Veritas Storage Foundation™ and High Availability Solutions Microsoft Clustering Solutions Guide for Microsoft SQL 2008

Windows Server 2003
Windows Server 2008

5.1 Service Pack 1

Veritas Storage Foundation and HA Solutions Microsoft Clustering Solutions Guide for Microsoft SQL 2008

Product version: 5.1. Service Pack 1

Document version: 5.1.SP1.0

Legal Notice

Symantec Corporation
350 Ellis Street
Mountain View, CA 94043
http://www.symantec.com

Technical Support

Symantec Technical Support maintains support centers globally. Technical Support's primary role is to respond to specific queries about product features and functionality. The Technical Support group also creates content for our online Knowledge Base. The Technical Support group works collaboratively with the other functional areas within Symantec to answer your questions in a timely fashion. For example, the Technical Support group works with Product Engineering and Symantec Security Response to provide alerting services and virus definition updates.

Symantec's maintenance offerings include the following:

- A range of support options that give you the flexibility to select the right amount of service for any size organization
- Telephone and Web-based support that provides rapid response and up-to-the-minute information
- Upgrade assurance that delivers automatic software upgrade protection
- Global support that is available 24 hours a day, 7 days a week
- Advanced features, including Account Management Services

For information about Symantec's Maintenance Programs, you can visit our Web site at the following URL:

http://www.symantec.com/business/support/index.jsp

Contacting Technical Support

Customers with a current maintenance agreement may access Technical Support information at the following URL:

http://www.symantec.com/business/support/contact_techsupp_static.jsp

Before contacting Technical Support, make sure you have satisfied the system requirements that are listed in your product documentation. Also, you should be at the computer on which the problem occurred, in case it is necessary to replicate the problem.

When you contact Technical Support, please have the following information available:

- Product release level
- Hardware information
- Available memory, disk space, and NIC information
- Operating system
- Version and patch level
- Network topology
- Router, gateway, and IP address information
- Problem description:

- Error messages and log files
- Troubleshooting that was performed before contacting Symantec
- Recent software configuration changes and network changes

Licensing and registration

If your Symantec product requires registration or a license key, access our technical support Web page at the following URL:

http://customercare.symantec.com

Customer service

Customer service information is available at the following URL:

http://customercare.symantec.com

Customer Service is available to assist with the following types of issues:

- Questions regarding product licensing or serialization
- Product registration updates, such as address or name changes
- General product information (features, language availability, local dealers)
- Latest information about product updates and upgrades
- Information about upgrade assurance and maintenance contracts
- Information about the Symantec Buying Programs
- Advice about Symantec's technical support options
- Nontechnical presales questions
- Issues that are related to CD-ROMs or manuals

Maintenance agreement resources

If you want to contact Symantec regarding an existing maintenance agreement, please contact the maintenance agreement administration team for your region as follows:

Asia-Pacific and Japan	customercare_apac@symantec.com
Europe, Middle-East, and Africa	semea@symantec.com
North America and Latin America	supportsolutions@symantec.com

Additional enterprise services

Symantec offers a comprehensive set of services that allow you to maximize your investment in Symantec products and to develop your knowledge, expertise, and global insight, which enable you to manage your business risks proactively.

Enterprise services that are available include the following:

Symantec Early Warning Solutions	These solutions provide early warning of cyber attacks, comprehensive threat analysis, and countermeasures to prevent attacks before they occur.
Managed Security Services	These services remove the burden of managing and monitoring security devices and events, ensuring rapid response to real threats.
Consulting Services	Symantec Consulting Services provide on-site technical expertise from Symantec and its trusted partners. Symantec Consulting Services offer a variety of prepackaged and customizable options that include assessment, design, implementation, monitoring, and management capabilities. Each is focused on establishing and maintaining the integrity and availability of your IT resources.
Educational Services	Educational Services provide a full array of technical training, security education, security certification, and awareness communication programs.

To access more information about Enterprise services, please visit our Web site at the following URL:

www.symantec.com

Select your country or language from the site index.

Contents

Chapter 4 Installing SFW with Microsoft clustering

Chapter 5 Configuring SFW storage

Chapter 6 Implementing a dynamic mirrored quorum resource

Chapter 7 Installing SQL Server 2008 and configuring resources

Chapter 8 Configuring disaster recovery for SQL Server 2008

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*.

About the solutions guides

The *Veritas Storage Foundation and High Availability Solutions Microsoft Clustering Solutions Guide for Microsoft SQL 2008* contains the following solutions using Microsoft clustering with Veritas Storage Foundation for Windows:

- High availability (HA)
- Campus clusters
- Disaster recovery (DR) with Veritas Volume Replicator

For SFW HA clustering solutions using Veritas Cluster Server, see *Veritas Storage Foundation and High Availability Solutions HA and Disaster Recovery Solutions Guide for Microsoft SQL 2008.*

For Quick Recovery solutions, see *Veritas Storage Foundation and High Availability Solutions Quick Recovery Solutions Guide for Microsoft SQL 2008.*

Separate guides are available for Microsoft Exchange and additional application solutions.

How this guide is organized

This guide is organized to follow the workflow for deployment. Locate the workflow table for the solution you want to deploy. Then follow the steps of the workflow in sequence. The chapters of the book are arranged in the sequence of the workflow.

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.

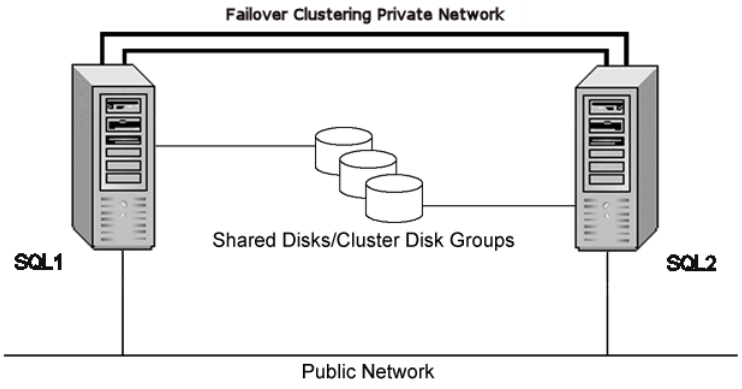
A cluster is a group of independent computers working together as a single system to ensure that mission-critical applications and resources are highly available. The cluster is managed as a single system, shares a common namespace, and is specifically designed to tolerate component failures and to support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

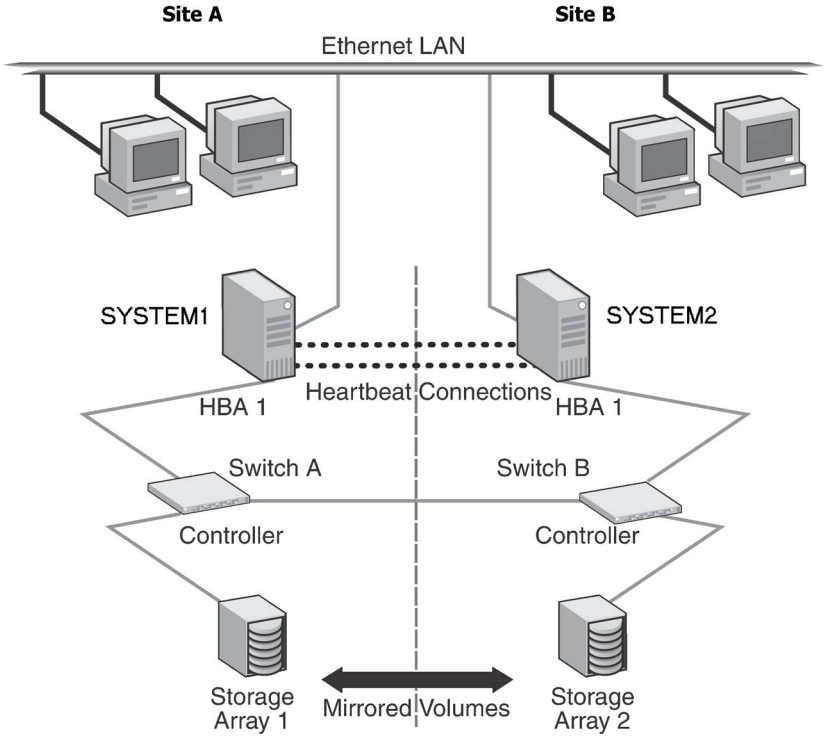
Typical campus clusters involve two sites; you can use more than two sites for additional redundancy.

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.

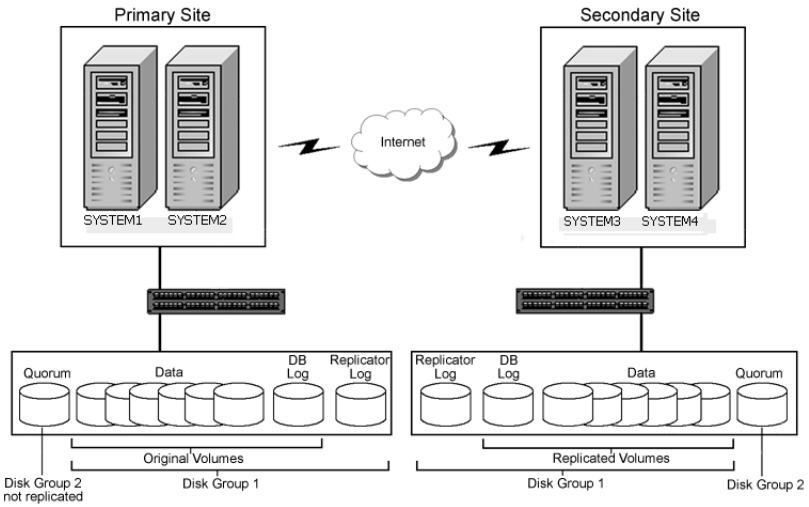
Using VVR with Microsoft clustering provides a replicated backup of your application data, which can be used for recovery after an outage or disaster. However, this solution does not provide the automated failover capability for disaster recovery that can be achieved using VVR with Veritas Cluster Server (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 the Microsoft SQL Server on SYSTEM1 fails, SQL Server 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 SQL services to clients.

Figure 1-3 shows a typical SFW VVR configuration with Microsoft clustering.

Figure 1-3 SFW-Microsoft clustering-VVR configuration



Chapter 2

Workflows for deploying SQL 2008 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 SQL Server 2008 in a Microsoft cluster for high availability on a single site.

This process applies on either Windows Server 2003 or Windows Server 2008.

Table 2-1 show the process for deploying SQL Server 2008 with SFW in a Microsoft high-availability cluster.

Table 2-1 Process for deploying SQL Server 2008 with SFW in a Microsoft high-availability cluster

Action	Description
Verify hardware and software prerequisites	See "Requirements for deploying SQL Server 2008 with SFW in a Microsoft cluster" on page 30.
Understand the configuration	See "Planning your high availability configuration" on page 33.
Configure the storage hardware and network	■ Set up the storage hardware for a cluster environment. ■ Verify the DNS entries for the systems on which SQL will be installed. See "Configuring the storage hardware and network" on page 48.
Establish a Microsoft cluster	Refer to Microsoft documentation for details on this task. **Note:** On Windows Server 2008, 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.

Table 2-1 Process for deploying SQL Server 2008 with SFW in a Microsoft high-availability cluster (Continued)

Action	Description
Install SFW with the MSCS/Failover cluster option	Perform a rolling installation. See "Installing SFW with MSCS/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 MSCS/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. For details on the installation process, see the *SFW HA Solutions Installation and Upgrade Guide*.
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. ■ Understand how to deport and import disk groups and volumes to cluster nodes. See "Managing disk group and volumes" on page 67.
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 71.
Create the SQL virtual server resource group	■ Create a SQL Server resource group in the cluster. ■ Add the VMDG disk group resource(s). See "Creating the resource group for the SQL Server instance" on page 78.

Table 2-1 Process for deploying SQL Server 2008 with SFW in a Microsoft high-availability cluster (Continued)

Action	Description
Create the MSDTC resource (Windows Server 2003)	This procedure is required for multiple instances of SQL Server on Windows Server 2003. See "Creating the MSDTC resource (Windows Server 2003)" on page 79.
Install SQL Server 2008	■ Mount the disk group and volumes created for the data files on the node where you install. See "Managing disk group and volumes" on page 67. ■ Install the software. Ensure that you install the data files to the path of the dynamic volume on shared storage. See "Installing SQL Server 2008" on page 82. ■ Verify the resource dependencies. See "Dependency graph for SQL Server 2008" on page 84.
Verify the cluster configuration	Move the online SQL Server cluster group to the second node and back to the first node. See "Verifying the SQL Server group in the Microsoft cluster" on page 85.

Workflow for a campus cluster configuration

You can install and configure Storage Foundation for Windows (SFW) and SQL Server 2008 in a Microsoft campus cluster.

This process applies on either Windows Server 2003 or Windows Server 2008.

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.

Table 2-2 shows the process for deploying SQL Server 2008 with SFW in a Microsoft campus cluster.

Table 2-2 Process for deploying SQL Server 2008 with SFW in a Microsoft campus cluster

Action	Description
Verify hardware and software prerequisites	See "Planning your campus cluster configuration" on page 36.
Understand the configuration	See "Planning your campus cluster configuration" on page 36.
Configure the storage hardware and network	■ Set up the storage hardware for a cluster environment. ■ Verify the DNS entries for the systems on which SQL will be installed. See "Configuring the storage hardware and network" on page 48.
Establish a Microsoft cluster	Refer to Microsoft documentation for details on this task. Connect the two campus cluster nodes after setting up the Microsoft cluster. See "Campus cluster: Connecting the two nodes" on page 50.
Install SFW with the MSCS/Failover cluster option	Perform a rolling installation. See "Installing SFW with MSCS/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 MSCS/Failover cluster. ■ Verify that the Veritas Storage Foundation for Windows (Client Components) check box is checked, to install the client component. For details on the installation process, see the *SFW HA Solutions Installation and Upgrade Guide*.

Table 2-2 Process for deploying SQL Server 2008 with SFW in a Microsoft campus 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. 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 58. ■ Understand how to deport and import disk groups and volumes to cluster nodes. See "Managing disk group and volumes" on page 67.
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 71.
Create the SQL virtual server group	■ Create a SQL Server cluster group. ■ Add the VMDG disk group resource(s). See "Creating the resource group for the SQL Server instance" on page 78.
Create the MSDTC resource (Windows Server 2003)	This procedure is required for multiple instances of SQL Server on Windows Server 2003. See "Creating the MSDTC resource (Windows Server 2003)" on page 79.

Table 2-2 Process for deploying SQL Server 2008 with SFW in a Microsoft campus cluster (Continued)

Action	Description
Install SQL Server 2008	■ Mount the disk group and volumes created for the data files on the node where you install. See "Managing disk group and volumes" on page 67. ■ Install the software. Ensure that you install the data files to the path of the dynamic volume on shared storage. See "Installing SQL Server 2008" on page 82. ■ Verify the resource dependencies. See "Dependency graph for SQL Server 2008" on page 84.
Verify the cluster configuration	Move the online SQL Server cluster group to the second node and back to the first node. See "Verifying the SQL Server group in the Microsoft cluster" on page 85.

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 SQL Server 2008 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 SQL Server 2008 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 18. 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.

Table 2-3 Process for deploying SQL Server 2008 with SFW and VVR for disaster recovery in a Microsoft cluster

Action	Description
Review the prerequisites and planning information	Verify the prerequisites on the secondary site. See "Requirements for deploying SQL Server 2008 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 43.
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 SQL Server resource group, and SQL Server installation. See "Creating a parallel environment on the secondary site" on page 90.
Configure the storage hardware and network	■ Set up the storage hardware for a cluster environment. ■ Verify the DNS entries for the systems on which SQL will be installed. See "Configuring the storage hardware and network" on page 48.
Establish a Microsoft cluster	Refer to Microsoft documentation for details on this task. **Note:** On Windows Server 2008, 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.

Table 2-3 Process for deploying SQL Server 2008 with SFW and VVR for disaster recovery in a Microsoft cluster

Action	Description
Install SFW with the MSCS/Failover cluster option	Perform a rolling installation. See "Installing SFW with MSCS/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 MSCS/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. For details on the installation process, see the *SFW HA Solutions Installation and Upgrade Guide*.
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. ■ Understand how to deport and import disk groups and volumes to cluster nodes. See "Managing disk group and volumes" on page 67.
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 71.

Table 2-3 Process for deploying SQL Server 2008 with SFW and VVR for disaster recovery in a Microsoft cluster

Action	Description
Create the SQL virtual server group	■ Create a SQL Server cluster group. Ensure that it has the same name as on the primary site. ■ Add the VMDG disk group resource(s). See "Creating the resource group for the SQL Server instance" on page 78.
Create the MSDTC resource (Windows Server 2003)	This procedure is required for multiple instances of SQL Server on Windows Server 2003. See "Creating the MSDTC resource (Windows Server 2003)" on page 79.
Install SQL Server 2008	Before starting the SQL installation on the secondary site, note the following requirements: ■ Make sure that you take the SQL Server Network Name resource offline on the primary site. This will also offline the dependent resources. ■ Mount the disk group and volumes created for the data files on the node where you install. ■ During installation, specify the same name for the SQL virtual server as that on the primary site. ■ Ensure that you install the data files to the path of the dynamic volume on shared storage. See "Installing SQL Server 2008" on page 82.
Verify the cluster configuration	Move the online SQL Server cluster group to the second node and back to the first node. See "Verifying the SQL Server group in the Microsoft cluster" on page 85.
Understand the VVR components	See "VVR components overview" on page 91.
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 92.
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.

Table 2-3 Process for deploying SQL Server 2008 with SFW and VVR for disaster recovery in a Microsoft cluster

Action	Description
Set up an RDS	Create a replicated data set (RDS) using the VVR wizard. See "Configuring VVR: Setting up an RDS" on page 98.
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 110.
Set up the SQL Server resource dependencies	Change the SQL Server resource properties so that it depends on the RVG resource instead of the Volume Manager Disk Group resource. See "Setting the SQL server resource dependency on the RVG resource" on page 112.

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 SQL Server.
3. Click to expand the appropriate Microsoft Campus Cluster workflow, depending on whether you are deploying on Windows Server 2003 or Windows Server 2008.

   You can now begin the workflow.

Chapter 3

Planning for deploying SQL 2008 with SFW in a Microsoft cluster

This chapter covers the following topics:

Requirements for deploying SQL Server 2008 with SFW in a Microsoft cluster

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

Supported software for Microsoft clustering and SFW

For the latest information on supported software for SFW, see the Software Compatibility list at:

http://www.symantec.com/business/support/index.jsp

The following SFW software is required for deploying SQL Server 2008 with SFW in a Microsoft cluster:

- Veritas Storage Foundation 5.1 Service Pack 1 for Windows (SFW)
  Include the following option during installation:
  - Cluster Option for Microsoft Cluster Service (MSCS)/Failover Cluster

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

Table 3-1 lists the Microsoft SQL Server 2008 versions supported with SFW HA 5.1 Service Pack 1.

Table 3-1 Supported Microsoft SQL Server 2008 versions

SQL Server 2008	Windows Servers
Microsoft SQL Server 2008, 32-bit Standard Edition, Enterprise Edition, or Web Edition on Windows Server 2003 (SQL Server 2008 SP1)	■ Windows Server 2003 (32-bit) Standard Edition, Enterprise Edition or Datacenter Edition (SP2 required) ■ Windows Server 2003 R2 (32-bit) Standard Edition, Enterprise Edition, or Datacenter Edition (SP2 required) ■ Windows Server 2003 for Itanium-based Systems Enterprise Edition or Datacenter Edition (SP2 required for both) ■ Windows Server 2003 Standard x64 Edition, Enterprise x64 Edition, or Datacenter x64 Edition (SP2 required) ■ Windows Server 2003 x64 Editions (for AMD64 or Intel EM64T): Standard x64 R2 Edition, Enterprise x64 R2 Edition, or Datacenter x64 R2 Edition (SP2 required)

Table 3-1 Supported Microsoft SQL Server 2008 versions

SQL Server 2008	Windows Servers
Microsoft SQL Server 2008, 64-bit Standard Edition, Enterprise Edition, Enterprise IA64 Edition, Web Edition on Windows Server 2003 (SQL Server 2008 SP1)	■ Windows Server 2003 (64-bit) Standard x64 Edition, Enterprise x64 Edition or Datacenter x64 Edition (SP2 required) ■ Windows Server 2003 x64 Editions (for AMD64 or Intel EM64T): Standard x64 R2 Edition, Enterprise x64 R2 Edition, or Datacenter x64 R2 Edition (SP2 required) ■ Windows Server 2003 (64-bit) for Itanium-based systems Enterprise Edition or Datacenter Edition (SP2 required for both)
Microsoft SQL Server 2008, 32-bit Standard Edition, Enterprise Edition, or Web Edition on Windows Server 2008 (SQL Server 2008 SP1)	■ Windows Server 2008 (32-bit) Standard Edition, Enterprise Edition, Datacenter Edition, or Web Edition ■ Windows Server 2008 x64 R2 without Hyper-V on Standard, Enterprise, Datacenter Editions ■ Windows Server 2008 x64 R2 on Standard, Enterprise, Datacenter Editions (for physical host or guest, not parent partition/Hyper-V integration) ■ Windows Server 2008 R2 for IA Systems - IA64 ■ Windows Server 2008 x64 R2 Web Edition ■ Windows Server 2008 on all current editions and architectures Symantec currently supports (SP2 required) ■ Windows Storage Server 2008
Microsoft SQL Server 2008, 64-bit Standard Edition, Enterprise Edition, Enterprise IA64 Edition, Web Edition on Windows Server 2008 (SQL Server 2008 SP1)	■ Windows Server 2008 x64 Editions (for AMD64 or Intel EM64T): Standard x64 Edition, Enterprise x64 Edition, or Datacenter x64 Edition ■ Windows Server 2008 64-bit Itanium (IA64) ■ Windows Server 2008 x64 R2 without Hyper-V on Standard, Enterprise, Datacenter Editions ■ Windows Server 2008 x64 R2 on Standard, Enterprise, Datacenter Editions (for physical host or guest, not parent partition/Hyper-V integration) ■ Windows Server 2008 R2 for IA Systems - IA64 ■ Windows Server 2008 x64 R2 Web Edition ■ Windows Server 2008 on all current editions and architectures Symantec currently supports (SP2 required) ■ Windows Storage Server 2008

Disk space requirements

For normal operation, all installations require an additional 50 MB of disk space.

The following table summarizes disk space requirements for SFW.

Table 3-2 Disk space requirements

Installation options	Install directory/drive
SFW + all options + client components	1210 MB
SFW + all options	950 MB
Client components	354 MB

System requirements

Refer to Microsoft documentation for Microsoft cluster requirements. Use the following system requirements as a guideline for SFW with SQL Server 2008 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.
- Each system requires a minimum of 512 MB of RAM for SQL Server 2008; refer to the 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. (DHCP is not supported with Windows Server 2003.) 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 SQL Server documentation for instructions on creating a reverse lookup zone.

- Microsoft clustering requires at least two disks for SQL: one for SQL database files and one for SQL log files. If FILESTREAM is implemented, a separate disk is recommended for the FILESTREAM filegroup. A separate disk is recommended for the cluster quorum.
- 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.

Note: Refer to the Hardware Compatibility List on the Symantec Support web site at http://www.symantec.com/business/support/index.jsp to determine the approved hardware for SFW.

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 MSCS/Failover Cluster option" on page 51.

Note: You can install the SFW option for MSCS/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*.

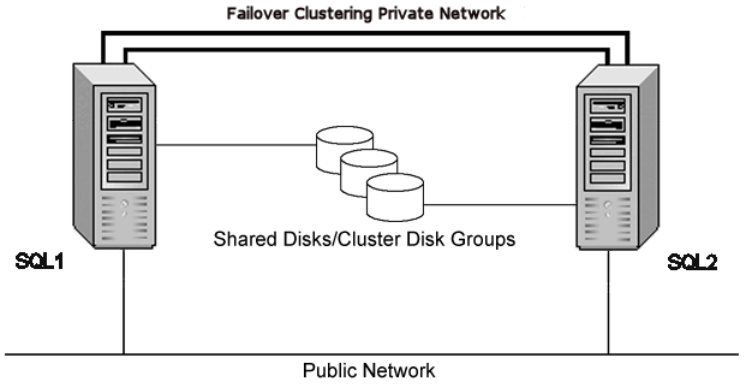
Planning your high availability configuration

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

In the example high availability configuration, you create a virtual server in an active/passive SQL Server configuration on a Microsoft cluster. The active node of the cluster hosts the virtual server. The second node is a dedicated redundant server able to take over and host the virtual server in the event of a failure on the active node. In a high availability configuration both nodes are located on the same site.

Figure 3-1 illustrates a typical two-node active/passive configuration.

Figure 3-1 High availability active/passive configuration



Some key points about the configuration:

- The SQL virtual server is configured on the active node (SQL1). If SQL1 fails, SQL2 becomes the active node and the SQL virtual server comes online on SQL2.
- One or more application virtual 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 SQL databases are configured on the shared storage on volumes contained in one or more cluster disk groups.
- 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.
- SFW enables you to add fault-tolerance to data volumes. Symantec recommends mirroring log volumes and a mirrored striped RAID layout for data volumes.

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

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

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

Sample high availability configuration for SQL Server with SFW

The example configuration includes the dynamic mirrored quorum and requires setting up two or more dynamic cluster disk groups in SFW—one or more cluster disk groups for the application and data and one for the dynamic mirrored quorum.

The following names describe the objects created and used during the installation and configuration.

Name	Object
SYSTEM1 & SYSTEM2	server names
SQL_GROUP	Microsoft SQL Server resource group
SQLCLUST	Microsoft cluster for SQL Server high availability
SQLVS	Microsoft SQL Server virtual server
INST1	Microsoft SQL Server instance name
INST1_DG	disk group for Microsoft SQL Server volumes
INST1_DATA_FILES	volume for Microsoft SQL Server system data files
INST1_DB1_VOL	volume for storing a Microsoft SQL Server user-defined database
INST1_DB1_LOG	volume for storing a Microsoft SQL Server user-defined database log file
INST1_DB1_FS	volume for storing FILESTREAM filegroups (if FILESTREAM is implemented)
QUORUM_DG	disk group for quorum volume
SQLVS_QRM	volume for storing the Microsoft cluster quorum

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

Configuring the quorum device for high availability

Either a single basic disk used as a physical disk resource or a volume located on a three-disk SFW cluster disk group can serve as the Microsoft clustering quorum device.

In general, a disk group containing a dedicated, three-way mirrored volume makes an ideal quorum device.

In Microsoft clustering environments, the proper configuration of a quorum device is critical to providing the highest availability with SFW storage.

Using a single disk as the quorum device introduces a nonredundant component into an otherwise highly available system. A failure-tolerant volume used as a quorum device provides a level of availability that is consistent with that of the rest of the cluster.

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.

A disk group containing only a 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.

Planning your campus cluster configuration

You can configure Storage Foundation for Windows (SFW) and SQL Server 2008 in a Microsoft campus cluster.

This configuration example 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.

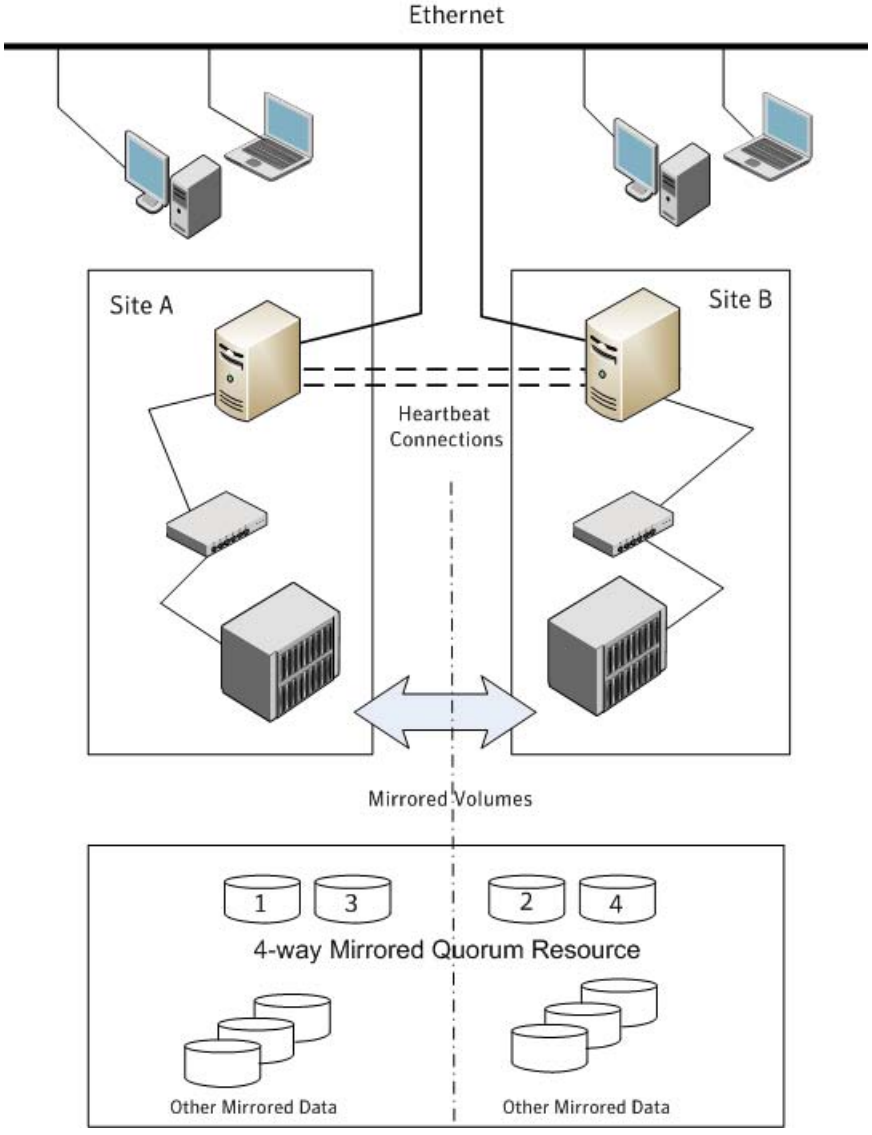
For more information on disk group and volume configuration, see “Planning for SFW cluster disk groups and volumes” on page 54.

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 42.

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

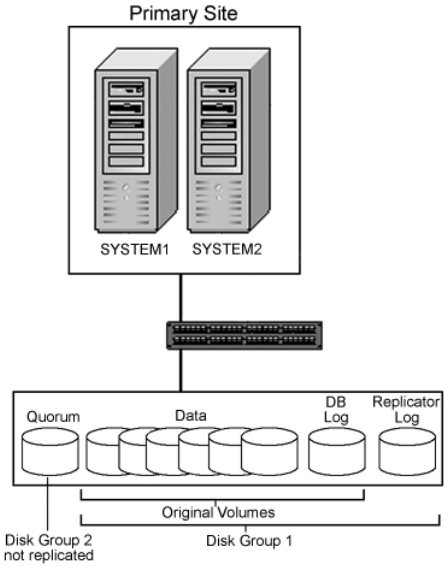
After creating a high-availability cluster on a primary site, you can configure Storage Foundation for Windows (SFW) and SQL Server 2008 on a secondary site cluster for disaster recovery.

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

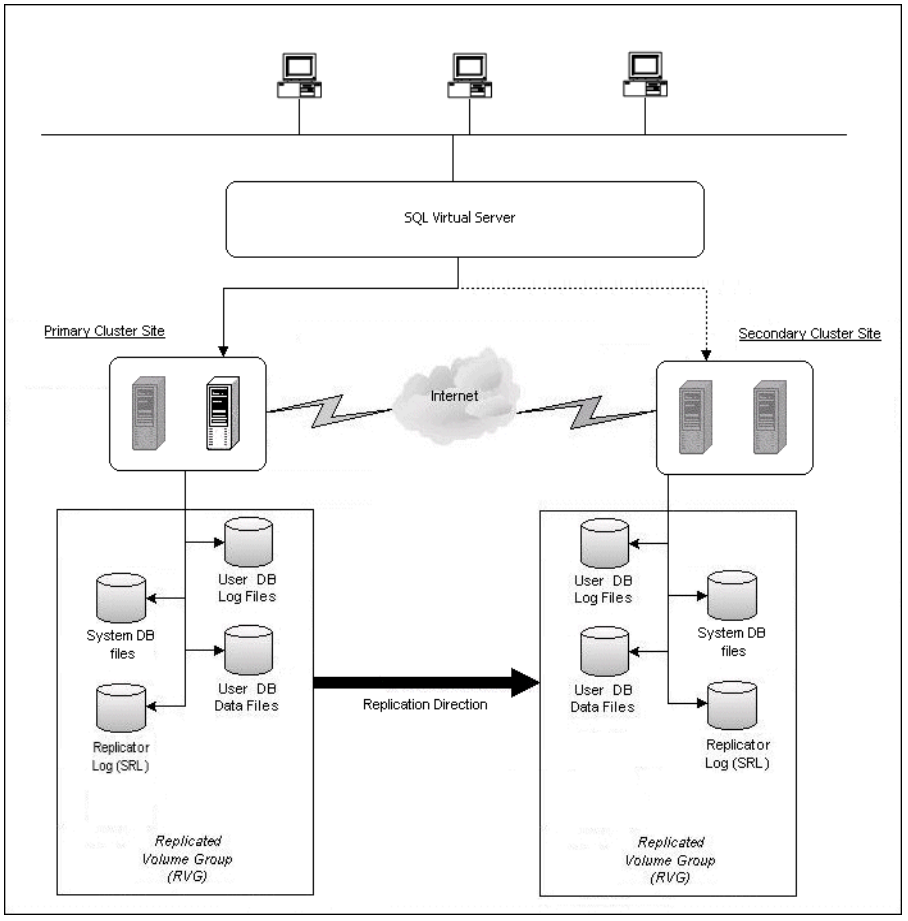


The quorum disk group is created separately on each site; it does not get replicated because each cluster has its own quorum.

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

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

Figure 3-4 Typical VVR RVG configuration



Sample disaster recovery configuration for SQL Server with SFW and VVR

The sample setup has four servers, two for the primary site and two for the secondary site. The nodes will form two separate clusters, one at the primary site and one at the secondary site.

The following names describe the objects created and used when configuring two sites for disaster recovery with Veritas Storage Foundation for Windows and Veritas Volume Replicator on a Microsoft cluster.

Primary Site

SYSTEM1 & SYSTEM2	server names
SQL_GROUP	Microsoft SQL Server virtual server group
SQLCLUST	Microsoft cluster
SQLVS	Microsoft SQL Server virtual server
SQL_IP	Microsoft SQL virtual server IP address resource
INST1	Microsoft SQL Server instance name
INST1_DG	disk group for Microsoft SQL volumes
INST1_DATA_FILES	volume for Microsoft SQL Server system data files
INST1_DB1_VOL	volume for storing a Microsoft SQL Server user-defined database
INST1_DB1_LOG	volume for storing a Microsoft SQL Server user-defined database log file
INST1_DB1_FS	volume for storing FILESTREAM filegroups (if FILESTREAM is implemented)
QUORUM_DG	quorum volume disk group for mirroring the quorum
SQLVS_QRM	volume for storing the Microsoft cluster quorum

Secondary Site

SYSTEM3 & SYSTEM4	first and second nodes of the secondary site

All the other parameters are the same as on the primary site.

DR Components

INST1_RDS	VVR Replicated Data Set (RDS) name
INST1_RVG	VVR Replicated Volume Group (RVG) name
INST1_REPLOG	VVR Replicator log volume
INST1_RVG_RES	Replicated Volume Group Resource name
VVR_IP	SQL RVG IP address resource

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 SQL will be installed. See "Configuring the storage hardware and network" on page 48.
Establish a Microsoft cluster	Establish the cluster before installing SFW. Refer to Microsoft documentation for details on this task.

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

Action	Description
For a campus cluster, connect the two nodes	For a campus cluster, connect the two nodes after setting up the cluster. See "Campus cluster: Connecting the two nodes" on page 50.
Install SFW with the MSCS/Failover cluster option	Perform a rolling installation. See "Installing SFW with MSCS/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 MSCS/Failover 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. For details on the installation process, see the *SFW HA Solutions Installation and Upgrade Guide*.

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.

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 MSCS/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.

Refer to the Microsoft documentation for information on configuring a Microsoft cluster.

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 Cluster Service (MSCS)/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 58. 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.
Configure volumes	Use the VEA console to create volumes. See "Creating dynamic volumes" on page 63.
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 67.

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
- 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 58
- "Considerations when creating volumes for a DR configuration using VVR replication" on page 59

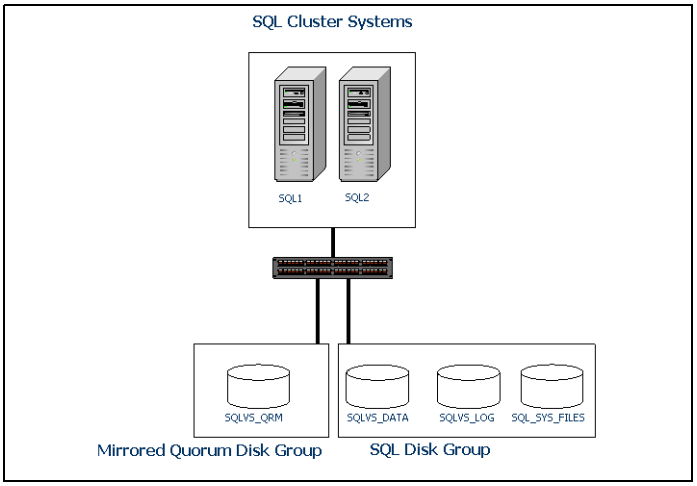
Sample high-availability cluster storage configuration

The number of disk groups for SQL Server depends on the planned organization of the data. The application program files need to be installed on the local drive of the server. Data files and other related files, such as logs, or FILESTREAM filegroups (if implemented), are placed on the shared storage in a cluster disk group. Symantec recommends that you place database files, log files, and FILESTREAM filegroups on separate volumes.

You create at least one disk group for the system data files. You may want to create additional disk groups for user databases.

Figure 5-1 shows an example configuration of the disk groups and volumes for SQL Server in a Microsoft cluster environment.

Figure 5-1 SFW disk groups and volumes for SQL virtual server SQLVS in a Microsoft high-availability cluster



SQL disk group SQLVS contains three volumes:

- SQLVS_Data contains the SQL database. Each database typically resides on a separate volume.
- SQLVS_LOG contains the transaction log.
- SQL_SYS_FILES contains the volume for Microsoft SQL Server system data files.

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

Note: If FILESTREAM is implemented, the configuration should also contain a separate volume for the FILESTREAM filegroup.

Sample campus cluster storage configuration

For the Microsoft SQL Server application data files, you could create a separate disk group for each database. Symantec recommends that you place database files, log files, and (if implemented) FILESTREAM filegroups on separate volumes.

SQL disk group SQLVS contains three volumes:

- SQLVS_Data contains the SQL database. Each database typically resides on a separate volume.

- SQLVS_LOG contains the transaction log.
- SQL_SYS_FILES contains the volume for Microsoft SQL Server system data files.

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

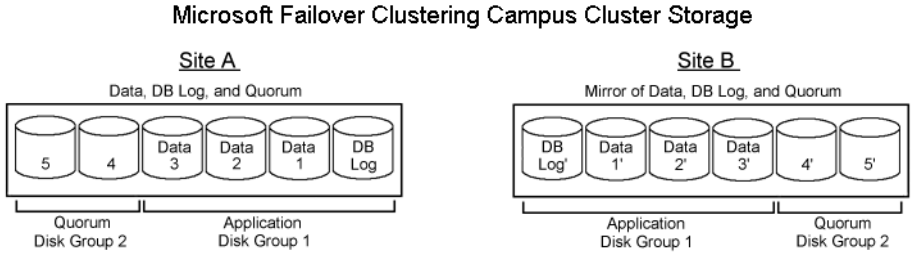
Note: If FILESTREAM is implemented, the configuration should also contain a separate volume for the FILESTREAM filegroup.

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.

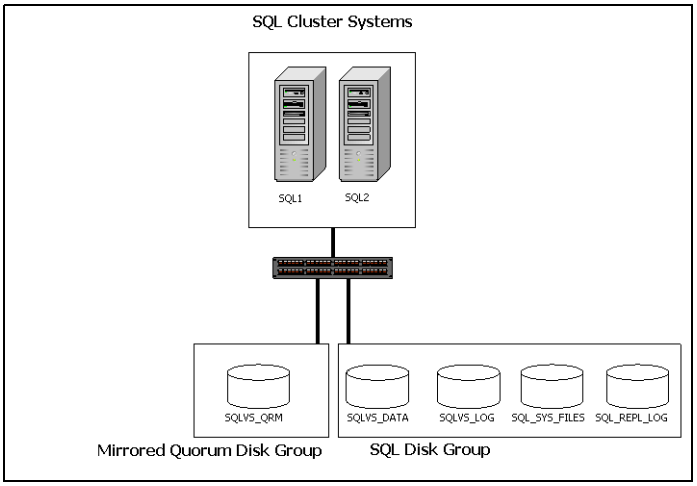
Figure 5-2 SFW disk groups and volumes for in a Microsoft campus cluster



Sample disaster recovery storage configuration

Figure 5-3 shows an example configuration of the disk groups and volumes for SQL Server on the primary site of a Microsoft cluster disaster recovery configuration.

Figure 5-3 SFW disk groups and volumes for SQL virtual server In a Microsoft disaster recover configuration



SQL disk group SQLVS contains at least four volumes:

- SQLVS_Data contains the SQL database. Each database typically resides on a separate volume.
- SQLVS_LOG contains the transaction log.
- SQL_SYS_FILES contains the volume for Microsoft SQL Server system data files.
- SQL_REPL_LOG contains the replicator log for VVR.

Note: If FILESTREAM is implemented, the configuration should also contain a separate volume for the FILESTREAM filegroup.

Warning: When configuring the disk groups and volumes on the secondary site, be sure to use the same disk group and volume names as on the primary site.

Considerations when creating disk groups and volumes for a campus cluster

In a campus cluster configuration, review the following considerations before creating disk groups and volumes.

- Ensure that each disk group contains an equal number of disks on each site, and that each volume is 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.
- While creating the dynamic disk groups and volumes at Site A, note carefully which disks and volumes are allocated. These will later become the Site A plexes for the mirrors.
- When you create a volume, you must select the "mirrored across enclosures" option.
- Selecting "stripe across enclosures" is not recommended because then you need four enclosures, instead of two.
- Choosing "Mirrored" and the "mirrored across" option without having two enclosures that meet requirements causes new volume creation to fail.
- Logging can slow performance.
- Symantec recommends using either simple mirrored (concatenated) or striped mirrored 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.
- You cannot select RAID-5 for mirroring.

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:

- Replicating the system databases is not required or recommended. Make sure that the system databases are not placed on volumes that will be replicated.
- 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.

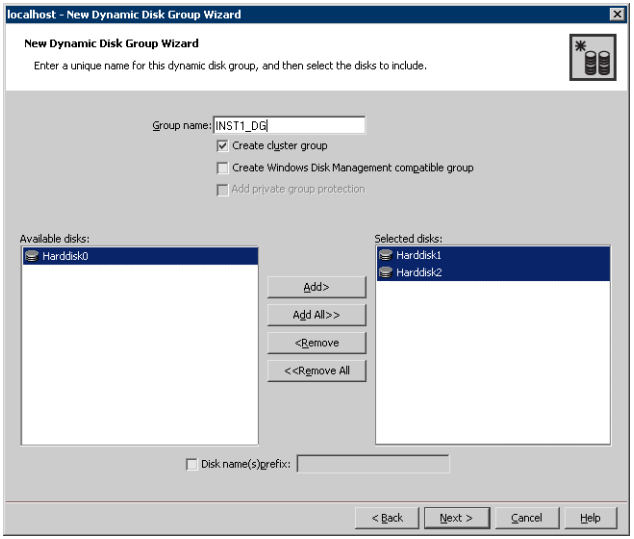
Note: On Windows Server 2008, setting up a Microsoft failover cluster creates physical disk resources for all the basic disks on the shared bus. To use these disks when you create your SFW cluster disk groups, you must first remove the physical disk resources from the cluster. Otherwise, a reservation 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.

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.



- In the **Group name** field, enter a name for the disk group (for example**,** INST1_DG) .
- Click the checkbox for **Create cluster group**.
- 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 2003, Windows Disk Management Compatible Dynamic Disk Group creates a disk group that is compatible with the disk groups created with Windows Disk Management and with earlier versions of Volume Manager for Windows products.

- Click **Next**.

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

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

Creating dynamic volumes

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

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

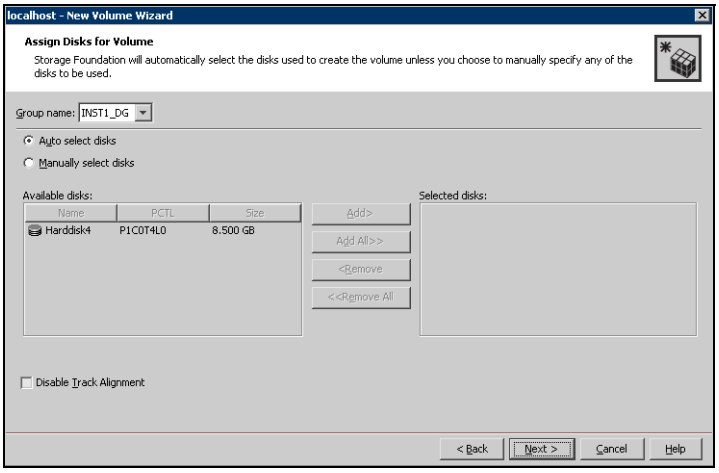
- "Considerations when creating disk groups and volumes for a campus cluster" on page 58
- "Considerations when creating volumes for a DR configuration using VVR replication" on page 59

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

To create dynamic volumes

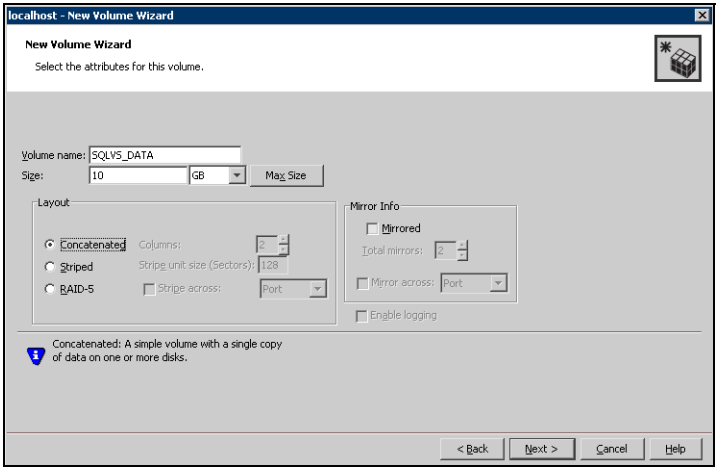
1. If the VEA console is not already open, click **Start > All Programs > Symantec > Veritas Storage Foundation > Veritas Enterprise Administrator** and select a profile if prompted.
2. Click **Connect to a Host or Domain**.
3. In the Connect dialog box select the host name from the pull-down menu and 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 INST1_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.



- Automatic disk selection is the default setting and 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.
- To manually select the disks, click the **Manually select disks** radio button and use the **Add** and **Remove** buttons to move the appropriate disks to the “Selected disks” list.
- 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**.

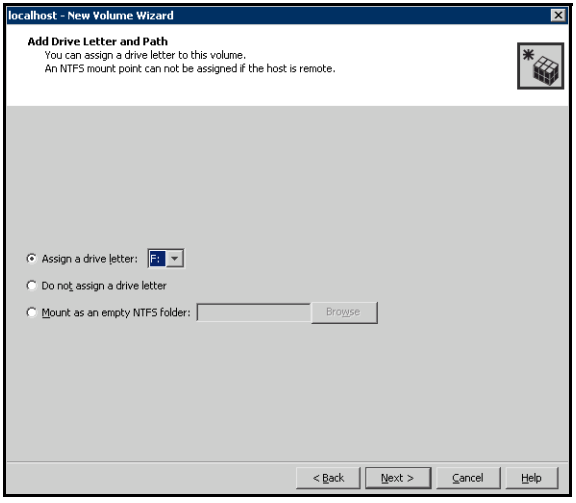
7 Specify the parameters of the volume.



- 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.
  For campus clusters, 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.
  For campus clusters, if you select Striped, click the **Stripe across** checkbox and select **Ports** from the drop-down list.
- To select mirrored striped, click both the **Mirrored** checkbox and the **Striped** radio button.
  For campus clusters, you select the **Mirrored** checkbox for either layout type.
- In the Mirror Info area, select the appropriate mirroring options.
  For campus clusters, in the **Mirror Info** area, after selecting the **Mirrored** checkbox, click **Mirror across** and select **Enclosures** from the drop-down list.
- Verify that **Enable logging** is not selected.
- Click **Next**.

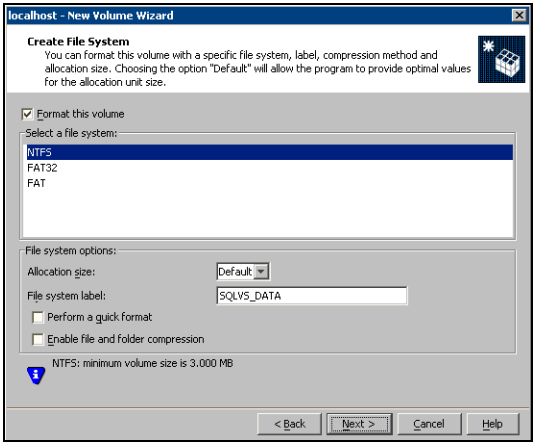
8 Assign a drive letter or mount point to the volume. You must use the same drive letter or mount point on all systems in the cluster. Make sure to verify the availability of the drive letter before assigning it.

- 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.

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 72.

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. Choose the appropriate procedure for your operating system. For Windows Server 2003, you add the quorum resource to the cluster group. For Windows Server 2008, you must create a new quorum group, then add the resource. ■ See "Adding the quorum resource on Windows Server 2003" on page 73 ■ See "Adding the quorum resource on Windows Server 2008" on page 74
Change the cluster quorum resource to the dynamic mirrored quorum resource	Change the cluster quorum properties to use the Volume Manager Disk Group resource. For Windows Server 2008, select either the Node and Disk Majority or No Majority: Disk Only option when configuring the quorum. Choose the appropriate procedure for your operating system: ■ See "Changing the quorum to a dynamic mirrored quorum resource on Windows Server 2003" on page 75 ■ See "Changing the quorum to a dynamic mirrored quorum resource on Windows Server 2008" 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.

For additional information, see "Creating dynamic volumes" on page 63.

For detailed procedures on creating cluster disk groups and volumes, see "Tasks for configuring SFW storage" on page 53.

Adding a Volume Manager Disk Group resource for the quorum

You add a Volume Manager Disk Group resource for the disk group that you created for the quorum. You do not set any dependencies for this resource.

On Windows Server 2003, you add the resource to the Cluster Group.

See "Adding the quorum resource on Windows Server 2003" on page 73.

On Windows Server 2008, you first create a service or application for the quorum resource, name it (for example, `QUORUM)` , and add the resource to it.

See "Adding the quorum resource on Windows Server 2008" on page 74.

Adding the quorum resource on Windows Server 2003

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

To add a Volume Manager Disk Group resource for the quorum in a Windows Server 2003 cluster

1. Open Cluster Administrator (**Start > Control Panel > Administrative Tools > Cluster Administrator**).
2. Verify that the Cluster Group is online on the same node where you created the disk group.
3. Right-click the Cluster Group, click **New**, and click **Resource**.

4 In the New Resource dialog box, specify the following, and then click **Next.**

Name	Specify a name for the quorum resource (QuorumDG).
Description	If necessary, type a description about the resource.
Resource type	Click **Volume Manager Disk Group.**

5 In the Possible Owners dialog box, click **Next**.

6 In the Dependencies dialog box, click **Next**. You do not need to set dependencies for a quorum resource.

7 In the Volume Manager Disk Group Parameters dialog box, select the disk group, and then click **Finish.**

8 Click **OK**.

9 Bring the newly added resource online.

Adding the quorum resource on Windows Server 2008

You must 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 in a Windows Server 2008 cluster

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.

Note: For Windows Server 2008, select either the **Node and Disk Majority** or **No Majority: Disk Only** option when configuring the quorum.

For details see the following topics:

- "Changing the quorum to a dynamic mirrored quorum resource on Windows Server 2003" on page 75
- "Changing the quorum to a dynamic mirrored quorum resource on Windows Server 2008" on page 76

Changing the quorum to a dynamic mirrored quorum resource on Windows Server 2003

Change the quorum resource to a dynamic mirrored quorum resource by selecting the Volume Manager Disk Group resource that you added for the quorum.

To change the quorum to a dynamic mirrored quorum resource on Windows Server 2003

1 From Cluster Administrator, right-click the cluster name in the configuration tree, and click **Properties**.

2 Select the Quorum tab of the Properties window.

3 Select the name of the dynamic quorum disk group resource that was added.

4 Click **OK**.

Changing the quorum to a dynamic mirrored quorum resource on Windows Server 2008

Change the quorum resource to a dynamic mirrored quorum resource by selecting the Volume Manager Disk Group resource that you added for the quorum.

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 SQL Server 2008 and configuring resources

This chapter covers the following topics:

Creating the resource group for the SQL Server instance

Before installing SQL Server you must do the following tasks:

- Create the SQL Server resource group, for example, `SQL_GROUP`.
- Add the resource for the SFW disk group that you created for SQL Server. You add it as the resource type Volume Manager Disk Group.
  If you created an additional disk group for a user database, you can add a Volume Manager Disk Group resource for that as well.

SQL Server installation adds the required SQL Server resources to the resource group and sets the appropriate dependencies for them.

During SQL Server 2008 installation, if you select the checkbox to enable FILESTREAM for file I/O streaming access, the installation creates a resource SQL Server FILESTREAM share of type File Share. It is created with the appropriate dependencies set on the Volume Manager Disk Group, SQL Server, and SQL Server Network Name resource.

The procedures for creating the SQL Server resource group and adding a disk group resource are different on Windows Server 2003 and Windows Server 2008. For details see the following topics:

- "Creating the SQL Server resource group on Windows Server 2003" on page 78
- "Creating the SQL Server resource group on Windows Server 2008" on page 80

In addition, on Windows Server 2003 you may need to add the MSDTC resource.

See "Creating the MSDTC resource (Windows Server 2003)" on page 79.

Creating the SQL Server resource group on Windows Server 2003

Before installing SQL Server on Windows Server 2003, you must create the SQL Server resource group.

You add to it the resource for the SFW disk group that you created for SQL Server.

SQL virtual server installation requires a separate volume on which the system database files will be placed, for example SQLVS_SYS_FILES. You must create a Volume Manager Disk Group resource for the disk group that contains this volume. Creating this resource will enable SQL to monitor the system database files.

If you created additional SFW disk groups for SQL Server, for example, for user databases, you add Volume Manager Disk Group resources for those as well.

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

To create the SQL Server resource group and add a disk group resource

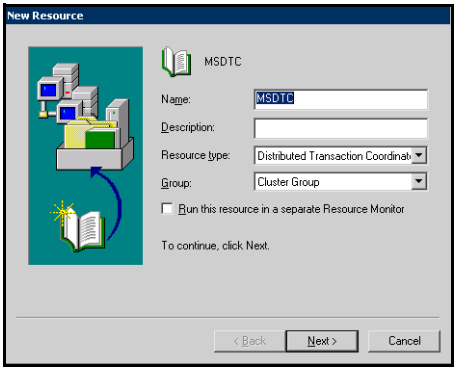
1. Launch the Cluster Administrator **(Start > Setting > Control Panel > Administrative Tools > Cluster Administrator)** and make sure you are connected to the required cluster.
2. In the left pane, right-click **Groups** node and add a new group.
   For example, add a group named `SQL_GROUP`. Refer to the Cluster Administrator documentation if you need more information on creating a new group.
3. Right-click the SQL Server resource group (`SQL_GROUP`) and select **New > Resource**.
   The New Resource wizard appears.
4. Specify a name for the disk group resource, for example, `SQL_DG_RES`, in the **Name** field.
   If required, you can add a description about the resource in the **Description** field.
   Specify the resource type by selecting **Volume Manager Disk Group** from the **Resource Type** field drop down list.
   Click **Next**.
5. By default, in the Possible Owners page, all the nodes in the cluster are listed as possible owners. Click **Next**.
6. On the Dependencies page, click **Next**. You do not need to set any dependency for a Disk Group resource.
7. On the **Volume Manager Disk Group Parameters** page, select the created disk group. Click **Finish.**
   The specified disk group resource, `SQL_DG_RES` resource is created under the `SQL_GROUP` group.

Creating the MSDTC resource (Windows Server 2003)

Prior to installing SQL Server, create the MSDTC resource. This procedure is required for multiple instances of SQL.

To create the MSDTC resource

1. From Cluster Administrator (**Start>Control Panel>Administrative Tools>Cluster Administrator**), right-click **Cluster Group**, click **New**, and click **Resource**.
2. In the New Resource dialog box, specify a name for the MSDTC resource. If necessary, add a description about the resource.



3. Select **Distributed Transaction Coordinator** from the **Resource type** list and click **Next**.
4. In the Possible Owners dialog box, all the nodes in the cluster are listed as possible owners. Click **Next**.
5. In the Dependencies dialog box, select the cluster IP address, cluster name, and physical disk resources from the **Available Resources** list and add them to the **Resource dependencies** list. The volume with the SQL Server system data files must be included. Click **Finish**.
6. Click **OK**.
7. Bring the MSDTC resource online. In the left pane, expand the Groups icon.
8. Click **Cluster Group**.
9. Right-click **Bring Online**. The state changes to online.

Creating the SQL Server resource group on Windows Server 2008

Before installing SQL Server on Windows Server 2008, you must create the SQL Server resource group.

You add to it the resource for the SFW disk group that you created for SQL Server.

SQL virtual server installation requires a separate volume on which the system database files will be placed, for example SQLVS_SYS_FILES. You must create a Volume Manager Disk Group resource for the disk group that contains this volume. Creating this resource will enable SQL to monitor the system database files.

If you created additional SFW disk groups for SQL Server, for example, for user databases, you add Volume Manager Disk Group resources for those as well.

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

To create the SQL Server resource group and add a disk group resource

1. Launch Failover Cluster Management (**Start > Administrative Tools > Failover Cluster Management)** and make sure you are connected to the required cluster.
2. In the left pane, right-click **Services and Applications** and select **More Actions > Create Empty Service or Application**. An empty group named New service or application is created. Right-click it and rename it, for example, SQL_GROUP.
3. In the left pane, right-click the group you must created and select **Add a resource > More resources > Add Volume Manager Disk Group**.
4. In the center panel under Disk Drives, double-click **New Volume Manager Disk Group** to open its Properties dialog box.
5. On the General tab of the Properties dialog box, type a name for the resource.
   For example, type SQL_DG_RES.
6. On the Properties tab, in the Disk Group Name field, type the exact name of the disk group you previously created for the application (for example, SQLVS), and click **OK** to close the dialog box.
7. Right-click the newly named resource and select **Bring this resource online**.

Installing SQL Server 2008

As you progress through the installation, use these guidelines to create an installation that will function properly in a Microsoft cluster environment with SQL Server 2008 and SFW.

Note: Refer to the Microsoft documentation for detailed installation information for creating a new SQL Server 2008 failover cluster.

Sequence for installing SQL Server 2008 on a Microsoft cluster

You use the following sequence when installing on multiple nodes of a Microsoft cluster:

- Install SQL Server 2008 on the first (active) node.
- Verify that the SQL virtual server group is correctly created and keep it online on the active node.
- Install SQL Server 2008 on additional passive nodes.

Prerequisites for installing SQL Server 2008

Before you begin installing SQL Server, note the following prerequisites for installing in the SFW environment:

- Make sure that you have created the SFW disk groups and volumes.
  See "Tasks for configuring SFW storage" on page 53.
- Make sure that you have created the SQL Server resource group.
  See "Creating the resource group for the SQL Server instance" on page 78.
- Make sure that the cluster disk group is imported to the first node and the volumes are mounted.
  See "Managing disk group and volumes" on page 67.
- The Setup program automatically installs a new, separate instance of SQL Server binaries on the local disk of each server in the cluster. You must install the binaries in exactly the same path on each cluster node, so it is important to ensure that each node has a local drive letter in common with all the other nodes in the cluster.

- If you are installing on a secondary site for a disaster recovery configuration, make sure that you take the SQL Network Name resource offline on the primary site before you begin installation on the secondary site. This will also offline the dependent resources. If the sites are on the same subnet and therefore use the same SQL IP address, ensure that the IP Address resource is offline on the primary site before beginning installation on the secondary site.
  See "Creating a parallel environment on the secondary site" on page 90.

Guidelines for installing SQL Server 2008

While installing SQL Server 2008 follow these guidelines:

- Review the prerequisites for installation before you begin.
  See "Prerequisites for installing SQL Server 2008" on page 82.
- Ensure that you set the installation path for the data files to the drive letter and location of the volume created for the SQL Server system data files (`SQLVS_SYS_FILES`). Allow the rest of the path (`Program Files\Microsoft SQL Server`) to remain. This must be the same as the path on all nodes.
  The Setup program installs the system databases on the specified cluster (shared) disk. System databases must be on a clustered disk so that they can be shared between the nodes (and failed over when necessary), because these databases contain specific user login and database object information that must be the same for each node. The virtual server name will allow users access to the online node.
- If you are installing multiple instances, specify an instance name; only one default instance is allowed per cluster. Specify the same instance name when installing this instance on all cluster nodes.
- You must assign a unique virtual server name, for example, *SQLVS,* during installation. Specify the same virtual server name when installing this SQL instance on all cluster nodes.
  For a disaster recovery configuration, when installing on a secondary site, you must specify the same name for the SQL virtual server as that on the primary site.
- When configuring the virtual server, specify the IP address for the SQL virtual server.
- For the cluster group, specify the SQL Server resource group that you configured earlier.
  See "Creating the resource group for the SQL Server instance" on page 78.

- After installation, verify that SQL Server installed correctly according to Microsoft instructions. Check that the SQL virtual server group has the correct dependencies.
  See “Dependency graph for SQL Server 2008” on page 84.
- After installation on the first node of a high-availability cluster, 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.
  See “Managing disk group and volumes” on page 67.

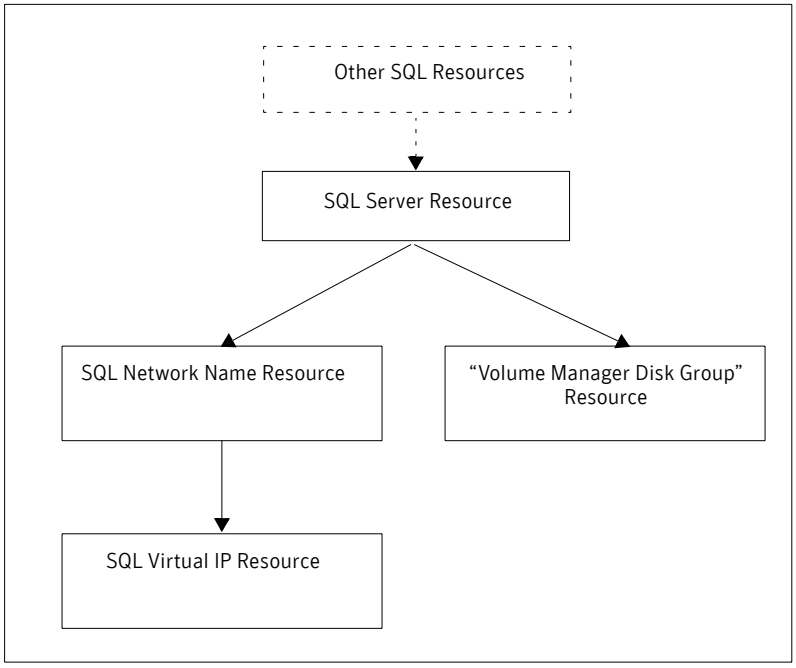
Dependency graph for SQL Server 2008

Once SQL is installed, the SQL Server Resource with dependencies on the SQL Network Name and the Volume Manager Disk Group resource is created.

Figure 7-1 indicates the dependencies that are established.

Note: If you enabled the FILESTREAM file I/O streaming functionality during SQL Server installation, a FILESTREAM resource is created with a dependency on the SQL Network Name resource, the SQL Server resource, and the Volume Manager Disk Group Resource.

Figure 7-1 Dependency graph after the SQL installation is completed



Verifying the SQL 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 SQL Server 2008

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 SQL Server 2008 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 90.
Review the prerequisites and planning information	Verify the prerequisites on the secondary site. See "Requirements for deploying SQL Server 2008 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 43.
Create the parallel configuration on the secondary site	Ensure that you follow the secondary site requirements and guidelines for IP addresses, disk groups and volumes, the SQL Server resource group, and SQL Server installation. See "Creating a parallel environment on the secondary site" on page 90.
Understand the VVR components	See "VVR components overview" on page 91.
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 92.

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 98.
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 110.
Set up the SQL Server resource dependencies	Change the SQL Server resource dependency properties so that it depends on the RVG resource instead of the Volume Manager Disk Group resource. See "Setting the SQL server resource dependency on the RVG resource" on page 112.

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 18.

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 a SFW environment with Microsoft clustering on the primary site, complete the same tasks on the secondary site prior to the SQL installation.

See "Workflow for a high availability (HA) configuration" on page 18.

However, note the following guidelines and exceptions.

- 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.
- During SFW installation, be sure to select the option to install VVR. (This must also be installed on the primary site.)
- During the creation of disk groups and volumes for the secondary site, make sure the following is exactly the same as the cluster on the primary site:
  - Cluster disk group name
  - Volume names and sizes
  - Drive letters
- Specify the same name for the SQL Server resource group as the name on the primary site.
- Before starting the SQL installation make sure you take the SQL Server Network Name resource offline on the primary site. This will also offline the dependent SQL resources. In addition, if the secondary is in the same subnet, take the IP Address resource offline on the primary site.
- During installation, specify the same name for the SQL virtual server as the name on the primary site.

Do not begin VVR configuration until you have completed all the steps for setting up the parallel configuration on the secondary site, including:

- SFW installed on all nodes
- Disk groups and volumes configured

- SQL Server installed on all the nodes

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.

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: The VxSAS wizard will not be launched automatically after installing SFW or SFW HA. You must launch this wizard manually to complete the VVR security service configuration. For details on this required service, see *Veritas Storage Foundation Veritas Volume Replicator Administrator's Guide*.

To configure the VxSAS service

1. To launch the wizard, select **Start** > **All Programs > Symantec > Veritas Storage Foundation > Configuration Wizards > VVR Security Service Configuration Wizard** or run `vxsascfg.exe` from the command prompt of the required machine.
   Read the information provided on the Welcome page and click **Next**.
2. Complete the Account Information panel as follows:

Account name (domain\account)	Enter the administrative account name.

Password	Specify a password.

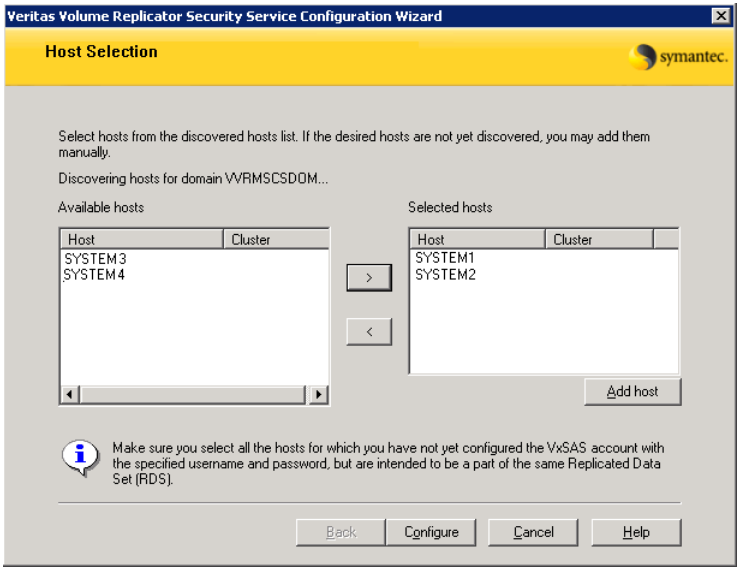
If you have already configured the VxSAS service for one host that is intended to be a part of the RDS, make sure you specify the same username and password when configuring the VxSAS service on the other hosts.
Click **Next**.

3 On the Domain Selection panel, select the domain to which the hosts that you want to configure belong:

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.

Click **Next**.

4 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.

5 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.
Click **Back** to change any information you had provided earlier.

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

Creating resources for VVR

VVR resources must be created on the primary and secondary site cluster:

- IP address for replication
- Network name resource

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.

The procedures are slightly different when configuring these resources on Windows Server 2003 and Windows Server 2008. On Windows Server 2003, you configure the resources separately. On Windows Server 2008 you can configure a Client Access Point that includes both the network name and IP resources.

See the following for details:

- "Creating resources for VVR on Windows Server 2003" on page 95
- "Creating resources for VVR on Windows Server 2008" on page 96

Creating resources for VVR on Windows Server 2003

Create the IP Address and Network Name resources for VVR replication. Create the resources on the primary site and then repeat the procedures to create the resources on the secondary site.

To create an IP Address resource

1. Right-click on the SQL Server resource group and select **New > Resource**.
2. In the Resource creation wizard, configure the IP address. Specify a name for the **IP Address** resource.
   Add a **Description** if required.
3. Select **IP Address** from the **Resource Type** field drop down list. Click **Next**.
4. In the Possible Owners page, click **Next**. All the nodes in the cluster are listed as possible owners by default.
5. In the Dependencies Page, make sure the **Resource Dependencies** pane is empty, and click **Next**.
6. On the TCP/IP Address Parameters page, set the TCP/IP parameters. Enter the IP address and the corresponding subnet mask.
7. Make sure the Network is set to **Public** and click **Finish** to create the IP Address resource.

8 Bring the resource online.

To create a Network Name resource

1 Right-click on the SQL_GROUP group and select **New > Resource**.

2 In the Resource creation wizard, create a Network Name resource. Specify the **Network Name**.
Add a **Description** if required.

3 Specify the resource type by selecting **Network Name** from the **Resource Type** field drop down list. Click **Next**.

4 In the Possible Owners page, click **Next**. All the nodes in the cluster are listed as possible owners by default.

5 On the Dependencies page, select the IP Address resource you just created for the RVG from the Available Resources pane. Add it to the Resource Dependencies pane and click **Next**.

6 In the **Name** field on the Network Name Parameters page, specify any name except the node and SQL Virtual Server names. Click **Finish**.

Note: The network name for the RVG must be different for the primary and secondary cluster.

7 Repeat the same procedures to create the IP and the Network Name resource for the secondary site.

8 Bring the resources online.

Creating resources for VVR on Windows Server 2008

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 SQL user 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 SQL virtual server Network Name resource resource is offline on the secondary site. This would also bring offline all the dependent SQL resources. If on the same subnet, ensure that the SQL IP Address resource is also offline.

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.

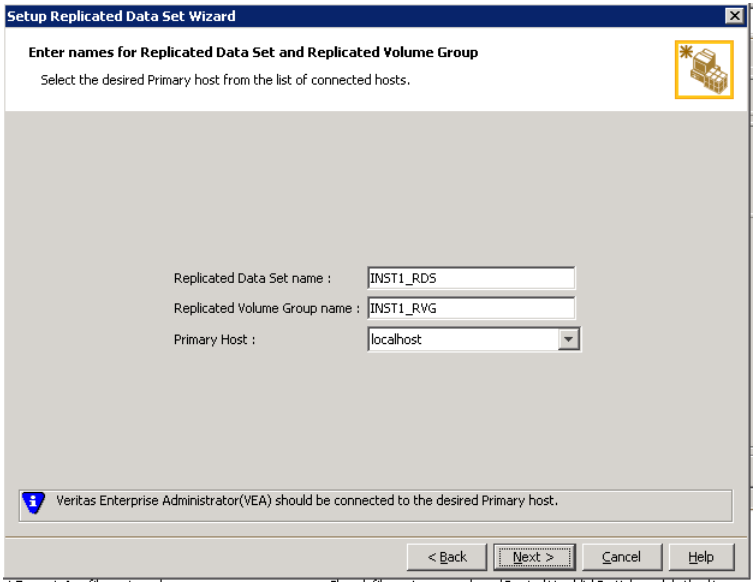
Caution: Do not use volume types that are not supported by VVR.

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. From the cluster node on the Primary where the cluster disk group is imported, launch the Veritas Enterprise Administrator (VEA):
   - Use the VEA console to launch the Setup Replicated Data Set Wizard.
     OR
   - Launch the VEA by clicking **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 **Set up Replicated Data Set**.
3. Read the Welcome page and click **Next**.

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

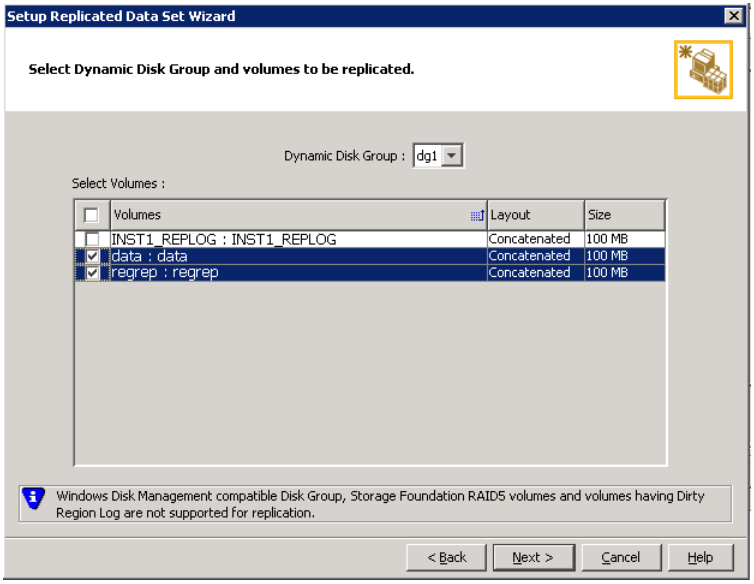


By default, the local host is selected as the **Primary Host**. To specify a different host name, make sure the required host is connected to the VEA console and select it in the **Primary Host** list.

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 Click **Next**.

6 Select from the table the dynamic disk group and data volumes that will undergo replication.

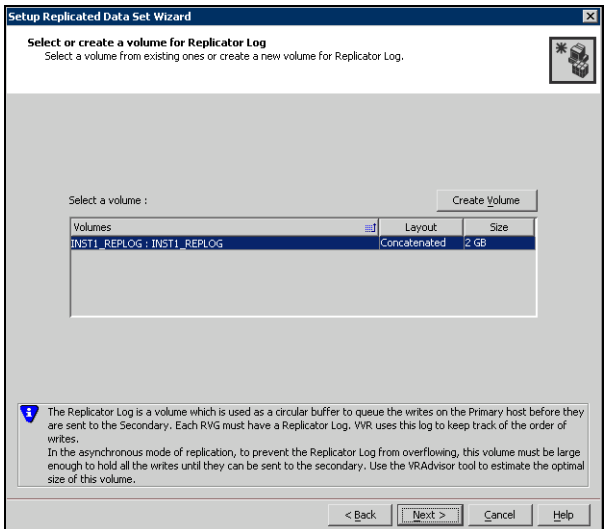


To select multiple volumes, press the Shift or Control key while using the up or down arrow keys.

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.

7 Click **Next**.

8 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 (INST1_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** checkbox to ensure that the Replicator Log volume is created only on Thin Provisioned (TP) disks.

Note: The checkbox 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 checkbox 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.

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

10 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.

11 On the Specify Secondary host for replication page, enter the name or IP address of the Secondary host in the **Secondary Host** field. 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.

12 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.

13 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.

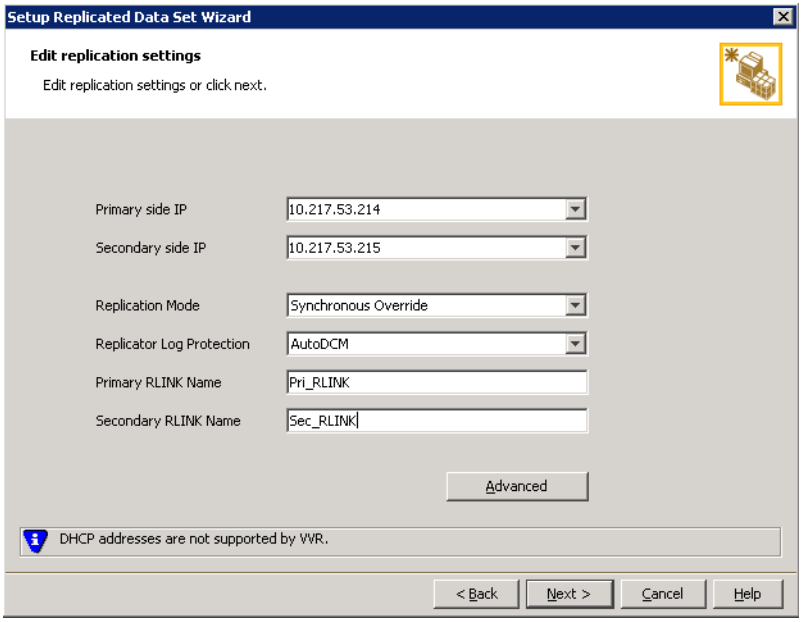
This page does not appear if all the required volumes that are available on the Primary host are also available on the Secondary hosts.

- 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.

14 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.

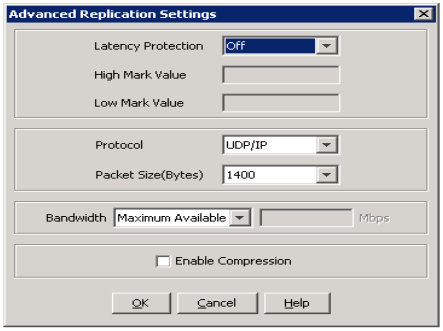
Secondary side IP — Enter the virtual IP address on the Secondary that is to be used for replication. If there is more than one IP address available for replication, you can choose the one that you want to use from the drop-down list. If the required IP address is not displayed in the list then edit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

Click **Next** to start replication with the default settings.

15 Click **Advanced** to specify advanced replication settings. 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.

Caution: 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.

16 Click **Next**.

17 On the **Start Replication** page, select **Start Replication**.

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.

18 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 SQL Server 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.

For details on the procedures, see the following:

- "Creating an RVG resource on Windows Server 2003" on page 110
- "Creating an RVG resource on Windows Server 2008" on page 111

Creating an RVG resource on Windows Server 2003

Use the following procedure to configure an RVG resource on Windows Server 2003.

To create a Replicated Volume Group (RVG) resource

1. Right click on the `SQL_GROUP` group that you have created and select **New > Resource**. The New Resource wizard appears.
2. Specify a name for the Replicated Volume Group resource in the Name field. If required, you can add a description about the resource in the Description field.
3. Specify the resource type by selecting **Replicated Volume Group** from the Resource Type field drop down list. Click **Next**.
4. In the Possible Owners page, configure a separate resource monitor process for the RVG resource. Select the **Run this resource in a separate Resource Monitor** checkbox provided in the New Resource wizard.
5. By default, all the nodes in the cluster are listed as possible owners. Click **Next**.
6. On the Dependencies page, select the VVR IP resource and the Disk Group resource from the **Available Resources** and add them to **Resource Dependencies**. Click **Next**.
7. On the Replicated Volume Group Parameters page, select the created RVG. Click **Finish**.

8 Repeat the steps to create the RVG resource on the secondary site.

Creating an RVG resource on Windows Server 2008

Use the following procedure to configure an RVG resource on Windows Server 2003.

To create a Replicated Volume Group (RVG) resource

1 In Failover Cluster Management, expand Services and Applications, right-click the SQL Server virtual server 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 SQL server resource dependency on the RVG resource

The SQL 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.

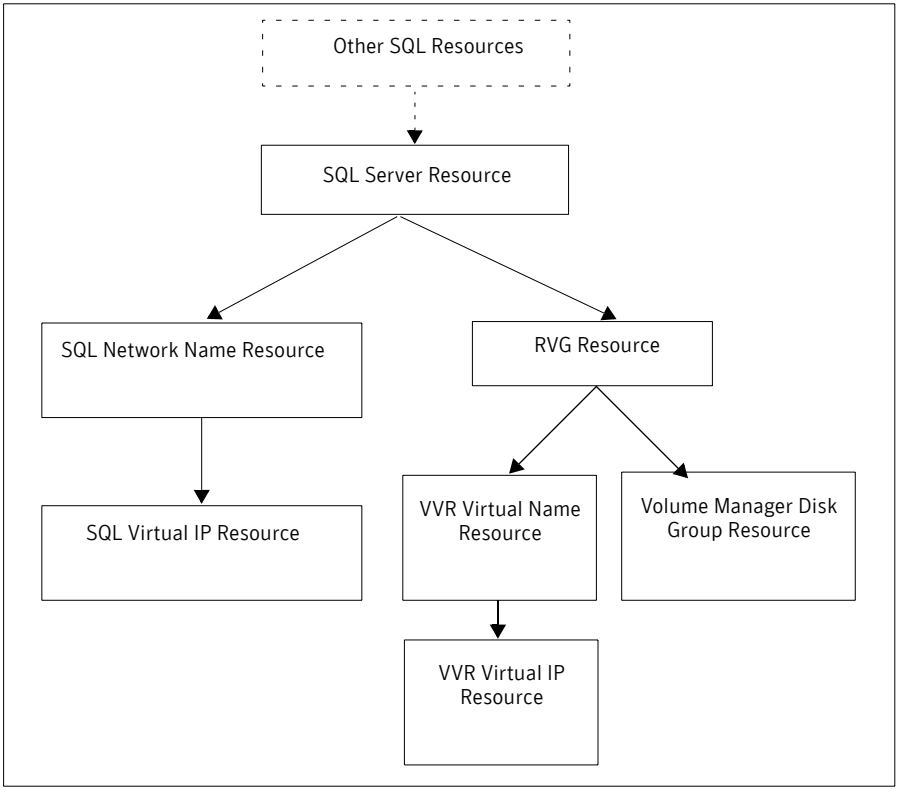
Note: Your configuration may include a Filestream volume as part of the RVG. If so, you must modify the Filestream resource to remove the Volume Manager Disk Group resource from its dependency list and add the RVG resource to its dependency list. Since the SQL Server resource is also a dependency of the Filestream resource, you do not need to modify the SQL Server resource as well.

To change the SQL Server resource dependency properties

1. Ensure that the SQL Server resource is offline.
2. Right-click the SQL Server resource and select **Properties.**
3. On the Properties dialog box, select the Dependencies tab.
4. Make the appropriate selections on the Dependencies tab to:
   - Add the Replicated Volume Group resource to the dependencies.
   - Delete the Volume Manager Disk Group resource from the dependencies.
5. The cluster configuration is now complete. Online the entire `SQL_GROUP` group on the primary cluster.

Figure 8-1 indicates the dependencies required.

Figure 8-1 Dependency graph for SQL 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 `SQL_GROUP` group online on the new Primary.
7. Attach the databases. See the Microsoft documentation for instructions.

You can now verify that SQL 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 SQL 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 SQL on the secondary host

To recover the SQL 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 `SQL_GROUP` group online.
5. Attach the databases. See the Microsoft SQL Server documentation for instructions.

   Now you can start using SQL 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

1. Detach the user database. See the Microsoft documentation for instructions. Note that the `master`, `model`, and `tempdb`, databases cannot be detached.
2. Take the RVG resource offline on both the clusters.
3. 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.
4. 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.
5. Ensure that the volumes have retained the same drive letters that existed before the disaster.
6. Bring the RVG resource online on the Secondary.
7. Bring the `SQL_GROUP` group online on the original Primary.
8. Attach the databases on the original Primary. See the Microsoft documentation for instructions.

Index

S

V