

# SANtricity<sup>TM</sup> Storage Manager Remote Volume Mirroring

## **Feature Guide for Version 9.x**

ES1440-0-E1, First Edition



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This document describes the Remote Volume Mirroring premium feature of SANtricity™ Storage Manager version 9.x and will remain the official reference source for all revisions/releases of this product until rescinded by an update.

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**DANGER** indicates an imminently hazardous situation that will result in death or severe personal injury.

**WARNING** indicates a potentially hazardous situation that could result in death or severe personal injury.

**CAUTION** indicates a potentially hazardous situation that could result in moderate or minor personal injury.

### Definitions of Informational Notices

**CAUTION** indicates a potentially hazardous situation that could result in data loss (or other interruption) or equipment damage.

**IMPORTANT** indicates information or criteria that is necessary to perform a procedure correctly.

**NOTE** indicates a concept that will be clarified or a maintenance tip that will be presented.

## Revision Record

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# About This Book

The SANtricity™ Storage Manager Remote Volume Mirroring Feature Guide is a software guide that combines the concepts and procedures necessary to understand, install, configure, and use the Remote Volume Mirroring premium feature. This guide also contains concepts and procedures for disaster recovery and troubleshooting issues.

## Intended Readers

This book is intended for system administrators who are responsible for operating and maintaining storage systems, with an emphasis on data replication, and disaster prevention and recovery.

## Related Publications

SANtricity Storage Manager Installation Guide for Version 9.1x

SANtricity Storage Manager Concepts Guide for Version 9.1x

SANtricity Storage Manager Volume Copy Feature Guide for Version 9.x

Storage System Product Release Notes for Version 9.10

## Web Address

For web sites related to the products in this publication, refer to the *Product Release Notes*.





## *Remote Volume Mirroring Feature Concepts and Requirements*

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This chapter introduces the basic concepts of the Remote Volume Mirroring feature, describing Remote Volume Mirroring, how information is replicated between storage arrays, the software and hardware required, and the recommended system configurations. Additionally, this chapter presents how to configure other premium features to properly function with the Remote Volume Mirroring premium feature.

After you have an understanding of the basic Remote Volume Mirroring concepts, read the software and hardware requirements and recommended configurations. Complete the checklists provided to ensure that all the hardware and software requirements have been met before configuring your systems for the Remote Volume Mirroring premium feature.

## Introduction to Remote Volume Mirroring

The Remote Volume Mirroring premium feature is used for online, real-time replication of data between storage arrays over a remote distance. In the event of a disaster or catastrophic failure at one storage array, you can promote a second storage array to take over responsibility for computing services.

This section introduces you to primary, secondary, and mirror repository volumes, and describes how they interact to replicate data between storage arrays using the Remote Volume Mirroring feature.

### Primary and Secondary Volumes

When you create a remote volume mirror, a mirrored volume pair is created and consists of a primary volume at a primary storage array and a secondary volume at a secondary storage array. A standard volume may only be included in one mirrored volume pair. There can be up to 32 defined mirrors on an E2600 storage array, and up to 64 defined mirrors on the E4600 or E5600 storage array. The E2510 and E2520 do not support the Remote Volume Mirroring feature.

The primary volume is the volume that accepts host I/O and stores application data. When the mirror relationship is first created, data from the primary volume is copied in its entirety to the secondary volume. This process is known as a full synchronization and is directed by the controller owner of the primary volume. During a full synchronization, the primary volume remains fully accessible for all normal I/O operations.

The controller owner of the primary volume initiates remote writes to the secondary volume to keep the data on the two volumes synchronized.

The secondary volume maintains a mirror (or copy) of the data on its associated primary volume. The controller owner of the secondary volume receives remote writes from the primary volume controller owner, but will not accept host write requests. Hosts are able to read from the secondary volume, which appears as read-only.

In the event of a disaster or catastrophic failure of the primary site, a role reversal can be performed to promote the secondary volume to a primary role. Hosts will then be able to read and write to the newly promoted volume and business operations can continue.

[Figure 1-1](#) shows the primary and secondary volumes displayed in the Array Management Window for the primary storage array and the secondary storage array.

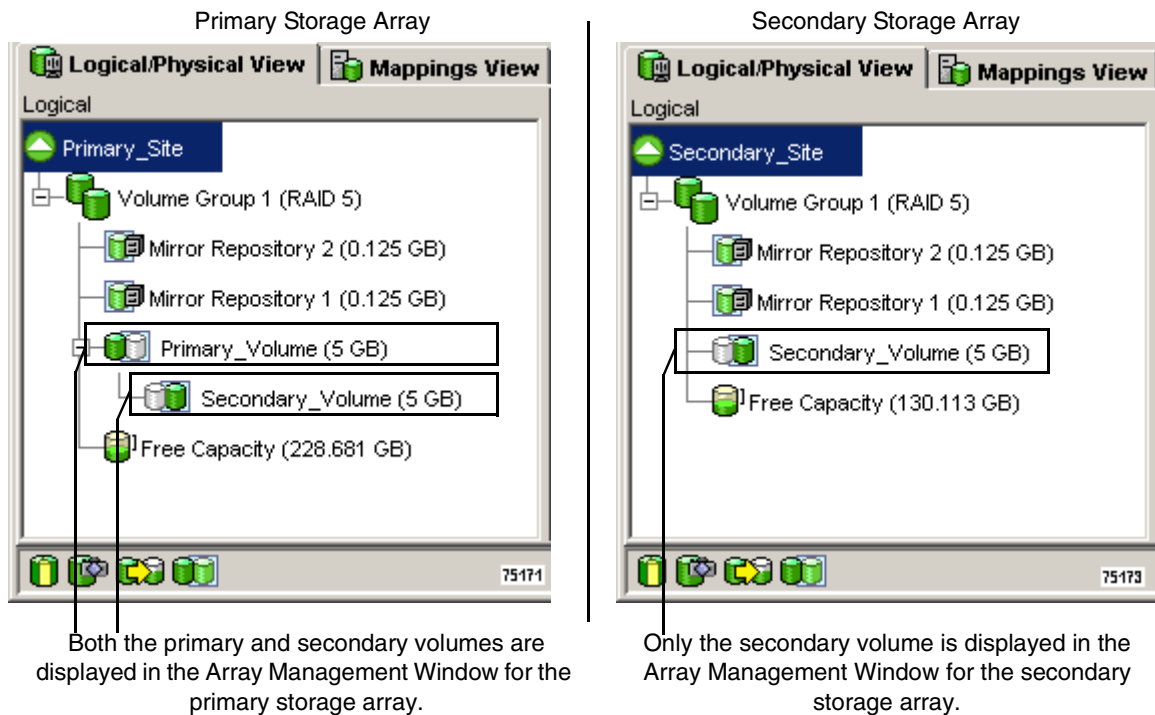


Figure 1-1 Primary and Secondary Volumes in the Array Management Window

## Mirror Repository Volumes

A mirror repository volume is a special volume in the storage array created as a resource for the controller owner of the primary volume in a Remote Volume Mirror. The controller stores mirroring information on this volume, including information about remote writes that are not yet complete. The controller can use this information to recover from controller resets and accidental powering-down of storage arrays.

When you activate the Remote Volume Mirroring premium feature on the storage array, you create two mirror repository volumes, one for each controller in the storage array. An individual mirror repository volume is not needed for each Remote Volume Mirror.

When you create the mirror repository volumes, you specify the location of the volumes. You can either use existing free capacity, or you can create a volume group for the volumes from unconfigured capacity and then specify the RAID level.

[Figure 1-2 on page 1-4](#) shows the mirror repository volumes displayed in the Array Management Window for the primary storage array.

Because of the critical nature of the data being stored, the RAID level of mirror repository volumes must not be RAID 0 (for data striping). The required size of each volume is 128 MB, or 256 MB total for both mirror repository volumes of a dual controller storage array. In previous versions of the Remote Volume Mirroring feature, the mirror repository

volumes required less disk space, but now need to be upgraded in order to utilize the maximum amount of mirror relationships. For additional information, refer to [“Upgrading Mirror Repository Volumes” on page 3-6](#).

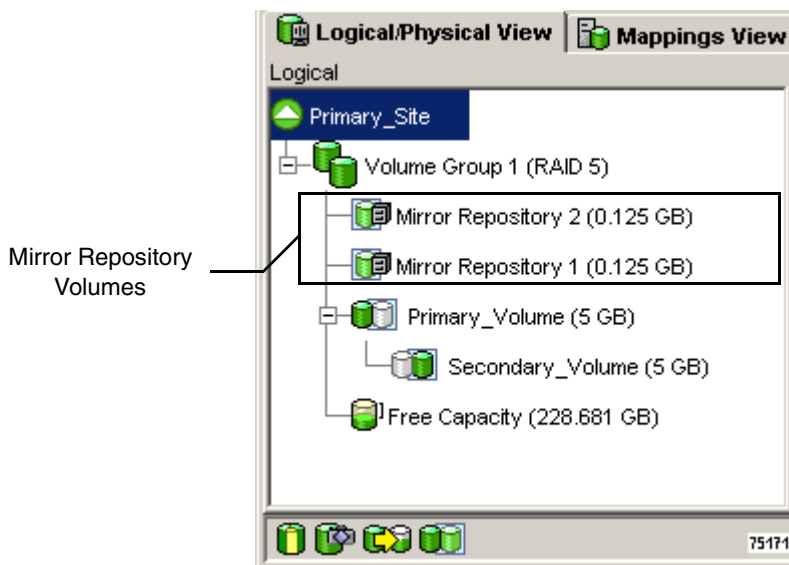


Figure 1-2 Mirror Repository Volumes in the Array Management Window

## Mirror Relationships

Prior to creating a mirror relationship, the Remote Volume Mirroring premium feature must be enabled on both the primary and secondary storage arrays. A secondary volume candidate must be created on the secondary site if one does not already exist and must be a standard volume of equal or greater capacity than the associated primary volume.

When secondary volume candidates are available, a mirror relationship can be established in the storage management software by identifying the storage array containing the primary volume and the storage array containing the secondary volume.

When the mirror relationship is first created, a full synchronization automatically occurs, with data from the primary volume copied in its entirety to the secondary volume. For more information on creating mirror relationships, refer to [“Using the Remote Volume Mirroring Premium Feature” on page 3-1](#).

# Data Replication

Data replication between the primary volume and the secondary volume is managed by the controllers and is transparent to host machines and applications. This section describes how data is replicated between storage arrays participating in Remote Volume Mirroring and the actions taken by the controller owner of the primary volume if a link interruption occurs between storage arrays.

## Write Modes

When the controller owner of the primary volume receives a write request from a host, the controller first logs information about the write to a mirror repository volume, then writes the data to the primary volume. The controller then initiates a remote write operation to copy the affected data blocks to the secondary volume on the secondary storage array.

There are two write mode options that affect when the I/O completion indication is sent back to the host: Synchronous and Asynchronous.

### Synchronous

In the event of a communication failure, the synchronous write mode offers the best chance of full data recovery from the secondary storage array. However, this is often accomplished at the expense of host I/O performance. When this write mode is selected, any host write requests are written to the primary volume and then copied to the secondary volume. After the host write request has been written to the primary volume and the data has been successfully copied to the secondary volume, the controller removes the log record on the mirror repository volume and sends an I/O completion indication back to the host system. The synchronous write mode is selected by default and is the recommended write mode.

### Asynchronous

The asynchronous write mode offers faster host I/O performance but does not guarantee that the copy has been successfully completed before processing the next write request. When this write mode is selected, host write requests are written to the primary volume, and the controller then sends an I/O completion indication back to the host system regardless of when the data was successfully copied to the secondary storage array.

## Write Consistency

Write consistency is a configuration option available for any primary volumes or secondary volumes participating in a mirror relationship that have been configured to use the asynchronous write mode and to preserve write order.

When asynchronous write mode is selected, write requests to the primary volume are completed by the controller without waiting for an indication of a successful write to the secondary storage array.

As result of selecting the asynchronous write mode, write requests are not guaranteed to be completed in the same order on the secondary volume as they are on the primary volume. If the order of write requests is not retained, data on the secondary volume may become inconsistent with the data on the primary volume, and could jeopardize any attempt to recover data if a disaster occurs on the primary storage array.

When write consistency is selected for multiple mirror relationships on the same storage array, the order in which the data is synchronized is preserved. For example, the write from Mirror 1 is always performed before Mirror 2. Selecting write consistency for a single mirror relationship does not change the process in which data is replicated. More than one mirror relationship must reside on the primary storage array for the replication process to change.

## Write Consistency Groups

When multiple mirror relationships exist on a single storage array and have been configured to use asynchronous write mode and to preserve write consistency, they are considered to be an interdependent group known as a write consistency group. All mirror relationships in the write consistency group maintain the same order when sending writes from the primary volumes to their corresponding secondary volumes.

The data on the secondary, remote storage array cannot be considered fully synchronized until all Remote Volume Mirrors in the write consistency group are synchronized. If one mirror relationship in a write consistency group becomes Unsynchronized, all of the mirror relationships in the write consistency group will become Unsynchronized, and any write activity to the remote, secondary storage arrays will be prevented to protect the consistency of the remote data set.

**EXAMPLE** On a campus site, Remote Volume Mirroring has been configured between two storage arrays. At the primary site, the primary storage array has three defined mirror relationships (RVM-A, RVM-B, and RVM-C), with each mirror relationship configured to copy data to the secondary storage array.

All three mirror relationships have been configured to use the Asynchronous write mode and to preserve write order. If the mirrored pair RVM-A becomes Unsynchronized due to a link interruption, the controller will automatically transition RVM-B and RVM-C into an Unsynchronized state until communication can be resumed.

## Resynchronization Methods

Data replication between the primary volume and secondary volume in a mirror relationship is managed by the controllers and is transparent to host machines and applications. When the controller owner of the primary volume receives a write request from a host, the controller first logs information about the write to a mirror repository volume, then writes the data to the primary volume. The controller then initiates a write operation to copy the affected data to the secondary volume on the secondary storage array.

If a link interruption or volume error prevents communication with the secondary storage array, the controller owner of the primary volume transitions the mirrored pair into an Unsynchronized status and sends an I/O completion to the host sending the write request. The host can continue to issue write requests to the primary volume, but remote writes to the secondary volume will not take place.

When connectivity is restored between the controller owner of the primary volume and the controller owner of the secondary volume, resynchronization takes place. Only the blocks of data that have changed on the primary volume during the link interruption will be copied to the secondary volume.

---

**CAUTION** Any communication disruptions between the primary and secondary storage array while resynchronization is underway could result in a mix of new and old data on the secondary volume. This would render the data unusable in a disaster recovery situation.

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Two resynchronization methods are available in the current release of storage management software: Manual Resynchronization, which is the recommended method, and Automatic Resynchronization.

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**IMPORTANT** Manual Resynchronization is the recommended setting for all mirror relationships in a write consistency group. If Automatic Resynchronization is selected for a mirror relationship in a write consistency group, resynchronizations will start as soon as communication is re-established, which does not preserve consistency in the write consistency group.

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## Manual Resynchronization

When enabled, resynchronization of the data on the primary volume and secondary volume can be started manually after communication has been restored to the Unsynchronized mirrored pair.

---

**IMPORTANT** Only the blocks of data that have changed on the primary volume during the link interruption are copied to the secondary volume.

---

Selecting the Manual Resynchronization option allows you to manage the resynchronization process in a way that provides the best opportunity for recovering data. When this option is selected and a communication failure occurs between the primary and secondary volumes, the mirror relationship transitions to an Unsynchronized state. Any write requests to the primary volume will be logged and a Needs Attention state is displayed for the storage array.

After the controller owner of the primary volume detects that communication has been restored, the mirror relationship will remain in an Unsynchronized state until the Volume >> Remote Volume Mirroring >> Resume option is selected.

## Automatic Resynchronization

When the Automatic Resynchronization option is selected and a communication failure occurs between the primary and secondary storage arrays, the controller owner of the primary volume will start resynchronizing the primary and secondary volumes immediately after detecting that communication has been restored.

---

**IMPORTANT** Only the blocks of data that have changed on the primary volume during the link interruption are copied to the secondary volume.

---

## Performance Considerations

The following general performance considerations should be noted when creating mirror relationships.

- The controller owner of a primary volume performs a full synchronization in the background while processing local I/O reads and writes to the primary volume and associated remote writes to the secondary volume. Because the full synchronization diverts controller processing resources from I/O activity, it can have a performance impact to the host application.

To reduce the performance impact, you can set the Synchronization Priority Level to determine how the controller owner will prioritize the full synchronization relative to other I/O activity. The following are some basic guidelines to setting the Synchronization Priority Level.

- A full synchronization at the Lowest Synchronization Priority Level will take approximately eight times as long as a full synchronization at the Highest Synchronization Priority Level.
- A full synchronization at the Low Synchronization Priority Level will take approximately six times as long as a full synchronization at the Highest Synchronization Priority Level.
- A full synchronization at the Medium Synchronization Priority Level will take approximately three and a half times as long as a full synchronization at the Highest Synchronization Priority Level.
- A full synchronization at the High Synchronization Priority Level will take approximately twice as long as a full synchronization at the Highest Synchronization Priority Level.



For more information on setting the Synchronization Priority Level, refer to [“Changing the Synchronization Settings” on page 3-13](#).

- When the mirrored volume pair is in a Synchronization in Progress status, all host write data is copied to the remote system. Both controller I/O bandwidth and I/O latency can affect host write performance. Host read performance is not affected by the mirroring relationship.
- The time that it takes for data to be copied from the primary volume to the secondary volume may impact overall performance and is primarily because of the delay and overhead of copying data to the Remote Volume Mirror. Some delay may also occur because of the limit to the number of simultaneous writes.

## Link Interruptions or Secondary Volume Errors

When processing write requests, the primary controller may be able to write to the primary volume, but a link interruption prevents communication with the remote secondary controller.

In this case, the remote write cannot complete to the secondary volume, and the primary and secondary volumes are no longer correctly mirrored. The primary controller transitions the mirrored pair into an Unsynchronized status and sends an I/O completion to the primary host. [Figure 1-3](#) shows the primary and secondary volumes in an Unsynchronized status. The primary host can continue to write to the primary volume, but remote writes will not take place.

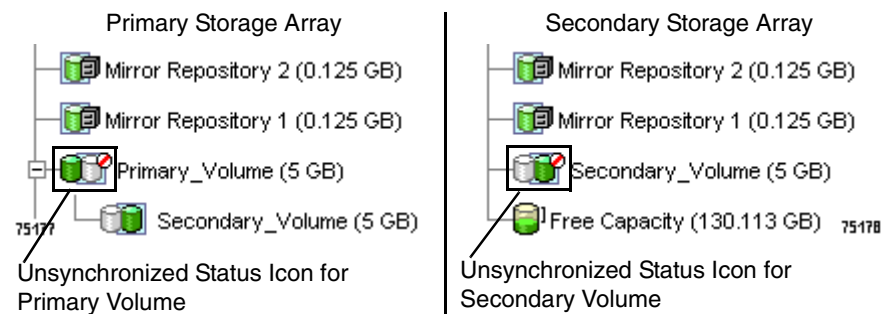


Figure 1-3 Mirrored Volume Pair in Unsynchronized Status

When connectivity is restored between the controller owner of the primary volume and the controller owner of the secondary volume, a resynchronization will take place either automatically or will need to be started manually, depending on which method you chose when setting up the mirror relationship. During the resynchronization, only the blocks of data that have changed on the primary volume during the link interruption are copied to the secondary volume. After the resynchronization begins, the mirrored pair will transition from an Unsynchronized status to a Synchronization in Progress status. [Figure 1-4 on page 1-10](#) shows the primary and secondary volumes in a Synchronization-in-Progress status.

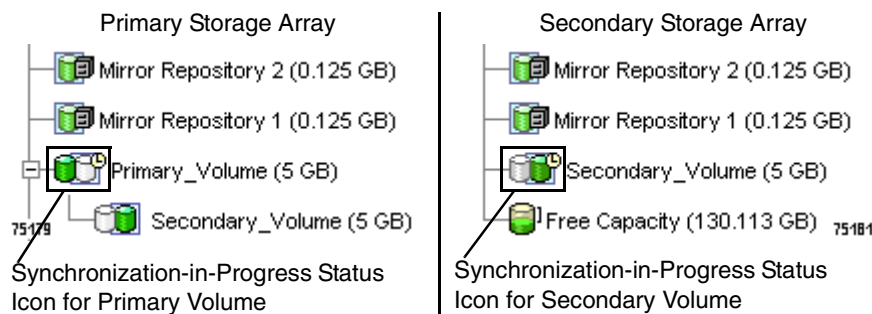


Figure 1-4 Mirrored Volume Pair in Synchronization-in-Progress Status

The primary controller will also mark the mirrored pair as Unsynchronized when a volume error on the secondary side prevents the remote write from completing. For example, an offline or a failed secondary volume can cause the Remote Volume Mirror to become Unsynchronized. When the volume error is corrected (the secondary volume is placed online or recovered to an Optimal status), a synchronization (automatic or manual) is required, and the mirrored pair transitions to a Synchronization in Progress status.

For more information on Remote Volume Mirroring statuses, refer to [Chapter 3, “Using the Remote Volume Mirroring Premium Feature.”](#)

## Connectivity and Input/Output

The Remote Volume Mirroring feature requires a dedicated host port for mirroring data between storage arrays. This section describes the typical configurations used to connect storage arrays for Remote Volume Mirroring, controller ownership of volumes within storage arrays, and distance restrictions between storage arrays.

After the Remote Volume Mirroring feature has been activated, one Fibre Channel host-side I/O port on each controller is solely dedicated to mirroring operations. For example, in the primary storage array, controller ports A2 and B2 are dedicated to mirroring operations. In the secondary storage array, controller ports A2 and B2 are also dedicated to mirroring operations.

Any host-initiated I/O operations will not be accepted by the dedicated port, and any requests received on this dedicated port will only be accepted from another controller participating in the mirror relationship.

Controller ports dedicated to Remote Volume Mirroring must be attached to a Fibre Channel fabric environment with support for the Directory Service and Name Service interfaces.

### Fibre Channel Fabric Configurations

Three Fibre Channel fabric configurations are supported in this version of the storage management software. The level of redundancy available will depend on the type of configuration selected.

- **Highest Availability Campus Configuration** – Functioning as a fully redundant configuration, the Highest Availability Campus Configuration consists of a primary storage array and a secondary storage array in separate locations. For more information, refer to [“Highest Availability Campus Configuration” on page 1-18](#).
- **Campus Configuration** – Serving as a lower-cost configuration, the Campus Configuration consists of a primary storage array and a secondary storage array in separate locations. For more information, refer to [“Campus Configuration” on page 1-20](#).
- **Intra-Site Configuration** – Serving as the lowest-cost configuration, the Intra-Site Configuration consists of a primary storage array and secondary storage array located within the same site. For more information, refer to [“Intra-Site Configuration” on page 1-21](#).

For instructions on how to configure storage arrays, refer to [Chapter 2, “Hardware and Software Installation.”](#)

## Volume Ownership

The controller owner of the primary volume will only attempt to communicate with its mirrored controller in the secondary storage array. Controller A in the primary storage array only attempts communication with Controller A in the secondary storage array.

The controller (A or B) that owns the primary volume determines the controller owner of the secondary volume. If the primary volume is owned by Controller A on the primary storage array, the secondary volume is therefore owned by Controller A on the secondary storage array. If primary Controller A cannot communicate with secondary Controller A, no controller ownership changes take place. If the secondary controller becomes unresponsive, then the mirror relationship becomes Unsynchronized, because the alternate controller is not available for the Remote Volume Mirroring feature.

If an I/O path error causes a volume ownership change on the primary storage array, or if the storage administrator changes the controller owner of the primary volume, the next remote write processed will automatically trigger an ownership change on the secondary storage array.

If a primary volume is owned by Controller A and the controller owner is changed to Controller B, the next remote write will change the controller owner of the secondary volume from Controller A to Controller B.

Because controller ownership changes on the secondary storage array are controlled by the primary controller, these ownership changes do not require any special intervention and cannot be manually changed by the storage administrator.

## Distance Between Primary and Secondary Storage Array

The maximum distance permitted between storage arrays participating in a mirror relationship is governed by the distance limits of the Fibre Channel links. Using standard Single-Mode Fibre technology, a maximum link distance of 10km (6.25 Miles) between storage arrays can be achieved.

Specialized third-party products, such as Fibre Channel over IP (FCIP) switches, allow for distances up to approximately 4000km (2500 miles) to be supported between storage arrays in a Fibre Channel environment.

For additional information on the Fibre Channel switches and FCIP switches supported for this release, refer to the *Product Release Notes*.

## Using Other Features and Remote Volume Mirroring

This section describes how the Remote Volume Mirroring premium feature can be used in conjunction with other premium features available in this version of the storage management software.

### SANshare Storage Partitioning

SANshare Storage Partitioning is a premium feature that enables hosts to share access to volumes in a storage array. A storage partition is created when you define a collection of hosts (a host group) or a single host and then define a volume-to-logical unit number (LUN) mapping. This mapping allows you to define what host group or host will have access to a particular volume in the storage array.

Figure 1-5 shows the Mappings View of the Array Management Window, where Primary\_Volume has been included in a partition accessible by the Default Host Group.

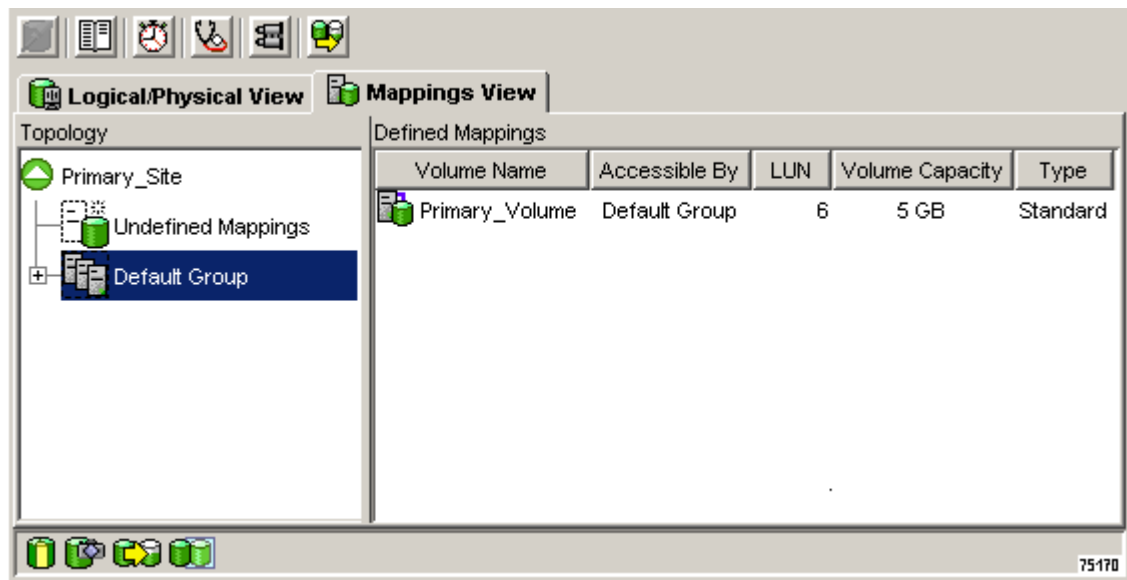


Figure 1-5 SANshare Storage Partitioning Example

The storage partition definitions for the primary and secondary storage arrays are independent of each other. If these definitions are put in place while the volume is in a secondary role, it will reduce the administrative effort associated with site recovery if it becomes necessary to promote the volume to a primary role. For more information on defining storage partitions, refer to the Array Management Window online help.

## Snapshot Volumes

A snapshot volume is a point-in-time image of a volume and is typically created so that an application, such as a backup application, can access the snapshot volume and read the data while the base volume remains online and accessible to hosts.

The volume for which the point-in-time image is created is known as the base volume and must be a standard volume in the storage array. The snapshot repository volume stores information about all data altered since the snapshot was created.

In this version of the storage management software, snapshot volumes based on the primary volume or secondary volume of a mirrored volume pair are permitted. The left pane of [Figure 1-6](#) shows the primary volume (also the base volume for the snapshot volume), the secondary volume, and the snapshot volume in the Array Management Window for the primary storage array. The right pane of [Figure 1-6](#) shows the secondary volume (also the base volume for the snapshot volume), and the snapshot of the secondary volume.

For additional information about creating and maintaining snapshot volumes, refer to the Array Management Window online help.

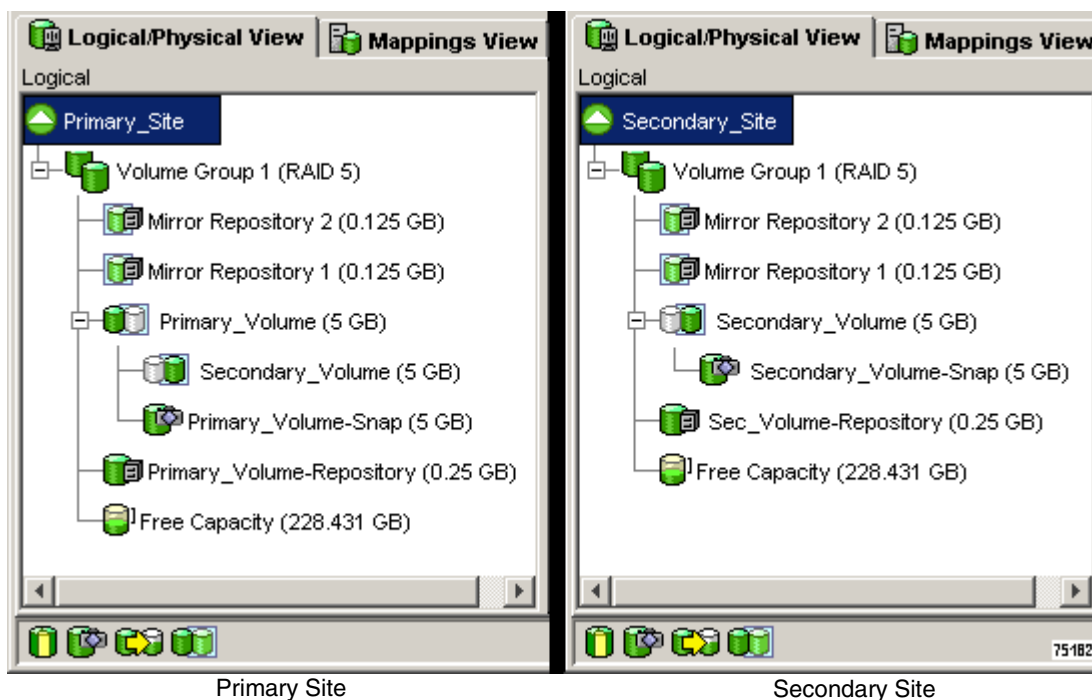


Figure 1-6 Snapshots of a Primary and Secondary Volumes

## Volume Copy

The Volume Copy premium feature is used to copy data from one volume (the source volume) to another volume (the target volume) in a single storage array. This feature can be used to copy data from volume groups that use smaller capacity drives to volume groups that use larger capacity drives, to back up data, or to restore snapshot volume data to the base volume. This premium feature includes a Create Copy Wizard to assist in creating a volume copy, and a Copy Manager to monitor volume copies after they have been created.

A primary volume in a mirror relationship can be a source volume or a target volume in a volume copy. Volume copies are not allowed on secondary volumes. If a copy of a secondary volume is required, a role reversal must be performed to change the secondary volume to a primary volume. If a role reversal is initiated during a copy in progress, the copy will fail and cannot be restarted.

---

**NOTE** Another method to produce a copy of the secondary volume is to create a snapshot volume of the secondary volume, then perform a volume copy of the snapshot volume. This method eliminates the need to perform a role reversal on the secondary volume.

---

## Dynamic Volume Expansion

Dynamic Volume Expansion (DVE) is a modification operation used to increase the capacity of a standard volume or a snapshot repository volume. The increase in capacity is achieved by using the free capacity available on the volume group of the standard or snapshot repository volume.

This modification operation is considered to be “dynamic” because you have the ability to continually access data on volume groups, volumes, and disk drives throughout the entire operation.

A DVE operation can be performed on a primary or secondary volume of a mirror relationship; however, even though the storage management software indicates that the volume has increased in capacity, its *usable capacity* becomes the smaller of the two volumes.

---

**NOTE** To perform a DVE operation, the mirror relationship must be in an Optimal status.

---

A DVE operation is not allowed on a mirror repository volume. If the mirror repository volume exists from a previous release of the storage management software and needs to be upgraded, refer to [“Upgrading Mirror Repository Volumes” on page 3-6](#).

## Hardware and Software Requirements

This section describes the minimum hardware and software requirements for the Remote Volume Mirroring feature.

### Hardware Requirements

The following are the minimum hardware requirements needed when configuring your system to use the Remote Volume Mirroring premium feature. The list includes components that are supplementary to the standard required for a basic storage array environment as described in the *Command Module and Drive Module Site Preparation Guide*.

- **Storage Arrays** – A minimum of two E2600, E4600, or E5600 storage arrays with RAID controllers with two or more host ports are required. The storage array containing the primary volume does not need to be the same model as the storage array containing the secondary volume. For example, the primary volume can reside on an E5600, while the secondary volume resides on an E4600.
- **Host Bus Adapters (HBA)** are used to connect hosts to the primary and secondary volumes through the controllers. For the certified HBAs for this version of the storage management software, refer to the *Product Release Notes*.
- **Switches** are used to connect multiple hosts with multiple storage arrays in a controlled environment. To complete a Fabric Environment, multiple switches can be connected over a distance up to 10km (6.25 miles) using Single-mode Fibre Channel switches, and up to approximately 4000km (2500 miles) using Fibre Channel over IP (FCIP) switches.

The switches certified for use with the Remote Volume Mirroring feature are listed in the *Product Release Notes*.

- **Short or Medium Range Fibre Channel Cables** are used to connect the hosts and storage arrays to the switches.
- **Long Range Fibre Channel Cables (Campus Configurations only)** that are up to 10km (6.25 miles) in length and are used to connect Fibre Channel switches to complete long distance fabrics using Single-mode Fibre Channel Switches.

### Software Requirements

The following are the minimum software requirements needed when configuring your system to use the Remote Volume Mirroring premium feature.

- **Supported version of SANtricity™ Storage Manager** – For information about the supported version of the storage management software, refer to the *Product Release Notes*.



- **Supported version of Controller Firmware** – For information about supported firmware versions for this release of the storage management software, refer to the *Product Release Notes*.
- **Remote Volume Mirroring Feature Key(s)** – The Remote Volume Mirroring premium feature must be activated and enabled on both the primary and secondary storage arrays.
- **Certified Host Operating Systems** – For information about supported operating systems for this release of the storage management software, refer to the *Product Release Notes*.

## Recommended Configurations

This section describes the key configurations supported for Remote Volume Mirroring in this version of the storage management software. The configuration you choose determines the level of redundancy.

### Highest Availability Campus Configuration

The Highest Availability Campus Configuration is a fully redundant configuration and consists of two storage arrays and four switches using a Fibre Channel fabric environment. [Figure 1-7](#) shows a Highest Availability Campus Configuration.

For detailed instructions on setting up this configuration, refer to [Chapter 2, “Hardware and Software Installation.”](#)

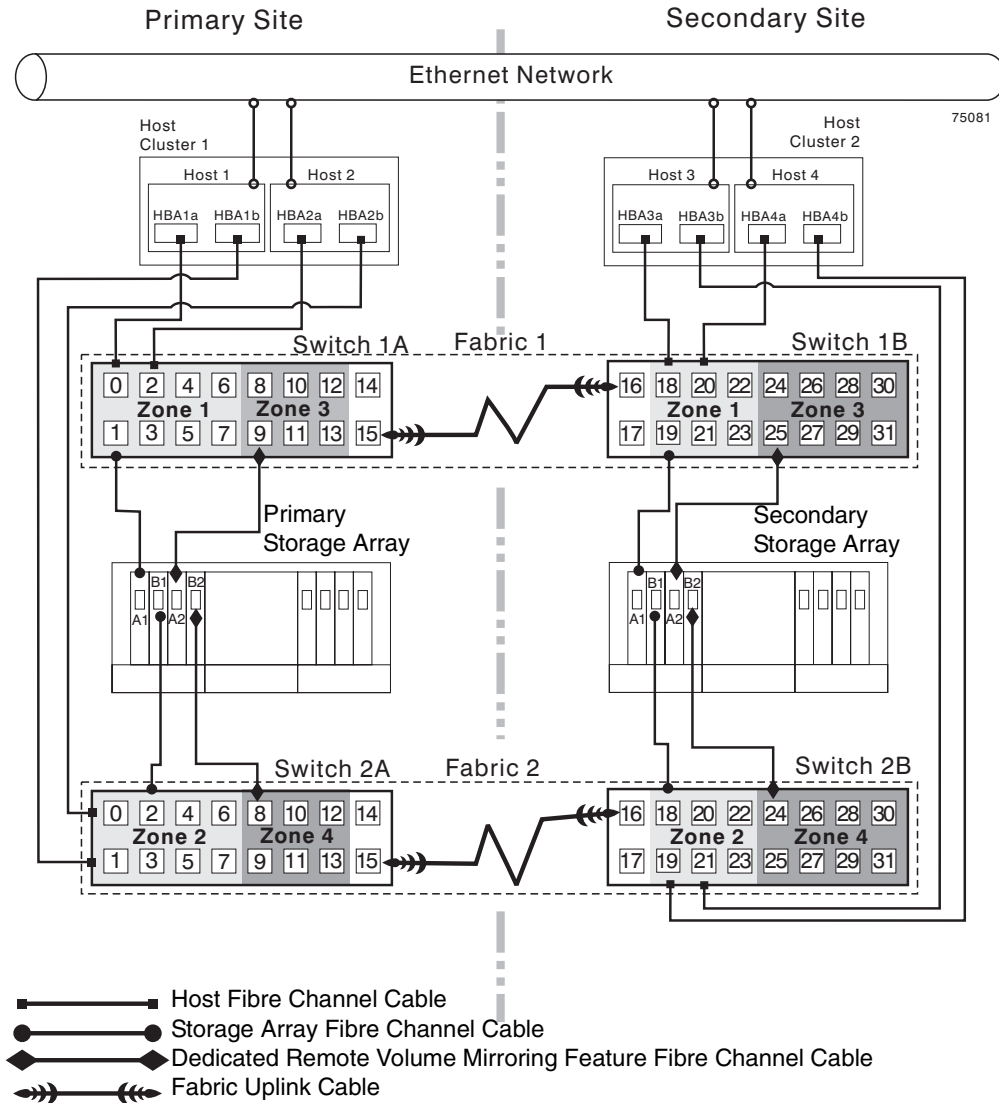


Figure 1-7 Highest Availability Campus Configuration

## Campus Configuration

The Campus Configuration is a lower-cost configuration and consists of two storage arrays and two switches using a Fibre Channel fabric environment. [Figure 1-8](#) shows a Campus Configuration.

For detailed instructions on setting up this configuration, refer to [Chapter 2, “Hardware and Software Installation.”](#)

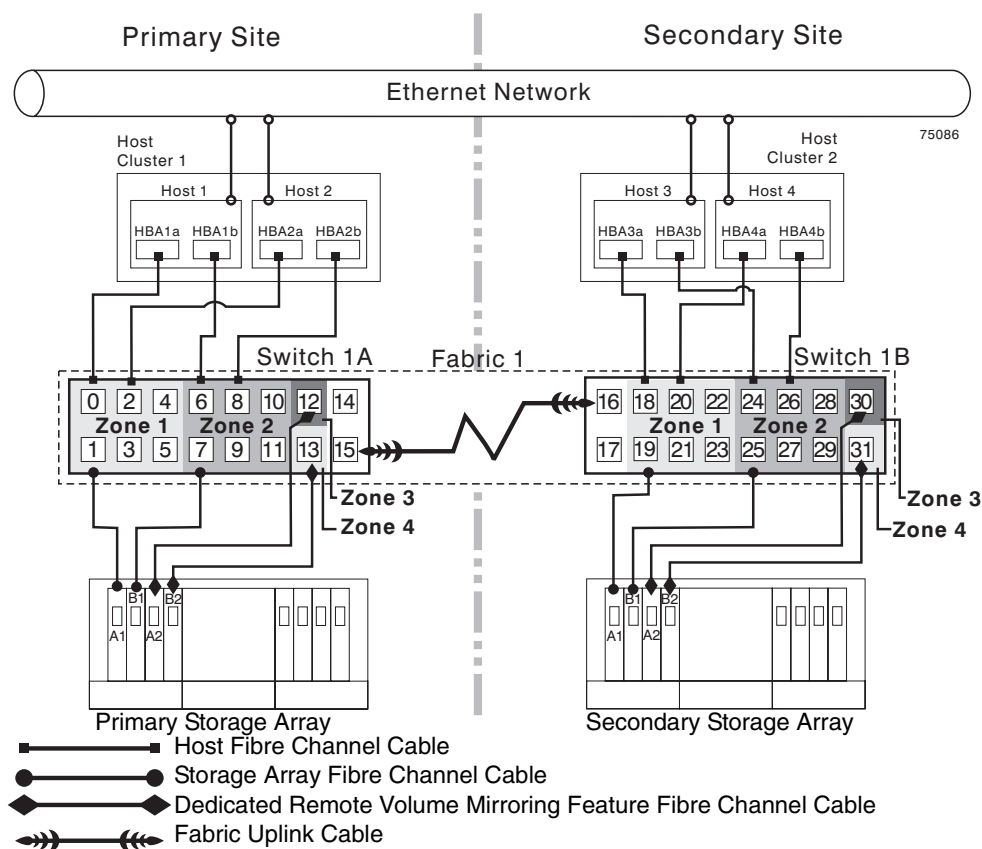


Figure 1-8 Campus Configuration

## Intra-Site Configuration

The Intra-Site Configuration is the lowest-cost configuration that consists of two storage arrays and two switches using a Fibre Channel fabric environment. [Figure 1-9](#) shows an Intra-Site Configuration. The primary storage array and secondary storage array may have a maximum connection distance of up to 500m (or 0.32 miles) and would typically be located in the same building or in the same room.

For detailed instructions on setting up this configuration, refer to [Chapter 2, “Hardware and Software Installation.”](#)

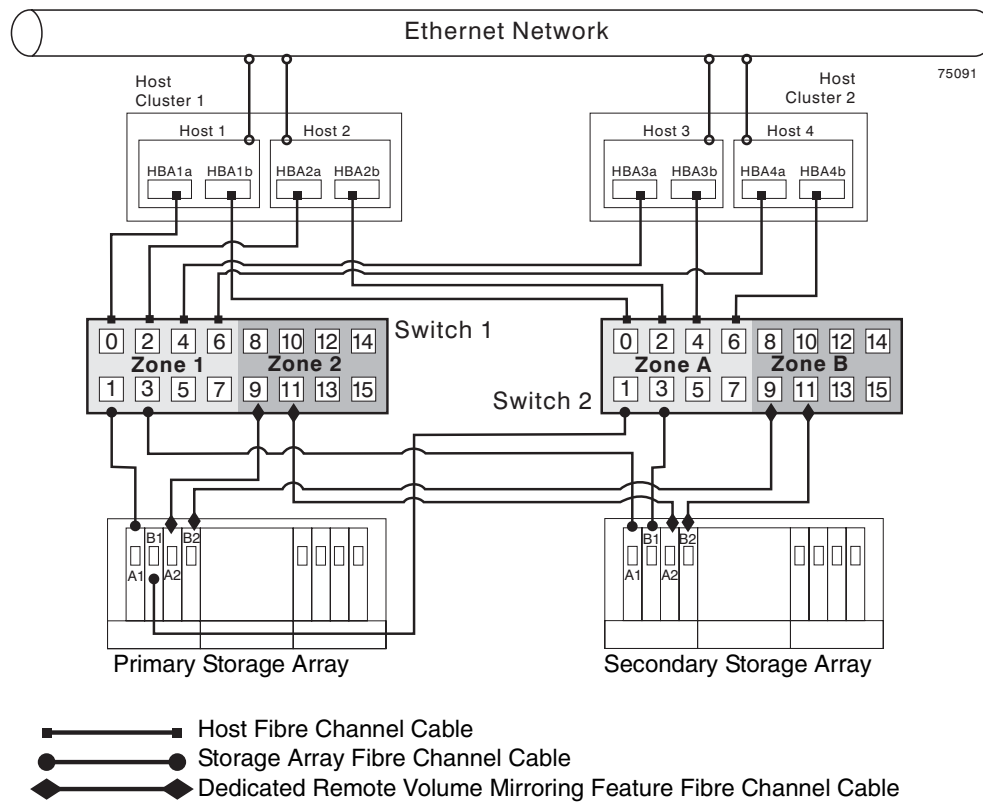


Figure 1-9 Intra-Site Configuration

## Hardware and Software Checklist

To ensure that all the required hardware and software components have been configured properly, complete the following checklists.

### Hardware Checklist

Before starting the storage management software, complete the following tasks.

Table 1-1 Hardware Checklist

Task Description	Validation Activity
<p>1 Ensure that the minimum hardware requirements have been met.</p> <p>For a complete list of the hardware requirements, refer to <a href="#">“Hardware Requirements” on page 1-16</a>.</p>	<p><input type="checkbox"/> Completed.</p>
<p>2 Ensure your primary and secondary storage arrays have been properly configured.</p> <p>Refer to the <i>SANtricity Storage Manager Installation Guide</i> for storage array configuration information.</p>	<p><input type="checkbox"/> Completed.</p>
<p>3 Ensure that your switches and cables have been properly configured.</p> <p>For more information on configuring switches for use with the Remote Volume Mirroring feature, refer to <a href="#">Chapter 2, “Hardware and Software Installation.”</a></p>	<p><input type="checkbox"/> Completed.</p>

## Software Checklist

Prior to establishing mirror relationships in your storage arrays, complete the following tasks.

Table 1-2 Software Checklist

Task Description	Validation Activity
1 Ensure that data on the primary and secondary storage arrays participating in Remote Volume Mirroring have been backed up.	<input type="checkbox"/> Completed.
2 Ensure that the correct versions of firmware and storage management software have been installed.  For more information on upgrading firmware or installing the storage management software, refer to <a href="#">Chapter 2, “Hardware and Software Installation.”</a>	<input type="checkbox"/> Completed.
3 Ensure that the Remote Volume Mirroring premium feature has been enabled on both the primary and secondary storage arrays.  For information on enabling premium features, refer to <a href="#">Chapter 2, “Hardware and Software Installation,”</a> or the Array Management Window online help.	<input type="checkbox"/> Completed.
4 Ensure that the Remote Volume Mirroring feature has been activated and that a mirror repository volume has been created for each controller on the primary storage array.  For more information on activating the Remote Volume Mirroring feature, refer to <a href="#">Chapter 3, “Using the Remote Volume Mirroring Premium Feature.”</a>	<input type="checkbox"/> Completed.
5 Ensure that the required primary and secondary volumes have been created on the primary and secondary storage arrays.  For more information on establishing a mirror relationship, refer to <a href="#">Chapter 3, “Using the Remote Volume Mirroring Premium Feature.”</a>	<input type="checkbox"/> Completed.





## *Hardware and Software Installation*

---

This chapter presents information necessary to install hardware and software to run the Remote Volume Mirroring premium feature. The beginning of the chapter explores the steps that need to be completed before any hardware or software installation. Next, hardware installation procedures are presented, followed by software installation procedures. The sections and procedures in this chapter are to be followed and completed sequentially, from start to end.

## Pre-Installation Requirements

This section provides necessary pre-installation information, such as site preparation, hardware and software requirements, and concepts that should be reviewed and completed before beginning any hardware or software installation procedures.

### Site Preparation

The Remote Volume Mirroring feature uses Fibre Channel switches to create a fabric environment for data replication. These switches require only minimal additional site preparation requirements beyond basic storage array operation.

For basic site preparation considerations including the use of Fibre Channel cables and connections, refer to the *Command Module and Drive Module Site Preparation Guide*.

For additional site preparation considerations concerning the Fibre Channel switches, including power requirements and physical dimensions/requirements, refer to the documentation provided by the switch manufacturer.

### Hardware and Software Requirements

Ensure that all of the required hardware and software are available before proceeding. For a list of requirements, refer to [“Hardware and Software Requirements” in Chapter 1](#).

### Switch Zoning Overview

Because of possible restrictions at the host level, the supported Remote Volume Mirroring configurations contain Fibre Channel switches zoned so that a single host adapter can access only one controller per storage array. Additionally, all configurations utilize a separate zone for the ports reserved for the Remote Volume Mirroring feature.

---

**IMPORTANT** The uplink port (E\_port) that connects (cascades) switches within a fabric should not be zoned.

---

Switch zoning configurations are typically set up using management software provided by the manufacturer of the Fibre Channel switch. This software should be included with the materials provided when the switch was purchased.

When two or more Fibre Channel switches are cascaded together, the switch management software will combine the ports for all switches that are linked. For example, if two 16-port Fibre Channel switches are cascaded with a physical connection using a Fibre Channel cable, the switch management software will show ports 0 through 31 participating in the fabric rather than 2 switches each with ports 0 through 15. Therefore, a zone that is created containing any of these ports can exist on multiple cascaded switches.

Figure 2-1 shows cascaded and non-cascaded switches. The top set of switches in Figure 2-1 is on the same network and is cascaded; therefore, Zone 1 is the same zone on Switch 1A as Zone 1 is on Switch 1B. In a Single-mode Fibre environment, the two switches are connected by a single port on each switch designated as an E\_port, which is not in a zone. In a configuration utilizing Fibre Channel over IP (FCIP) switches, the switches are connected over a remote distance through Ethernet link ports.

The bottom set of switches in Figure 2-1 are on the same network, but are not cascaded. Even though both contain a Zone 1 (shown as Zone A in Switch 2), these zones are independent of each other.

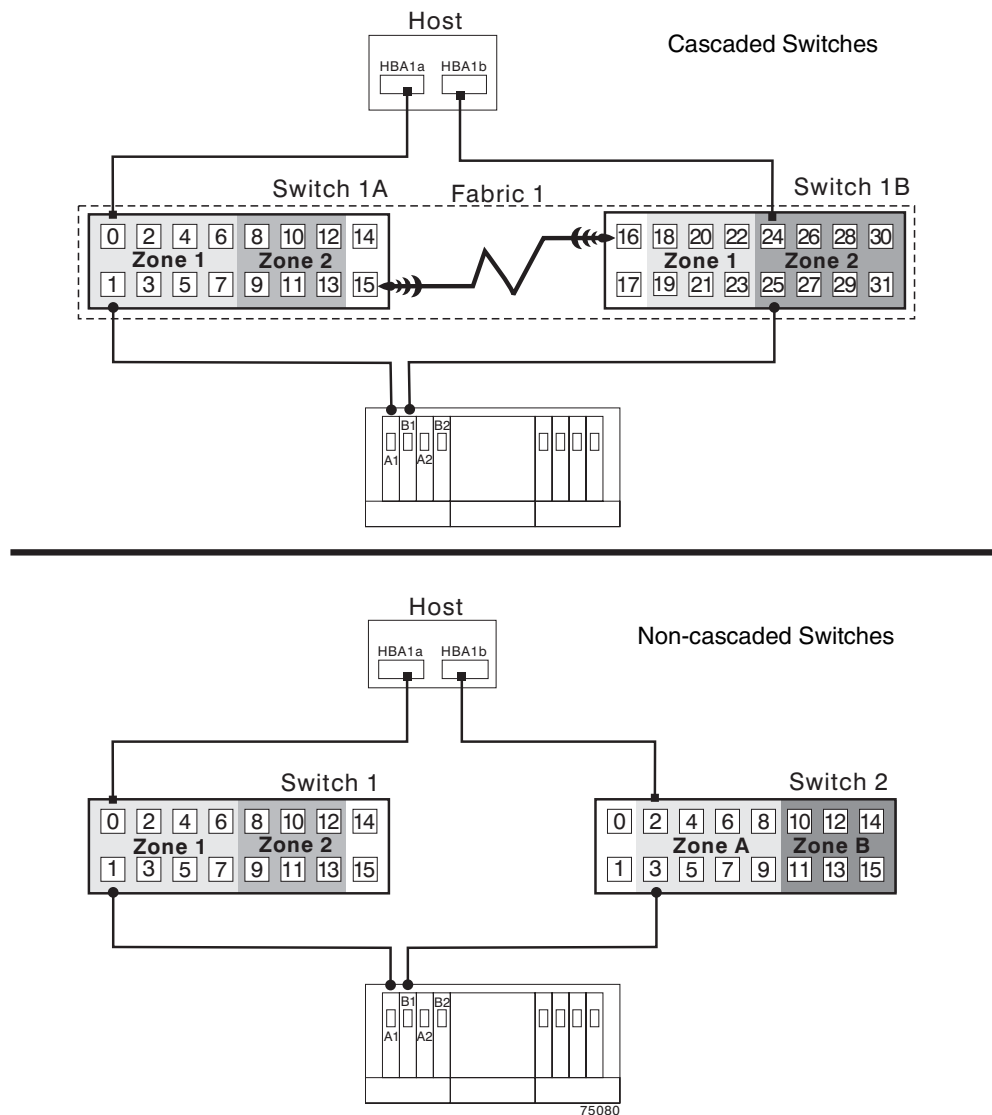


Figure 2-1 Switch Zoning in Cascaded and Non-Cascaded Fibre Channel Switches

For more information about Fibre Channel switch zoning or setting up a zone configuration, refer to the manufacturer's documentation provided with the switch.

Because of the varying Remote Volume Mirroring configurations, the switch zone settings are presented preceding each configuration in this chapter.

## Hardware Installation

This section describes the procedures necessary to properly connect and configure one or more storage arrays for use with the Remote Volume Mirroring feature.

The following configurations are covered in this section:

- **Highest Availability Campus Configuration** – Four total switches (two at each site) provide for complete redundancy in the Fibre Channel switches and fabrics in addition to all storage array components and hosts. There is no single point of failure in this configuration; and therefore, is the recommended configuration for the Remote Volume Mirroring feature. To begin installing hardware for this configuration, go to the next section, [“Highest Availability Campus Configuration.”](#)
- **Campus Configuration** – The number of Fibre Channel switches is reduced from four to two and the number of fabrics from two to one; thus, this configuration is not fully redundant. Consequently, this makes the switches and fabric a single point of failure. A switch failure does not usually result in a loss of data, but it does affect data synchronization until the error is corrected. Therefore, the Highest Availability Campus Configuration is the recommended configuration, because data synchronization can continue for any single switch failure. This configuration essentially allows the minimum required components to successfully operate the Remote Volume Mirroring premium feature between two sites. To begin installing hardware for this configuration, go to [“Campus Configuration” on page 2-11.](#)
- **Intra-Site Configuration** – Since there are only two switches in the Intra-Site configuration, it is similar to the Campus Configuration. However, no multiple-switch fabrics exist in this configuration. Because all hosts and storage arrays are in proximity of both Fibre Channel switches, full redundancy can be obtained within the site since each controller path is connected to a different switch. The Highest Availability Campus Configuration is the recommended configuration, because it is fully redundant which makes disaster recovery easier. The Intra-Site Configuration creates a single point of failure if a disaster affects the entire site. To begin installing hardware for this configuration, go to [“Intra-Site Configuration” on page 2-16.](#)

For a list of required materials to complete any hardware installation, refer to [“Hardware and Software Requirements” in Chapter 1.](#)

### Highest Availability Campus Configuration

---

**IMPORTANT** The Highest Availability Campus Configuration is the recommended configuration for the Remote Volume Mirroring feature.

---

This configuration has two Fibre Channel switches at both the primary and secondary sites (four switches total), which provide for complete failover and redundancy. Failures could involve Fibre Channel switches, Fibre Channel cables, and any host or storage array. Two

Fibre Channel switches at each site also provide redundancy to the local site in addition to a fully redundant remote configuration. There is no single point of failure in the hardware components.

Figure 2-2 shows the Highest Availability Campus Configuration after installation is complete.

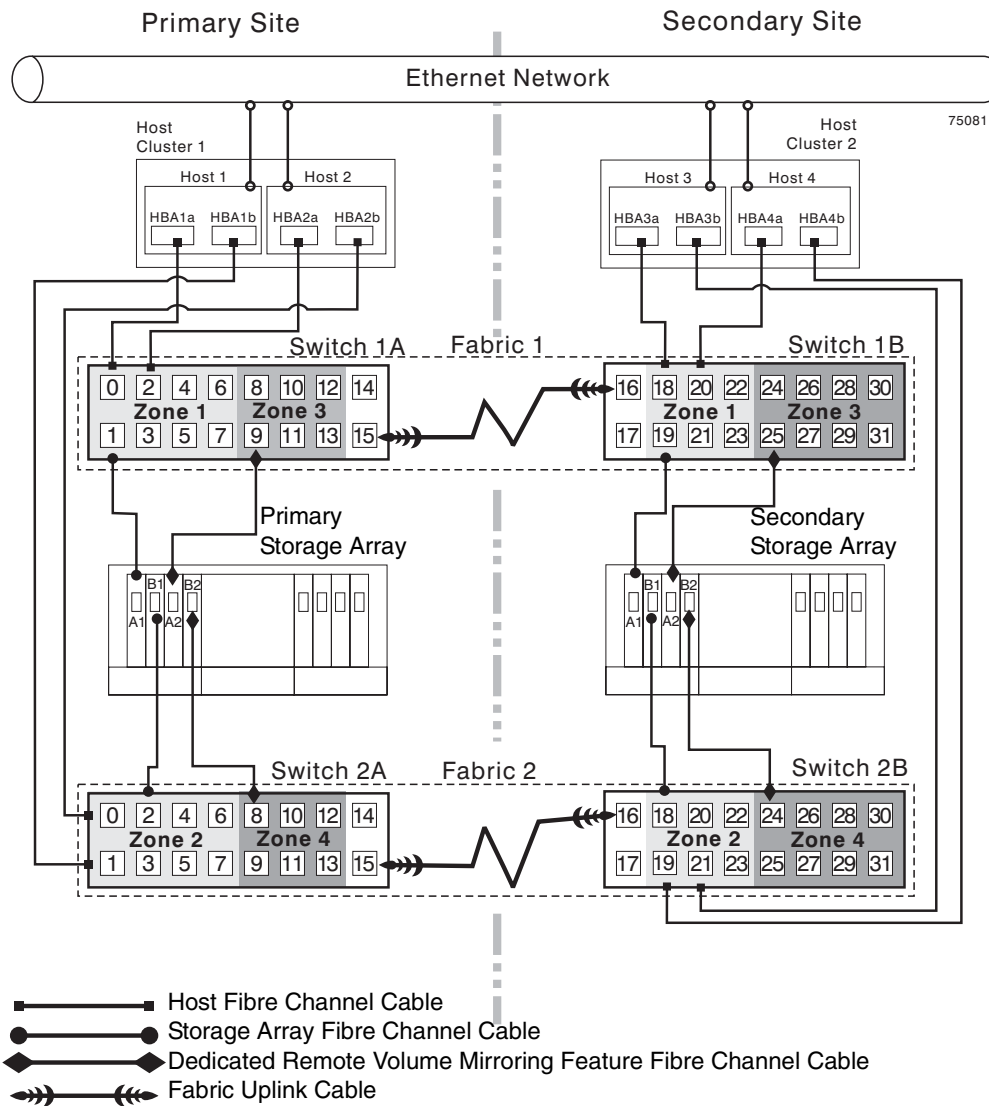


Figure 2-2 Highest Availability Campus Configuration

## Switch Zoning for the Highest Availability Campus Configuration

This configuration allows for a separate zone for each reserved port for the Remote Volume Mirroring feature.

The switches do not need to be zoned exactly as presented in this configuration. However, the following are requirements when zoning switches for the Highest Availability Campus Configuration.

- There will be a total of four zones in this configuration.
  - Zones 1 and 3 will exist on Fabric 1 (Switch 1A at the primary Site, and Switch 1B at the secondary site).
  - Zones 2 and 4 will exist on Fabric 2 (Switch 2A at the primary Site, and Switch 2B at the secondary site).
- Configure the zones on the switch so that there is one port per zone for a storage array connection and one port per zone for each host.

---

**IMPORTANT** The uplink ports (E\_ports) must not be zoned on any of the Fibre Channel switches.

---

- Switches are zoned so that a single host adapter can access only one controller per storage array.

Figure 2-3 shows how the four switches are zoned for the Highest Availability Campus Configuration.

The switches in Figure 2-3 contain 16 ports each, which leaves many unused ports per switch when following the requirements, above. The remaining ports can be distributed among the other zones. However, it is recommended that most remaining ports be assigned to the zones containing the host connections (Zones 1 and 2 in Figure 2-3). This will allow easy setup for additional hosts to connect to the environment.

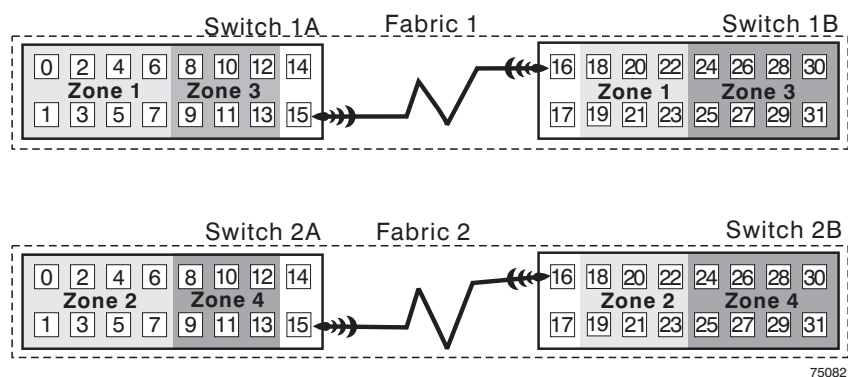


Figure 2-3 Switch Zoning for the Highest Availability Campus Configuration

Given the requirements listed above and the zoning shown in Figure 2-3, ensure that all four switches are properly zoned before proceeding. For more information on zoning switches, refer to “Switch Zoning Overview” on page 2-2.

## Cabling for the Highest Availability Campus Configuration

---

**IMPORTANT** Begin the installation at the primary site. Repeat these steps for the secondary site when instructed to do so.

---

After the four Fibre Channel Switches are properly zoned, complete the following procedure to set up the Highest Availability Campus Configuration for the Remote Volume Mirroring feature.

---

**NOTE** All connections are completed using Fibre Channel cables of appropriate length.

---

- 1** Is Remote Volume Mirroring feature equipment being added to an existing storage array environment?
  - **Yes** – Stop I/O activity from all hosts before proceeding. Go to [step 2](#).
  - **No** – This is a new storage array installation. Go to [step 3](#).
- 2** Power down all storage arrays, hosts, Fibre Channel switches, and all other equipment in the storage array environment.
- 3** Ensure that cabling between all command modules and drive modules is complete as presented in the *Cabling Guide*.

---

**IMPORTANT** Depending on which site is being configured, Switch 1 represents Switch 1A for the primary site, and Switch 1B for the secondary site. This applies to Switch 2 as well.

---

---

**NOTE** [Figure 2-4](#) shows the cabling as described in steps [4](#) and [5](#).

---

- 4** Connect the primary host bus adapter for each local host to an available port in Zone 1 of Switch 1.

---

**NOTE** The cables can be connected to *any* port in the proper zone of the switch.

---

- 5** Connect the secondary host bus adapter for each host at this site to an available port in Zone 2 of Switch 2.



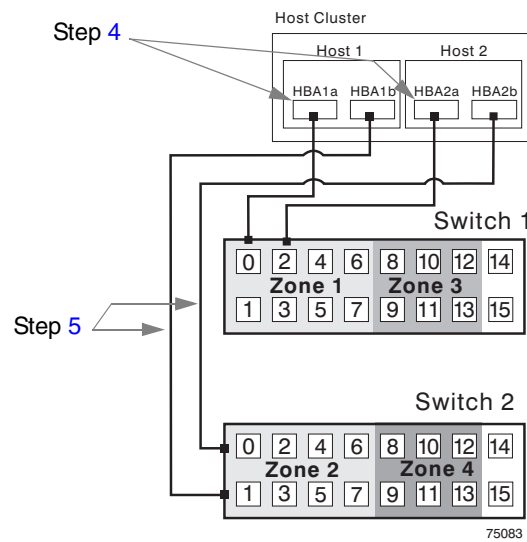


Figure 2-4 Host Bus Adapter Connections to Fibre Channel Switches

**NOTE** Figure 2-5 on page 2-10 shows the cabling as described in steps 6 through 9.

- 6 Connect controller port A1 of the storage array to an available port in Zone 1 of Switch 1.
- 7 Connect controller port B1 of the storage array to an available port in Zone 2 of Switch 2.
- 8 Connect controller port A2 of the storage array to an available port in Zone 3 of Switch 1.
- 9 Connect controller port B2 of the storage array to an available port in Zone 4 of Switch 2.

**NOTE** Controller ports A2 and B2 are reserved for mirror relationship synchronization upon activation of the Remote Volume Mirroring feature. For more information, refer to “Connectivity and Input/Output” on page 1-11.

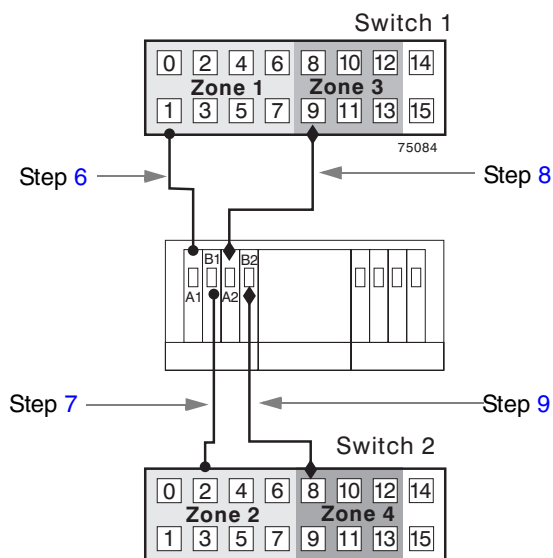


Figure 2-5 Storage Array Connections to Fibre Channel Switches

- 10** The primary site cabling is now complete. Is the secondary site cabling complete?
- **No** – Repeat [step 1 on page 2-8](#) through [step 9 on page 2-9](#) for the secondary site.
  - **Yes** – Go to [step 11](#).

---

**NOTE** [Figure 2-6](#) shows the cabling as described in [steps 11 and 12](#).

---

- 11** Complete the fabric environment for Switch 1 by connecting Switch 1A with Switch 1B.
- 12** Repeat [step 11](#) for Switch 2A and 2B to complete the fabric environment for Switch 2.

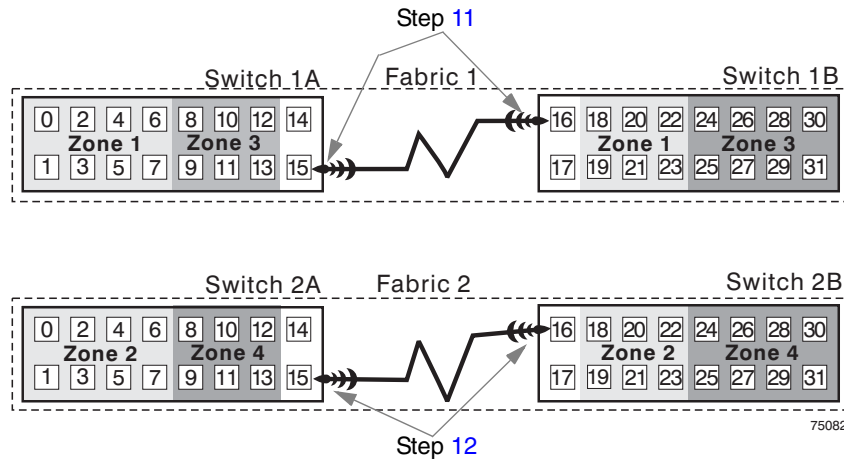


Figure 2-6 Connecting Remote Switches to Complete Fabric Environments

- 13** Cabling for the Highest Availability Campus Configuration is complete. Repeat [step 4 on page 2-8](#) through [step 10 on page 2-10](#) for any additional storage arrays that exist in the same cabinet that will use the Remote Volume Mirroring feature.
- 14** Power up all storage arrays, hosts, Fibre Channel switches, and any other hardware at both sites that were powered down in [step 2 on page 2-8](#).
- 15** Hardware installation is complete. The next step will be to configure the storage management software to support mirror relationships. Go to [“Software Installation” on page 2-22](#).

## Campus Configuration

The Campus Configuration offers the same functionality as the Highest Availability Campus Configuration, but contains only one switch at each site, rather than two. The configuration is still redundant for host bus adapters, controllers, and Remote Volume Mirroring ports, but is a single point of failure for switches. If a switch at either site fails, the Remote Volume Mirroring Feature cannot function. For this reason, the Highest Availability Campus Configuration is highly recommended for total environment redundancy.

[Figure 2-7](#) shows the Campus Configuration after the installation is complete.

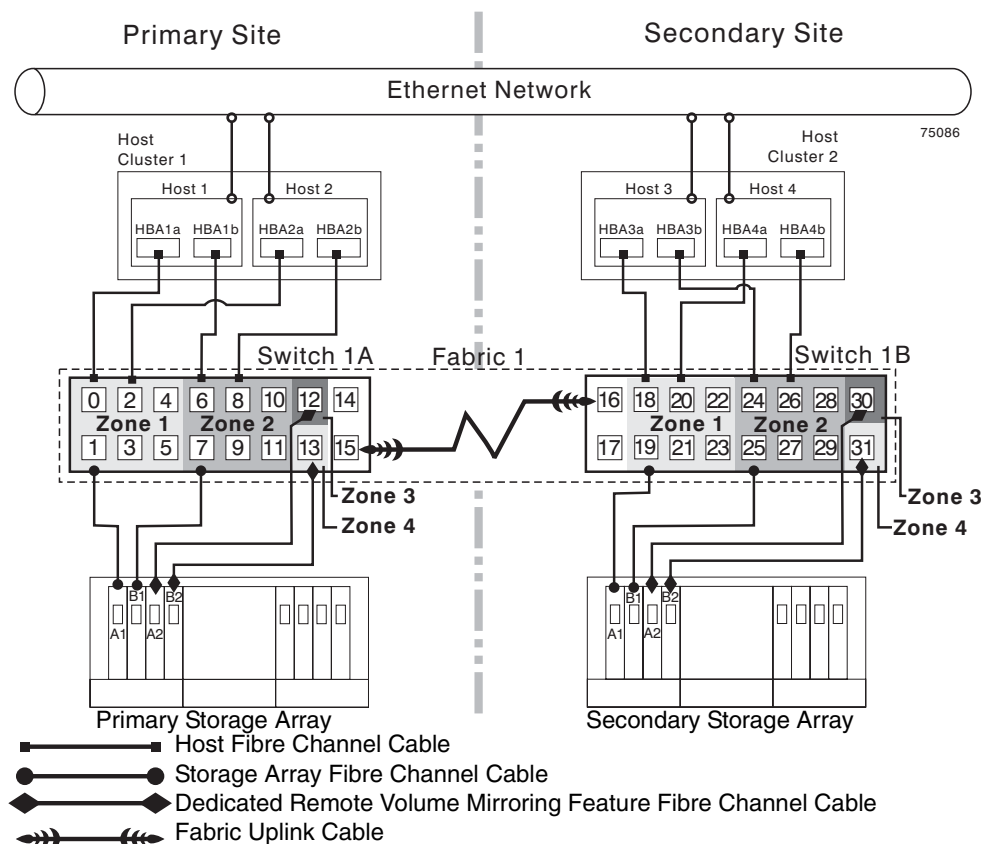


Figure 2-7 Campus Configuration

## Switch Zoning for the Campus Configuration

The Campus Configuration allows for a separate zone for each reserved port for the Remote Volume Mirroring feature.

The switches do not need to be zoned exactly as presented in this configuration. However, the following are requirements when zoning switches for the Campus Configuration.

- There will be a total of four zones in this configuration.
  - All zones will exist on Fabric 1 (Switch 1A at the primary site, and Switch 1B at the secondary site).
  - Zones 3 and 4 will be reserved for the dedicated Remote Volume Mirroring Feature connections.
- Configure the zones on the switches so that there is one port per zone for a storage array connection and one port per zone for each host.

---

**IMPORTANT** The uplink ports (E\_ports) must not be zoned on any of the Fibre Channel switches.

---

- Switches are zoned so that a single host adapter can access only one controller per storage array.

Figure 2-8 shows how the two switches are zoned for the Campus Configuration.

The switches in Figure 2-8 contain 16 ports each, which leaves many unused ports per switch. The remaining ports can be distributed among the other zones. However, it is recommended that most remaining ports be assigned to the zones containing the host connections (Zone 1 in Figure 2-8). This will allow easy setup for additional hosts to connect to the environment.

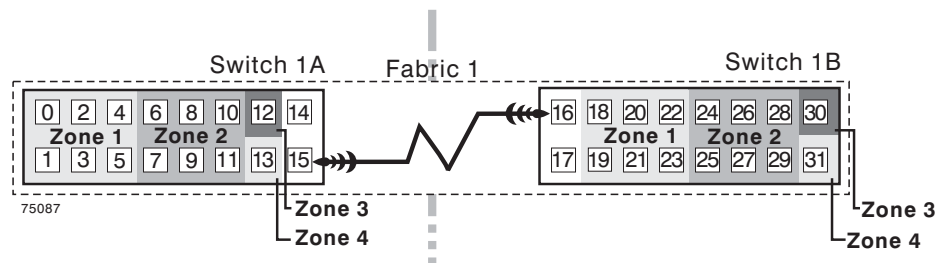


Figure 2-8 Switch Zoning for the Campus Configuration

Given the requirements and the zoning example shown in Figure 2-8, ensure that both switches are properly zoned before proceeding. For more information on Zoning switches, refer to “[Switch Zoning Overview](#)” on page 2-2.

## Cabling for the Campus Configuration

---

**IMPORTANT** Begin the installation at the primary site. Repeat these steps for the secondary site when instructed to do so.

---

After both Fibre Channel Switches are properly zoned, complete the following procedure to set up the Campus Configuration for the Remote Volume Mirroring feature.

---

**NOTE** All connections are completed using Fibre Channel cables of appropriate length.

---

- 1 Is Remote Volume Mirroring feature equipment being added to an existing storage array environment?
  - **Yes** – Stop I/O activity from all hosts before proceeding. Go to [step 2](#).

- **No** – This is a new storage array installation. Go to [step 3](#).
- 2** Power down all storage arrays, hosts, Fibre Channel switches, and all other equipment in the storage array environment.
  - 3** Ensure that basic cabling between all command modules and drive modules is complete as presented in the *Cabling Guide*.

---

**IMPORTANT** Depending on which site is being configured, Switch 1 represents Switch 1A for the primary site, and Switch 1B for the secondary site.

---



---

**NOTE** [Figure 2-9](#) shows the cabling as described in [steps 4 and 5](#).

---

- 4** Connect the primary host bus adapter for each host at this site to an available port in Zone 1 of Switch 1.

---

**NOTE** The cables can be connected to *any* port in the proper zone of the switch.

---

- 5** Connect the secondary host bus adapter for each host at this site to an available port in Zone 2 of Switch 1.

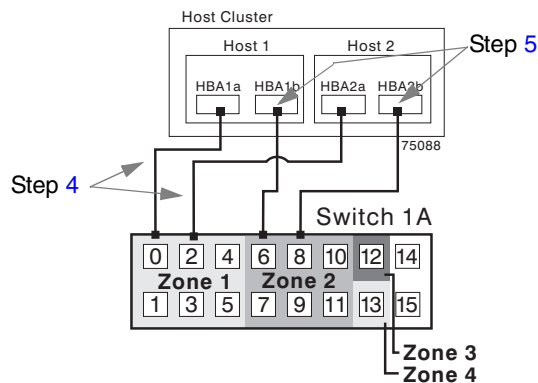


Figure 2-9 Host Bus Adapter Connections to Fibre Channel Switches

---

**NOTE** [Figure 2-10](#) shows the cabling as described in [steps 6 through 10](#).

---

- 6** Connect controller port A1 of the storage array to an available port in Zone 1 of Switch 1.
- 7** Connect controller port B1 of the storage array to an available port in Zone 2 of Switch 1.

- 8 Connect controller port A2 of the storage array to an available port in Zone 3 of Switch 1.
- 9 Connect controller port B2 of the storage array to an available port in Zone 4 of Switch 1.

**NOTE** Controller ports A2 and B2 are reserved for mirror relationship synchronization upon activation of the Remote Volume Mirroring feature. For more information, refer to [“Connectivity and Input/Output” on page 1-11](#).

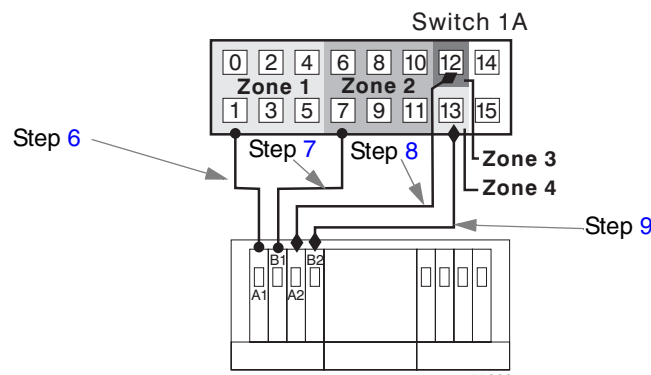


Figure 2-10 Storage Array Connections to Fibre Channel Switches

- 10 The primary site cabling is now complete. Is the secondary site cabling complete?
  - **No** – Repeat [step 1 on page 2-13](#) through [step 9](#) for the secondary site.
  - **Yes** – Continue with [step 11](#).

**NOTE** [Figure 2-11](#) shows the cabling as described in [step 11](#).

- 11 Complete Fabric 1 by connecting Switch 1A with Switch 1B.

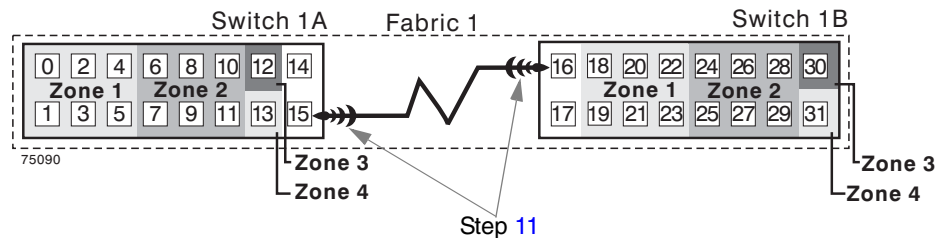


Figure 2-11 Connecting Remote Switches to Complete a Fabric Environment

- 12 Cabling for the Campus Configuration is complete. Repeat [step 4 on page 2-14](#) through [step 10 on page 2-15](#) for any additional storage arrays that exist in the same cabinet that will use the Remote Volume Mirroring feature.
- 13 Power up all storage arrays, hosts, Fibre Channel switches, and any other hardware at both sites that was powered down in [step 2 on page 2-14](#).
- 14 Hardware installation is complete. The next step will be to configure the storage management software to support mirror relationships. Go to [“Software Installation” on page 2-22](#).

## Intra-Site Configuration

The Intra-Site configuration is used in environments where a long distance fabric is not required because of the close proximity of the hosts and storage arrays. The configuration is still redundant for host bus adapters, controllers, Remote Volume Mirroring ports, and switches, but is a single point of failure for the site because all equipment can be destroyed by the same disaster. For this reason, the Highest Availability Campus Configuration is highly recommended for total environment redundancy.

---

**IMPORTANT** A switch failure in this configuration does not affect data access; however, an Unsynchronized state may occur for all mirror relationships on both primary and secondary storage arrays as a result.

---

[Figure 2-12](#) shows the Intra-Site Configuration after installation is complete.



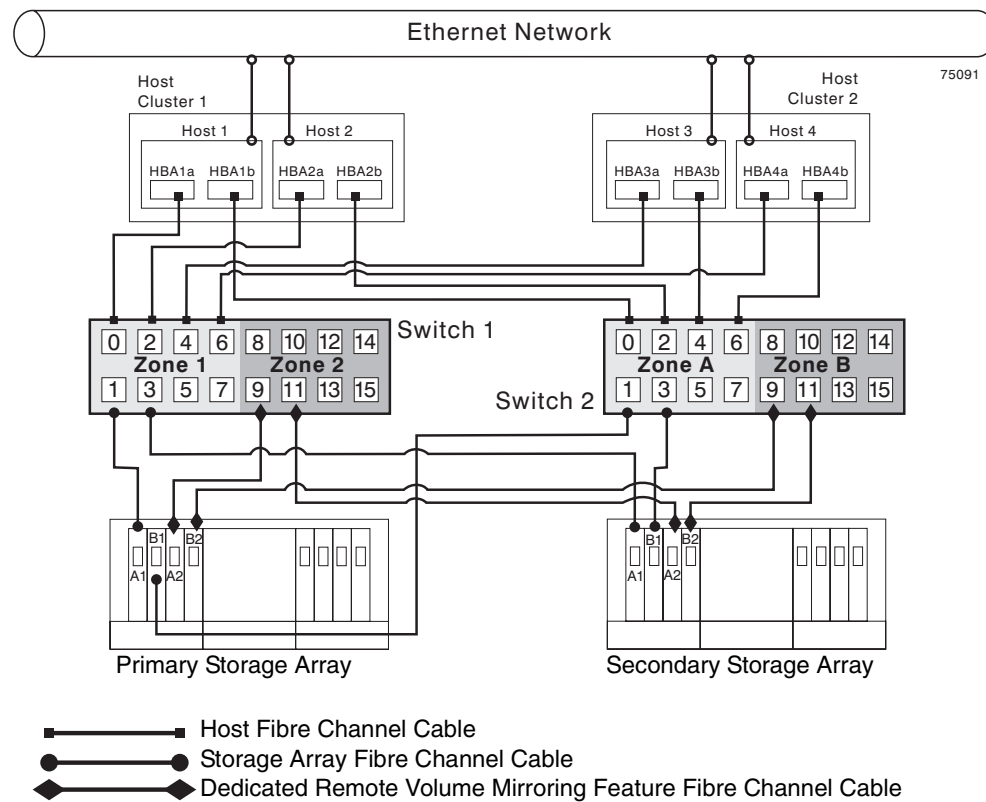


Figure 2-12 Intra-Site Configuration

## Switch Zoning for the Intra-Site Configuration

The Intra-Site configuration is designed for switch redundancy. However, the switches are not cascaded, and are, therefore, independent of each other. The switches do not need to be zoned exactly as presented in this configuration. However, the following requirements must be met when zoning switches for the Intra-Site Configuration.

**IMPORTANT** Switch 2 contains Zones A and B to show that there is no relationship between Switch 1 and Switch 2, contrary to the other configurations.

- There will be a total of four zones in this configuration.
  - Zones 1 and 2 will exist on Switch 1.
  - Zones A and B will exist on Switch 2.
- Configure the zones on the switch so that there is one port per zone for a storage array connection and one port per zone for each host.
- Switches are zoned so that a single host adapter can only access one controller per storage array.

Figure 2-13 shows the switch zoning for the Intra-Site configuration.

The switches in Figure 2-13 contain 16 ports each, which leaves many unused ports per switch. The remaining ports can be distributed among the other zones. However, it is recommended that most remaining ports be assigned to the zones containing the host connections (Zone 1 and Zone A in Figure 2-13). This will allow easy setup for additional hosts to connect to the environment.

For simplicity in this example, the switches use one-half of the ports for each zone, although Zone 2 and Zone B require less ports.



Figure 2-13 Switch Zoning for the Intra-Site Configuration

Given the requirements and the zoning example shown in Figure 2-13, ensure both switches are properly zoned before proceeding. For more information on zoning switches, refer to “Switch Zoning Overview” on page 2-2.

## Cabling for the Intra-Site Configuration

After both Fibre Channel Switches are properly zoned, complete the following procedure to set up the Intra-Site Configuration for the Remote Volume Mirroring feature.

---

**NOTE** All connections are completed using Fibre Channel cables of appropriate length.

---

- 1 Is Remote Volume Mirroring feature equipment being added to an existing storage array environment?
  - **Yes** – Stop I/O activity from all hosts before proceeding. Go to [step 2](#).
  - **No** – This is a new storage array installation. Go to [step 3](#).
- 2 Power down all storage arrays, hosts, Fibre Channel switches, and all other equipment in the storage array environment.
- 3 Ensure that basic cabling between all command modules and drive modules is complete on both storage arrays as presented in the *Cabling Guide*.

---

**NOTE** Figure 2-14 on page 2-19 shows the cabling as described in [step 4](#).

---

- 4 Connect the primary host bus adapter for each host to an available port in Zone 1 of Switch 1.

**NOTE** The cables can be connected to *any* port in the proper zone of the switch.

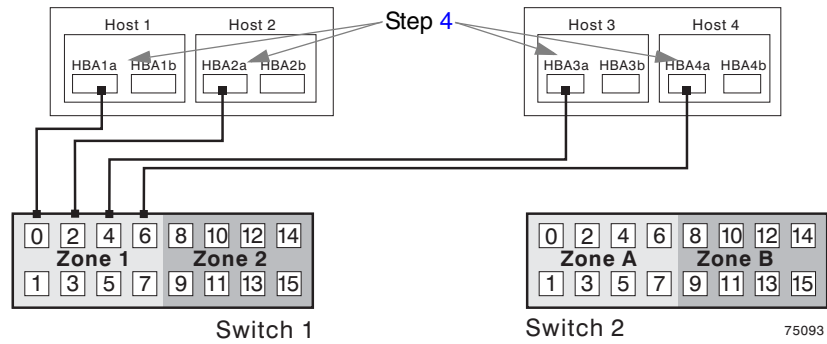


Figure 2-14 Primary Host Bus Adapter Connections to Fibre Channel Switches

**NOTE** [Figure 2-15](#) shows the cabling as described in step 5.

- 5 Connect the secondary host bus adapter for each host to an available port in Zone A of Switch 2.

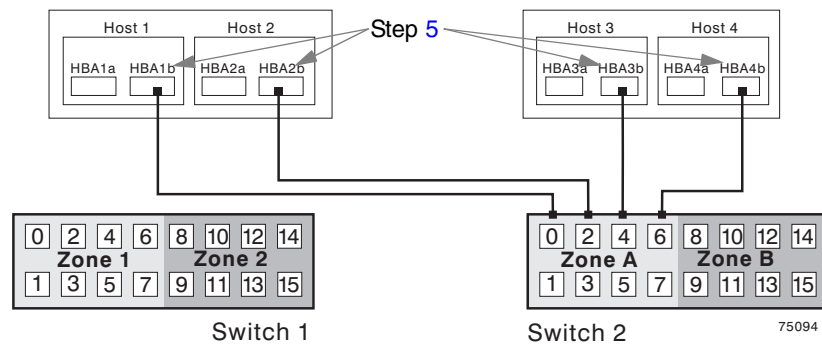


Figure 2-15 Secondary Host Bus Adapter Connections to Fibre Channel Switches

**NOTE** [Figure 2-16 on page 2-20](#) shows the cabling as described in steps 6 through 9.

- 6 Connect controller port A1 of the primary storage array to an available port in Zone 1 of Switch 1.
- 7 Connect controller port B1 of the primary storage array to an available port in Zone A of Switch 2.

- 8 Connect controller port A2 of the primary storage array to an available port in Zone 2 of Switch 1.
- 9 Connect controller port B2 of the primary storage array to an available port in Zone B of Switch 2.

---

**NOTE** Upon activation of the Remote Volume Mirroring feature, controller ports A2 and B2 are reserved for mirror relationship synchronization.

---

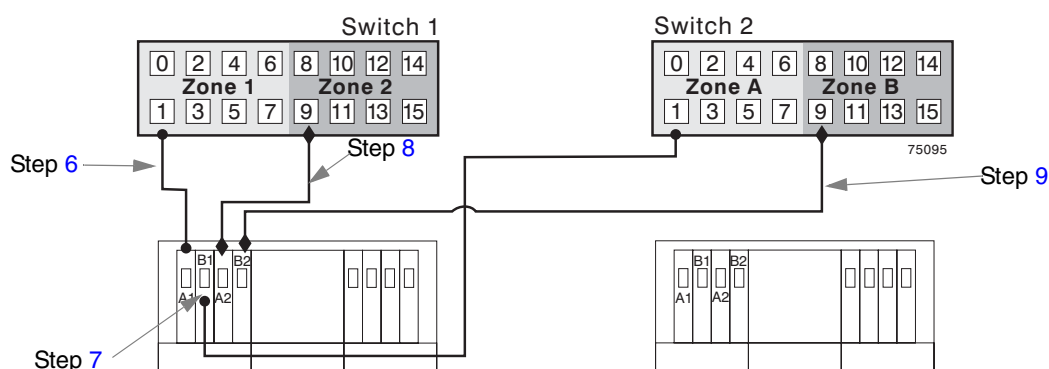


Figure 2-16 Primary Storage Array Connections to Fibre Channel Switches

---

**NOTE** [Figure 2-17 on page 2-21](#) shows the cabling as described in steps 10 through 13.

---

- 10 Connect controller port A1 of the secondary storage array to an available port in Zone 1 of Switch 1.
- 11 Connect controller port B1 of the secondary storage array to an available port in Zone A of Switch 2.
- 12 Connect controller port A2 of the secondary storage array to an available port in Zone 2 of Switch 1.
- 13 Connect controller port B2 of the secondary storage array to an available port in Zone B of Switch 2.

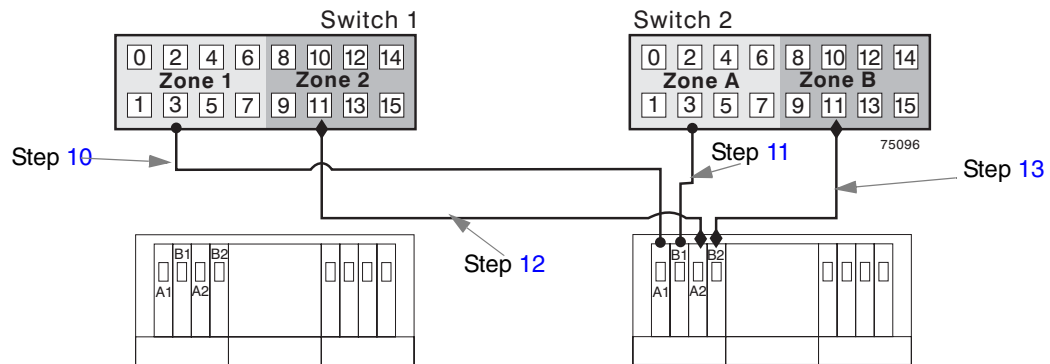


Figure 2-17 Secondary Storage Array Connections to Fibre Channel Switches

- 14** Cabling for the Intra-Site Configuration is complete. Repeat [step 4 on page 2-18](#) through [step 13 on page 2-20](#) for any additional storage arrays that exist in the same cabinet that will use the Remote Volume Mirroring feature.
- 15** Power up all storage arrays, hosts, Fibre Channel switches, and any other hardware that was powered down in [step 2 on page 2-18](#).
- 16** Hardware installation is complete. The next step will be to configure the storage management software to support mirror relationships. Go to “[Software Installation](#)” on [page 2-22](#).

## Software Installation

The Remote Volume Mirroring premium feature is automatically included as part of the SANtricity™ Storage Manager installation. However, the feature is not enabled or activated by default after installation. For more information about enabling or activating the Remote Volume Mirroring premium feature, refer to [“Configuring the Remote Volume Mirroring Feature” on page 3-2](#).

---

**IMPORTANT** All storage arrays participating in mirror relationships must have a supported firmware version installed. For information about the supported firmware version for this release, refer to the *Product Release Notes*.

---

For more information about installing SANtricity Storage Manager and upgrading firmware, refer to *SANtricity Storage Manager Installation Guide*.

## Verifying Installation and Configuration

All hardware and software is now set up to support mirror relationships through the Remote Volume Mirroring feature. However, before creating mirror relationships, ensure that all required software components are working properly.

Complete the following procedure for each storage array that will participate in any aspect of a mirror relationship to verify correct configuration.

- 1 Have the storage management software and controller firmware been installed or upgraded to the supported versions?
  - **Yes** – Go to [step 2](#).
  - **No** – Refer to the *Product Release Notes* to obtain the supported versions, then install or upgrade the storage management software and firmware using the procedures provided in the *SANtricity Storage Manager Installation Guide*. When finished, go to [step 2](#).
- 2 Start the storage management software.

For more information about operating system-specific procedures for starting the storage management software, refer to the *SANtricity Storage Manager Installation Guide*.

- a Is this the first time the storage management software has been started?
  - **Yes** – Go to [step b](#).
  - **No** – Go to [step c](#).
- b Select OK when prompted for Automatic Discovery of devices. Go to [step e](#).
- c From the Enterprise Management Window, select Tools >> Automatic Discovery.

**d** Select OK.

**e** Ensure that all storage arrays designated to participate in mirror relationships are displayed in the Device Tree view of the Enterprise Management Window.

**NOTE** If the storage arrays do not appear, refer to [Chapter 5, “Troubleshooting.”](#)

- 3** From the Enterprise Management Window, select a storage array that will participate in mirror relationships.
- 4** Select Tools >> Manage Device to open the Array Management Window for that storage array.
- 5** From the Array Management Window, select Help >> About.
- 6** Verify that the version of the storage management software is 09.1x.xx.xx or higher. If this requirement is not met, refer to the storage management software upgrade procedures in the *SANtricity Storage Manager Installation Guide*.
- 7** Select OK.
- 8** From the Array Management Window, select Storage Array >> View Profile.
- 9** Select the Controllers tab.
- 10** Complete the following based on the current firmware version of the controllers.
  - **Lower than 06.10.xx.xx** – Upgrade to the firmware version provided with this release (06.xx.xx.xx). For firmware upgrade procedures, refer to *SANtricity Storage Manager Installation Guide*. When finished, go to [step 11](#).
  - **06.10.xx.xx or higher** – The firmware is currently at the supported level, no upgrade is necessary. Go to [step 11](#).
- 11** Select Close.
- 12** To begin working with Mirror Relationships, go to [Chapter 3, “Using the Remote Volume Mirroring Premium Feature.”](#)





## *Using the Remote Volume Mirroring Premium Feature*

---

This chapter consists of procedures necessary to perform the major tasks associated with the Remote Volume Mirroring feature. The chapter is organized sequentially; after the feature has been enabled and activated, mirror relationships can be created and then maintained. The final section references how to deactivate and disable the Remote Volume Mirroring premium feature and is provided for reference only, as the procedures may be required when a mirror relationship is no longer needed.

## Configuring the Remote Volume Mirroring Feature

The Remote Volume Mirroring premium feature must be enabled and activated before any mirror relationships can be created. First, determine the status of the Remote Volume Mirroring feature. After determining the status, the feature will need to be enabled and activated in order to perform all functions of the Remote Volume Mirroring feature.

This section contains information about upgrading mirror repository volumes. If a storage array contains mirror relationships from a previous release of the storage management software, the mirror repository volumes can be upgraded in order to utilize the maximum number of mirror relationships.

### Determining Remote Volume Mirroring Feature Status

There are four possible statuses of the Remote Volume Mirroring feature: Disabled/Deactivated, Disabled/Activated, Enabled/Deactivated, and Enabled/Activated.

---

**IMPORTANT** The Remote Volume Mirroring feature must be in an Enabled/Activated state on both the primary storage array and the secondary storage array to utilize all the functionality of the feature.

---

Figure 3-1 shows the Premium Feature Status Area and how to determine the current status of the Remote Volume Mirroring premium feature.

The current status can be determined by moving the mouse pointer to the Remote Volume Mirroring feature icon in the premium feature status area of the Array Management Window.

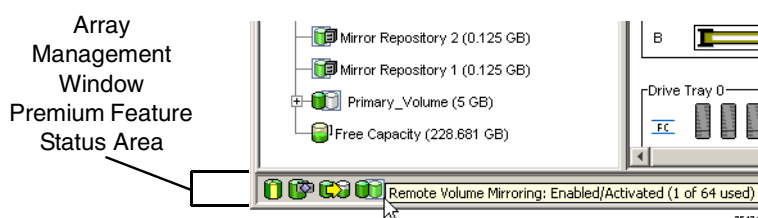


Figure 3-1 Remote Volume Mirroring Feature Status

---

**IMPORTANT** The Remote Volume Mirroring feature status for the primary storage array is managed independently from the secondary storage array. To determine the status for both storage arrays, select each storage array independently, then determine the status.

---

The Remote Volume Mirroring feature will be in one of the following statuses:

- **Disabled/Deactivated** – No functions of the Remote Volume Mirroring feature can be performed. Full Remote Volume Mirroring feature functionality is not available until the feature is enabled and activated. The icon for this state is displayed in the premium feature status area as a cylinder with a mirrored reflection. The icon has a red slash through it to show it is disabled, and is greyed-out to show it is deactivated. For more information about enabling the Remote Volume Mirroring feature, refer to [“Enabling the Remote Volume Mirroring Feature.”](#) To activate the feature, refer to [“Activating the Remote Volume Mirroring Feature”](#) on page 3-4.
- **Disabled/Activated** – The Remote Volume Mirroring feature is disabled, preventing new mirror relationships from being created. However, any pre-existing mirror relationships can be maintained with all functions of the Remote Volume Mirroring feature. The icon displayed for this state is similar to the Disabled/Deactivated state, because the red slash remains to show the feature is disabled. However, the cylinder and its reflection now appear green to show the feature is active. For more information about enabling the Remote Volume Mirroring feature, refer to [“Enabling the Remote Volume Mirroring Feature.”](#)
- **Enabled/Deactivated** – The Remote Volume Mirroring feature is enabled, but not activated. The feature must be activated in order to use the functionality of the feature. The icon displayed for this state is similar to the Disabled/Deactivated state, because the cylinder and its reflection remain grey. However, the red slash no longer appears, therefore, the feature is enabled. To activate the feature, refer to [“Activating the Remote Volume Mirroring Feature”](#) on page 3-4.
- **Enabled/Activated** – The Remote Volume Mirroring feature is enabled and active. Mirror relationships can be created and maintained. The icon for this state is displayed in the premium feature status area as a green cylinder with a mirrored reflection. [Figure 3-1](#) shows an example of the Enabled/Activated state. For more information about creating a mirror relationship, refer to [“Creating Mirror Relationships”](#) on page 3-9.

## Enabling the Remote Volume Mirroring Feature

If the current status of the Remote Volume Mirroring feature is Disabled/Deactivated or Disabled/Activated, complete the following procedure to enable the Remote Volume Mirroring feature.

- 1 From the Array Management Window, select Storage Array >> Premium Features >> Enable.

The Select Feature Key File dialog is displayed.

---

**NOTE** The Select Feature Key File dialog filters for files with the .key extension.

---

- 2 Select the folder in which you placed the generated key file.
- 3 Select the appropriate key file, and then select OK.

The Enable Premium Feature dialog is displayed.

**4** Select Yes.

The Remote Volume Mirroring premium feature is now enabled. The icon in the premium feature status area no longer displays a red slash. To further verify the status of the feature, select Storage Array >> Premium Features >> List.

**5** Repeat [step 1](#) through [step 4](#) for the secondary storage array and any additional storage array that will participate in mirror relationships.

**6** Has the Remote Volume Mirroring feature been activated on both primary and secondary storage arrays?

- **Yes** – Go to [“Creating Mirror Relationships” on page 3-9.](#)
- **No** – Go to [“Activating the Remote Volume Mirroring Feature.”](#)

## Activating the Remote Volume Mirroring Feature

Activating the Remote Volume Mirroring feature prepares the storage array to create and configure mirror relationships. After the feature is activated, the secondary ports for each controller are reserved and dedicated to Remote Volume Mirroring feature usage. In addition, a mirror repository volume is automatically created for each controller in the storage array.

If the current status of the Remote Volume Mirroring feature is Enabled/Deactivated, complete the following to activate the premium feature.

**1** From the Array Management Window, select Storage Array >> Remote Volume Mirroring >> Activate.

The Activate Remote Volume Mirroring - Introduction dialog is displayed.

---

**NOTE** Select Back at any time to change information in previous dialogs.

---

**2** Select one of the following options based on where the mirror repository volumes will reside:

---

**IMPORTANT** The Free Capacity or Unconfigured Capacity node you select for the mirror snapshot repository volumes must have a total of 256 MB capacity available. Two mirror repository volumes are created on this capacity, one for each controller. Each existing mirror repository volume with a capacity of 4 MB will need to be upgraded to 128 MB. For more information about upgrading the mirror repository volumes, refer to [“Upgrading Mirror Repository Volumes” on page 3-6.](#)

---

- **Free capacity on existing volume groups** – A corresponding volume group must be selected as well.
    - a Select a volume group.
    - b Select Next.
    - c Go to [step 6](#).
  - **Unconfigured capacity (create new volume group)** – More information must be collected about the new volume group. Go to [step 3](#).
- 3 In the Create New Volume Group dialog, select the RAID level for the new volume group.

---

**NOTE** If you require more detailed information about the selections in this dialog, select the Help button to launch the online help specific to the dialog.

---

- 4 Under the drive selection choices, select one of the following options:
- **Automatic** – The drives are chosen automatically according to available capacity. Go to [step 5](#).
  - **Manual** – The user specifies which drives contain the mirror repository volume.
    - IMPORTANT** If the RAID level for the new volume group is RAID 1, then the number of drives must be an even number.
    - IMPORTANT** RAID 0 is not an option; therefore, the number of drives selected must always be greater than one for all RAID levels.
    - IMPORTANT** RAID 3 and RAID 5 require a minimum of three drives.
- a Select the desired drives. Multiple drives can be selected by pressing Ctrl+click.
  - b Select Add to move the drives to the Selected Drives area.
- 5 Select Next.
- 6 Review the information in the Preview dialog, then select Finish if all information is satisfactory.
- 7 If prompted for a password, enter the password and select OK, otherwise, continue with [step 8](#).
- 8 Review the information in the Completed dialog, then select OK.
- The Remote Volume Mirroring premium feature is now activated. The icon in the premium feature status area changes from grey to green.
- 9 Repeat [step 1 on page 3-4](#) through [step 8](#) for the secondary storage array and any additional storage array that will contain mirror relationships.

**10** Has the Remote Volume Mirroring feature been enabled on both primary and secondary storage arrays?

- **No** – Go to [“Enabling the Remote Volume Mirroring Feature” on page 3-3.](#)
- **Yes** – Go to [“Creating Mirror Relationships” on page 3-9](#)

## Upgrading Mirror Repository Volumes

---

**IMPORTANT** Upgrading the mirror repository volumes is only required if a previous version of the storage management station software existed with the Remote Volume Mirroring feature installed. If this version of the storage management software (version 09.1x.xx.xx) is the first time the Remote Volume Mirroring feature will be activated, then the procedures in this section do not need to be completed.

---

Use the Upgrade Mirror Repository Volumes Wizard to create new, larger mirror repository volumes on your storage array, to move any data from the existing mirror repository volumes to the new ones, and then to delete the old mirror repository volumes.

In previous versions of the storage management software, a maximum of 32 volumes could participate in mirror relationships. The current version of storage management software allows 64 volumes to participate in mirror relationships. To support creating more than 32 mirror relationships, any existing mirror repository volumes on the storage array will need to be upgraded to have a minimum capacity of 256 MB.

---

**IMPORTANT** If there is not enough free capacity or unconfigured capacity available on your storage array, you will not be able to upgrade your mirror repository volumes. The node you select must have a minimum of 256 MB of available capacity.

---

Complete the following procedure to upgrade the mirror repository volumes.

- 1** Select Storage Array >> Remote Volume Mirroring >> Upgrade Mirror Repository Volumes.

The Upgrade Mirror Repository Volumes: Introduction dialog is displayed.

- 2** Select one of the following options based on where the upgraded mirror repository volumes will reside:

---

**IMPORTANT** The Free Capacity or Unconfigured Capacity node you select for the mirror snapshot repository volumes must have a total of 256 MB capacity available. Two mirror repository volumes are created on this capacity, one for each controller. Any existing mirror repository volumes with a capacity of 4 MB will need to be upgraded to 128 MB.

---

- **Free capacity on same volume group (create individual volume)** – A corresponding volume group must be selected as well.
    - a** Select a volume group.
    - b** Select Next.
    - c** Go to [step 6 on page 3-8](#).
  - **Free capacity on different volume group (create individual volume)** – A corresponding volume group must be selected as well.
    - a** Select a volume group.
    - b** Select Next.
    - c** Go to [step 6 on page 3-8](#).
  - **Unconfigured capacity (create new volume group)** – More information must be collected about the new volume group. Go to [step 3](#).
- 3** In the Create New Volume Group dialog, select the RAID level for the new volume group.

---

**NOTE** If you require more detailed information about the selections in this dialog, select the Help button to launch the online help specific to the dialog.

---

- 4** Under the drive selection choices, select one of the following options:
- **Automatic** – The drives are chosen automatically according to available capacity. Go to [step 5](#).
  - **Manual** – The user specifies which drives contain the mirror repository volume.
    - IMPORTANT** If the RAID level for the new volume group is RAID 1, then the number of drives must be an even number. If an odd number of drives is selected, an error message will display when Apply is selected.
    - IMPORTANT** RAID 0 is not an option; therefore, the number of drives selected must always be greater than one for all RAID levels.
    - IMPORTANT** RAID 3 and RAID 5 require a minimum of three drives.
- a** Select the desired drives. Multiple drives can be selected by pressing Ctrl+click.

**b** Select Add to move the drives to the Selected Drives area.

**5** Select Next.

**6** Review the information in the Preview dialog, then select Finish if all information is satisfactory.

**7** If prompted for a password, enter the password and select OK, otherwise, continue with [step 8](#).

---

**NOTE** The upgrade process may take a minute or longer to complete, depending on the current workload of the storage array. Any I/O activity to the storage array may be delayed during the upgrade process.

---

**8** Review the information in the Completed dialog, then select OK.

The mirror repository volumes are now upgraded, and the storage array can support up to 64 mirror relationships.

**9** Repeat [step 1 on page 3-6](#) through [step 8](#) for the secondary storage array and any additional storage array that contain mirror repository volumes that need to be upgraded.

**10** Go to [“Creating Mirror Relationships.”](#)



## Creating Mirror Relationships

The Remote Volume Mirroring premium feature must be enabled and activated prior to creating mirror relationships. After the feature is enabled and activated, the secondary host ports on the storage arrays are reserved for data synchronization between a primary and secondary volume of a mirror relationship, and mirror relationships can be created.

This section will present information for the following topics:

- How to create a volume to function as a primary or secondary volume in a mirror relationship.
- How to use the Create Remote Volume Mirror Wizard to create mirror relationships.

### Creating Volumes for Mirror Relationships

Before any mirror relationships can be created, volumes must exist at both the primary and secondary sites. The volume residing in the primary storage array is the primary volume. Similarly, the volume residing in the secondary storage array is the secondary volume.

If a primary volume does not exist, one will need to be created on the primary storage array.

If a secondary volume does not exist, one will need to be created on the secondary storage array.

Consider the following when creating the secondary volume:

- The secondary volume must be of equal or greater size than the primary volume.
- The RAID level of the secondary volume does not have to be the same as the primary volume.

For more information about creating volumes, refer to the Array Management Window online help.

When adequate volumes exist at both sites, mirror relationships can be created using the Remote Volume Mirror Wizard.

### Creating a Mirror Relationship Using the Create Remote Volume Mirror Wizard

The Create Remote Volume Mirror Wizard allows a user to create a mirror relationship between a primary volume and a secondary volume.

---

**NOTE** If you require more detailed information about the selections in the following dialogs, select the Help button to launch the online help specific to that dialog.

---

- 1 Before beginning the wizard, ensure the following requirements are met.

- The Remote Volume Mirroring premium feature is enabled and activated on both storage arrays in which the primary and secondary volumes will reside.
  - Both of the storage arrays that will contain the primary and secondary volumes have been added to the Enterprise Management Window.
  - The storage arrays are connected through a proper Fibre Channel fabric configuration.
  - The secondary volume is of equal or greater size than the primary volume.
- 2** In the Logical/Physical View of the Array Management Window, select the volume that will be the primary volume in the mirror relationship.
  - 3** Select Volume >> Remote Volume Mirroring >> Create.  
  
The Create Remote Volume Mirror dialog is displayed listing requirements similar to those listed in [step 1](#).
  - 4** Select Next.
  - 5** Select the storage array that will contain the secondary volume.
  - 6** Select Next.
  - 7** Review the directions in the Select Secondary Volume dialog, then select the volume that will be the secondary volume in the mirror relationship.
  - 8** Select Next.
  - 9** Select the write mode for the mirror relationship.  
  
For additional information on write modes and write consistency groups, refer to [“Data Replication” on page 1-5](#).
  - 10** Select Next.
  - 11** Select the Synchronization Priority Level.  
  
For more information about the Synchronization Priority Level, refer to [“Changing the Synchronization Settings” on page 3-13](#).
  - 12** Select the Resynchronization Method.  
  
For more information about the resynchronization methods, refer to [“Resynchronization Methods” on page 1-6](#).
  - 13** Select Finish.
  - 14** If prompted for a password, enter the password and select OK, otherwise, continue with [step 15](#).
  - 15** Do you need to create another mirror relationship?
    - **Yes** – Complete the following steps:

- a Select Yes.
  - b Select the new primary volume from the list provided.
  - c Repeat [step 5 on page 3-10](#) through [step 14 on page 3-10](#) for each additional mirror relationship.
  - **No** – Select No, and then continue with [step 16](#).
- 16** Review the information in the Completed dialog, then select OK to complete the Create Remote Volume Mirror wizard.

The primary and secondary volumes are now displayed with the mirror relationship icons, which change slightly upon completion of the data synchronization. The amount of time for the data to be synchronized between the two volumes varies proportionally to the size of the primary volume. After the synchronization is complete, the icons will change to the optimal state mirror relationship icons.

---

**NOTE** To view all icons associated with the Remote Volume Mirroring feature and to obtain descriptions of their purposes, refer to the Array Management Window online help.

---

[Figure 3-2](#) shows how the icons appear during and after data synchronization.

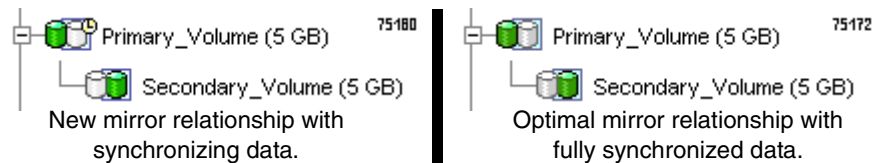


Figure 3-2 Synchronizing (Left) and Optimal (Right) Mirror Relationship

The mirror relationship is now created and ready for data replication.

The next step is to maintain the mirror relationship. Go to [“Maintaining Mirror Relationships” on page 3-12](#).

## Maintaining Mirror Relationships

After a mirror relationship is active, certain attributes of the relationship can be modified at any time. This section describes how to view information about the mirror relationship, change the synchronization priority level, suspend and resume a mirror relationship, remove a mirror relationship, and delete volumes participating in a mirror relationship.

### Viewing Mirror Relationship Details

The mirror relationship that exists between the primary volume and the secondary volume can be examined by various methods, including the Storage Array Profile, the Mirroring Properties Dialog, and the View Associated Components dialog.

#### Storage Array Profile

The Storage Array Profile is the most efficient way to view information about any or all components of the storage array. Details for all volumes, including the primary, secondary, and mirror repository volumes, can be easily viewed simultaneously through the Storage Array Profile. The Storage Array Profile also contains specific information for components associated with mirror relationships.

Complete the following procedure to view information about mirror relationships and mirror repository volumes using the Storage Array Profile.

- 1** From the Array Management Window select Storage Array >> View Profile.
  - 2** Select the Volumes tab.
    - a** To view information about the mirror relationships that exist on the selected storage array, select the Mirrors Tab.
    - b** To view information about the mirror repository volume, select the Repositories tab.
- NOTE** All information shown in the Storage Array Profile can be saved as a .txt file by selecting the Save as... button. The Save Profile dialog has the options of saving the information in the current tab, the information from multiple tabs, or the entire Storage Array Profile.

**End Of Procedure**

#### Mirroring Properties Dialog

The Mirroring Properties dialog displays all the physical characteristics of a *single volume* in the mirror relationship. The dialog displays the same information as the Storage Array Profile for the selected volume, but is specific *to that volume*. In addition, if the selected volume is synchronizing data with another volume in a mirror relationship, the synchronization progress bar is displayed.

---

**NOTE** Use the following procedure to view the synchronization progress of a recently created mirror relationship.

---

Complete the following procedure for each volume that needs to be examined in the mirror relationship.

- 1 Select the primary or secondary volume.
- 2 Select Volume >> Properties.
- 3 Select the Mirroring tab.

**End Of Procedure**

### **View Associated Components Dialog**

The View Associated Components dialog provides a more graphical representation of the volumes participating in the mirror relationship. In addition, details are given for all components, rather than only the selected volume.

Complete the following procedure to view all associated components in a mirror relationship, including primary, secondary, and mirror repository volumes.

- 1 Select the primary or secondary volume in a mirror relationship.
- 2 Select View >> Associated Components.

The View Associated Components dialog is displayed.

**End Of Procedure**

## **Changing the Synchronization Settings**

The Synchronization Priority Level of a mirror relationship defines the amount of system resources used to synchronize the data between the primary and secondary volumes of a mirror relationship. If the highest priority level is selected for a mirror relationship, the data synchronization uses a high amount of system resources to perform the full synchronization, but may decrease performance for host I/O activity, including other mirror relationships. Conversely, if the lowest synchronization level is selected, there is less impact on complete system performance, but the full synchronization may take more time to complete.

The Resynchronization Method defines whether the communication between the primary and secondary volume is restored manually or automatically after a communication interruption.

To change the Synchronization Settings for a mirror relationship, complete the following procedure.

- 1 In the Logical/Physical view of the Array Management Window, select a primary volume of a mirror relationship.
- 2 Select Volume >> Remote Volume Mirroring >> Change >> Synchronization Settings.  
The Change Synchronization Settings dialog is displayed.
- 3 Select one or more volumes.  
You can make multiple selections by using the Select All button, Ctrl+click, or Shift+click.
- 4 Select the synchronization priority level by moving the slider bar. The five levels are Lowest, Low, Medium, High, and Highest. All selected volumes will change to the same synchronization priority level.  
For more information about the impact of the five priority settings to system performance, refer to [“Performance Considerations” on page 1-8](#).
- 5 Select the Resynchronization Method.  
For more information about the resynchronization methods, refer to [“Resynchronization Methods” on page 1-6](#).
- 6 Select OK.
- 7 Select Yes when the Confirmation dialog is displayed.
- 8 Select OK when the Completed dialog is displayed.

**End Of Procedure**

## Suspending a Mirror Relationship

Use the Suspend option to stop data transfer between a primary volume and secondary volume participating in a mirror relationship without removing the mirror relationship.

Suspending a mirror relationship enables you to control when the data on the primary volume and secondary volume should be synchronized. This will help reduce any performance impact to the host application that may occur while any changed data on the primary volume is copied to the secondary volume.

When a mirror relationship is in a Suspended state, no attempt is made to contact the secondary volume. Any writes to the primary volume are persistently logged in the mirror repository volumes. After the mirror relationship is resumed, only the modified regions of the primary volume are written to the secondary volume. The Suspend option can be used to backup a secondary volume.

---

**IMPORTANT** Suspending a mirror relationship removes any Needs Attention status resulting from communication failure between the primary and secondary volumes.

---

Figure 3-3 shows a mirror relationship in a suspended state

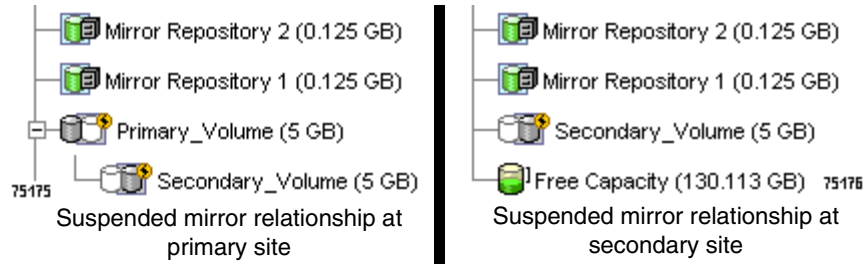


Figure 3-3 Suspended Mirror Relationships at Primary Site and Secondary Site

---

**CAUTION Potential Loss of Data Access** – If the selected mirrored pair is part of a write consistency group, you will automatically suspend *all* mirrored pairs in the write consistency group. Use the command line interface to resume single write-consistent mirrored pairs. For more information about using the command line interface, refer to the Enterprise Management Window online help. For more information about write consistency groups, refer to [“Write Consistency” on page 1-5](#).

---



---

**IMPORTANT** Any data that is written to the primary volume will be logged while the mirror relationship is suspended and will automatically be written to the secondary volume when the mirror relationship is resumed. A full synchronization will not be required.

---



---

**IMPORTANT** The state of the remote volume mirror remains suspended until you use the Resume option to resume synchronization activity.

---

Complete the following procedure to suspend a mirror relationship.

- 1** In the Logical/Physical view of the Array Management Window, select a primary volume of a mirror relationship.
- 2** Select Volume >> Remote Volume Mirroring >> Suspend.  
The Suspend Mirrored Pair dialog is displayed.
- 3** Select one or more mirror relationships to suspend.  
You can make multiple selections by using the Select All button, Ctrl+click, or Shift+click.
- 4** Select Suspend.

The Suspend Mirrored Pair - Confirmation dialog is displayed.

---

**CAUTION Potential Loss of Data Access** – If the selected mirrored pair is part of a write consistency group, you will automatically suspend *all* mirrored pairs in the write consistency group. For more information about using the command line interface, refer to the Enterprise Management Window online help. For more information about write consistency groups, refer to [“Write Consistency” on page 1-5](#).

---

**5** Type `Yes` and select **OK**.

The Suspend Mirrored Pair - Progress dialog is displayed while the selected mirrored volumes are suspended. After all of the selected mirrored pairs have been suspended, the **OK** button becomes available.

**6** Select **OK**.

The Array Management Window is displayed, and the primary volume and secondary volume are displayed with an Optimal/Suspended status.

For information about icons used for mirror relationships, refer to the Array Management Window online help.

**End Of Procedure**

## Resuming a Mirror Relationship

Use the Resume option to restart data transfer between a primary volume and secondary volume participating in a mirror relationship, after the mirror has been suspended or unsynchronized.

This option enables you to control when the data on the primary volume and secondary volume should be resynchronized. This will help reduce any performance impact to the host application that may occur while any changed data on the primary volume is copied to the secondary volume.

After the mirrored pair is resumed, only the regions of the primary volume known to have changed since the mirrored pair were suspended are written to the secondary volume.

---

**CAUTION Potential Loss of Data Access** – If the selected mirrored pair is part of a write consistency group, you will automatically resume *all* mirrored pairs in the write consistency group. For more information about using the command line interface, refer to the Enterprise Management Window online help. For more information about write consistency groups, refer to [“Write Consistency” on page 1-5](#).

---



- 1** In the Logical/Physical view of the Array Management Window, select a primary volume of a mirror relationship.

- 2** Select Volume >> Remote Volume Mirroring >> Resume.

The Resume Mirrored Pair dialog is displayed.

- 3** Select one or more mirror relationships to resume.

You can make multiple selections by using the Select All button, Ctrl+click, or Shift+click.

- 4** Select Resume.

The Resume Mirrored Pair - Confirmation dialog is displayed.

- 5** Select Yes to resume data transfer to the mirrored pairs you selected.

The Resume Mirrored Pair - Progress dialog is displayed while data transfer is resumed to the selected mirrored pairs. After data transfer has been resumed to the mirrored pairs, the OK button becomes available.

- 6** Select OK.

The Array Management Window is displayed, and the primary volume and secondary volume are displayed with an Optimal or Synchronizing status.

**End Of Procedure**

## Removing a Mirror Relationship

Removing a mirror relationship between a primary and secondary volume does not affect any of the existing data on either volume. The link between the volumes is removed, but the primary volume still continues normal I/O operation. This action is not recommended for backup routines, rather use the suspend option because the mirror relationship is still maintained. A mirror relationship between the two volumes can be re-created unless one of the volumes is deleted.

To remove a mirror relationship between two volumes, complete the following procedure.

- 1** From the Array Management Window, select a local primary volume or local secondary volume of a mirror relationship.

- 2** Select Volume >> Remote Volume Mirroring >> Remove Mirror Relationship.

The Remove Mirror Relationship dialog appears displaying all mirror relationships associated with this storage array.

- 3** Select one or more mirror relationships to remove.

You can make multiple selections by using the Select All button, Ctrl+click, or Shift+click.

- 4** Select Remove.

5 Carefully review the information presented in the Confirmation dialog.

6 Select Yes.

**End Of Procedure**

## Changing the Write Mode

When the Synchronous write mode is selected, the controller on the primary storage array waits until data has been successfully copied to the secondary storage array before sending an I/O completion indication back to the host system. If the Asynchronous write mode is selected, the controller on the primary storage array sends an I/O completion indication to the host system before the data has successfully been copied to the secondary storage array.

Complete the following to change the write mode for a mirror relationship.

1 From the Array Management Window, select a local primary volume of a mirror relationship.

2 Select Volume >> Remote Volume Mirroring >> Change >> Write Mode.

The Change Write Mode dialog is displayed.

3 Select one or more mirrored pairs.

You can make multiple selections by using the Select All button, Ctrl+click, or Shift+click.

4 Select one of the following write modes:

- **Synchronous** - The Synchronous write mode offers the best chance of full data recovery from the secondary storage array in the event of a disaster; however, this happens at the expense of host I/O performance. The synchronous write mode is the preferred mode of operation.
- **Asynchronous** - The Asynchronous write mode offers faster host I/O performance but does not guarantee that data was successfully written to the secondary volume before indicating a successful write to the host system.

If Asynchronous mode is selected, the Add to write consistency group check box becomes available.

5 Select the Add to write consistency group check box if you want to ensure that writes to the secondary storage array are completed in the same order as on the primary storage array. For additional information on write consistency groups, refer to [“Write Consistency” on page 1-5](#).

---

**NOTE** Selecting this option may impact host I/O performance.

---

**End Of Procedure**

## Deleting a Primary Volume

Deleting a primary volume participating in a mirror relationship removes the mirror relationship and completely deletes the primary volume from the storage array. The mirror relationship cannot be redefined until a new volume is created or an alternate volume is chosen to replace the deleted volume.

A secondary volume in a mirror relationship cannot be deleted while actively participating in a mirror relationship. When a primary volume is deleted, the mirror relationship is removed, and the secondary volume becomes a standard volume, which can be deleted.

To delete a primary or secondary volume from a mirror relationship, complete the following procedure.

---

**CAUTION** This action permanently removes the volume including all data on the volume.

---

- 1 From the Array Management Window for the primary site, select a primary volume.
- 2 Select Volume >> Delete.
- 3 The Delete Volumes dialog is displayed.
- 4 Select one or more volumes to delete.

You can make multiple selections by using the Select All button, Ctrl+click, or Shift+click.

- 5 Select OK.

The Confirm Delete Volume(s) dialog is displayed.

---

**IMPORTANT** Carefully review the information displayed in the Confirm Delete Volume(s) dialog before proceeding with [step 6](#).

---

- 6 Type Yes in the text area.
- 7 Select OK.
- 8 From the Array Management Window for the secondary site repeat steps 2 through 7 to remove the secondary volume, if required.

**End Of Procedure**

## Deactivating and Disabling the Remote Volume Mirroring Feature

If no mirror relationships exist and the Remote Volume Mirroring feature is no longer required, then deactivating the feature will reestablish normal use of dedicated ports on both storage arrays and delete both mirror repository volumes.

The Remote Volume Mirroring feature can also be disabled. When the feature is in the Disabled/Active state, previously existing mirrors can still be maintained and managed; however, new mirror relationships cannot be created. When in the Disabled/Deactivated state, no Remote Volume Mirroring feature activity can occur.

### Deactivating the Remote Volume Mirroring Feature

To change the Remote Volume Mirroring feature status from Enabled/Activated to Enabled/Deactivated or from Disabled/Activated to Disabled/Deactivated, complete the following procedure.

---

**IMPORTANT** This procedure will delete all mirror repository volumes on the selected storage array.

---

- 1 Verify that all mirror relationships have been removed.

For more information, refer to [“Removing a Mirror Relationship” on page 3-17](#).

- 2 Select Storage Array >> Remote Volume Mirroring >> Deactivate.
- 3 Carefully review the information in the Confirmation dialog, then select Yes.

**End Of Procedure**

### Disabling the Remote Volume Mirroring Feature

To change the Remote Volume Mirroring feature status from Enabled/Deactivated to Disabled/Deactivated or from Enabled/Activated to Disabled/Activated, complete the following procedure.

- 1 From the Array Management Window, select Storage Array >> Premium Features >> Disable.
- 2 Select Remote Volume Mirroring.
- 3 Select OK.
- 4 Carefully review the information presented in the Confirmation dialog.
- 5 Select Yes.

**End Of Procedure**

## *Disaster Recovery*

---

This chapter describes the actions needed to prepare for a disaster and the actions to take if a hardware component or complete site failure should occur.

As businesses require the ability to access critical data around-the-clock with little or no downtime, system administrators are required to ensure that critical data is safeguarded against potential disasters whether natural or man-made.

In preparing for a potential disaster, system administrators need to develop disaster recovery plans that describes the procedures devised to prevent and prepare for disasters, and proposed actions for responding to and recovering from disasters if they occur.

## Planning for Disaster Recovery

This section provides information on the steps that should be undertaken in preparation for a possible disaster or catastrophic failure. Preparation steps discussed include backing up critical data prior to and during mirroring, preparing the secondary storage array that will participate in the mirror relationship, and using host clustering software for failover protection.

The “[Disaster Preparation Checklist](#)” on [page 4-3](#) should be completed to ensure that your primary and secondary storage arrays are prepared correctly.

### Backing Up Critical Data

Backing up critical data regularly is vital insurance against disasters or catastrophic failure. Backups should be performed regardless of whether the Remote Volume Mirroring feature is in use.

A backup of all critical data on both the primary and secondary storage arrays participating in the Remote Volume Mirroring feature should be performed prior to creating a mirror relationship. Periodic backups of the primary storage array should be completed while using the Remote Volume Mirroring feature.

Backups to tape or disk can be made while I/O activity continues using the Snapshot Volume premium feature, which captures a point-in-time image of a volume. For more information on using snapshot volumes, refer to “[Snapshot Volumes](#)” on [page 1-14](#) or the Array Management Window online help.

### Preparing the Secondary Storage Array

When preparing for a potential disaster, ensure the secondary storage array, to which the data is being mirrored, is structured in the same manner as the primary storage array.

Prior to creating a mirror relationship, you will need to prepare your secondary storage array to ensure that storage partitions are defined and ready to function if secondary storage array volumes are promoted to primary roles.

### Defining SANshare Storage Partitioning

The SANshare Storage Partitioning premium feature allows you to define which hosts have access to which volumes on the storage array using a defined logical unit number (LUN). When configuring your secondary storage array, replicate the storage partitions that were previously defined on the primary storage array. This ensures that after a role reversal is carried out, hosts are able to access their required data.

For more information on SANshare Storage Partitioning, refer to “[SANshare Storage Partitioning](#)” on [page 1-13](#), or refer to the Array Management Window online help.

## Ensuring Failover Protection Using Host Clustering Software

Host failover clustering is a process in which the operating system and application software work together to provide continuous availability in the event of an application failure, hardware failure, or operating system error. Software products that support remote failover may refer to global or geographic cluster management.

The Remote Volume Mirroring feature can be used in conjunction with remote host failover to provide complete redundancy of host systems and storage arrays. If a disaster occurs at the primary storage array, hosts at the secondary storage array take over processing and initiate a role reversal to the secondary storage array.

Remote failover is not a requirement for a disaster recovery plan. Depending on the requirements for how quickly operations must be functioning at Optimal status again, mirroring the storage arrays and depending on manual startup of the remote hosts may be acceptable.

## Disaster Preparation Checklist

The following checklist should be completed in preparation for disaster recovery. Complete the steps listed to ensure access to mirrored data is possible in the event of a disaster or catastrophic failure.

Table 4-1 Disaster Preparation Checklist

Task Description	Validation Activity
1 Ensure that all critical data has been backed up on both the primary and secondary storage arrays.	<input type="checkbox"/> Completed.
2 Ensure that SANshare Storage Partitioning is configured on the secondary storage array. This will reduce any lag time when promoting a secondary volume to the primary volume role.  For more information on setting up SANshare Storage Partitioning, refer to the Array Management Window online help.	<input type="checkbox"/> Completed.
3 If possible, ensure that your host clustering software is configured to allow host failover between the primary storage array and secondary storage array participating in the Remote Volume Mirroring feature.  For more information, refer to your host clustering software documentation.	<input type="checkbox"/> Completed.

## Recovering from Switch Failures

The Campus Configuration is the only configuration in which each switch is a single point of failure. In all other configurations, if a switch fails, at least one other switch is configured to be an alternate path for all I/O activity. The single switch at each site is not only responsible for the communication between the two sites for the Remote Volume Mirroring feature, but for all host to storage array I/O activity as well.

If a switch fails in the Campus Configuration, the system administrator should decide whether or not to do a complete site failover. This decision should be based on the immediate availability of a backup switch or the time it will take to receive a replacement.

If a replacement switch is not readily available, one of the following temporary scenarios will need to occur until the switch can be replaced.

- **Direct connection between hosts and storage arrays** – The switch is bypassed and normal I/O activity continues. All mirror relationships will be suspended until a normal configuration is resumed. Since the storage arrays have a finite number of host connections, all hosts may not be able to access the storage array. For information on how to directly connect hosts and storage arrays, refer to the *Cabling Guide*.
- **Entire Site Failover** – The switch at the primary site has failed; however, the switch at the secondary site is still functional, which allows all hosts to access the switch and storage arrays. Mirror relationships will be suspended until the primary storage array is recovered. If a complete site failover is needed to continue normal operations, refer to [“Entire Site Failover Procedure.”](#)



## Recovering from Storage System Failures

This section provides procedures for recovering storage systems when one of the following situations has occurred:

- The primary storage array is damaged or destroyed.
- The entire primary site is damaged or destroyed.

Both situations require a complete site failover from the primary site to the secondary site so that business operations can continue. For a secondary site failure, no site failover is necessary. If the primary volume is not damaged, then a full synchronization will occur when the site is recovered. If the primary storage array is damaged, follow the procedure in [“Rebuilding a Damaged Site” on page 4-6](#).

---

**IMPORTANT** The procedures in this section should be completed in the order presented to ensure that the affected site or storage array is recovered successfully.

---

### Entire Site Failover Procedure

Entire site failover is necessary when an event occurs that inhibits normal operation to the primary site for a period of time longer than typical communication interruptions.

- 1 Manually reverse the role of the secondary volume of the mirror relationship to the primary role. For more information, refer to [“Reversing the Roles of Primary and Secondary Volumes” on page 4-8](#).
- 2 Have all hosts at the secondary site been properly configured for host failover?
  - **Yes** – Go to [step 4](#).
  - **No** – Go to [step 3](#).
- 3 Reinstall host cluster software and reconfigure settings as needed. For more information about installing and configuring host cluster software, refer to the documentation provided with the software.
- 4 Has SANshare Storage Partitioning been preconfigured so that proper hosts can access appropriate volumes?
  - **Yes** – Go to [step 6](#).
  - **No** – Go to [step 5](#).
- 5 Configure the storage partitioning so that host to volume access is identical to the primary site configuration. For more information about setting up storage partitioning, refer to [“Using Other Features and Remote Volume Mirroring” on page 1-13](#).
- 6 Resume normal operation with the secondary site acting as a new, fully-functioning primary site.

The entire site failover is complete. The primary site must now be reconfigured and the mirroring environment must be re-created. The next step will depend on the resulting status of the storage array from the disaster.

- 7 Is the storage array and all the contained data recovered and fully operational?
  - **Yes** – Go to [“Re-creating a Mirror Relationship.”](#)
  - **No** – Go to [“Rebuilding a Damaged Site.”](#)

## Rebuilding a Damaged Site

If a disaster occurs to the primary or secondary site that renders the storage array or all data on the storage array irreparable, then the site needs to be rebuilt with new equipment.

Complete the following procedure to rebuild a damaged site:

- 1 Obtain new storage arrays and any hosts and equipment needed to properly use the Remote Volume Mirroring feature. It is recommended that the new equipment have equal or greater hardware and software specifications than the damaged equipment.
- 2 Depending on the configuration, complete the switch zoning and hardware installation procedure as presented in [Chapter 2, “Hardware and Software Installation”](#) for this site only.
- 3 Create a volume to replace the mirrored volume damaged on the original storage array. The new volume should be identical to the specifications of the previously damaged volume.
- 4 Ensure SANshare Storage Partitioning is properly defined so that it may take over normal operation from the secondary site. For more information on setting up storage partitioning, refer to [“Using Other Features and Remote Volume Mirroring” on page 1-13](#).
- 5 Ensure the host cluster software is properly configured so that the hosts can take over I/O activity from the secondary site hosts. For more information about installing and configuring host cluster software, refer to the documentation provided with the software.
- 6 The previously damaged site is now ready to support mirror relationships. Go to [“Re-creating a Mirror Relationship.”](#)

## Re-creating a Mirror Relationship

After the previously damaged site is back online and properly configured, mirror relationships can be resumed by completing the following procedure.

---

**NOTE** To ensure that the site was rebuilt accurately, perform steps 1 through 5 for each mirror relationship prior to removing the subsequent mirror relationship.

---

- 1 From the undamaged site, remove mirror relationships that existed prior to the disaster one-at-a-time.
- 2 From the undamaged site, create a mirror relationship using the volume on the recovered primary site as the secondary volume. For more information, refer to [“Creating Mirror Relationships” on page 3-9](#).
- 3 Ensure SANshare Storage Partitioning is properly defined on the recovered primary site so that it may take over normal operation from the secondary site. For more information on setting up storage partitioning, refer to [“Using Other Features and Remote Volume Mirroring” on page 1-13](#).
- 4 Ensure the host cluster software is properly configured so that the hosts at the recovered primary site can take over I/O activity from the secondary site hosts. For more information about installing and configuring host cluster software, refer to the documentation provided with the software.
- 5 Perform a role reversal so that the recovered primary site now possesses the active primary volume, and the secondary volume now exists on the secondary site. For more information, refer to [“Reversing the Roles of Primary and Secondary Volumes” on page 4-8](#).
- 6 Repeat steps 1 through 5 for each additional mirror relationship.

The Remote Volume Mirroring feature configuration is now complete.

**End Of Procedure**

## Reversing the Roles of Primary and Secondary Volumes

A role reversal is the act of promoting the secondary volume to be the primary volume within the mirrored volume pair, and demoting the primary volume to be the secondary volume.

A role reversal may be performed using one of the following methods:

- **Changing a secondary mirrored volume to a primary volume** – The selected secondary volume is promoted to become the primary volume of the mirrored pair and is used when a catastrophic failure has occurred. For step-by-step instructions, refer to [“Changing a Secondary Volume to a Primary Volume.”](#)
- **Changing a primary mirrored volume to a secondary volume** – The selected primary volume is demoted to become the secondary volume of the mirrored pair and is used during normal operating conditions. For step-by-step instructions, refer to [“Changing a Primary Volume to a Secondary Volume.”](#)

### Changing a Secondary Volume to a Primary Volume

A secondary volume is typically promoted to a primary volume role when a failure has occurred to the storage array that contains the primary volume, and the secondary volume needs to be promoted so that hosts can access data and business operations can continue. If the mirror relationship is in an Optimal state, promoting the secondary volume to be the primary volume automatically demotes the primary volume to be the secondary volume.

This option is not available unless the Remote Volume Mirroring premium feature has been activated.

---

**IMPORTANT** When the secondary volume becomes a primary volume, any hosts that are mapped to the volume through a volume-to-LUN mapping will now be able to read or write to the volume.

---

If a communication problem between the secondary and primary sites prevents the demotion of the remote primary volume, an error message is displayed. However, you are given the opportunity to proceed with the promotion of the secondary volume, even though this will lead to a dual-primary condition. For additional information about recovering from a dual-primary condition, refer to [Chapter 5, “Troubleshooting.”](#)

To promote a secondary volume to a primary role:

- 1 Select a local secondary volume in the Logical View.

---

**IMPORTANT** A secondary volume can only be promoted to a primary volume from the storage array that contains the secondary volume.

---

- 2 Select Volume >> Remote Mirroring >> Change >> Role to Primary.

The Change to Primary dialog is displayed.

- 3 Select Yes.

The secondary volume is promoted to be the primary volume role in the mirror relationship.

**End Of Procedure**

## Changing a Primary Volume to a Secondary Volume

Changing a primary volume to a secondary role is used for role reversals during normal operating conditions. You can also use this option during a Recovery Guru procedure when a dual-primary condition occurs. If the mirror relationship is in an Optimal state, demoting the primary volume to be the secondary volume automatically promotes the secondary volume to be the primary volume.

This option is not available unless the Remote Volume Mirroring premium feature has been activated.

---

**IMPORTANT** Any host that accesses the primary volume through a volume-to-LUN mapping will no longer be able to write to the volume. When the primary volume becomes a secondary volume, only remote writes initiated by the primary controller will be written to the volume.

---

If a communication problem between the primary and secondary sites prevents the promotion of the secondary volume, an error message is displayed. However, you are given the opportunity to proceed with the demotion of the primary volume, even though this will lead to a dual-secondary condition.

If the selected primary volume has associated snapshot volumes, demoting this volume to a secondary role will not affect the associated snapshot volumes.

To demote a primary volume to a secondary role:

- 1 Select a local primary volume in the Logical View.

---

**IMPORTANT** A primary volume can only be demoted to a secondary volume from the storage array that contains the primary volume.

---

- 2 Select Volume >> Remote Volume Mirroring >> Change >> Role to Secondary.

The Change to Secondary dialog is displayed.

- 3 Select Yes.

The primary volume is now displayed as the secondary volume in the Array Management Window.

**End Of Procedure**

## *Troubleshooting*

---

This chapter provides information about troubleshooting some of the more commonly encountered problems when using the Remote Volume Mirroring feature.

Troubleshooting topics include using the Test Communication feature, general Remote Volume Mirroring problems, problems with Fibre Channel fabric configurations, problems with storage array components involved in Remote Volume Mirroring, and basic switch troubleshooting. Also provided is a list of the critical events that may be generated and instructions for upgrading future versions of controller firmware.

Locate the section that directly relates to your problem or consult the section describing general troubleshooting techniques. If your problem is not discussed in any of the sections in this chapter, contact technical support.

## Testing Communication

Use the Test Communication dialog to diagnose possible communication problems between a primary volume and secondary volume participating in a mirror relationship.

After the communication test has been completed, the dialog will display either a Passed, Warning, or Failed status together with values for the following:

- Test data round trip time
- Maximum allowed round trip time
- Average round trip time

---

**IMPORTANT** If the communication test returns a Failed status, the test will continue to run after you close the Test Communication dialog until communication between the mirrored pair is restored. If you have enabled automatic resynchronization, the mirrored pair will automatically synchronize. Otherwise, select Volume >> Remote Volume Mirroring >> Resume to manually start re-synchronization.

---

- 1 Select a primary volume or secondary volume in the Logical View.
- 2 Select Volume >> Remote Volume Mirroring >> Test Communication.

The Communication Test dialog is displayed.

If the communication test returns a Passed with Caution status, the primary volume and secondary volume are communicating correctly; however, the test data round trip time is approaching the maximum allowed. This indicates that you will need to take some kind of action to fix this problem.

If the communication test returns a Failed status, the reason for the failure is indicated, and you are directed to reference the Recovery Guru to correct the problem.

- 3 Review the information displayed in the dialog, and click OK to return to the Array Management Window.

**End Of Procedure**



## General Troubleshooting

This section describes some of the typical problems that may be encountered when using the Remote Volume Mirroring premium feature. The information is presented in order from the time the feature is enabled and activated, to problems that may be encountered completing typical tasks when using the Remote Volume Mirroring Feature.

Information about the probable cause and recommended resolution for each problem is provided. If your problem is not addressed in this section, refer to the remaining sections in this chapter before contacting technical support.

The Remote Volume Mirroring menu options in the Array Management Window are greyed-out and unavailable.	
Cause:	The Remote Volume Mirroring premium feature is not enabled or activated.
Resolution:	<ol style="list-style-type: none"> <li>1 Enable the Remote Volume Mirroring premium feature. A feature key file is required to enable premium features. If one has not been supplied, contact your storage supplier.</li> <li>2 Activate the Remote Volume Mirroring feature.</li> </ol> <p>For step-by-step instructions on enabling and activating the Remote Volume Mirroring feature, refer to <a href="#">“Configuring the Remote Volume Mirroring Feature” on page 3-2</a> or the Array Management Window online help.</p>

The Remote Volume Mirroring icon in the premium feature status area is greyed-out with a red line.	
Cause:	The Remote Volume Mirroring premium feature is not enabled or activated.
Resolution:	<ol style="list-style-type: none"> <li>1 Enable the Remote Volume Mirroring premium feature. A feature key file is required to enable premium features. If one has not been supplied, contact your storage supplier.</li> <li>2 Activate the Remote Volume Mirroring feature.</li> </ol> <p>For step-by-step instructions on enabling and activating the Remote Volume Mirroring feature, refer to <a href="#">“Configuring the Remote Volume Mirroring Feature” on page 3-2</a> or the Array Management Window online help.</p>

<b>When creating a mirror relationship, an error message is received stating the following:  “Error 158 – The operation cannot complete because the selected volume is not  a valid candidate for remote volume mirroring.”</b>	
Cause:	<p>The secondary volume candidate was participating in a mirror relationship with a different volume on this storage array. The mirror relationship was successfully removed from the other storage array. However, a communication error prevented the successful removal of the mirror relationship on this storage array.</p> <p>A volume on this storage array still has a mirror relationship with the secondary volume candidate.</p>
Resolution:	<ol style="list-style-type: none"> <li>1 Select the Storage Array &gt;&gt; View Profile option, then select the Volumes tab and the Mirrors tab.</li> <li>2 Locate the volume that is still participating in the mirror relationship with the secondary volume candidate and remove the mirror relationship. For step-by-step instructions, refer to <a href="#">“Removing a Mirror Relationship” on page 3-17</a> or the Array Management Window online help.</li> <li>3 Re-create the intended mirror relationship using the original candidate volumes. For step-by-step instructions, refer to <a href="#">“Creating a Mirror Relationship Using the Create Remote Volume Mirror Wizard” on page 3-9</a> or the Array Management Window online help.</li> </ol>

<b>The primary volume is showing a Synchronization in Progress status.</b>	
Cause:	<p>A synchronization is in progress between the primary and secondary volumes participating in a mirror relationship. The data on the primary volume is being copied to its associated secondary volume.</p>
Resolution:	<p>Wait for the synchronization to complete. After it has finished copying data from the primary volume to the secondary volume, the mirrored volume pair transitions to a Synchronized status.</p> <p>For more information on monitoring the status of a mirror relationship, refer to the Array Management Window online help.</p>

<b>Both the primary and secondary volumes are displayed as being the primary volume.</b>	
Cause:	<p>A communication failure has occurred on the storage array containing the primary volume, and the secondary volume has been promoted to the primary volume role.</p> <p>The primary storage array is now operational, but unreachable because of a link failure. A forced promotion of the secondary volume has resulted in both the primary and secondary volumes viewing themselves in the primary volume role.</p>
Resolution:	<p><b>1</b> From the Array Management Window of the primary site, select the primary volume.</p> <p><b>2</b> Select Volume &gt;&gt; Remote Volume Mirroring &gt;&gt; Remove Mirror Relationship.</p> <p><b>Note</b> The mirror relationship for the secondary volume will not be removed if there is a connection problem between the storage arrays. If the mirror relationship still exists at the secondary site, repeat steps <b>1</b> and <b>2</b> for the secondary volume from the secondary site Array Management Window.</p> <p><b>3</b> Recreate the mirror relationship using the volume with the most recent data as the primary volume.</p> <p>For additional information about recreating mirror relationships, refer to <a href="#">“Creating a Mirror Relationship Using the Create Remote Volume Mirror Wizard”</a> on page 3-9 or the Array Management Window online help.</p>

<b>Both the primary and secondary volumes are displayed as being the secondary volume.</b>	
Cause:	<p>In response to a dual primary volume condition, a role reversal was carried out and the primary volume was demoted to the secondary volume role.</p> <p>The secondary storage array is operational, but unreachable because of a link failure. The forced demotion of the primary volume has resulted in both the primary and secondary volumes viewing themselves in the secondary volume role.</p>
Resolution:	<p><b>1</b> From the Array Management Window of the primary site, select the local secondary volume.</p> <p><b>2</b> Select Volume &gt;&gt; Remote Volume Mirroring &gt;&gt; Remove Mirror Relationship.</p> <p><b>Note</b> The mirror relationship for the secondary site will not be removed if there is a connection problem between the storage arrays. If the mirror relationship still exists at the secondary site, repeat steps <b>1</b> and <b>2</b> for the secondary volume from the secondary site Array Management Window.</p> <p><b>3</b> Recreate the mirror relationship.</p> <p>For additional information about recreating mirror relationships, refer to <a href="#">“Creating a Mirror Relationship Using the Create Remote Volume Mirror Wizard”</a> on page 3-9 or the Array Management Window online help.</p>

<b>The primary volume/secondary volume is displayed as being a Missing Volume.</b>	
Cause:	A physical drive on which a mirror relationship depends (primary volume, secondary volume) has been removed from the storage array, and the volume is now displayed under the Missing Volumes node in the Logical View of the Array Management Window.
Resolution:	<ul style="list-style-type: none"> <li>• If a missing volume is detected because a drive has been accidentally removed, or because of a loss of power to the drive module, recovery of the volume is possible by: <ol style="list-style-type: none"> <li>1 Re-inserting the drive back into the drive module.</li> <li>2 Ensuring that the drive module power supplies are properly connected to an operating power source and have an Optimal status.</li> </ol> For more information, refer to Recovery Guru or contact technical support. </li> <li>• If the missing volume is no longer required, it may be deleted.</li> </ul> <p><b>Important</b> Deleting a missing volume is a permanent action. Any associated volumes or volume-to-LUN mappings will also be deleted. For more information, refer to the Recovery Guru or the Array Management Window online help.</p>

<b>The mirror relationship was removed successfully from the primary side, but not from the secondary side.</b>	
Cause:	<p>When removing a mirror relationship, a link failure occurred between the primary and secondary storage arrays, and an error message was displayed.</p> <p>The Array Management Window for the primary storage array indicates that the mirror relationship has been removed successfully; however, the Array Management Window for the secondary storage array indicates that the mirror relationship still exists.</p>
Resolution:	<p>Open the Array Management Window for the secondary storage array and remove the mirror relationship.</p> <p>For step-by-step instructions, refer to <a href="#">“Removing a Mirror Relationship” on page 3-17</a> or the Array Management Window online help.</p>

<b>The mirror relationship was removed successfully from the secondary side, but not from the primary side.</b>	
Cause:	<p>When removing a mirror relationship, a link failure occurred between the primary and secondary storage arrays.</p> <p>The Array Management Window for the secondary storage array indicates that the mirror relationship has been removed successfully; however, the Array Management Window for the primary storage array indicates that the mirror relationship still exists. The primary volume is showing an Unresponsive status.</p>
Resolution:	<p>Open the Array Management Window for the primary storage array and remove the mirror relationship.</p> <p>For step-by-step instructions, refer to <a href="#">“Removing a Mirror Relationship” on page 3-17</a> or the Array Management Window online help.</p>

<b>The primary volume is showing an Unsyncronized status.</b>	
Cause:	<p>The mirror relationship is in an Unsyncronized status because the data mirrored between the primary volume and secondary volume are no longer identical. Typical causes for this status include link errors, a failed primary volume or secondary volume, or a dual primary or dual secondary error condition.</p> <p>While the mirror relationship is in an Unsyncronized status, no mirroring activity will take place.</p>
Resolution:	<p>After the controller owner of the primary volume can communicate with the controller owner of the secondary volume and the volume is online and optimal, a synchronization takes place if Automatic Resynchronization is enabled; otherwise, the resynchronization needs to be started manually. When a synchronization begins, the mirror relationship transitions to a Synchronization in Progress status.</p> <p>If the volume remains in an Unsyncronized status and a dual-primary volume condition exists after the link between the sites is restored, refer to <a href="#">“Both the primary and secondary volumes are displayed as being the primary volume.” on page 5-5</a> for procedures about correcting this situation.</p> <p>For information on monitoring the status of a mirror relationship, refer to the Array Management Window online help.</p>

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**Error message indicates that the Remote Volume Mirroring premium feature is out of compliance.**

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Cause	The Remote Volume Mirroring premium feature is out of compliance. This normally occurs if a volume group with volumes participating in Remote Volume Mirroring has been moved into a storage array and the Remote Volume Mirroring premium feature is not enabled on the selected storage array.
Resolution	<ul style="list-style-type: none"> <li>• If the Remote Volume Mirroring feature is not enabled for the storage array: <ol style="list-style-type: none"> <li>1 Obtain a feature key for this feature from your storage supplier.</li> <li>2 Enable the Remote Volume Mirroring premium feature.</li> </ol> </li> </ul> <p>For step-by-step instructions, refer to <a href="#">“Enabling the Remote Volume Mirroring Feature” on page 3-3</a> or the Array Management Window online help.</p>

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**The remote volume candidate is unresponsive and cannot be updated.**

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Cause	<p>The primary storage array is unable to notify the secondary storage array that its world wide name (WWN) has changed.</p> <p>This may be the result of a controller in the primary storage array being swapped or removed. Storage array recovery procedures that result in configurations being reset could also cause a change to the WWN.</p> <p>The first write to the primary volume will cause the mirrored volume pair to transition into an Unsynchronized status.</p>
Resolution	<ol style="list-style-type: none"> <li>1 Remove all the existing mirror relationships from the primary storage array. For step-by-step instructions, refer to <a href="#">“Removing a Mirror Relationship” on page 3-17</a> or the Array Management Window online help.</li> <li>2 Re-establish the required mirror relationships. For step-by step instructions, refer to <a href="#">“Creating a Mirror Relationship Using the Create Remote Volume Mirror Wizard” on page 3-9</a> or the Array Management Window online help.</li> </ol>

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**There is a long boot time for Windows 2000 hosts with secondary volumes mapped.**

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Cause	<p>A Windows 2000 host can take up to two hours to boot if all of the following statements are true:</p> <ul style="list-style-type: none"> <li>• The storage management software is installed on the host.</li> <li>• The Remote Volume Mirroring premium feature is enabled.</li> <li>• One or more secondary volumes are mapped to the host.</li> </ul>
Resolution	Do not map the secondary volumes to the host until they are needed for data access. If the host needs to be re-started, and the secondary volumes are mapped to that host, unmap the secondary volumes until the host has completed the restart. Remap the secondary volumes only when they are needed for data access.

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## Fibre Channel Fabric Configuration Problems

This section describes Fibre Channel fabric configuration problems that may be encountered after you have configured your storage arrays and have activated and enabled the Remote Volume Mirroring feature.

Information about the probable cause and recommended resolution for each problem is provided. If your problem is not addressed in this section, refer to the remaining sections in this chapter before contacting technical support.

<b>The primary volume is unable to contact the Fibre Channel fabric.</b>	
Cause:	Typically, this error occurs because of a failed Fibre Channel fabric or because of cabling between the primary and secondary storage arrays participating in a mirror relationship.
Resolution:	<ul style="list-style-type: none"> <li>• If the Fibre Channel fabric has failed: Repair or replace the failed fabric.</li> <li>• If the Fibre Channel fabric is operational: Check the configurations cabling. The cable should not go through a hub or be connected directly between storage arrays. Ensure that the cable is attached through a switch.</li> </ul> <p>For step-by-step instructions on configuring storage arrays for Remote Volume Mirroring, refer to <a href="#">Chapter 2, “Hardware and Software Installation.”</a></p>

<b>The primary volume is unable to communicate with the secondary storage array. The primary storage array can still communicate with the fabric.</b>	
Cause:	Typically, this error occurs when the secondary storage array has lost power or when network problems exist between the secondary storage array and the fabric.
Resolution:	<ul style="list-style-type: none"> <li>• Secondary storage array has no power: If the secondary storage array has no power and is not operational, restore power to the storage array. For information on powering on storage arrays, refer to your hardware documentation.</li> <li>• Secondary storage array has power and is operational: Check the storage area network status. Ensure the secondary storage array is visible on the network. Ensure the cables are correctly connected. For step-by-step instructions on configuring storage arrays for Remote Volume Mirroring, refer to <a href="#">Chapter 2, “Hardware and Software Installation.”</a></li> </ul>

## Storage Array Component Failures

This section describes the impact of physical or logical storage array component failures on Remote Volume Mirroring functionality.

Information about the probable cause and recommended resolution for each problem is provided. If your problem is not addressed in this section, refer to the remaining sections in this chapter before contacting technical support.

<b>The primary storage array controller indicates that it has failed.</b>	
Cause:	<p>Failure of the owning controller on the primary storage array will typically cause the associated multi-path driver on the attached host system to transfer ownership of the alternate controller on the primary storage array.</p> <p>When this occurs, the alternate controller on the primary storage array will begin forwarding newly-written data to its peer on the secondary storage array. The secondary controller will take ownership of the volume from its (secondary) peer controller. This is a reactive event, which occurs because of the arrival of a write request from the primary storage array to the non-owning controller on the secondary storage array.</p>
Resolution:	<p>Allow the ownership transfer to complete. Operations will continue in a normal fashion, with the alternate (typically the non-preferred) controller on the primary storage array interacting with the alternate controller on the secondary storage array.</p> <p>Failure of the non-owning controller on the primary storage array will have no direct impact on the status of any Remote Volume Mirrors.</p>

<b>The secondary storage array controller indicates that it has failed.</b>	
Cause:	<p>One of the following scenarios has occurred:</p> <ul style="list-style-type: none"> <li>• Controller A on the secondary storage array has failed, while Controller A is the owner of the primary volume.</li> <li>• Controller B on the secondary storage array has failed while Controller B is the owner of the primary volume.</li> </ul> <p>In both scenarios, the mirrored volume pair transitions to the Unsynchronized status.</p>
Resolution:	<p>Restore the failed controller. For detailed recovery procedures, refer to Recovery Guru.</p> <p>Upon restoration of the failed controller, a synchronization takes place if Automatic Resynchronization is enabled, otherwise, the resynchronization needs to be started manually. The transition to a Synchronizing status restores coherency between the volumes.</p>



## General Switch Troubleshooting

This section describes some common switch-related problems that may be encountered when using the Remote Volume Mirroring feature. The troubleshooting information provided relates to switches supported for use with this version of the storage management software. For a list of supported switches, refer to [Chapter 1, “Remote Volume Mirroring Feature Concepts and Requirements.”](#)

Information about the probable cause and recommended resolution for each problem is provided. If your problem is not addressed in this section, refer to the remaining sections in this chapter before contacting technical support.

<b>Host is unable to detect primary and secondary storage arrays participating in Remote Volume Mirroring.</b>	
Cause:	When two or more switches are cascaded together and have the same Domain ID, hosts will be unable to locate the target device. Each switch must have a unique Domain ID when attempting to cascade two switches together.
Resolution:	Change the Domain ID of one or more of your switches, ensuring that each one is unique. The Domain ID should be a unique number between 1 and 239, which is used to identify the switch to a Fibre Channel fabric.  For more information on setting a Domain ID, refer to your switch user documentation.

## Remote Volume Mirroring Critical Events

Critical Major Event Log (MEL) events are generated when an error occurs that can affect data availability or results in a degraded mode of operation. The storage management software responds by alerting the appropriate administrators using e-mail, SNMP trap, or other configured mechanisms.

Because administrative action is required to correct the problem, the storage array will generally enter a Needs Attention status. This causes the appropriate indications to be presented through the storage management software and an associated Recovery Guru procedure to be displayed when requested by the end user.

The following provides a description of critical MEL events, with a brief explanation of what caused the event to trigger, and the recommended resolution. If your problem is not addressed in this section, refer to the remaining sections in this chapter before contacting technical support.

<b>Mirrored pair becomes unsynchronized.</b>	
Cause:	A critical event is logged when a mirror relationship transitions to an Unsynchronized status, from either a Synchronization in Progress or Optimal status.
Resolution:	Refer to the associated Recovery Guru message for specific recovery procedures.

<b>Dual-role conflict detected.</b>	
Cause:	A critical event is logged when a dual-role conflict is detected, and is typically the result of a role reversal. Since both sides of the mirrored volume pair are in the same primary or secondary volume role, both the primary and secondary storage arrays will report this MEL event.
Resolution:	Refer to the associated Recovery Guru message for specific recovery procedures.

<b>Communication error with the secondary volume on the secondary, remote storage array.</b>	
Cause:	A critical event is logged when an interruption in the link is detected that cannot be recovered by the firmware Fibre Channel driver. Error codes and recovery procedures will assist the user in finding the exact cause of the communication problem between storage arrays participating in a mirror relationship.
Resolution:	Refer to the associated Recovery Guru message for specific recovery procedures.

World wide name (WWN) change notification failed.	
Cause:	<p>A critical event is logged when a storage array detects during start-up processing that its world wide name (WWN) has changed. The WWN can only change if both controllers of the storage array are exchanged while the storage array is powered off.</p> <p>When the firmware detects this name change, it attempts to notify any remote storage array that had previously been participating in a mirroring relationship with any volume on the storage array.</p>
Resolution:	Refer to the associated Recovery Guru message for specific recovery procedures.

# Controller Firmware Version 5.20 and Higher Upgrades

The Remote Volume Mirroring feature is designed so that it is not necessary for the primary storage array and the secondary storage to be running exactly the same controller firmware level. All inter-controller operations (including those needed for propagation of newly-written data from the primary volume to the secondary volume) have been implemented so as to support mixed firmware levels to the greatest extent possible. This allows firmware upgrades to be performed on both the primary and secondary storage arrays without any loss of data.

This section describes the procedure that should be followed for upgrading controller firmware (version 5.20 and higher) to ensure that the Remote Volume Mirroring features work as intended. The preferred sequence for performing firmware upgrades on storage arrays participating in mirror relationships is detailed below.

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**IMPORTANT** By following this sequence, it is possible to avoid transitions of the mirrored volume pair to an Unsynchronized status, avoiding the need for a full resynchronization afterwards.

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- 1** Stop I/O activity to applications that operate on all affected primary volumes temporarily inactive.
- 2** Download firmware to the secondary storage array.
- 3** Resume application access to primary volumes. There will be a period of time after this step when the primary storage array is operating with a different firmware level than the secondary storage array, but the inter-controller protocols for data replication will support such interactions.
- 4** Download firmware to the primary storage array. For procedures on downloading controller firmware, refer to the Array Management Window online help.

## End Of Procedure

You will receive error messages when certain configuration operations are not allowed between storage arrays that have different firmware levels. Examples of the forbidden configuration options include establishing new mirrors and modifying mirror parameters. However, the key data availability operations, including promotion from the secondary volume to the primary volume, will be allowed in such circumstances.

# Glossary

## A

### **Array Management Window (AMW)**

A graphical user interface (GUI) from which a user can manage and configure physical components (controllers and drives) and logical components (volumes and volume groups), recover from errors, and monitor performance in a storage array.

See also Logical View, Mappings View, and Physical View.

### **Asynchronous Write Mode**

A configuration option for mirror relationships, which allows write requests to the primary volume to be completed by the controller before waiting for an I/O completion indication that the data has been successfully copied to the secondary storage array.

Asynchronous write mode offers faster host I/O performance but does not guarantee that data was successfully written to the secondary volume before indicating a successful write to the host system.

See also Synchronous Write Mode.

## B

### **Base Volume**

A volume from which you create a snapshot volume. Beginning with version 8.00 of the storage management software, a base volume must be a standard volume in the storage array.

## C

### **Cascade**

A multiple switch configuration with either a tree-like or a linear chain-like structure.

## D

### **Dual Primary Remote Volume Mirror Condition**

A Remote Volume Mirror containing two primary volumes, instead of one primary volume and one secondary volume.

This error condition is created when a communication error has taken place between the primary and secondary storage arrays. The secondary volume was promoted to be the primary volume so that business operations could continue. A forced role reversal was performed because the primary site could not be contacted. Communication was then restored, resulting in two primary volumes.

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### **Dual Secondary Remote Volume Mirror Condition**

A Remote Volume Mirror containing two secondary volumes, instead of one secondary volume and one primary volume.

This error condition occurs when the Change to Secondary option is used under ordinary conditions to perform a role reversal. An inter-site communication failure interrupted the promotion of the original secondary volume to become the primary volume of the mirrored pair. A decision was made to proceed with the role reversal despite the fact that the original secondary volume could not be promoted. This is an example of a forced role reversal.

Because secondary volumes cannot accept data writes by hosts, the condition must be corrected to promote one of the secondary volumes to be the primary volume of the mirrored pair.

## **E**

### **E\_port**

Expansion Port. It specifies the interconnection and initialization for a Fibre Channel switch to create an inter-switch link.

### **Enterprise Management Window (EMW)**

A graphical user interface (GUI) from which a user can manage storage arrays, monitor the health of the storage arrays, configure e-mail and Simple Network Management Protocol (SNMP) alert notifications, launch an appropriate Array Management Window for a particular storage array, or edit and execute a script to perform batch management tasks.

## **F**

### **Fabric**

Fibre Channel-defined interconnection methodology that handles routing in Fibre Channel networks.

### **Feature Key File**

The storage array controller uses this file to enable an authorized premium feature. The file contains the Feature Enable Identifier of the storage array for which the premium feature is authorized and generates data about the premium feature to be enabled.

### **Full Synchronization**

The copy of all data on the primary volume to the secondary volume. A full synchronization only occurs when the Remote Volume Mirror is initially created. Further synchronizations contain only the data that was changed during a communication error.

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The controller owner of the primary volume in the mirrored pair performs this operation in the background, while it is writing host I/O activity to the primary volume and sending associated remote writes to the secondary volume. You set a synchronization priority to determine how the controller owner of the primary volume will prioritize the full synchronization relative to the I/O activity.

## M

### **Mirror Repository Volume**

A special volume in the storage array created as a resource for the controller owner of the primary volume in a Remote Volume Mirror. The controller stores mirroring information on this volume, including information about remote writes that are not yet written to the secondary volume. The controller can use this information to recover when the storage array is powered on and off or when there is a controller reset.

When you activate the Remote Volume Mirroring premium feature on the storage array, you create two mirror repository volumes, one for each controller in the storage array. The mirror repository volume for a controller stores information about *every* Remote Volume Mirror that contains a primary volume owned by this controller. An individual mirror repository volume is not needed for each Remote Volume Mirror.

When you create the mirror repository volumes, you specify placement of the volumes. You can use either existing free capacity or create a volume group for the volumes from unconfigured capacity and specify the RAID level.

### **Mirror Relationship**

A mirrored volume pair that consists of a primary volume at the primary site and a secondary volume at a secondary, remote site. A mirror relationship is also referred to as a Remote Volume Mirror or Remote Mirror.

In the event of disaster at the primary site, you can fail over to the secondary site by performing a role reversal to promote the secondary volume to be a primary volume. Then the recovery host will be able to write to the newly promoted volume and business operations can continue.

### **Mirror Synchronization in Progress Status**

An operational state reported through the graphical user interface (GUI) that shows that a synchronization is occurring between the primary volume and the secondary volume of a mirror relationship.

When the synchronization is completed, the mirror relationship transitions to a Mirror Synchronized status.

### **Mirror Synchronized Status**

An operational state reported through the graphical user interface (GUI) that shows that an identical copy of the data on the primary volume in a Remote Volume Mirror is present on the secondary volume.

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### **Mirror Unsynchronized Status**

An operational state reported through the graphical user interface (GUI) that shows that the data on the primary volume in a Remote Volume Mirror is not currently replicated identically on the secondary volume. Some causes for this status include link errors, a failed primary volume or secondary volume, or a dual primary or dual secondary error condition.

While the mirror relationship is in an Unsynchronized status, no mirroring activity takes place. When the controller owner of the primary volume can communicate with the controller owner of the secondary volume and the volume is online and optimal, then a synchronization can take place. When a synchronization begins, the mirror relationship transitions to a Mirror Synchronization in Progress status.

### **Missing Volume**

A placeholder node displayed in the Logical View of the Array Management Window indicating that the storage array has detected that drives associated with a volume are no longer accessible. Typically, this is the result of removing drives associated with a volume group or when there is a loss of power to one or more drive modules.

Missing volumes are identified by their world wide name and are displayed below the Unconfigured Capacity node or directly below the storage array or root node. They are identified as being standard volumes, base volumes, snapshot volumes, snapshot repository volumes, primary volumes, secondary volumes, or mirror repository volumes.

## **P**

### **Primary Volume**

A volume in a mirror relationship that accepts host I/O activity and stores application data. The data on a primary volume is replicated to the secondary volume.

The controller owner of the primary volume initiates remote writes to the secondary volume to keep the data on the two volumes synchronized.

The controller owner of the primary volume initiates a synchronization after a link interruption or volume error that caused a mirror relationship to become unsynchronized is corrected.

## **R**

### **Remote Volume Mirroring Premium Feature**

This feature allows you to create Remote Volume Mirrors to replicate data from a primary volume to a secondary volume.

### **Remote Write**

Remote writes keep data on the secondary volume synchronized with data on the primary volume.



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After the controller owner of a primary volume receives a host I/O write request and writes the data to the primary volume, the controller initiates a remote write to copy data blocks that have changed on the primary volume to the secondary volume.

### **Resynchronization Method**

The Resynchronization Method defines whether the communication between the primary and secondary volume is restored manually or automatically after a communication interruption.

### **Role Reversal**

The act of promoting the secondary volume to be the primary volume of the mirrored volume pair, and demoting the primary volume to be the secondary volume.

Both options result in the promotion of the secondary volume and the demotion of the primary volume to effect the role reversal.

If communication with the remote storage array is down, you can force a role reversal even when there will be a resulting dual-primary or dual-secondary condition. Use the Recovery Guru to recover from one of those conditions after communication is restored with the remote storage array.

## **S**

### **Secondary Volume**

This volume is used to store replicated data from a primary volume. The controller owner of a secondary volume receives remote writes for the volume from the controller owner of the primary volume. The controller owner of the secondary volume accepts host read requests, but does not accept host write requests.

### **Snapshot Repository Volume**

A special volume in the storage array created as a resource for a snapshot volume. A snapshot repository volume contains snapshot data and copy-on-write data for a particular snapshot volume.

A snapshot repository volume is not host-addressable, but you can increase its capacity, rename it, specify the action (either failing it or failing writes to the base volume) when it becomes full, or view its capacity or media scan properties.

### **Snapshot Volume**

A logical point-in-time image of another volume, called a base volume, in the storage array. A snapshot is the logical equivalent of a complete physical copy, but you create it much more quickly than a physical copy and it requires less disk space.

Because a snapshot is a host-addressable volume, you can perform backups using the snapshot while the base volume remains online and user-accessible. In addition, you can write to the snapshot volume to perform application testing or scenario development and analysis.

### **Standard Volume**

A logical structure you create on a storage array for data storage.

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## **Storage Array**

A storage entity entirely managed by storage management software. A storage array consists of a collection of both physical components (such as drives, controllers, fans, and power supplies) and logical components (such as volume groups and volumes). A storage array can span multiple physical enclosures.

For example, several drive modules connected to a command module constitutes one storage array. A unit that contains drives and a controller in a single enclosure is also considered one storage array. A rackmount subsystem may contain more than one storage array.

Also known as RAID Module.

## **Storage Partition**

A logical entity consisting of one or more storage array volumes that can be shared among hosts that are part of a host group or accessed by a single host. A Storage Partition is created when you define a collection of hosts (a host group) or a single host and then define a volume-to-logical unit number (LUN) mapping. This mapping allows you to define what host group or host will have access to a particular volume in your storage array.

## **Synchronization Priority Level**

The controller owner of a primary volume performs a synchronization in the background while processing local I/O writes to the primary volume and associated remote writes to the secondary volume. Because the synchronization diverts controller processing resources from I/O activity, it can have a performance impact to the host application.

You can choose from five different synchronization priorities for the primary controller owner, ranging from Lowest to Highest, that determines how much of a priority the synchronization will be relative to host I/O activity and, therefore, how much of a performance impact there will be.

You set the Synchronization Priority Level when you create the mirror relationship, or you can change it later using the Change Synchronization Settings option. Although the primary controller owner performs the synchronization and uses the synchronization priority, it is set for both the primary and secondary volumes during mirror relationship creation in case of a role reversal.

## **Synchronous Write Mode**

A configuration option for mirror relationships, which ensures that controller on the primary storage array waits until data has been successfully copied to the secondary storage array before sending an I/O completion back to the host system.

Synchronous write mode offers the best chance of full data recovery from the secondary storage array in a disaster, at the expense of host I/O performance and is the preferred write mode.

See also Asynchronous Write Mode.

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## U

### **Uplink Port**

See “[E\\_port.](#)”

### **Usable Capacity**

The usable capacity of a volume participating in a mirroring relationship is the minimum of the primary volume and secondary volume actual capacities.

In the Array Management Window, all primary and secondary volumes display both actual and usable capacity in the Logical View.

## V

### **Volume**

A logical structure you create on a storage array for data storage. A volume is defined over a set of drives called a volume group, and has a defined Random Array of Independent Disks (RAID) level and capacity. The drive boundaries of the volume group are hidden to the host computer.

Also known as Logical Unit Number (LUN).

### **Volume Group**

A set of drives that the controller logically groups together to provide one or more volumes to an application host.

## W

### **Write Consistency**

A configuration option available for any remote volume mirror that is configured to use asynchronous write mode.

When asynchronous write mode is selected, any write requests to the primary volume are completed by the controller, without waiting for an I/O completion indication from the secondary storage array that the data was successfully copied.

As a result of selecting this write mode, write requests are not guaranteed to be completed in the same order on the secondary volume as they on the primary volume. If the order of write requests is not preserved, data on the secondary volume may become inconsistent with the data on the primary volume, which would jeopardize any attempt to recover data if a disaster occurs on the primary storage array.

The Preserve consistent write order option enables you to preserve the remote write order, while retaining the performance benefits obtained with the asynchronous write mode. If a new write request to the primary volume attempts to change data associated with a pending write request, the write request will be placed into a queue until the pending write has been completed.

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## **Write Consistency Group**

A configuration option available for any mirror relationship that is configured to use asynchronous write mode, and is configured on a per-mirror basis.

If you create multiple remote volume mirrors on your storage array, and configure each of the remote volumes mirrors to use the asynchronous write mode and preserve write consistency, the controller owner will treat all of the remote volume mirrors as members of a write consistency group and ensure that the write order is preserved for all remote writes.

Preserving the write order of remote writes will ensure that the data on the secondary volume for each of the mirrored pairs remains synchronized with the data on its corresponding primary volume. This feature is especially important to applications, such as a database, where data is stored on more than one volume.

## **Write Mode**

A configuration option for remote volume mirrors, which determines when an I/O completion indication is sent to the host application to signal that data has successfully been copied from the primary storage array to the secondary storage array.

There are currently two write modes available:

**Synchronous** – Synchronous write mode offers the best chance of full data recovery from the secondary storage array in the event of a disaster, at the expense of host I/O performance. When this write mode is selected, any host write requests will be written to the primary volume and then copied to the secondary storage volume. The controller sends an I/O completion indication to the host system after the copy has been successfully completed. This write mode is selected by default, and is the preferred write mode.

**Asynchronous** – Asynchronous write mode offers faster host I/O performance, but does not guarantee that the copy has been successfully completed before processing the next write request. When this write mode is selected, host write requests are written to the primary volume, and then the controller sends an I/O completion indication back to the host system, before the data has been successfully copied to the secondary storage array.

# **Z**

## **Zoning**

The ability to divide a Storage Area Network (SAN) into a number of independent zones for binding targets to initiators. This allows a logical mapping of a physical configuration.

## C

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