options in the Drive Letter and Paths dialog box depending on whether you want to assign a drive letter to the volume or mount it as a folder.
   - To assign a drive letter
     Select **Assign a Drive Letter**, and select a drive letter.
   - To mount the volume as a folder
     Select **Mount as an empty NTFS folder**, and click **Browse** to locate an empty folder on the shared disk.
5. Click **OK**.

Unmounting a volume and deporting a disk group

Use the VEA Console to unmount a volume and deport a disk group.

To unmount a volume and deport the dynamic disk group

1. From the VEA tree view, right-click the volume, click **File System**, and click **Change Drive Letter and Path**.

2 In the Drive Letter and Paths dialog box, click **Remove.** Click **OK** to continue.

3 Click **Yes** to confirm.

4 From the VEA tree view, right-click the disk group, and click **Deport Dynamic Disk Group**.

5 Click **Yes**.

Chapter 6

Implementing a dynamic mirrored quorum resource

This chapter covers the following topics:

Tasks for implementing a dynamic mirrored quorum resource

One of the key advantages of using SFW with Microsoft clustering is the ability to create a mirrored quorum resource that adds fault tolerance to the quorum and protects the cluster.

Table 6-1 shows the tasks for implementing the mirrored quorum resource.

Table 6-1 Tasks for configuring disk groups and volumes

Action	Description
Create a dynamic cluster disk group and a mirrored volume for the quorum resource.	Create a dynamic cluster disk group and a mirrored volume for the quorum resource. See "Creating a dynamic cluster disk group and a mirrored volume for the quorum resource" on page 74.

Table 6-1 Tasks for configuring disk groups and volumes

Action	Description
Add a Volume Manager Disk Group resource to the cluster	Add a Volume Manager Disk Group resource for the disk group that you created for the quorum. See "Adding a Volume Manager Disk Group resource for the quorum" on page 75.
Change the cluster quorum resource to the dynamic mirrored quorum resource	Change the cluster quorum properties to use the Volume Manager Disk Group resource. See "Changing the quorum resource to a dynamic mirrored quorum resource" on page 76.

Creating a dynamic cluster disk group and a mirrored volume for the quorum resource

Use SFW to create a separate cluster disk group for the quorum disks. Microsoft recommends 500 MB for the quorum disk.

Note: If you add other volumes to this disk group, any failures related to their operation can cause disruptive failovers of the quorum volume. If a volume in the group experiences a high level of read/write activity, failovers may result from delayed access to the quorum volume by Microsoft clustering.

Symantec recommends the following configuration for the quorum disk group in order to create the mirrored quorum volume:

- For a failover cluster, use three small disks; you need a minimum of two disks.
- For a campus cluster, use four small disks.

Use the following guidelines when creating the mirrored volumes:

- Select the **Concatenated** layout.
- Select the **Mirrored** check box.
- For a high-availability failover cluster, specify the three mirrors.
- For a campus cluster, specify the four mirrors.

Detailed procedures are available for creating cluster disk groups and volumes.

See "Creating dynamic cluster disk groups" on page 60.

See "Adding disks to campus cluster sites" on page 62.

Adding a Volume Manager Disk Group resource for the quorum

You first create a service or application for the quorum resource and name it (for example, QUORUM).

You add the Volume Manager Disk Group resource corresponding to the disk group that you created for the quorum.

To add a Volume Manager Disk Group resource for the quorum

1. If Failover Cluster Management is already open, then proceed to Step 2.
   To launch Failover Cluster Management, select it from **Start > Administrative Tools > Failover Cluster Management**.
2. Verify that the cluster is online on the same node where you created the disk group.
3. In the left pane of Failover Cluster Management, right-click **Services and Applications** and select **More Actions > Create Empty Service or Application**.
4. Right-click the new group and rename it, for example QUORUM.
5. Right-click QUORUM and select **Add a resource > More resources > Add Volume Manager Disk Group**.
6. Right-click **New Volume Manager Disk Group** in the center pane and click **Properties**.
7. In the General tab of the Properties dialog box, type a name for the resource in the Resource Name field, for example, QUORUM_DG_RES.
8. On the Properties tab, in the Disk Group Name field, type the name of the disk group that you previously created for the quorum, and click **OK** to close the dialog box.
9. Right-click the Quorum disk group resource (for example, QUORUM_DG_RES) in the left pane and select **Bring this resource online**.
   The specified disk group resource, QUORUM_DG_RES resource, is created under the Quorum group (for example, QUORUM).

Changing the quorum resource to a dynamic mirrored quorum resource

After adding a Volume Manager Disk Group resource for the quorum, you change the cluster quorum properties to use that resource. This changes the quorum resource to a dynamic mirrored quorum resource.

Use the following procedure to configure the cluster quorum settings and change the quorum resource to a dynamic mirrored quorum resource.

To change the quorum to a dynamic mirrored quorum resource

1. In Failover Cluster Management, right-click the cluster node in the configuration tree, and select **More Actions > Configure Cluster Quorum Settings**.
   The Configure Cluster Quorum Wizard opens.
2. Review the screen and click **Next**.
3. Select either the **Node and Disk Majority** or **No Majority: Disk Only** radio button, and click **Next**.
4. Select the storage resource that you want to assign as the disk witness for the quorum and click **Next**.
   This is the Volume Manager Disk Group resource that you previously created for the quorum disk group, for example, `QUORUM_DG_RES`.
5. Review the information in the Confirmation screen and click **Next**.
6. Click **Finish** to close the wizard.

Chapter 7

Installing Exchange Server and configuring resources

This chapter covers the following topics:

Tasks for installing and configuring Exchange Server

Table 7-1 show the process for deploying Exchange Server with SFW in a Microsoft failover cluster or campus cluster. If you are installing and configuring Exchange on a secondary site for disaster recovery, see the following topic:

"Creating a parallel environment on the secondary site" on page 88

Table 7-1 Process for deploying Exchange Server with SFW in a Microsoft failover cluster

Action	Description
Configure disk groups and volumes for Exchange Server	If you have not yet done so, use the VEA console to create disk groups and volumes for Exchange Server. See "Tasks for configuring SFW storage" on page 53.
Add the VMDG resource for the First Storage group to the quorum group	Add the VMDG disk group resource(s) for the First Storage Group. See "Adding a Volume Manager Disk Group resource for Exchange 2007 installation" on page 79.
Install Exchange Server	See "Installing Exchange Server" on page 79.
Add the VMDG resources to the Exchange group	See "Adding the Volume Manager Disk Group resources to the Exchange group" on page 80.
Set the database dependency on the disk group resource	See "Setting the database dependency on the disk group resource" on page 81 .
Move Exchange databases and logs to shared storage.	See "Moving Exchange databases and logs to shared storage" on page 81
Verify the cluster configuration	Move the online Exchange Server cluster group to the second node and back to the first node. See "Verifying the Exchange Server group in the Microsoft cluster" on page 83.

Adding a Volume Manager Disk Group resource for Exchange 2007 installation

Before installing Exchange 2007 in a Microsoft failover cluster with SFW, you add a Volume Manager Disk Group (VMDG) resource for the disk group that you created for the First Storage Group. By doing so, you can install the First Storage Group on a dynamic volume.

You add this resource to the Quorum group temporarily. After installation, you will move it to the Exchange group created by installation and set the appropriate dependencies.

Before creating this resource, start the cluster service on all the nodes in the cluster.

To create a Volume Manager Disk Group resource for the application

1. In the left pane (tree view) of the Failover Cluster Management tool, right-click the Quorum resource group under Services and Applications. Select **Add a resource > More resources > Add Volume Manager Disk Group**.
2. In the General tab of the Properties dialog box, type a resource name for the new Volume Manager Disk Group (for example, EVS1_SG1_RES).
3. In the Properties tab, in the Disk Group Name field, type the name of the disk group you previously created for the First Storage Group (for example, EVS1_SG1_DG).
4. Click **OK** to close the dialog box.
5. To bring the resource online, right-click the newly named resource and click **Bring this resource online**.

Installing Exchange Server

Refer to the Microsoft documentation for prerequisites and details on installing a clustered mailbox server. You must install the Active Clustered Mailbox role on the first node and install the Passive Clustered Mailbox role on the failover node.

Make sure that the same drive letter and path are available on all nodes and have adequate space for the installation. For example, if you install the Exchange program files in `C:\Program Files\ExchSrvr` on one node, you must install the files in `C:\Program Files\ExchSrvr` on all the other nodes. Use a drive letter on the local disk of each node in the cluster.

For requirements when installing Exchange Server on a secondary site for disaster recovery, see the following topic:

See “Creating a parallel environment on the secondary site” on page 88.

Adding the Volume Manager Disk Group resources to the Exchange group

Exchange 2007 installation creates an application group with resources required by Exchange.

You need to move to the Exchange Group the Volume Manager Disk Group (VMDG) resource that you added to the cluster quorum group for the First Storage Group installation.

Also add to the Exchange group the Volume Manager Disk Group resources for any other disk groups that you created for Exchange.

To move the Volume Manager Disk Group resource to the application group

1. In the quorum group, right click the resource you created for the Exchange First Storage Group and select the option to move it to another group.
2. Select the Exchange group as the target for the move and click **OK**.

To add Volume Manager Disk Group resources for the application

1. In the left pane (tree view) of the Failover Cluster Management tool, right-click the resource group under Services and Applications. Select **Add a resource > More resources > Add Volume Manager Disk Group**.
   A Volume Manager disk group resource is automatically created.
2. In the center panel under Disk Drives, double-click **New Volume Manager Disk Group** (in the center pane) to open the Properties dialog box.
   You can also right-click **New Volume Manager Disk Group** and select **Properties**.
3. In the General tab of the Properties dialog box, type the resource name for the New Volume Manager Disk Group (for example, ExchDG).
4. In the Properties tab, type the name of the disk group for which you want to add a resource.
5. Click **OK** to close the dialog box.
6. To bring the resource online, right-click the newly named disk group and click **Bring this resource online**.

Setting the database dependency on the disk group resource

After adding the Volume Manager Disk Group resources to the Exchange group, you must set the Exchange database resources to be dependent on them.

To set the database resource dependency on the VMDG resource

1. In Failover Cluster Management, select the Exchange resource group.
2. In the result pane, under Other Resources, right-click the appropriate database resource and select Properties.
3. In the Dependencies tab of the Properties dialog box:
   - Click the box **Click here to add a dependency**.
   - Select the appropriate Volume Manager Disk Group resource from the dropdown list of available resources.
   - Click **Insert.**
4. Click **OK** to close the Properties dialog box.
5. Repeat steps 2 through 4 for each additional database resource that exists in the Exchange group.

Moving Exchange databases and logs to shared storage

During Exchange installation, the First Storage Group is installed to a dynamic volume. You must move the log to a separate volume.

If you created any other Exchange storage groups that were not located on the SFW dynamic volumes, move them to the dynamic volumes.

For each Exchange 2007 storage group, set the log files path and system files path to point to the log volume. For each database, set the database path to point to the appropriate database volume.

You can use either the Exchange Management Console or the Exchange Management Shell cmdlets to specify log and database locations. You can specify locations when creating new storage groups or databases or change the locations for existing storage groups or databases.

Note: You cannot use the Exchange Management Console to change the log file location for remote Mailbox servers.

The following procedures can be used to change paths for existing storage groups and databases.

See the Microsoft Exchange 2007 documentation for additional information on creating new storage groups and databases.

To use the Exchange Management Console to change log file and system file locations for an existing database

1. Start the Exchange Management Console (**Start > All Programs > Microsoft Exchange Server 2007 > Exchange Management Console)** on the server on which the storage group is located.
2. In the console tree, expand **Server Configuration**, and then click **Mailbox**.
3. In the result pane, click the Mailbox server that contains the storage group for which you want to change the log file location.
4. In the work pane, right-click the storage group for which you want to change the log file location and click **Move Storage Group Path**. The Move Storage Group Path wizard appears.
5. On the Introduction panel, click **Browse**, specify the SFW volume to which to move the log files, and create a folder for the log files. Repeat for the system files. The volume should be the same for both.
6. Click **Move**. A warning appears that all databases in the storage group must be temporarily dismounted, which will make them inaccessible to any user. To continue, click **Yes**.
7. On the Completion panel, confirm whether the path was changed successfully. A status of Completed indicates that the wizard completed the task successfully. A status of Failed indicates that the task was not completed. If the task fails, review the summary for an explanation, and then click **Back** to make any configuration changes. Click **Finish** to complete the Move Storage Group Path wizard.

To use the Exchange Management Console to change the database file location for an existing database

1. Start the Exchange Management Console (**Start > All Programs > Microsoft Exchange Server 2007 > Exchange Management Console)** on the server on which the storage group is located.
2. In the console tree, expand **Server Configuration**, and then click **Mailbox**.

3 In the result pane, click the Mailbox server that contains the database for which you want to change the database file location.

4 In the work pane, right-click the desired database and click **Move Database Path**. The Move Database Path wizard appears.

5 On the Introduction panel, click **Browse**, specify the SFW volume to which to move the database file, and create a folder for it as needed.

6 Click **Move**. A warning appears indicating that the database must be temporarily dismounted, which will make it inaccessible to any user. To continue, click **Yes**.

7 On the Completion panel, confirm whether the database files were moved successfully. A status of Completed indicates that the wizard completed the task successfully. A status of Failed indicates that the task was not completed. If the task fails, review the summary for an explanation, and then click **Back** to make any configuration changes. Click **Finish** to complete the Move Database Path wizard.

Verifying the Exchange Server group in the Microsoft cluster

You can verify your installation by moving the cluster between nodes to see if it fails over properly. The ultimate test of the cluster's failover capability involves shutting down the node that is currently online and bringing it back up after the cluster fails over to the other node.

Refer to the Microsoft documentation for instructions.

Chapter 8

Configuring disaster recovery for Exchange Server in a Microsoft cluster

This chapter covers the following topics:

Tasks for configuring the secondary site for disaster recovery

After creating a high-availability Microsoft cluster with SFW and Exchange Server on a primary site, you can configure a secondary site for disaster recovery.

This disaster recovery solution requires Veritas Volume Replicator (VVR).

Refer to the *Veritas Volume Replicator Administrator's Guide* for additional details on VVR.

Table 8-1 describes the process for configuring the secondary site for disaster recovery.

Table 8-1 Process for configuring the secondary site for disaster recovery

Action	Description
Verify the primary site configuration.	See "Verifying the primary site configuration" on page 88.
Review the prerequisites and planning information	Verify the prerequisites on the secondary site. See "Requirements for deploying Exchange Server 2007 with SFW in a Microsoft cluster" on page 30. **Note:** If the DR site is on a different network segment, ensure that you allocate two IP addresses for the virtual server, one for the primary site and one for the DR site. Understand the DR configuration. See "Planning your disaster recovery configuration" on page 42.
Create the parallel Microsoft cluster configuration with SFW and Exchange 2007 on the secondary site	Many procedures are the same as on the primary site. However, there is a different procedure for installing Exchange and setting up the Exchange resource group. See "Creating a parallel environment on the secondary site" on page 88.
Set up security for VVR	Set up the security for VVR on all nodes on both the primary and secondary sites. See "Setting up security for VVR" on page 91.
Understand the VVR components	See "VVR components overview" on page 94.

Table 8-1 Process for configuring the secondary site for disaster recovery

Action	Description
Create the cluster resources for VVR	■ Create an IP address for the Replicated Volume Group (RVG). ■ Create a Network Name resource for the Replicated Volume Group (RVG). See "Creating resources for VVR" on page 95.
Set up an RDS	Create a replicated data set (RDS) using the VVR wizard. See "Configuring VVR: Setting up an RDS" on page 96.
Create the RVG resource (primary and secondary sites)	Create the RVG resource on both primary and secondary sites. See "Creating the RVG resource" on page 108.
Set up the Exchange Server resource dependencies	Change the Exchange Server resource dependency properties so that it depends on the RVG resource instead of the Volume Manager Disk Group resource. See "Setting the Exchange server resource dependency on the RVG resource" on page 109.

Verifying the primary site configuration

Before you can configure the secondary site, you set up the primary site for high availability.

See "Workflow for a high availability (HA) configuration" on page 20.

Ensure that you install the Veritas Volume Replicator option on the primary site. Ensure that you are using static IP addresses as required for VVR.

Creating a parallel environment on the secondary site

After setting up an SFW environment with Microsoft failover clustering and Exchange Server 2007 on the primary site, configure a parallel environment for Exchange on the secondary site. Many tasks use the same procedures as on the primary site. The following procedures are different on the secondary site:

- Install Exchange 2007
  - See "Installing Exchange on the secondary site" on page 90
- Set up the Exchange group on the secondary site
  - See "Setting up the Exchange group on the secondary site" on page 90.

Table 8-2 shows the full list of tasks in the recommended order, with guidelines specific to the secondary site. After completing these tasks you will have a clustered site with SFW and Exchange installed and configured on all the nodes on both the primary and the secondary sites. You can then proceed to configuring the Veritas Volume Replicator components for disaster recovery.

Table 8-2 Creating a parallel environment on the secondary site

Action	Description
Configure the storage hardware and network	Use the same procedure as on the primary site. See "Configuring the storage hardware and network" on page 48.
Establish a Microsoft failover cluster	Use the same procedure as on the primary site. See "Establishing a Microsoft failover cluster" on page 49.

Table 8-2 Creating a parallel environment on the secondary site (Continued)

Action	Description
Install SFW for a disaster recovery configuration	Use the same procedure as on the primary site. Be sure to select the option to install VVR. (This must also be installed on the primary site.) See "Installing SFW with Microsoft Failover Cluster option" on page 51.
Configure SFW disk groups and volumes,	Use the same procedure as on the primary site. Make sure the following are exactly the same as the cluster on the primary site: ■ Cluster disk group names ■ Volume names and sizes ■ Drive letters See "Tasks for configuring SFW storage" on page 53.
Implement a dynamic mirrored quorum resource	Use the same procedure as on the primary site. See "Tasks for implementing a dynamic mirrored quorum resource" on page 73.
Add Volume Manager Disk Group resources for the Exchange 2007 disk group(s)	Use the same procedure as on the primary site. Unlike on the primary site, the resource will not be used during the Exchange 2007 installation but will be used in the process of recovering the existing database and log information from Active Directory after Exchange installation. If you created any other Exchange storage groups, include resources for those disk groups as well. See "Adding a Volume Manager Disk Group resource for Exchange 2007 installation" on page 79.
Install Exchange 2007	See "Installing Exchange on the secondary site" on page 90
Set up the Exchange group	Unlike on the primary site, Exchange installation does not create the Exchange group and resources. However, after Exchange installation, you can run a command that recovers the resource information from Active Directory. See "Setting up the Exchange group on the secondary site" on page 90.

Table 8-2 Creating a parallel environment on the secondary site (Continued)

Action	Description
Move the Volume Manager Disk Group resources to the Exchange group	Use the same procedure as on the primary site. See "Moving Exchange databases and logs to shared storage" on page 81.

Installing Exchange on the secondary site

Review the following requirements for installing Exchange Server 2007 on the secondary site:

- Before you begin installation, make sure to take the Exchange cluster group offline on the primary site; otherwise, the installation on the secondary site will not function properly.
- On the secondary site nodes, do not install the Active Clustered Mailbox role. Instead, install the Passive Clustered Mailbox role on all nodes of the secondary site.
- Make sure that the same drive letter and path are available on all nodes and have adequate space for the installation. For example, if you install the Exchange program files in `C:\Program Files\ExchSrvr` on one node, you must install the files in `C:\Program Files\ExchSrvr` on all the other nodes. Use a drive letter on the local disk of each node in the cluster.

Refer to the Microsoft documentation for additional prerequisites and details on Exchange installation.

Setting up the Exchange group on the secondary site

Installing Exchange 2007 on the secondary site does not create the Exchange group and resources as it does on the primary site. However, after Exchange installation, you can use run the RecoverCMS command to recover the Exchange group and resource information from Active Directory.

To set up the Exchange group on the secondary site

1. On the secondary site, ensure that you have set up the cluster disk groups and dynamic volumes to match those on the primary site.
2. Ensure that you have created the Volume Manager Disk Group resources that correspond with the Exchange disk groups.
3. Ensure that the disk groups are online and volumes mounted on the node where you are going to run the RecoverCMS command.
4. Change to the directory where you installed Exchange.

5 Run the RecoverCMS command, using the following syntax:

```
Setup.com /recoverCMS
/CMSName:<name>/CMSIPaddress:<ip>
```

Where <*name*> is the name you assigned to the Exchange server during installation on the primary site and <*ip*> is the IP assigned during Exchange installation on the primary site.

You may receive an error message due to a Microsoft issue that states the command failed to bring cluster resource Network Name online, and that the group or resource is not in the correct state to perform the requested operation.

In this case, complete the following steps on the secondary site:

- On the secondary site, using the Failover Management console, bring the clustered mailbox server (Network Name) resource online manually.
- After the Network Name resource comes online, take the IP resource offline. (This will also offline the Network Name resource.)
- Delete the Network Name resource and the IP resource.
- Run the RecoverCMS command over again. This time it will succeed and all the Exchange resources will be created on the secondary site.

6 On the secondary site, bring the Exchange cluster group and its resources offline.

7 On the primary site, bring the Exchange cluster group and its resources online.

Setting up security for VVR

As the first configuration step for VVR replication, you must configure the VVR Security Service (VxSAS) on all cluster nodes on both the primary and secondary sites. This procedure should not be done until you have installed SFW on all cluster systems. Otherwise, you will get an error message from the VxSAS wizard if you try to select a system without SFW installed.

You can run the VxSAS wizard from any site once SFW is installed on all cluster systems; at that time, you can run the wizard for both the primary and secondary site systems. The Microsoft cluster groups can be either online or offline.

Complete the following procedure to configure the VxSAS service for VVR.

The procedure has these prerequisites:

- You must be logged on with administrative privileges on the server for the wizard to be launched.

- The account you specify must have administrative and log-on as service privileges on all the specified hosts.
- Avoid specifying blank passwords. In a Windows Server environment, accounts with blank passwords are not supported for log-on service privileges.
- Make sure that the hosts on which you want to configure the VxSAS service are accessible from the local host.

Note: For details on this required service, see *Veritas Storage Foundation Veritas Volume Replicator Administrator's Guide*.

To configure the VxSAS service

1. Launch the VVR Security Service Configuration Wizard.
   Click **Start** > **All Programs > Symantec > Veritas Storage Foundation > Configuration Wizards > VVR Security Service Configuration Wizard**.
   or
   Type `vxsascfg.exe` at the command prompt.
2. Read the information provided on the Welcome page and click **Next**.
3. Complete the Account Information panel as follows and then click **Next**:

Account name (domain\account)	Enter the administrative account name.
Password	Specify a password.

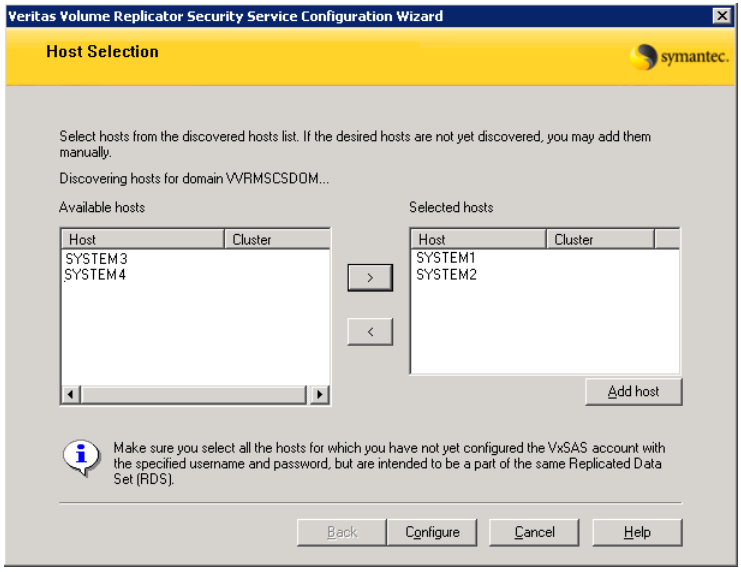
   If you have already configured the VxSAS service for one host that is intended to be a part of the RDS, make sure you specify the same username and password when configuring the VxSAS service on the other hosts.
4. On the Domain Selection panel, select the domain to which the hosts that you want to configure belong and then click **Next**:

Selecting domains	The Available domains pane lists all the domains that are present in the Windows network neighborhood. Move the appropriate name from the Available domains list to the Selected domains list, either by double-clicking it or using the arrow button.

Adding a domain

If the domain name that you require is not displayed, click **Add domain**. This displays a dialog that allows you to specify the domain name. Click **Add** to add the name to the Selected domains list.

5 On the Host Selection panel, select the required hosts:



Selecting hosts

The Available hosts pane lists the hosts that are present in the specified domain.

Move the appropriate host from the Available hosts list to the Selected hosts list, either by double-clicking it or using the arrow button. Use the Shift key with the up or down arrow keys to select multiple hosts.

Adding a host

If the host name you require is not displayed, click **Add host**. In the Add Host dialog specify the required host name or IP in the **Host Name** field. Click **Add** to add the name to the Selected hosts list.

After you have selected a host name, the **Configure** button is enabled. Click **Configure** to proceed with configuring the VxSAS service.

6 After the configuration completes, the Configuration Results page displays whether or not the operation was successful. If the operation was not

successful, the page displays the details on why the account update failed, along with the possible reasons for failure and recommendations on getting over the failure.

When configuring the VxSAS service for VVR in a firewall setup, the VxSAS wizard may not be able to configure the machines that are across the firewall, although the Host Selection dialog may list these nodes. In this case, configure the VxSAS service locally on the machines that are across the firewall.

Click **Back** to change any information you had provided earlier.

7 Click **Finish** to exit the wizard.

VVR components overview

You configure the following Veritas Volume Replicator components:

Replicated Volume Group (RVG)	An RVG is made up of one or more volumes in a SFW disk group. The updates made on the RVG on the primary host are sent to a configured secondary host. Thus, on the secondary host 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. Optionally, to add more redundancy, you can have multiple secondary hosts, all with the same corresponding copy of the RVG. 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 any corresponding RVGs on the secondary host or hosts make up a Replicated Data Set (RDS).
Replicator Log volume	Each RVG must have a Replicator Log associated with it. The Replicator Log volume at the primary site holds a copy of any RVG updates 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 needs to become the new primary site. The log volumes at the two sites must have the same name. Symantec recommends having Replicator Log volumes of the same size at the primary site and the secondary site.

Creating resources for VVR

Create the resources for VVR replication at the primary and secondary sites using the Failover Cluster Management tool. You create a network name resource and IP address resource to be used for VVR replication.

A separate valid IP address is necessary for VVR replication, because on the secondary cluster before a disaster, the application IP must be offline whereas the VVR IP must be online.

You create the resources for the primary site and then repeat the procedure to create the resources on the secondary site.

To create a Network Name resource and IP address resource for VVR replication

1. Right-click on the application group and select **Add a Resource > Client Access Point**.
2. In the Client Access Point panel of the New Resource Wizard, specify the following:
   - In the **Name** field, specify a name for the Network Name resource. The default is the name of the group you selected. Specify any name except the node and the virtual server name. The network name you assign when creating the resource for the secondary site must be different from the network name for the primary site.
   - Select the network and specify the IP address.

   Click **Next**.
3. In the Confirmation panel, review the information and click **Next**.
4. When configuration is complete, click **Finish**.
5. Repeat the same procedure to create the IP and the Network Name resource at the secondary site.
6. Bring the resources online.

Configuring VVR: Setting up an RDS

For each disk group you created for the application, you set up a Replicated Data Set (RDS) on the primary and secondary hosts. The Setup Replicated Data Set Wizard enables you to configure an RDS for both sites.

Before running the wizard, verify the following:

- Verify that the disk groups and volumes for the database files and log files have been created. The Replicator Log volume can be created while running the wizard if not created earlier.
- Verify that VxSAS has been configured.
- Verify that the Exchange clustered server IP resource is offline on the secondary site. This would also bring offline all the dependent Exchange resources.
- Verify that you have set the appropriate IP preference, whether VVR should use IPv4 or IPv6 addresses, before configuring replication. The default setting is IPv4.
  When you specify host names while configuring replication, VVR resolves the host names with the IP addresses associated with them. This setting determines which IP protocol VVR uses to resolve the host names.
  Use Veritas Enterprise Administrator (VEA) (Control Panel > VVR Configuration > IP Settings tab) to set the IP preference.

VVR does not support these types of volumes:

- Storage Foundation for Windows (software) RAID 5 volumes
- Volumes with the Dirty Region Log (DRL)
- Volumes with a comma in their names
- For the Replicator Log volume, in addition to the above types also make sure that the volume does not have a DCM.

Caution: Do not use volume types that are not supported by VVR.

The following procedure enables you to set up an RDS on the primary and secondary sites and to start replication.

To create the Replicated Data Set

1 Use the Veritas Enterprise Administrator (VEA) console to launch the Setup Replicated Data Set Wizard from the cluster node on the Primary where the cluster disk group is imported:

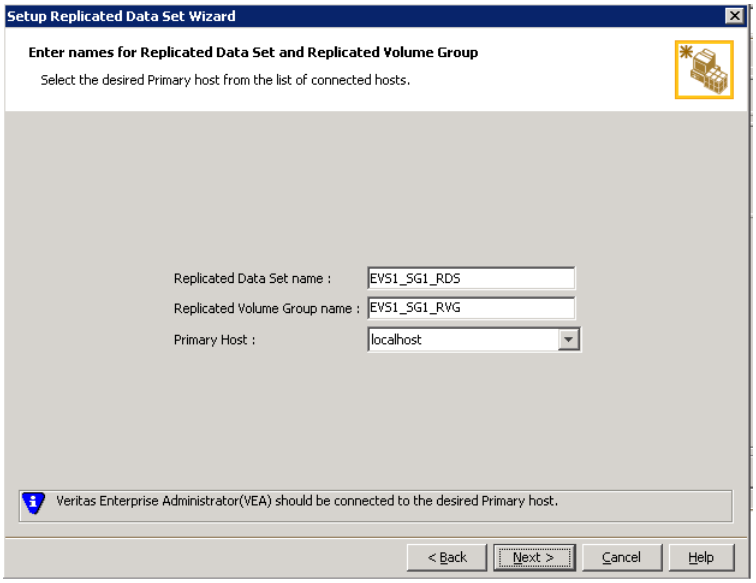
Click **Start** > **All Programs** > **Symantec** > **Veritas Storage Foundation** > **Veritas Enterprise Administrator**.

From the VEA console, click **View > Connection > Replication Network**.

2 Right-click **Replication Network** and select **Setup Replicated Data Set**.

3 Read the information on the Welcome page and then click **Next**.

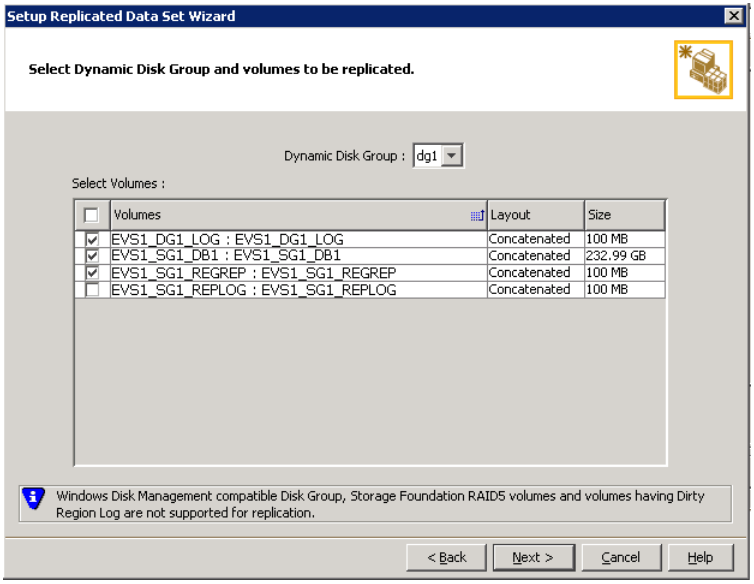
4 Specify names for the Replicated Data Set (RDS) and Replicated Volume Group (RVG) and then click **Next**.



By default, the local host is selected as the **Primary Host**. To specify a different host name, make sure the required host is connected to the VEA console and select it in the **Primary Host** list.

If the required primary host is not connected to the VEA console, it does not appear in the drop-down list of the Primary Host field. Use the VEA console to connect to the host.

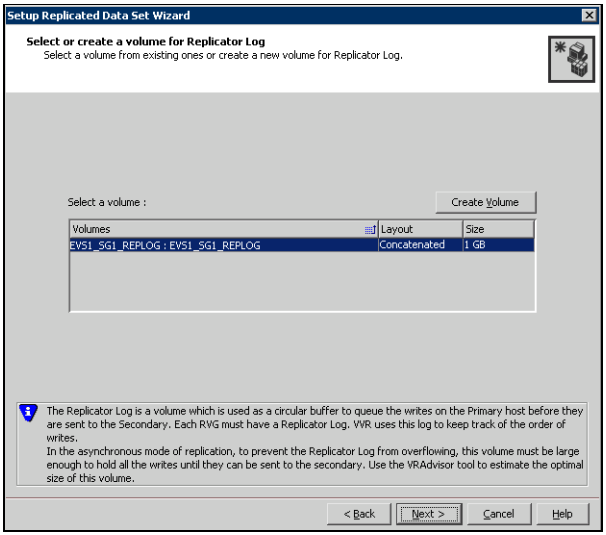
5 Select from the table the dynamic disk group and data volumes that will undergo replication and then click **Next**.



To select multiple volumes, press the Shift or Control key while using the up or down arrow keys.

By default, a mirrored DCM log is automatically added for all selected volumes. If disk space is inadequate to create a DCM log with two plexes, a single plex is created.

6 Complete the Select or create a volume for Replicator Log page as follows:



To select an existing volume

- Select the volume for the Replicator Log in the table (EVS1_SG1_REPLOG).
  If the volume does not appear in the table, click **Back** and verify that the Replicator Log volume was not selected on the previous page.
- Click **Next**.

To create a new volume

- Click **Create Volume** and enter the following information in the dialog box that displays.

Name	Enter the name for the volume in the **Name** field.
Size	Enter a size for the volume in the **Size** field.
Layout	Select the desired volume layout.

Disk Selection	Enables you to specify the disk selection method. ■ Enable the **Thin Provisioned Disks Only** check box to ensure that the Replicator Log volume is created only on Thin Provisioned (TP) disks. **Note:** The check box will remain disabled if the diskgroup does not have any TP disk. If this option is selected along with the **Select disks automatically** option, then the Replicator Log volume will be created only on TP disks. However, if you enable this check box along with **Select disks manually** option, then the user can select only TP disks from **Available Disks**. For more information on Thin Provisioning refer to the *Veritas Storage Foundation Administrator's Guide*. ■ Choose the **Select disks automatically** option if you want VVR to select the disks. ■ Choose the **Select disks manually** option to use specific disks from the Available disks pane for creating the volume. Either double-click on it or select **Add** to move the disks into the Selected disks pane.

- Click **OK** to create the Replicator Log volume.
- Click **Next** in the **Select or create a volume for Replicator Log** dialog box.

7 Review the information on the summary page and click **Create Primary RVG**.

8 After the Primary RVG has been created successfully, VVR displays the following message:

```
RDS with Primary RVG has been created successfully. Do you want
to add Secondary host to this RDS for replication now?
```

Click **No** to exit the Setup Replicated Data Set wizard without adding the Secondary host. To add the Secondary host later, use the **Add Secondary** option from the RDS right-click menu.

Click **Yes** to add the Secondary host to the Primary RDS now. The Specify Secondary host for replication page appears.

9 On the Specify Secondary host for replication page, enter the name or IP address of the Secondary host in the **Secondary Host** field and then click **Next**.

If the Secondary host is not connected to VEA, the wizard tries to connect it when you click Next. This wizard allows you to specify only one Secondary

host. Additional Secondary hosts can be added using the Add Secondary option from the RDS right-click menu.

Wait till the connection process is complete and then click **Next** again.

10 If only a disk group without any data volumes or Replicator Log, as on the Primary host exists on the Secondary, then VVR displays a message. Read the message carefully.

The option to automatically create volumes on the Secondary host is available only if the disks that are part of the disk group have:

- The same or larger amount of space as that on the Primary
- Enough space to create volumes with the same layout as on the Primary

Otherwise, the RDS setup wizard enables you to create the required volumes manually.

- Click **Yes** to automatically create the Secondary data volumes and the Replicator Log.
- Click **No** to create the Secondary data volumes and the Replicator Log manually, using the Volume Information on the connected hosts page.

11 The Volume Information on connected hosts page appears. This page displays information on the availability of volumes on the Secondary nodes, if the Primary and Secondary hosts are connected to VEA.

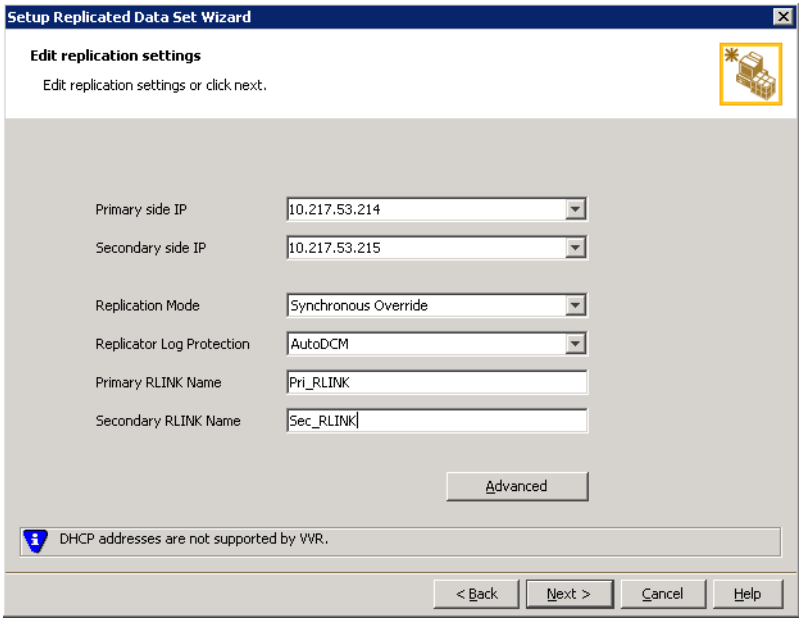
This page does not appear if all the required volumes that are available on the Primary host are also available on the Secondary hosts.

- If the required data volumes and the Replicator Log have not been created on the Secondary host, then the page displays the appropriate message against the volume name on the Secondary.
- If an error occurs or a volume needs to be created, a volume displays with a red icon and a description of the situation. To address the error, or to create a new Replicator Log volume on the secondary site, click the volume on the secondary site, click the available task button and follow the wizard.

  Depending on the discrepancies between the volumes on the primary site and the secondary site, you may have to create a new volume, recreate or resize a volume (change attributes), or remove either a DRL or DCM log.

  When all the replicated volumes meet the replication requirements and display a green check mark, click **Next**.
- If all the data volumes to be replicated meet the requirements, this screen does not occur.

12 Complete the Edit replication settings page to specify the basic and advanced replication settings for a Secondary host as follows:



- To modify each of the default values listed on this page, select the required value from the drop-down list for each property. If you do not wish to modify basic properties then replication can be started with the default values when you click **Next**.

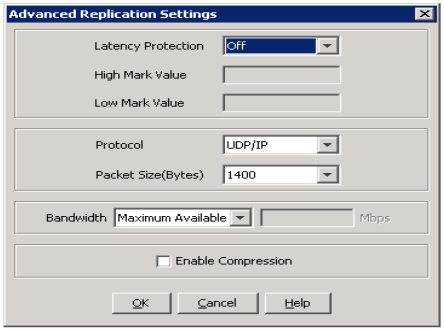
  Primary side IP — Enter the virtual IP address for the Primary IP resource that will be used for replication. If there is more than one IP address available for replication, you can choose the one that you want to use from the drop-down list. If the required IP address is not displayed in the list then edit the field to add the IP address.

  Secondary side IP — Enter the virtual IP address on the Secondary that is to be used for replication. If there is more than one IP address available for replication, you can choose the one that you want to use from the drop-down list. If the required IP address is not displayed in the list then edit the field to add the IP address.

Replication Mode	Select the required mode of replication: **Synchronous Override, Synchronous, or Asynchronous**. The default is synchronous override. **Synchronous Override** enables synchronous updates under typical operating conditions. If the Secondary site is disconnected from the Primary site, and write operations occur on the Primary site, the mode of replication temporarily switches to Asynchronous. **Synchronous** determines updates from the application on the Primary site are completed only after the Secondary site successfully receives the updates. **Asynchronous** determines updates from the application on the Primary site are completed after VVR updates in the Replicator Log. From there, VVR writes the data to the data volume and replicates the updates to the secondary site asynchronously. If the Secondary is set to the synchronous mode of replication and is disconnected, the Primary data volumes with NTFS file systems may be displayed with the status as MISSING.
Replicator Log Protection	The **AutoDCM** is the default selected mode for the Replicator Log overflow protection when all the volumes in the Primary RVG have a DCM log. The DCM is enabled when the Replicator Log overflows. The **DCM** option enables the Replicator Log protection for the Secondary host when the Replicator Log overflows, and the connection between the Primary and Secondary is lost. This option is available only if all the data volumes under the Primary RVG have a DCM Log associated with them. The **Off** option disables Replicator Log Overflow protection. In the case of the Bunker node. Replicator Log protection is set to **Off**, by default. Thus, if the Primary RLINK overflows due to the Bunker RLINK, then this RLINK is detached.

	The **Override** option enables log protection. If the Secondary node is still connected and the Replicator Log is about to overflow then the writes are stalled until a predetermined amount of space, that is, 5% or 20 MB (whichever is lesser) becomes available in the Replicator Log. If the Secondary becomes inactive due to disconnection or administrative action then Replicator Log protection is disabled, and the Replicator Log overflows. The **Fail** option enables log protection. If the log is about to overflow the writes are stalled until a predetermined amount of space, that is, 5% or 20 MB (whichever is lesser) becomes available in the Replicator Log. If the connection between Primary and Secondary RVG is broken, then, any new writes to the Primary RVG are failed.
Primary RLINK Name	This option enables you to specify a Primary RLINK name of your choice. If you do not specify any name then VVR assigns a default name.
Secondary RLINK Name	This option enables you to specify a Secondary RLINK name of your choice. If you do not specify any name then VVR assigns a default name.

- If you want to specify advanced replication settings, click **Advanced**. Edit the replication settings for a secondary host as needed.



Latency protection — Determines the extent of stalling write operations on the primary site to allow the secondary site to "catch up" with the updates before new write operations can occur.

Off is the default option and disables latency protection.

Fail enables latency protection. If the number of outstanding write operations reaches the **High Mark Value** (described below), and the secondary site is connected, VVR stalls the subsequent write operations until the number of outstanding write operations is lowered to the **Low Mark Value** (described below). If the secondary site is disconnected, the subsequent write operations fail.

Override enables latency protection. This option resembles the Off option when the secondary site is disconnected, and the Fail option when the secondary site is connected.

Throttling of write operations affects application performance on the primary site; use this protection only when necessary according to replication throughput and application write patterns.

High Mark Value — Is enabled only when either the Override or Fail latency protection option is selected. This value triggers the stalling of write operations and specifies the maximum number of pending updates on the Replicator Log waiting for replication to the secondary site. The default value is 10000, the maximum number of updates allowed in a Replicator Log.

Low Mark Value	Is enabled only when either the Override or Fail latency protection options is selected. After reaching the High Mark Value, write operations on the Replicator Log are stalled until the number of pending updates drops to an acceptable point at which the secondary site can "catch up" to the activity on the primary site; this acceptable point is determined by the Low Mark Value. The default value is 9950.

Caution: When determining the high mark and low mark values for latency protection, select a range that is sufficient but not too large to prevent long durations of throttling for write operations.

Protocol	UDP/IP is the default protocol for replication.
Packet Size	Updates to the host on the secondary site are sent in packets; the default size 1400 bytes. The option to select the packet size is enabled only when UDP/IP protocol is selected.
Bandwidth	By default, VVR uses the maximum available bandwidth. To control the bandwidth used, specify the bandwidth limit in Mbps.
Enable Compression	Enable this checkbox if you want to enable Compression for the secondary host.

Click **OK** to close the dialog box and then click **Next**.

13 On the **Start Replication** page, choose the appropriate option as follows:

- To add the Secondary and start replication immediately, select **Start Replication** with one of the following options:

Synchronize Automatically	If virtual IPs have been created, select the **Synchronize Automatically** option, which is the default recommended for initial setup to start synchronization of Secondary and start replication immediately. If the virtual IPs for replication are not yet created, automatic synchronization remains paused and resumes after the Replication Service Group is created and brought online. When this option is selected, VVR by default performs intelligent synchronization to replicate only those blocks on a volume that are being used by the file system. If required, you can disable intelligent synchronization. **Note:** Intelligent synchronization is applicable only to volumes with the NTFS file systems and not to raw volumes or volumes with FAT/FAT32 file systems.
Synchronize from Checkpoint	If you want to use this method, then you must first create a checkpoint. If you have considerable amount of data on the Primary data volumes, then you may first want to synchronize the secondary for existing data using the backup-restore method with checkpoint. After the restore is complete, use the Synchronize from Checkpoint option to start replication from checkpoint to synchronize the secondary with the writes that happened when backup-restore was in progress. For information on synchronizing from checkpoints, refer *Veritas Storage Foundation ™ Volume Replicator Administrator's Guide*.

- To add the secondary without starting replication, deselect the **Start Replication** option. You can start replication later by using the **Start Replication** option from the Secondary RVG right-click menu.
- Click **Next** to display the Summary page.

14 Review the information.

Click **Back** to change any information you had specified and click **Finish** to add the secondary host to the RDS and exit the wizard.

Creating the RVG resource

To enable a disaster recovery setup, once VVR is configured you will need to create the Replicated Volume Group (RVG) resource on the primary and secondary sites.

You add the RVG resource to the application resource group. You configure the RVG resource to depend on the VVR IP resource and on the appropriate Volume Manager Disk Group resource.

Since an RVG cannot span disk groups, if you have more than one disk group configured for the application, create a separate RVG resource for each disk group.

To create a Replicated Volume Group (RVG) resource

1. In Failover Cluster Management, expand Services and Applications, right-click the Exchange Virtual Server (EVS) group that you have created and select **Add a resource > More resources > Add Replicated Volume Group**.
   The New Replicated Volume Group appears in the center panel under Disk Drives.
2. Right-click **New Replicated Volume Group** and click **Properties**.
3. On the General tab of the Properties dialog box, in the Resource Name field, type a name for the RVG resource.
4. On the Dependencies tab, add the dependencies for the RVG resource:
   - Click the box **Click here to add a dependency**
   - From the Resource drop-down list, select the network name you created for the RVG. Click **Insert**.
   - Click the box **Click here to add a dependency**
   - From the Resource drop-down list, select the Volume Manager Disk Group resource created for the application disk group. Click **Insert**.
5. On the Properties tab, specify the following:
   - In the rvgName field, type the same name that you assigned the RVG on the General tab.
   - In the dgName field, type the name assigned in the VEA to the application disk group.
6. Click **OK** to close the Properties dialog box.
7. Right-click the RVG resource and click **Bring this resource online**.
8. Repeat the same steps to create the RVG resource at the secondary site.

Setting the Exchange server resource dependency on the RVG resource

The Exchange Server resource was earlier set to depend on a Volume Manager Disk Group resource that corresponded to the disk group created for the application. After you add the RVG resource for that disk group, you must change the dependency. You set the database resource to depend on the RVG resource instead.

You must set the dependency on the RVG resource on both primary and secondary sites.

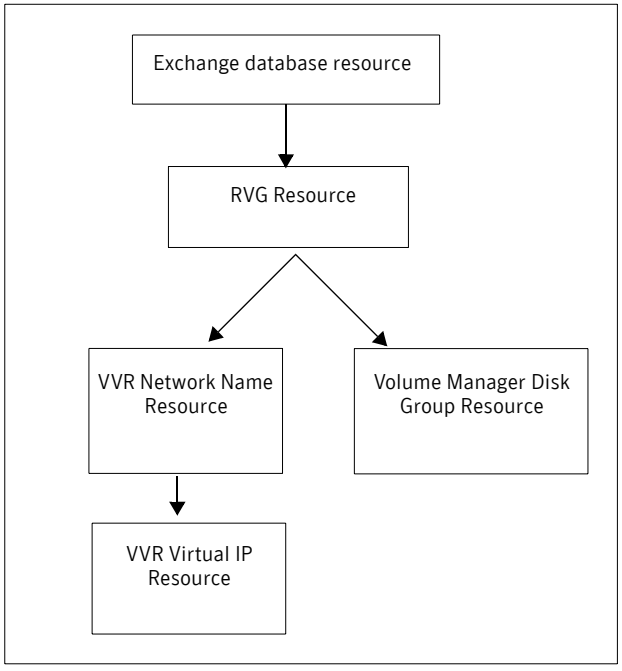
To set the database resource dependency on the RVG resource

1. In Failover Cluster Management, select the Exchange resource group.
2. In the result pane, under Other Resources, right-click the appropriate database resource and select Properties.
3. In the Dependencies tab of the Properties dialog box:
   - Click the box **Click here to add a dependency**.
   - Select the Replicated Volume Group resource from the dropdown list of available resources.
   - Select the Volume Manager Disk Group (VMDG) resource from the dependencies list and click **Delete**.
4. Click **OK** to close the Properties dialog box.
5. Repeat these steps for any additional database resources.

The cluster configuration is now complete. Bring online the entire application group on the primary cluster.

Figure 8-1 indicates the dependencies required.

Figure 8-1 Dependency graph for Exchange Server



Working with the solution: Normal operations and recovery procedures

This section gives considerations for normal VVR operations and also describes the recovery process.

Monitoring the status of the replication

Under normal operating conditions you can monitor the status of the replication using:

- VEA GUI
- Command Line Interface (CLI)
- Performance Monitor (perfmon)
- Alerts

For details, refer to the "Monitoring Replication" Chapter in the *Veritas Volume Replicator Administrator's Guide*.

Performing planned migration

You may want to migrate the application to the Secondary host for maintenance purposes and for testing the readiness of the Secondary host. You may need to perform a generic set of tasks as explained below.

To migrate the application to the Secondary

1. Detach the user database. See the Microsoft documentation for instructions.
   Note that the `master`, `model`, and `tempdb`, databases cannot be detached.
2. Bring the RVG resource offline on both clusters.
3. Transfer the Primary role to the secondary using the **Migrate** option:
   - From the VEA screen, right-click the Primary RVG and select **Migrate.**
   - Select the Secondary host and click **OK.** The replication role is migrated to the Secondary host.
4. Assign drive letters to the volumes on the new Primary. Ensure that these drive letters are the same as that of the original Primary.
5. Bring the RVG resource online on both the clusters.
6. Bring the Exchange group online on the new Primary.
7. Attach the databases. See the Microsoft documentation for instructions.

You can now verify that Exchange runs fine on the new Primary with the replicated data. After verifying, you can revert back the roles to its original state using the same set of tasks described above.

Any changes that you make to the data on the new Primary will get replicated to the original Primary, which is now the Secondary.

Replication recovery procedures

This section provides information on bringing up an Exchange server on the Secondary host, in the event of a disaster. It also explains how to migrate the Primary role back to the original Primary host once it is in a good state after a disaster.

Bringing up Exchange on the secondary host

To recover the Exchange data

1. From the left-pane in the VEA GUI console on the Secondary host, right-click on the desired secondary RVG node inside the replication network.
2. Select **Takeover** and follow the instructions in the wizard to perform the takeover operation. You can choose to perform takeover with the following options:
   - Perform the **Takeover with fast-failback** option to restore the original Primary easily once it becomes available again. When performing Takeover with fast-failback, make sure that you do not select the **Synchronize Automatically** option.
   - Perform the **Takeover without fast-failback** option. In this case, you need to perform a complete synchronization of the original Primary with the new Primary. This may take quite a while depending on the size of the data volume. Only after the synchronization is complete can you migrate the Primary role back to the original Primary.

   After takeover, the existing Secondary becomes the new Primary.
3. Assign drive letters to the volumes on the new Primary. Ensure that these drive letters are the same as that of the original Primary.
4. Bring the Exchange group online.
5. Attach the databases. See the Microsoft documentation for instructions.

Now you can start using Exchange on the new Primary.

Restoring the primary host

After a disaster, if the original Primary becomes available again you may want to revert the role of the Primary back to this host.

To restore the Primary role to the original Primary host

6 Take the RVG resource offline on both the clusters.

7 Depending on whether you performed **Takeover** with or without fast-failback option, do one of the following:

- For Takeover with the Fast-failback option, the original Primary, after it has recovered, will be in the `Acting as Secondary` state. If the original Primary is not in the `Acting as Secondary` state, verify whether your network connection has been restored.
  To synchronize this original Primary and the new Primary, use the **Resynchronize Secondaries** option from the right-click menu of the new Primary.
- For Takeover without the Fast-failback option, after you have performed this operation, you must convert the original Primary to a Secondary using the **Make Secondary** option.

Note: Before performing the **Make Secondary** operation, the original Primary's RVG and the new Primary's RVG will be shown in separate RDSs. However, after this operation they will be merged under a single RDS.

After the **Make Secondary** operation, the original Primary will be converted to a secondary. Right-click this secondary RVG and select **Start Replication** with **Synchronize Automatically** option.

8 After the sychronization is complete, perform a migrate operation to transfer the Primary role back to the original Primary. To do this, right-click the Primary RVG and select **Migrate** from the menu.

9 Ensure that the volumes have retained the same drive letters that existed before the disaster.

10 Bring the RVG resource online on the Secondary.

11 Bring the Exchange group online on the original Primary.

12 Attach the databases on the original Primary. See the Microsoft documentation for instructions.

Index

S

V