

IBM FAStT Remote Mirror Option



# Installation and User's Guide



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**Note:** Before using this information and the product it supports, be sure to read the general information in Appendix B, "Notices" on page 77.

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## About this book

This book provides information about setting up, installing, configuring, and working with the IBM® FASTT Remote Mirror Option. This option is used with IBM Fibre Array Storage Technology (FASTT) Storage Manager Version 8.2. This *Installation and User's Guide* is for system administrators who are responsible for operating and maintaining storage systems, with an emphasis on disaster prevention and recovery. Refer to the online help systems for detailed storage management procedures for topics not referred to in this book. Use this guide to:

- Determine the hardware and software that are required to install the IBM FASTT Remote Mirror Option
- Integrate the necessary hardware components into your network
- Install, enable, and activate the IBM FASTT Remote Mirror Option
- Identify other storage-management premium features that are unique to your specific installation
- Troubleshoot hardware and software problems

Before you begin the installation of this product, make sure that you have purchased the premium feature key and consult the following documentation:

- README.TXT file - Read this text file first. The README file is located in the root directory of the installation CD. Refer to the IBM Web site at <http://www.ibm.com/pc/support> for the latest installation and user information.
- *IBM FASTT Storage Manager Version 8.2 Installation and Support Guide* - Use this document to become familiar with terminology and features of the IBM FASTT Storage Manager Version 8.2 software. You can download this book from the <http://www.ibm.com/pc/support> Web site.

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## How this book is organized

Chapter 1, "Introduction" on page 1 provides an introduction to the IBM FASTT Remote Mirror Option and describes the hardware and software requirements for using the Remote Mirror Option, configuration types, describes how the Remote Mirror Option interfaces with other premium features, such as Storage Partitioning and FlashCopy™ logical drives, and provides a hardware and software checklist to ensure that all the requirements are met before installing and configuring your systems.

Chapter 2, "Hardware and software installation" on page 21 provides information on the site preparation and instructions for installing key hardware and software components.

Chapter 3, "Using the Remote Mirror Option" on page 43 provides step-by-step instructions on enabling and activating the IBM FASTT Remote Mirror Option, creating a mirror relationship, and maintaining a mirror relationship.

Chapter 4, "Disaster recovery" on page 53 provides a number of scenarios about how the IBM FASTT Remote Mirror Option can help prevent data loss, and assist with the recovery of critical data if a disaster or unrecoverable error occurs.

Chapter 5, "Troubleshooting" on page 61 provides information for troubleshooting hardware and software components, and describes events that might be logged when using the Remote Mirror Option.

Appendix A, “Getting information, help, and service” on page 73 provides information about how to obtain help, service, or technical assistance.

Appendix B, “Notices” on page 77 provides product notices and trademark information.

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## Notices used in this book

This book contains the following notices designed to highlight key information:

- **Notes:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information that might help you avoid inconvenient or problem situations.
- **Attention:** These notices indicate possible damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.

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## Related publications

The following publications are available in Adobe Acrobat Portable Document Format (PDF) on the IBM FAStT Storage Manager CD and at the <http://www.ibm.com/pc/support/> Web site.

- *IBM FAStT Remote Mirror Option Installation and User's Guide* (this book)
- *IBM FAStT Storage Manager Version 8.2 Installation and Support Guide for Microsoft Windows NT and Windows 2000*
- *IBM FAStT Storage Manager Version 8.2 Installation and Support Guide for Novell NetWare*
- *IBM FAStT Storage Manager Version 8.2 Installation and Support Guide for Linux<sup>®</sup>*
- *IBM TotalStorage<sup>™</sup> FAStT700 Fibre Channel Storage Server Installation Guide*
- *IBM TotalStorage FAStT700 Fibre Channel Storage Server User's Guide*
- *IBM FAStT700 Fibre Channel Cabling Instructions*
- *IBM Netfinity FAStT500 Raid Controller Enclosure Unit Installation Guide*
- *IBM Netfinity FAStT500 Raid Controller Enclosure Unit User's Guide*
- *IBM FAStT FC-2 Host Bus Adapter Installation and User's Guide*
- *IBM FAStT MSJ User's Guide*

In addition, the following IBM Redbooks<sup>™</sup> might be of interest:

- *Fibre Array Storage Technology: A FAStT Introduction*
- *Implementing Netfinity Disk Subsystems: ServeRAID SCSI, Fibre Channel, and SSA*
- *Tuning Netfinity Servers for Performance: Getting the most out of Windows 2000 and Windows NT 4.0*
- *Netfinity Director: Integration and Tools*
- *Netfinity Clustering Planning Guide*

You can download these books from the <http://www.ibm.com/redbooks> Web site.



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## Chapter 1. Introduction

This chapter introduces the basic concepts of the Remote Mirror Option, describing what a remote mirror is, how information is replicated between storage subsystems, the software and hardware required, and the preferred system configurations.

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### Introduction to the Remote Mirror Option

The Remote Mirror Option is a premium feature that comes with the IBM FASTT Storage Manager 8.2 software and is enabled by purchasing a premium feature key. The Remote Mirror Option is used for online, real-time replication of data between storage subsystems over a remote distance. In the event of a disaster or unrecoverable error at one storage subsystem, the Remote Mirror Option enables you to promote a second storage subsystem to take over responsibility for normal input/output (I/O) operations.

The maximum number of storage subsystems that can participate in a remote mirror configuration is two. The two storage subsystems are called primary and secondary storage subsystems or as local and remote storage subsystems. These names are used interchangeably to describe remote mirror setups or concepts. The names do not refer to the location of storage subsystems or the role storage subsystems have in a remote mirror relationship.

### Primary and secondary logical drives on a remote mirror setup

This section introduces you to primary and secondary logical drives, and describes how they interact to replicate data between storage subsystems using the Remote Mirror Option. When you create a remote mirror, a mirrored logical drive pair is defined and consists of a primary logical drive at the primary storage subsystem, and a secondary logical drive at a secondary storage subsystem. A standard logical drive might only be defined in one mirrored logical drive pair, the maximum number of supported mirrored logical drive pairs is determined by the storage subsystem model.

The primary and secondary role in a remote mirror setup is implemented at the logical drive level instead of at the storage subsystem level. A storage subsystem can have all logical drives participating in a remote mirror relationship be in either a primary or secondary role only. The storage subsystem can also have a combination of logical drives in a primary role and logical drives in a secondary role. Whether the logical drive is in a primary or secondary role, it counts towards of the maximum number of mirror logical drive pairs that can be defined in a storage subsystem.

There are no requirements for having certain number of logical drives be of certain role in a remote mirror relationship for a given storage subsystem. For example, a storage subsystem with a maximum of 16 remote mirror relationship pairs might have logical drives in any one of the following remote mirror relationship combinations:

Remote mirror drives in a primary role	Remote mirror drives in a secondary role	Description
16	0	This storage subsystem (local) has data in 16 logical drives mirrored in 16 logical drives in a separate (remote) storage subsystem.
8	8	This local storage subsystem has data in 8 logical drives mirrored in 8 logical drives in a remote storage subsystem. It also have 8 logical drives that are used to store the mirrored data from 8 logical drives in a remote storage subsystem.
4	12	This local storage subsystem has data in 4 logical drives mirrored in 4 logical drives in a remote storage subsystem. It also have 12 logical drives that are used to store the mirrored data from 12 logical drives in a remote storage subsystem.
0	16	This local storage subsystem has 16 logical drives that are used to store the mirrored data from 16 logical drives in a remote storage subsystem.

There is a limit to how many logical drives that you can create in a single storage subsystem. When Remote Mirror Option is enabled, the total number of logical drives that are supported for each storage subsystem is reduced from the number of logical drives you would have without the Remote Mirror Option enabled. The reduced maximum number of logical drives that a FASTt storage subsystem can support with firmware version 05.20.xx.xx depends on the model of the FASTt storage subsystem. Refer to Table 1 for more information.

Table 1. Logical drives using the Remote Mirror Option

Model Type	Maximum logical drives	Maximum logical drives per storage unit partition	Maximum flashCopy logical drives
3542	N/A <sup>7</sup>	N/A <sup>7</sup>	N/A <sup>7</sup>
3552	128 <sup>3,6</sup>	32 <sup>5</sup>	64 <sup>2</sup>
1742	256 <sup>1,4,6</sup>	32 <sup>5</sup>	128 <sup>2</sup>

**Note:** The access logical drive is also referred to as the Universal Xport Device.

<sup>1</sup>When using firmware version 5.xx.xx, the firmware reserves one logical drive for use by the system.

<sup>2</sup> Maximum of four FlashCopy logical drives for each standard logical drive

3. Maximum of eight remote mirror pairs
4. Maximum of 16 remote mirror pairs
5. The host-agent management method uses a special logical drive, called an *access logical drive*, to communicate with the controllers on the storage subsystem. The access logical drive uses one of the available LUNs. Therefore, managing storage subsystems with the host-agent software limits you to one fewer LUN than the maximum number supported by the operating system and the host adapter.
6. For firmware version 05.20.xx.xx, the maximum number of logical drives includes the flashCopy repository logical drives and the remote mirror repository logical drives, in addition to the standard data logical drives. If the Remote Mirror Option is enabled, two logical drives are reserved for use by the system.
- 7 The IBM FASTT200 (machine type 3542) storage subsystem does not support the Remote Mirror Option.

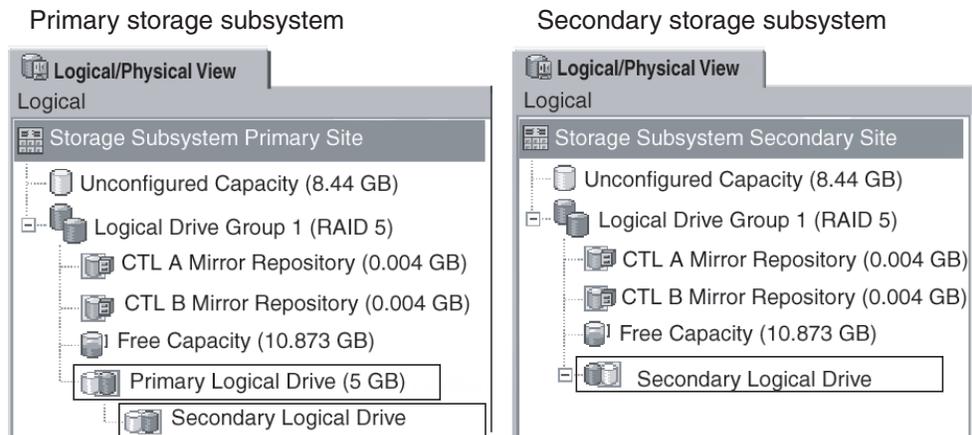
The primary logical drive is the drive that accepts host computer I/O and stores program data. When the mirror relationship is first created, data from the primary logical drive is copied (becomes a mirror image) in its entirety to the secondary logical drive. This process is known as a *full synchronization*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

When a write request is made to the primary logical drive, the controller owner of the primary logical drive also initiates remote write request to the secondary drive. The write request does not complete until both write requests are performed. This additional write request keeps the data on the two logical drives in the remote mirror relationship synchronized. Whenever the data on the primary drive and the secondary drive becomes unsynchronized, the controller owner of the primary drive initiates a full synchronization.

The secondary logical drive is used to store data copied from its associated primary logical drive. The controller owner of the secondary logical drive receives remote writes from the controller owner of the primary logical drive and will not accept host computer read or write requests.

The secondary logical drive is unavailable to host computer programs while mirroring is performed. In the event of a disaster or unrecoverable error of the primary storage subsystem, a role reversal is performed to promote the secondary logical drive to the primary logical drive. Host computers will then be able to access the newly promoted logical drive and normal operations can continue.

Figure 1 on page 4 shows the primary and secondary logical drives displayed in the Subsystem Management window for the primary storage subsystem and the secondary storage subsystem.



Both the primary and secondary logical drives are displayed in the Subsystem Management window for the storage subsystem.

Only the secondary logical drive is displayed in the Subsystem Management window for the Secondary storage subsystem.

Figure 1. Primary and secondary logical drives displayed in the Subsystem Management window

## Mirror repository logical drives

A mirror repository logical drive is a special logical drive in the storage subsystem created as a resource for the controller owner of the primary logical drive in a remote logical drive mirror. The controller stores mirrored information on this logical drive, including information about remote writes that are not yet written to the secondary logical drive. The controller can use this information to recover from controller resets and accidental powering-down of storage subsystems.

When you activate the Remote Mirror Option on the storage subsystem, two mirror repository logical drives will be created by the system, one for each controller in the storage subsystem. An individual mirror repository logical drive is not needed for each mirror logical drive pair.

When you create the mirror repository logical drives, you specify the location of the logical drives. You can either use existing free capacity (shown in Figure 2 on page 5) or you can create an array for the logical drives from unconfigured capacity and then specify the redundant array of independent disks (RAID) level.

Because of the critical nature of the data that is stored, the RAID level of mirror repository logical drives must be non-zero. The required size of each logical drive is 4 MB, for each mirror repository logical drive.

Figure 2 on page 5 shows mirror repository logical drives displayed in the Subsystem Management window for the primary storage subsystem.

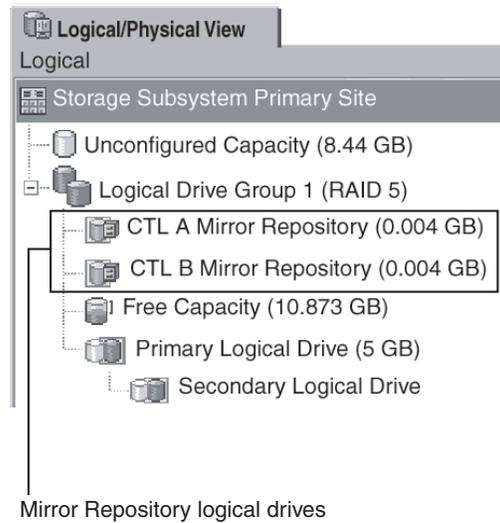


Figure 2. Mirror repository logical drives displayed in the Subsystem Management window

## Mirror relationships

Before you define a mirror relationship, the Remote Mirror Option must be enabled on both the primary and secondary storage subsystems. A secondary standard logical drive candidate must be created on the secondary storage subsystem if one does not already exist, it must be a standard logical drive, and is at least the same size or larger than the primary logical drive.

When secondary logical drive candidates are available, you can define a mirror relationship in the storage-management software by identifying the storage subsystem containing the primary logical drive and the storage subsystem containing the secondary logical drive.

When you set up the mirror relationship, a full synchronization occurs as data from the primary logical drive is copied in its entirety to the secondary logical drive. For more information on establishing mirror relationships, refer to “Creating mirror relationships” on page 46.

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## Data replication

This section describes how data is replicated between storage subsystems participating in remote logical drive mirroring, and the actions taken by the controller owner of the primary logical drive if a link interruption occurs between storage subsystems. Data replication between the primary logical drive and the secondary logical drive is managed by the controllers and is transparent to host computers and programs.

When the controller owner of the primary logical drive receives a write request from a host computer, the controller first logs information about the write to its mirror repository logical drive, and then writes the data to the primary logical drive. The controller then initiates a remote write operation to copy the affected data blocks to the secondary logical drive at the secondary storage subsystem.

After the host computer write request is written to the primary logical drive and the data is successfully copied to the secondary logical drive, the controller removes

the log record on the mirror repository logical drive and sends an I/O completion indication back to the host computer. See Figure 3 for the data replication process.

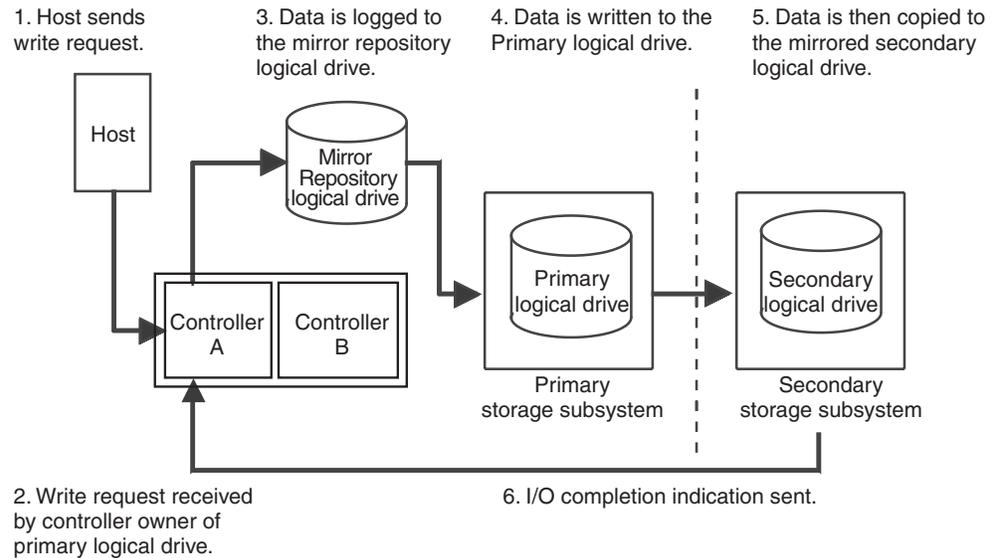


Figure 3. Data replication between primary and secondary storage subsystems

Because the controller does not send the I/O completion to the host computer until the data is copied to both the primary and secondary logical drives, this mirroring operation is called *synchronous*.

When a read request is received from a host computer, the controller owner of the primary logical drive manages the request. No communication takes place between the primary and secondary storage subsystems.

## Link interruptions or secondary logical drive errors

In the course of processing write requests, a primary controller might be able to write to the primary logical drive, while a link interruption prevents communication with the remote secondary controller.

After a link interruption, the remote write cannot complete to the secondary logical drive and the primary and secondary logical drives are no longer correctly mirrored. The primary controller transitions the mirrored pair into an Unsyncronized status and sends an I/O completion to the primary host computer, as shown in Figure 4 on page 7. The primary host computer can continue to write to the primary logical drive but remote writes will not take place.

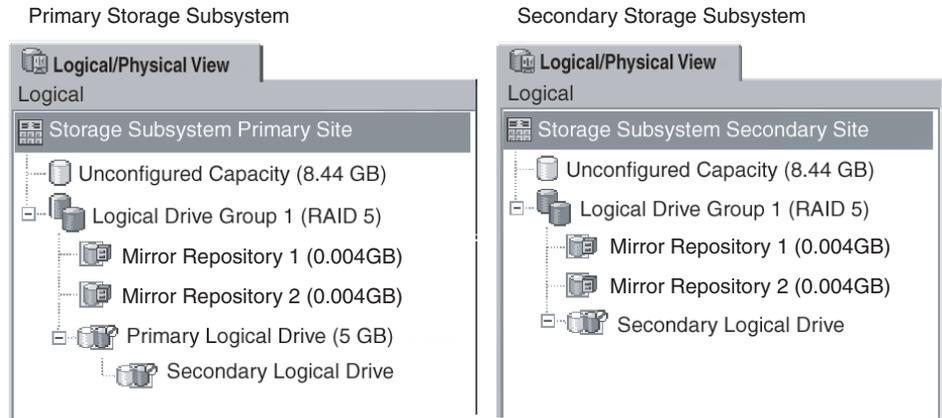


Figure 4. Mirrored logical drive pair showing *Unsynchronized status*

When connectivity is restored between the controller owner of the primary logical drive and the controller owner of the secondary logical drive, a full synchronization automatically takes place. The mirrored pair transitions from an *Unsynchronized* status to a *Synchronization-in-Progress* status, as shown in Figure 5.

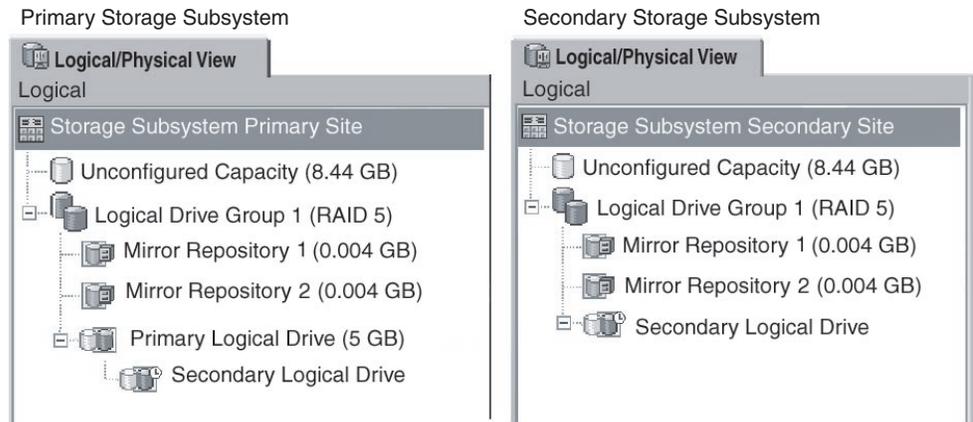


Figure 5. Mirrored logical drive pair showing *Synchronization-in-Progress status*

The primary controller marks the mirrored pair as *unsynchronized* when a logical drive error from the secondary storage subsystem prevents a remote write from completing. For example, an offline or a failed secondary logical drive can cause the remote logical drive mirror to become *unsynchronized*. When the logical drive error is corrected (the secondary logical drive is placed online or recovered to an *Optimal* status) then a full synchronization automatically begins and the mirrored pair transitions to a *Synchronization-in-Progress* status.

For more information about remote-mirror option status, refer to Chapter 3, “Using the Remote Mirror Option” on page 43.

## Connectivity and I/O

The Remote Mirror Option requires a dedicated host port for mirroring data between storage subsystems. This section describes three configurations that you can use to connect storage subsystems for remote logical drive mirroring, controller ownership of logical drives within storage subsystems, the maximum storage subsystem distance permitted, and some general performance considerations. If these configurations do not meet your remote mirror configuration requirement, contact your IBM technical-support representative.

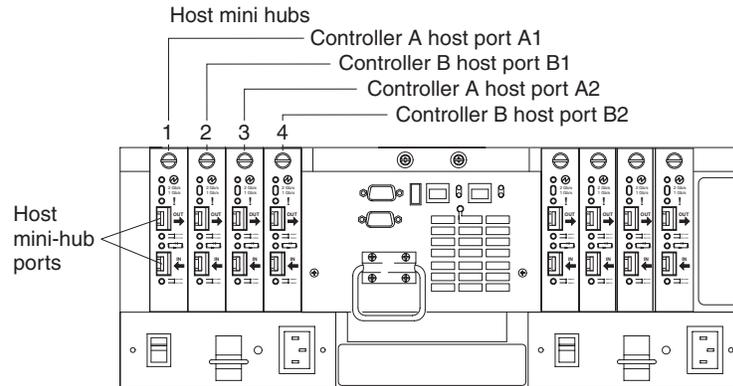


Figure 6. Controller A and Controller B host ports

The Remote Mirror Option is supported on FASTT storage subsystems that have at least two Fibre Channel host ports per controller (machines type 3553 and 1742). When Remote Mirror Option is activated, one Fibre Channel host-side I/O port on each controller is dedicated only to mirroring operations. For example, in the primary storage subsystem, controller host ports A2 and B2 are dedicated to mirroring operations. In the secondary storage subsystem, controller host ports A2 and B2 are also dedicated to mirroring operations. See Figure 6 for the location of the controller host port.

Each of the controller host ports are connected to a mini hub. Each mini hub has two SFP or GBIC port slots. If the first mini-hub SFP or GBIC port slot is connected to a Fibre Channel switch port as part of remote mirror setup, the second mini-hub port must not be occupied.

Host-initiated I/O operations are refused by the dedicated port. Requests received on this dedicated port are accepted from only a controller participating in the remote mirror relationship.

Controller ports dedicated to the remote logical drive mirror must be attached to a Fibre Channel fabric environment with support for the Directory Service and Name Service interfaces.

## Fibre Channel fabric configurations

The level of redundancy available depends on which Fibre Channel fabric configuration you use. The three Fibre Channel fabric configurations that are supported in version 8.2 of the storage-management software are as follows:

- **Highest Availability Campus configuration** - A fully redundant configuration that consists of a primary storage subsystem and a secondary storage

subsystem. This fully redundant configuration has a connection distance up to 10 Km (6.25 mi). For more information, refer to “Highest Availability Campus configuration” on page 16.

- **Campus configuration** - A lower-cost configuration which consists of a primary storage subsystem and a secondary storage subsystem. This low-cost configuration has a connection distance up to 10 Km (6.25 mi). For more information, refer to “Campus configuration” on page 17.
- **Intra-site configuration** - A low-cost configuration where the primary storage subsystem and secondary storage subsystem are located within the same site. For more information, refer to “Intra-site configuration” on page 18.

For instructions on how to configure storage subsystems, refer to Chapter 2, “Hardware and software installation” on page 21.

## Logical drive ownership

The controller owner of the primary logical drive attempts to communicate with only its mirrored controller in the secondary storage subsystem. As shown in Figure 7, Controller A in the primary storage subsystem with attempts communication with Controller A in the secondary storage subsystem.

The controller (A or B) that owns the primary logical drive determines the controller owner of the secondary logical drive. Regardless of the secondary logical drive controller ownership, If the primary logical drive is owned by Controller A on the primary storage subsystem, the secondary logical drive is then owned by Controller A on the secondary storage subsystem. If primary Controller A cannot communicate with secondary Controller A, no controller ownership changes take place and the remote mirror link is broken for that mirror logical drive pair. When primary controller A can communicate with secondary controller A, the next I/O request to the primary logical drive will result in a secondary drive ownership change.

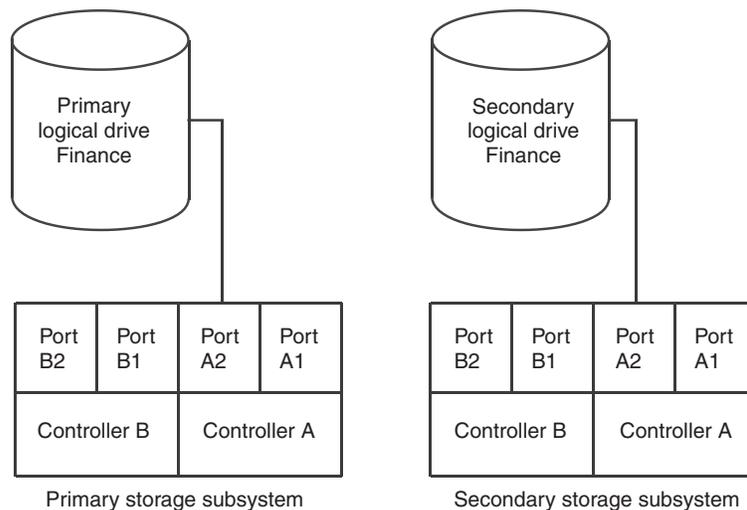


Figure 7. Controller A shown as the controller owner

When an I/O path error causes a logical drive ownership change on the primary storage subsystem, or if the storage administrator changes the controller owner of the primary logical drive, the next remote write that is processed automatically starts an ownership change on the secondary storage subsystem.

As shown in Figure 8, if a primary logical drive is owned by Controller A and the controller owner is changed to Controller B, the next remote write changes the controller owner of the secondary logical drive from Controller A to Controller B.

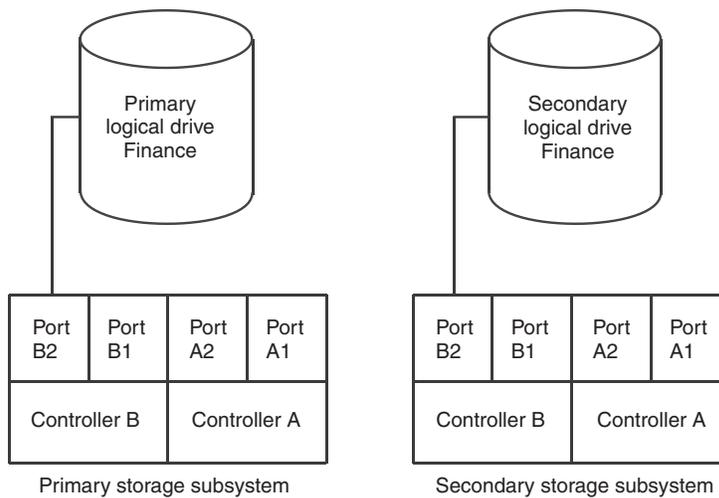


Figure 8. Controller B shown as controller owner

Because controller ownership changes on the secondary storage subsystem are controlled by the primary controller, they do not require any special intervention and the system administrator cannot be manually change them.

## Primary and secondary storage subsystem connection distance

The maximum connection distance permitted between storage subsystems participating in a mirror relationship is governed by the distance limits of the Fibre Channel interswitch links (ISL). Using standard single-mode fiber technology, a maximum link distance of 10 Km (6.25 mi) between storage subsystems can be achieved. In addition, the ISL link must be a standard Fibre Channel connection using single-mode Fibre Channel cables between two long-wave GBICs or SFPs that are inserted into the Fibre Channel switch port slots. Contact your IBM technical-support representative if you require a remote mirror configuration with a link distance greater than 10 Km (6.25 mi) or if you require protocol (for example, FC-ATM-FC) conversion between remote mirror nodes.

**Note:** The IBM FASTT Storage Manager Version 8.2 software limits distances between storage subsystems in a Fibre Channel environment to 10 Km (6.25 mi).

## General performance considerations

Note the following general performance considerations when creating remote logical drive mirrors.

- The controller owner of a primary logical drive performs a full synchronization in the background while processing local I/O writes to the primary logical drive and associated remote writes to the secondary logical drive. Because a full synchronization diverts controller processing resources from I/O activity, this can impact performance to the host computer program.

To reduce the performance impact, you can set the synchronization priority to establish how the controller owner prioritizes a full synchronization relative to other I/O activity. The following are some basic guidelines to setting the synchronization rate:

- A full synchronization at the lowest synchronization priority rate takes approximately eight times as long as a full synchronization at the highest synchronization rate.
- A full synchronization at the low synchronization priority rate takes approximately six times as long as a full synchronization at the highest synchronization rate.
- A full synchronization at the medium synchronization priority rate takes approximately three and a half times as long as a full synchronization at the highest synchronization rate.
- A full synchronization at the high synchronization priority rate takes approximately twice as long as a full synchronization at the highest synchronization rate.

For more information on setting the synchronization priority, refer to Chapter 3, “Using the Remote Mirror Option” on page 43.

- When the mirror logical drive pair is in the Synchronization-in-Progress status, all host computer write data is copied to the remote system in processing the I/O. Controller I/O bandwidth and I/O latency affect host computer write performance. Host read performance is not affected by the mirror relationship.
- The overall system performance is impacted when data is copied from the primary logical drive to the secondary logical drive and when the number of writes permitted at one time are limited.

---

## Using other premium features with the Remote Mirror Option

This section describes how you can use the Remote Mirror Option in conjunction with other premium features available in version 8.2 of the storage-management software.

### Storage Partitioning premium feature

Storage Partitioning is a premium feature which enables host computers to share access to logical drives in a storage subsystem. A storage partition is created when you define a collection of host computers (a host group) or a single host computer and then define a logical drive to logical unit number (LUN) map. This map enables you to define what host group or host computer has access to a particular logical drive in your storage subsystem.

Figure 9 on page 12 shows the Mappings View of the Subsystem Management window, where primary logical drive Accounting is included in a partition accessible by host group Campus East, and secondary logical drive Accounting 2 is included in a partition accessible by host group Campus West.

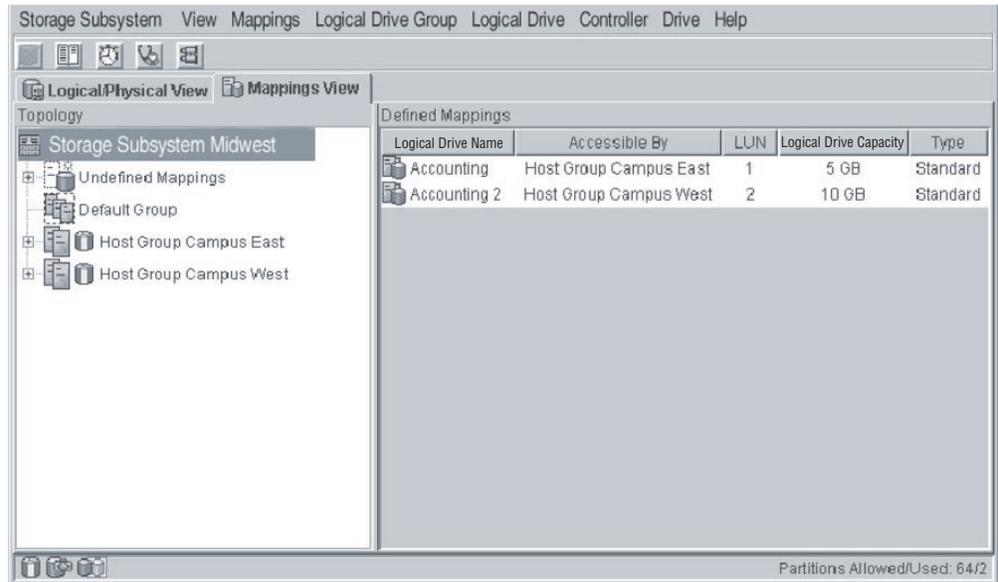


Figure 9. Mappings View of the Subsystem Management window showing storage partitioning

The storage partition definitions for the primary and secondary storage subsystems are independent of each other. If the storage partition definitions are put in place while the logical drive is in the secondary role, the storage partition reduces the administrative effort associated with storage subsystem recovery if it becomes necessary to promote the secondary logical drive to the primary role. However, depending on the host operating system and application, the secondary logical drive might not be assigned to the same host that the primary logical drive is mapped to. For more information on defining storage partitions, refer to the Subsystem Management window online help.

Storage partition definitions can be performed using the Create command in the Storage Manager Script window or the Command Line Interface (CLI). For more information, refer to the Enterprise Management window online help.

## FlashCopy logical drives

FlashCopy is a premium feature that comes with the IBM FAStT Storage Manager software. You can enable this premium feature by purchasing the IBM FAStT Storage Manager FlashCopy Option. A FlashCopy logical drive is a point-in-time (real-time) image of a logical drive and is created so that a program, such as a backup program, can access the FlashCopy logical drive and read the data while the base logical drive remains online and accessible to host computers.

The logical drive on which the point-in-time image is created is known as the base logical drive and must be a standard logical drive in the storage subsystem. For remote logical drive mirroring, only the base logical drive of a FlashCopy logical drive is permitted to be a candidate for the primary logical drive in a mirror relationship. Figure 10 on page 13 shows the primary logical drive (also the base logical drive for the FlashCopy logical drive), the secondary logical drive, and the FlashCopy repository logical drive in the Subsystem Management window for the primary storage subsystem.

**Important:** The base logical drive of a FlashCopy logical drive cannot be a candidate for the secondary logical drive role in a mirror relationship. Otherwise, the FlashCopy logical drive will fail when the remote mirror relationship is created.

Secondary logical drives are restricted from being the base logical drive for a FlashCopy logical drive because the full synchronization process would fill the FlashCopy repository logical drive, resulting in a failed FlashCopy logical drive.

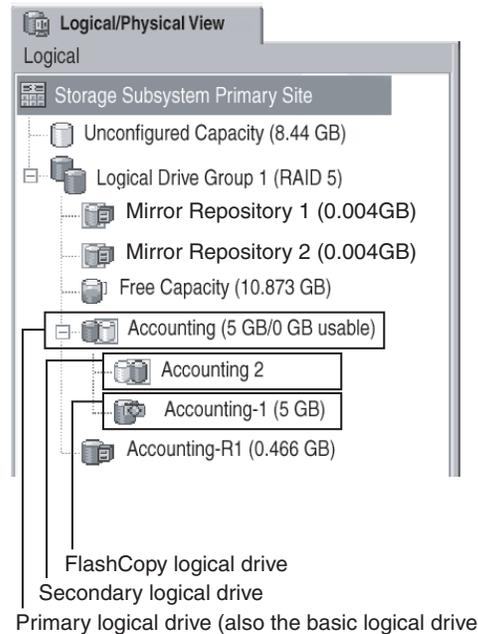


Figure 10. FlashCopy logical drive included in a mirror relationship

## FlashCopy logical drive failure

When the FlashCopy Option is enabled, you can have FlashCopy logical drives based on the primary logical drive of a mirrored logical drive pair.

If a role reversal is performed, and the primary logical drive is demoted to the secondary logical drive status, all FlashCopy logical drives that are associated with the demoted primary logical drive will show a Failed status.

**Important:** A secondary logical drive cannot be designated as the base logical drive of a FlashCopy logical drive.

As shown in Figure 11 on page 14, primary logical drive Accounting and secondary logical drive Accounting 2 are displayed in the Logical View of the Subsystem Management window for the primary storage subsystem. A FlashCopy logical drive of primary logical drive Accounting was created.

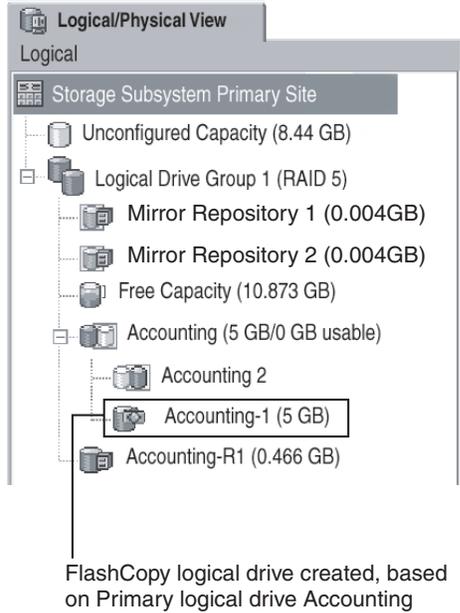


Figure 11. FlashCopy logical drive associated with primary logical drive Accounting

If a role reversal is performed, primary logical drive Accounting is demoted to secondary role status and the FlashCopy logical drive fails, as shown in Figure 12. This is because the secondary logical drive Accounting 2 is considered the base logical drive of the FlashCopy logical drive, which is not permitted.

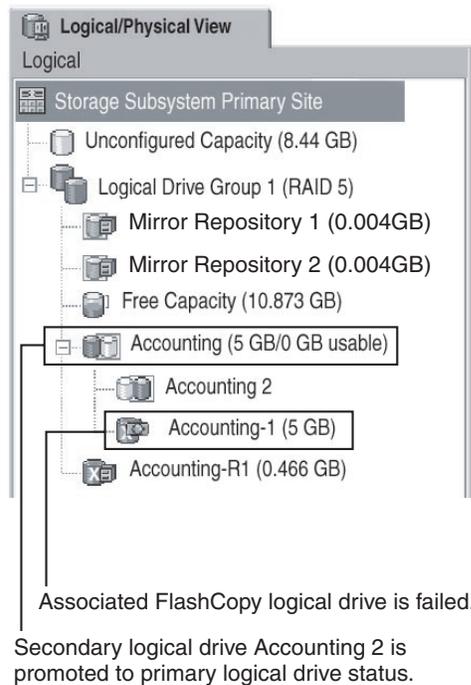


Figure 12. FlashCopy logical drive failure due to role reversal

If a FlashCopy logical drive fails as the result of a role reversal, you must perform another role reversal to promote the secondary logical drive back to primary logical drive status. After the role reversal is complete, the FlashCopy logical drive must be recreated. For more information, refer to Chapter 5, “Troubleshooting” on page 61.

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## Hardware and software requirements

This section describes the minimum software and hardware requirements needed to install the Remote Mirror Option. A list of host bus adapters compatible with each operating system is provided in the README file.

### Hardware requirements

The following list contains the minimum hardware requirements needed when configuring your system to use the Remote Mirror Option. The list includes components that are supplementary to the standard requirements of a basic storage-subsystem environment. For more information, refer to your *IBM FAStT Storage Manager Version 8.2 Installation and Support Guide*.

- Two Netfinity FAStT500 RAID Controller Enclosure Units or IBM FAStT700 TotalStorage Fibre Channel storage subsystems. It is possible to have different storage subsystems in each of the two nodes of the Remote mirror option. For example, the local storage subsystem may be the IBM FAStT500 storage subsystem and the remote storage subsystem may be the IBM FAStT700 storage subsystem and vice-versa. However, because the IBM FAStT500 and IBM FAStT700 storage subsystems are different sets of hardware with different performance characteristics, for optimal and reliable performance, the storage subsystem and its associated drives and drive enclosures in each of the nodes of the remote mirror setup must be the same.
- Fibre Channel switches - These devices are used to connect multiple host computers with multiple storage subsystems in a controlled environment. You can connect multiple Fibre Channel switches over a distance of up to 10 Km (6.25 mi) to create a fabric environment.  
Refer to the README file for a list of certified Fibre Channel switches for use with the Remote Mirror Option.
- Short or medium range Fibre Channel cables - To connect the host computers and storage subsystems to the Fibre Channel switches.
- Long range Fibre Channel cables - These cables support distances up to 10 Km (6.25 miles). These are used to connect between Fibre Channel Fibre Channel switches to complete long distance fabrics.
- Fibre Channel host bus adapters (HBAs) - Refer to the README file for a list of certified host bus adapters for use with the Remote Mirror Option.

### Software requirements

When configuring your host computer to use the Remote Mirror Option, be sure the following minimum software requirements are met:

- IBM FAStT Storage Manager Version 8.2x.xx
- Controller firmware version 5.20.xx
- IBM Remote Mirror Premium Feature Key (one for each storage subsystem)

### Host operating systems

Host computers accessing mirrored logical drives must have one of the following operating systems installed to use the Remote Mirror Option. Refer to the README file for the latest operating system support.

- Windows NT 4.0 Server Edition
- Windows 2000
- Solaris Version 2.6, 2.7 (Solaris 7), 2.8 (Solaris 8)
- HP-UX Version 11.0 or later
- Linux (Red Hat Version 7.x)
- Netware Version 5.1

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## Supported configurations

This section describes the three configurations that support the Remote Mirror Option installation when you have IBM FAStT Storage Manager Version 8.2 software installed. The level of redundancy is determined by the type of configuration you choose to use. Contact your IBM technical-support representative if you require modifications to the configurations described below.

### Highest Availability Campus configuration

The Highest Availability Campus configuration is fully redundant, includes two storage subsystems and four Fibre Channel switches connected with a Fibre Channel fabric, as shown in Figure 13 on page 17. The primary storage subsystem and secondary storage subsystem have a maximum connection distance of up to 10 Km (6.25 mi).

**Note:** For performance and high availability configuration, use two 10 Km (6.25 mi) interswitch links (ISL).

For detailed instructions on setting up the Highest Availability Campus configuration, refer to Chapter 2, “Hardware and software installation” on page 21.

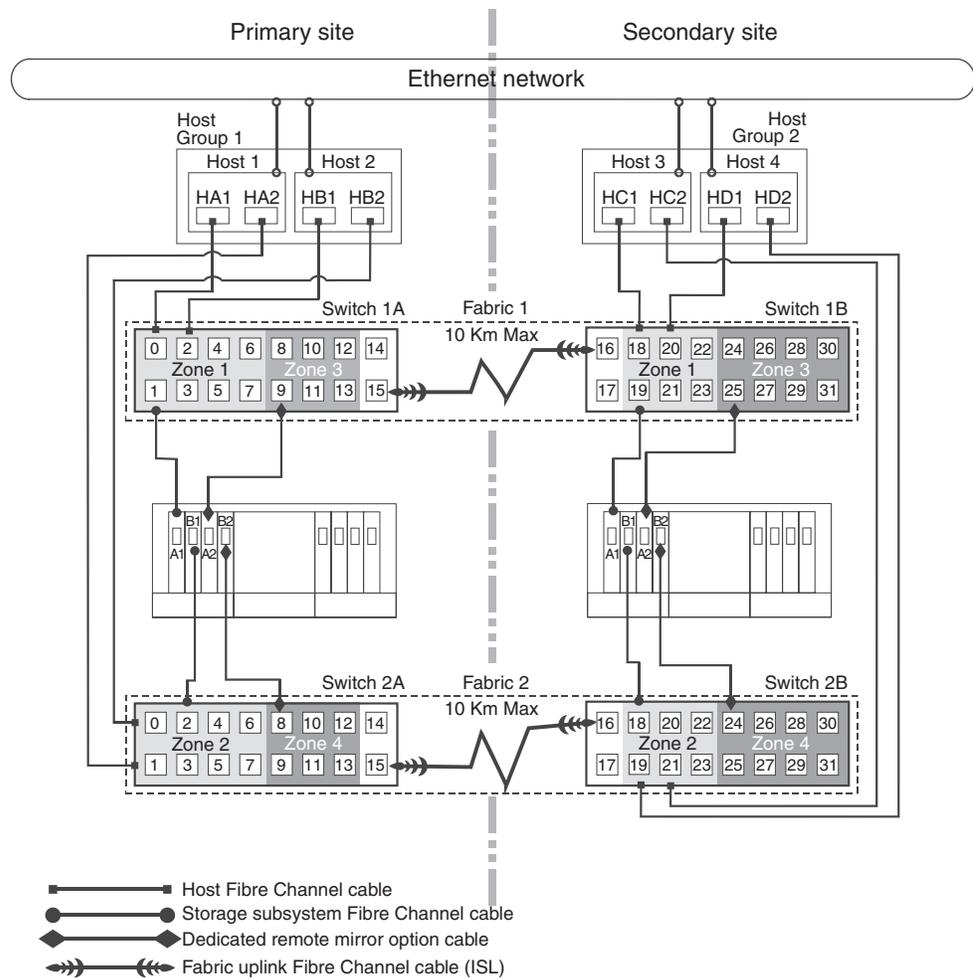


Figure 13. Dual-site, four-switch Highest Availability Campus configuration

## Campus configuration

The Campus configuration, a lower-cost configuration, consists of two storage subsystems and two Fibre Channel switches connected with a Fibre Channel fabric, as shown in Figure 14 on page 18. The primary storage subsystem and secondary storage subsystem have a maximum connection distance of up to 10 Km (6.25 mi).

For detailed instructions on setting up the Campus configuration, refer to Chapter 2, "Hardware and software installation" on page 21.

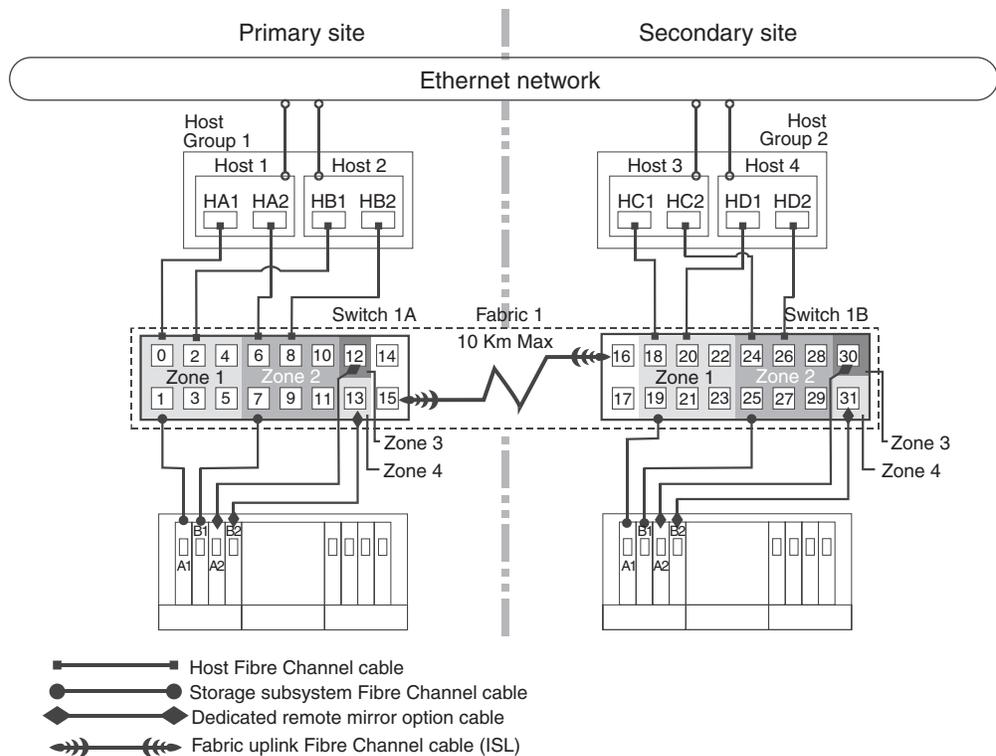


Figure 14. Dual-site, two-switch Campus configuration

## Intra-site configuration

The Intra-site configuration, a low-cost configuration, consists of two storage subsystems and two Fibre Channel switches connected with a Fibre Channel fabric as shown in Figure 15 on page 19.

The primary storage subsystem and secondary storage subsystem might have a maximum connection distance of up to 500 m (0.32 mi), and can be located in the same building or in the same room.

For detailed instructions on setting up the intra-site configuration, refer to Chapter 2, “Hardware and software installation” on page 21.

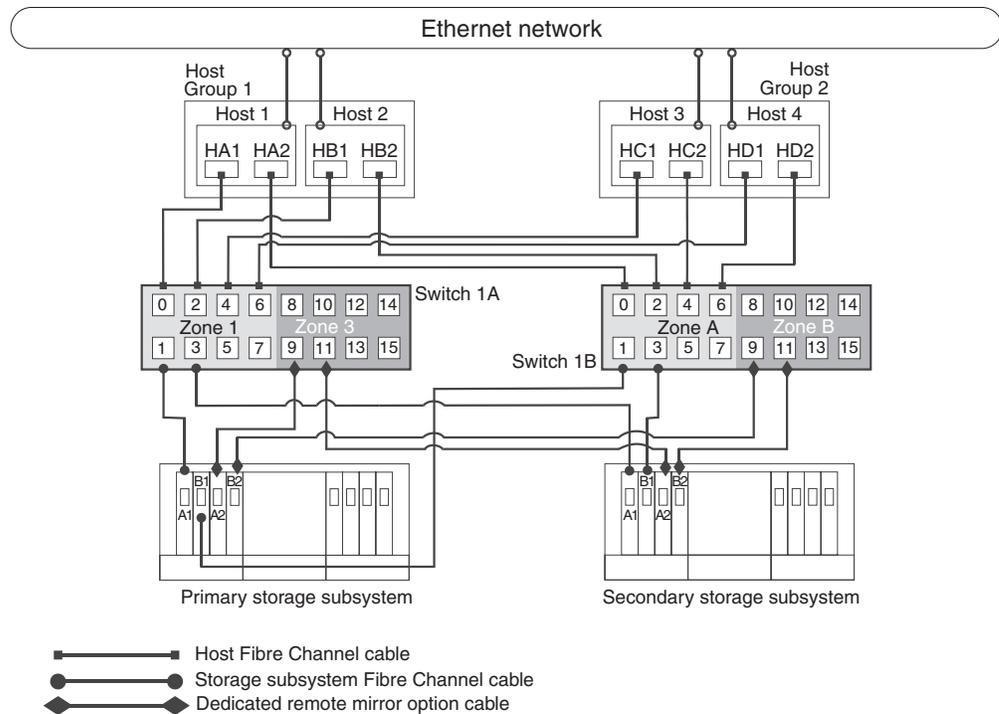


Figure 15. Intra-site configuration showing a two-switch connection

## Hardware and software checklist

Complete the hardware checklist in Table 2 and the software checklist in Table 3 on page 20 to ensure that all the required hardware and software components are configured properly.

### Hardware checklist

Complete the following tasks before starting the storage-management software.

Table 2. Hardware checklist

Task description	Validation activity
Ensure that the minimum hardware requirements are met. For a complete list of the hardware requirements, refer to “Hardware requirements” on page 15.	<input type="checkbox"/> Completed
Ensure your primary and secondary storage subsystems are properly configured. Refer to the appropriate storage subsystem <i>Installation and User’s Guide</i> for configuration information and refer to Chapter 2, “Hardware and software installation” on page 21.	<input type="checkbox"/> Completed
Ensure that your Fibre Channel switches and cables are properly configured. For more information on configuring Fibre Channel switches for use with the Remote Mirror Option, refer to Chapter 2, “Hardware and software installation” on page 21.	<input type="checkbox"/> Completed

### Software checklist

Complete the following software checklist tasks before defining mirror relationships in your storage subsystems.

Table 3. Software checklist

Task description	Validation activity
Ensure that data on the primary and secondary storage subsystems participating in remote logical drive mirroring are backed up.	<input type="checkbox"/> Completed
Ensure that the correct version of firmware and storage-management software are installed. For more information on upgrading firmware or installing the storage-management software, refer to the appropriate IBM FAStT Storage Manager Installation and Support Guide, Chapter 2, "Hardware and software installation" on page 21, or the Subsystem Management window online help.	<input type="checkbox"/> Completed
Ensure that the Remote Mirror Option is enabled on both the primary and secondary storage subsystems. For information on enabling features, refer to "Enabling and activating the Remote Mirror Option" on page 43.	<input type="checkbox"/> Completed
Ensure that the Remote Mirror Option is activated and that a mirror repository logical drive is created for each controller on the primary storage subsystem. For more information on activating the Remote Mirror Option, refer to "Enabling and activating the Remote Mirror Option" on page 43.	<input type="checkbox"/> Completed
Ensure that the required primary and secondary logical drives are created on the primary and secondary storage subsystems. For more information on establishing a mirror relationship, refer to Chapter 3, "Using the Remote Mirror Option" on page 43.	<input type="checkbox"/> Completed

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## Chapter 2. Hardware and software installation

This chapter contains the information that you need to install the hardware and software to run the Remote Mirror Option. The beginning of the chapter explores the steps that you must complete before a hardware or software installation. Next, hardware installation procedures are presented, followed by software installation procedures. Complete the procedures in this chapter sequentially, from beginning to end.

---

### Pre-installation

This section provides necessary information, such as site preparation, hardware and software requirements, and concepts that you must review and complete before beginning the hardware or software installation procedures.

#### Site preparation

The Remote Mirror Option uses Fibre Channel Fibre Channel switches to create a fabric environment for data replication. These Fibre Channel switches require only minimal additional site preparation requirements beyond basic storage subsystem operation.

For basic site preparation considerations including the use of Fibre Channel cables and connections, refer to your *IBM Netfinity FAStT500 Raid Controller Enclosure Unit Installation Guide* or your *IBM TotalStorage FAStT700 Fibre Channel Storage Server Installation Guide*.

For additional site preparation considerations concerning the Fibre Channel Fibre Channel switches, including power requirements and physical dimensions and requirements, refer to the documentation that comes with the fabric switch.

#### Hardware and software requirements

Ensure that all of the required hardware and software are available before proceeding. The list of these requirements is available in "Hardware and software requirements" on page 15.

#### Switch zoning overview

All Fibre Channel switches do not need to be zoned exactly as presented in this publication. The only zoning requirement is to zone the Remote Mirror host port connections together. For example, you can create one zone consisting all primary and secondary host port A2 and B2. You can create two zones - one zone consists of primary and secondary host ports A2 and the other zone consists of primary and secondary host ports B2. This is required to make sure that the host port of the controller be fully dedicated for remote mirroring operations.

There is no zone requirements for the server HBA connections. However, depending on the operating system, server HBA connections may be zoned so that a single host bus adapter in a server can only access one controller per storage subsystem.

**Important:** Do not zone the ISL port that connects (cascades) switches within a fabric environment.

Switch zoning configurations are set using the management software that comes with the Fibre Channel switch.

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

In the top illustration in Figure 16, the Fibre Channel switches are on the same network and cascaded; therefore, Zone 1 is the same zone on Switch 1A as Zone 1 on Switch 1B. In the bottom illustration in Figure 16, the Fibre Channel switches 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.

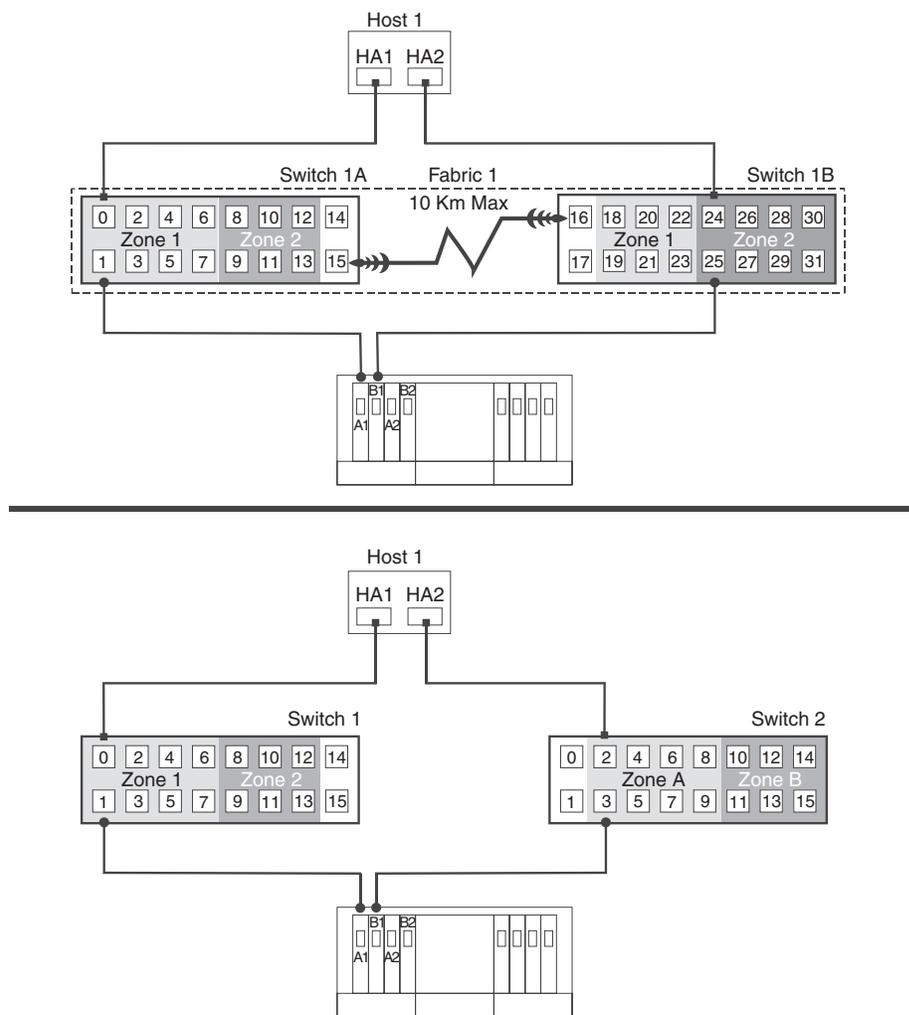


Figure 16. Switch zoning in cascaded (top) and noncascaded (bottom) Fibre Channel switches

For more information about Fibre Channel switch zoning or setting up a zone configuration, refer to the documentation that comes with the switch.

The switch zone settings for the three remote-mirror option configurations 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 subsystems for use with the Remote Mirror Option. The three configurations described in this section are as follows:

- **Highest Availability Campus configuration** - This is the preferred configuration for the Remote Mirror Option. Four total Fibre Channel switches (two at each site) provide complete redundancy in the Fibre Channel switches and fabrics (with a ISL distance up to 10 Km (6.25 mi)) in addition to all storage subsystem components and host computers. Therefore, the Highest Availability Campus configuration is the preferred configuration because data synchronization can continue for any single switch failure. Besides being a fully redundant configuration, the Highest Availability Campus configuration is still preferred due to disaster recovery implications. The single site creates a single point of failure if a disaster affects the entire site. To begin installing hardware for this configuration, go to “Highest Availability Campus configuration”.
- **Campus configuration** - This configuration is not fully redundant because the number of Fibre Channel switches is reduced from four to two, and the number of fabrics is reduced from two to one. Therefore, this makes the Fibre Channel switches and fabrics the single point of failure. A switch failure does not usually result in a loss of data, but does affect data synchronization until the error is corrected. This configuration allows the minimum required components to successfully operate the Remote Mirror Option between two sites up to 10 Km (6.21 mi). To begin installing hardware for this configuration, go to “Campus configuration” on page 29.
- **Intra-site configuration** - This configuration is similar to the Campus configuration in that there are only two Fibre Channel switches. However, no multiple-switch fabrics exist in this configuration. Since all host computers and storage subsystems are in proximity of both Fibre Channel switches, full redundancy is obtained within the site since each controller path is connected to a different switch. However, a single switch failure in this configuration can result in a degraded mirror. To begin installing hardware for this configuration, go to “Intra-site configuration” on page 34.

For a list of requirements to complete any hardware installation, refer to “Hardware and software requirements” on page 15.

---

## Highest Availability Campus configuration

**Note:** The Highest Availability Campus configuration is the preferred configuration for the Remote Mirror Option.

This configuration has two Fibre Channel switches at both the primary and secondary sites to provide complete failover and redundancy in Fibre Channel switches and cables, in addition to any host or storage subsystem failure. 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 17 shows the Highest Availability Campus configuration after installation is complete.

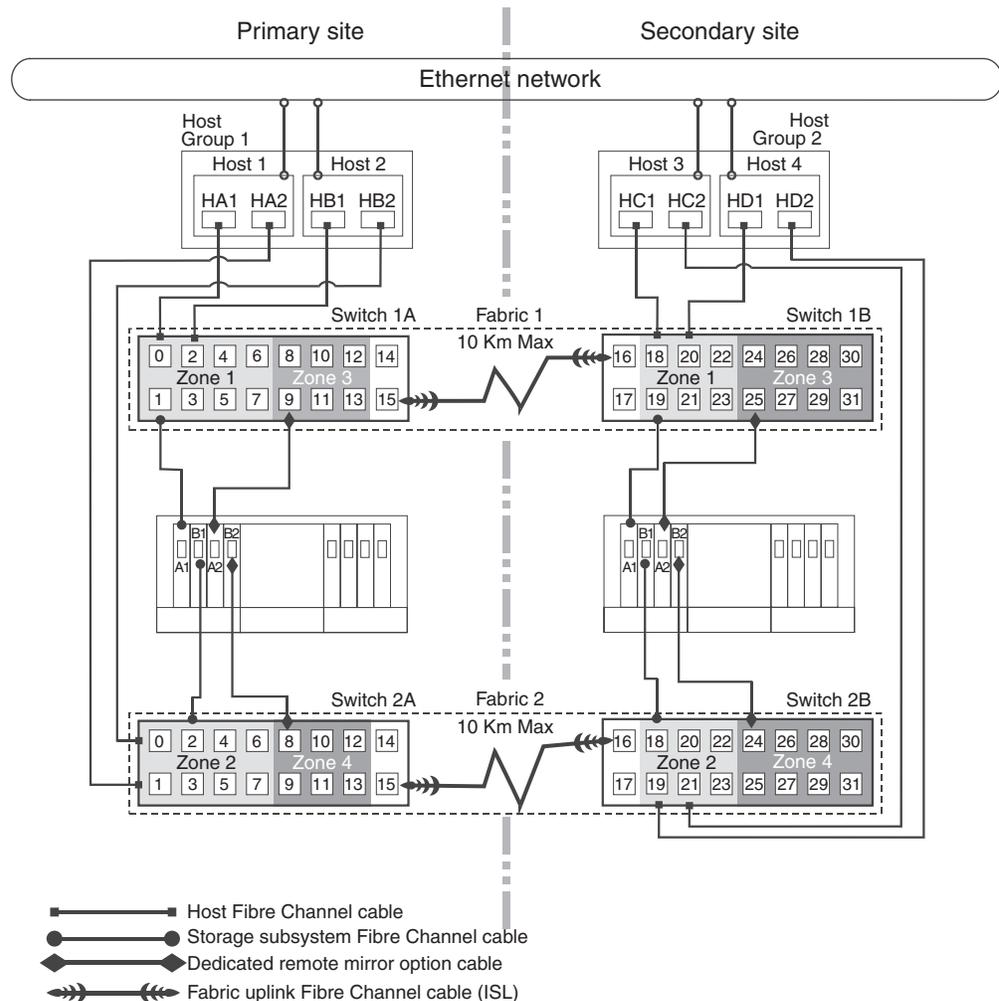


Figure 17. Highest Availability Campus configuration

## Switch zoning for the Highest Availability Campus configuration

This configuration provides a separate zone for each reserved port for the Remote Mirroring Option.

The Fibre Channel 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.

- The Remote Mirror host port connections must be zones together. For example, you can create one zone consisting all primary and secondary host port A2 and B2. You can create two zones - one zone consists of primary and secondary host ports A2 and the other zone consists of primary and secondary host ports B2. This is required to make sure that the host port of the controller be fully dedicated for remote mirroring operations.
- The uplink port must not be zoned on any Fibre Channel switch.

- There are no zone requirements for the server host bus adapter (HBA) connections. However, depending on the operating system, server HBA connections can be zoned so that a single host adapter can access only one controller per storage subsystem.

The Fibre Channel switches in Figure 18 contain 16 ports each, which leaves many unused ports per switch. You can redistribute the remaining ports among the other zones. However, it is preferred that most remaining ports be assigned to the zones containing the host connections (Zones 1 and 2 in Figure 18). This will allow easy setup for additional host computers to connect to the environment.

Figure 18 shows how the four Fibre Channel switches are zoned for this Highest Availability Campus configuration. The zones are configured on the switch to allow one port per zone for a storage subsystem connection, and one port per zone for each host. There are four zones in the following configuration example.

- Zones 1 and 3 exist on Fabric 1 (switch 1A at the primary site, and switch 1B at the secondary site)
- Zones 2 and 4 exist on Fabric 2 (switch 2A at the primary site, and switch 2B at the secondary site).

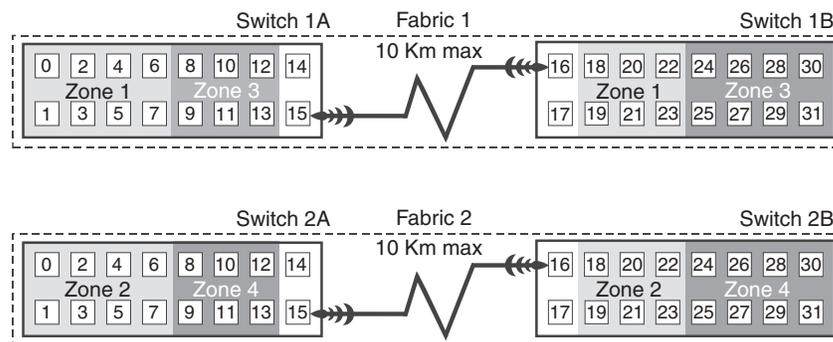


Figure 18. Switch zoning for the Highest Availability Campus configuration

Before proceeding to the next section, ensure that all four Fibre Channel switches are properly zoned according to the requirements and the zoning shown in Figure 18. For more information on zoning Fibre Channel switches, see “Switch zoning overview” on page 21.

## Cabling examples for the Highest Availability Campus configuration

Use Table 4 and Table 5 shows examples of the Fibre Channel cabling connections in the Highest Availability Campus configuration. Use the examples as a reference before you use the procedure in “Setting up the Highest Availability Campus configuration” on page 27.

Table 4. Highest Availability Campus configuration connections (Primary site) examples

Primary site					
Switch 1A			Switch 2A		
Zone	Port	Connection to and from:	Zone	Port	Connection to and from:
1	0	Host 1, HBA 1 (HA1)	2	0	Host 2, HBA 2 (HB2)
	1	Controller port A1		1	Host 1, HBA 2 (HA2)
	2	Host 2, HBA 1 (HB1)		2	Controller port B1
	3	Additional host, HBA 1 (optional)		3	Additional host, HBA 2 (optional)
	4	Additional host, HBA 1 (optional)		4	Additional host, HBA 2 (optional)
	5	Additional host, HBA 1 (optional)		5	Additional host, HBA 2 (optional)
	6	Additional host, HBA 1 (optional)		6	Additional host, HBA 2 (optional)
3	7	Additional host, HBA 1 (optional)	4	7	Additional host, HBA 2 (optional)
	8	Unused		8	Controller port B2 (dedicated remote-mirror port)
	9	Controller port A2 (dedicated remote-mirror port)		9	Unused
	10	Unused		10	Unused
	11	Unused		11	Unused
	12	Unused		12	Unused
N/A	13	Unused	N/A	13	Unused
N/A	14	Spare (can be added to either zone)	N/A	14	Spare (can be added to either zone)
N/A	15	Uplink with switch 1B	N/A	15	Uplink with switch 2B

Table 5. Highest Availability Campus configuration connections (Secondary site) examples

Secondary					
Switch 1B			Switch 2B		
Zone	Port	Connection from and to:	Zone	Port	Connection from and to:
N/A	16	Uplink with Switch 2A	N/A	16	Uplink with Switch 1A
N/A	17	Spare (can be added to either zone)	N/A	17	Spare (can be added to either zone)
1	18	Host 3, HBA 1 (HC1)	2	18	Controller port B1
	19	Controller port A1		19	Host 4, HBA 2 (HD2)
	20	Host 4, HBA 1 (HD1)		20	Additional host, HBA 1 (optional)
	21	Additional host, HBA 1 (optional)		21	Host 4, HBA 2 (HD2)
	22	Additional host, HBA 1 (optional)		22	Additional host, HBA 1 (optional)
	23	Additional host, HBA 1 (optional)		23	Additional host, HBA 1 (optional)

Table 5. Highest Availability Campus configuration connections (Secondary site) examples (continued)

Secondary					
3	24	Unused	4	24	Controller port B2 (dedicated remote-mirror port)
	25	Controller port A2 (dedicated remote-mirror port)		25	Unused
	26	Unused		26	Unused
	27	Unused		27	Unused
	28	Unused		28	Unused
	29	Unused		29	Unused
	30	Unused		30	Unused
	31	Unused		31	Unused

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

## Setting up the Highest Availability Campus configuration

Complete the following procedure to set up the Highest Availability Campus configuration for the Remote Mirror Option.

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

1. Do one of the following:
  - If you are adding the Remote Mirror Option hardware to an existing storage subsystem environment that stops I/O from all host computers, go to step 2.
  - If this is a new storage subsystem installation, go to step 3.
2. Power down all storage subsystems, host computers, Fibre Channel switches, and all other hardware in the storage-subsystem environment.
3. Ensure that cabling between all storage subsystems and drive enclosures is complete.

**Note:** Depending on which site you are configuring, Switch 1 represents Switch 1A for the primary site and Switch 1B for the secondary site. Repeat the same configuration for Switch 2.

4. Connect the primary host bus adapter (Hx1) for each local host to an available port in Zone 1 of Switch 1 (Figure 19 on page 28).

**Note:** You can connect the cables to any port in the proper zone of the switch.

5. Connect the secondary host bus adapter (Hx2) for each host at this site to an available port in Zone 2 of Switch 2 (Figure 19).

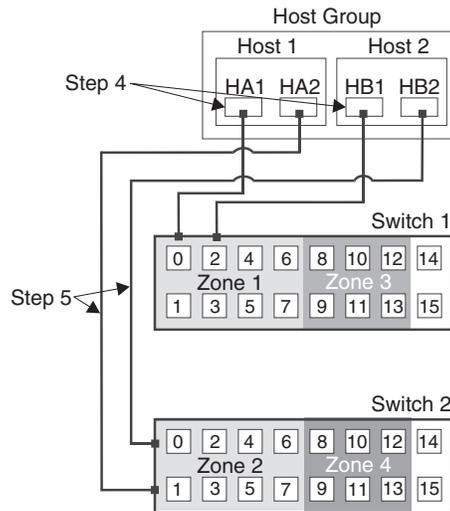


Figure 19. Host bus adapter connections to Fibre Channel switches

6. Connect controller port A1 of the storage subsystem to an available port in Zone 1 of Switch 1 (Figure 20 on page 29).
7. Connect controller port B1 of the storage subsystem to an available port in Zone 2 of Switch 2 (Figure 20 on page 29).
8. Connect controller port A2 of the storage subsystem to an available port in Zone 3 of Switch 1 (Figure 20 on page 29).
9. Connect controller port B2 of the storage subsystem to an available port in Zone 4 of Switch 2 (Figure 20 on page 29).

**Note:** Controller ports A2 and B2 are reserved for mirror relationship synchronization upon activation of the Remote Mirror Option. For more information, see “Connectivity and I/O” on page 8.

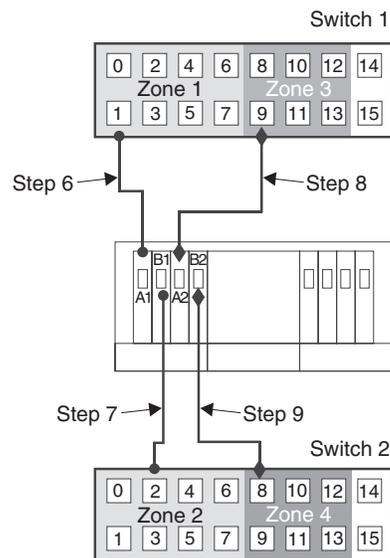


Figure 20. Storage subsystem connections to the Fibre Channel switches

10. If the primary site cabling and the secondary site cabling is complete, go to step 11. Otherwise, repeat steps 1 through 9 for the secondary site.
11. Complete the Fabric 1 environment for Switch 1 by connecting Switch 1A with Switch 1B. Connect each end of a long range Fibre Channel cable (that can support a distance up to 10 Km (6.25 mi)) to an unzoned port in each switch shown in Figure 21.
12. Repeat step 11 for Switch 2A and 2B to complete the Fabric 2 environment for Switch 2 shown in Figure 21.

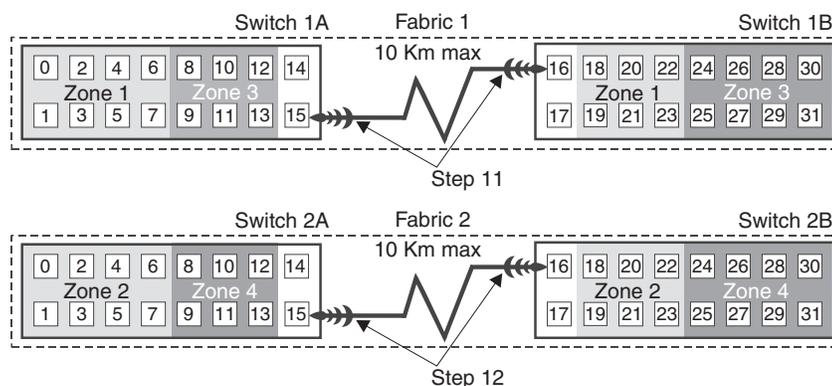


Figure 21. Connecting switches over a remote network to complete Fabric 1 and Fabric 2 environments

13. Cabling for this Highest Availability Campus configuration is complete. Repeat step 4 on page 27 through step 10 for any additional storage subsystems that exist in the same rack that uses the Remote Mirror Option.
14. Power up all storage subsystems, host computers, Fibre Channel switches, and any other hardware at both sites that were powered down in step 2.
15. Hardware installation is complete. The next step is to configure the storage management software to support mirror relationships. Go to “Software installation” on page 39.

## 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 logical drive mirroring ports, but is a single point of failure for Fibre Channel switches. If a switch at either site fails, the Remote Mirror Option cannot function. For this reason, the Highest Availability Campus configuration is highly preferred for total environment redundancy. Figure 22 on page 30 shows the Campus configuration after installation is complete.

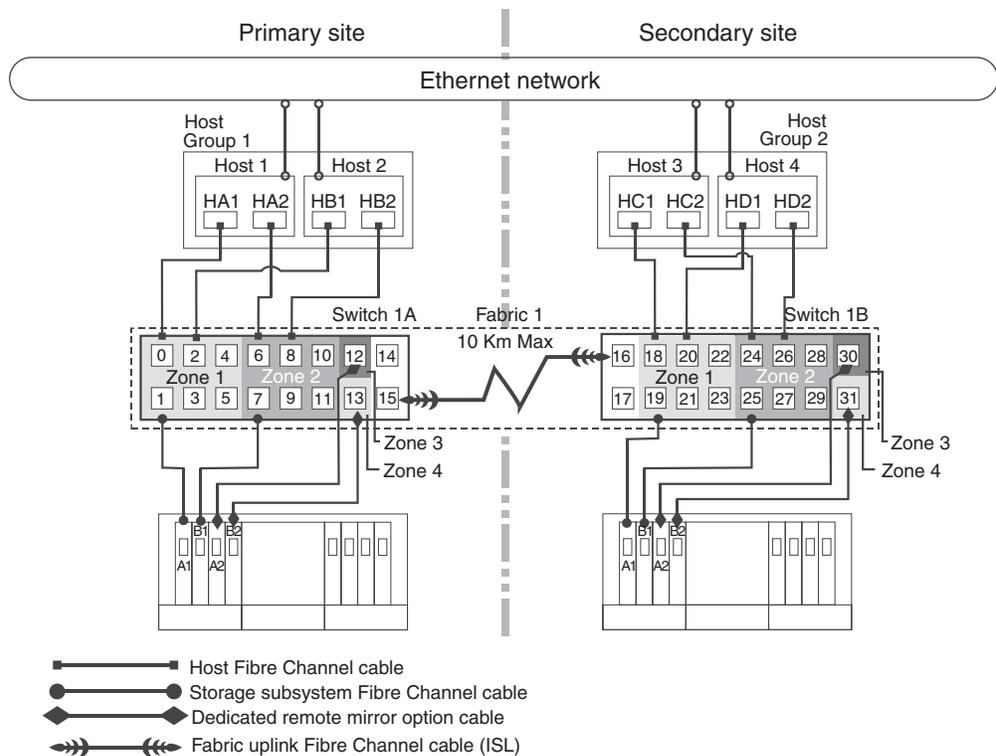


Figure 22. Campus configuration

## Switch Zoning for the Campus configuration

This configuration provides a separate zone for each reserved port for the Remote Mirroring Option.

The Fibre Channel 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.

- The Remote Mirror host port connections must be zones together. For example, you can create one zone consisting all primary and secondary host port A2 and B2. You can create two zones - one zone consists of primary and secondary host ports A2 and the other zone consists of primary and secondary host ports B2. This is required to make sure that the host port of the controller be fully dedicated for remote mirroring operations.
- The uplink port must not be zoned on any Fibre Channel switch.
- There are no zone requirements for the server host bus adapter (HBA) connections. However, depending on the operating system, server HBA connections can be zoned so that a single host adapter can access only one controller per storage subsystem.

The Fibre Channel switches in Figure 23 on page 31 contain 16 ports each, which leaves many unused ports per switch. You can distribute the remaining ports among the other zones. However, it is preferred that most remaining ports be assigned to the zones containing the host connections (Zone 1 in Figure 23 on page 31). This allows easy setup for additional host computers to connect to the fabric environment.

There are a total of four zones in this configuration.

- - All zones will exist on the Fabric 1 environment (Switch 1A at the primary site, and Switch 1B at the secondary site).
  - Zones 3 and 4 are reserved for the dedicated Remote Mirror Option connections.

Figure 23 shows how the two Fibre Channel switches are zoned for the Campus configuration.

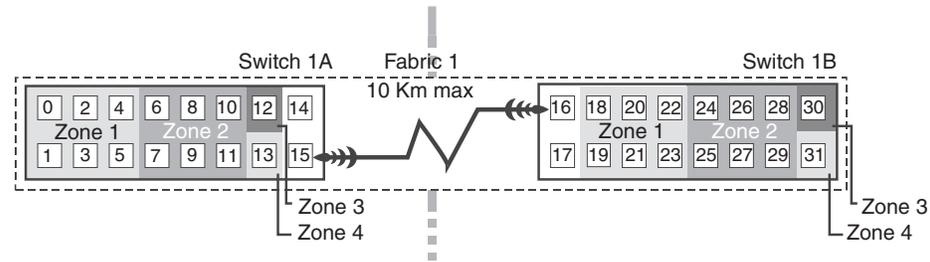


Figure 23. Switch zoning for the Campus configuration

Before proceeding to the next section, ensure that both Fibre Channel switches are properly zoned according to the requirements and the zoning example shown in Figure 23. For more information on zoning Fibre Channel switches, see “Switch zoning overview” on page 21.

## Cabling examples for the campus configuration

Use Table 6 and Table 7 on page 32 as a cabling reference before you use the procedure in “Setting up the Campus configuration” on page 32.

Table 6. Campus configuration connections (Primary site) examples

Primary site		
Switch 1A		
Zone	Port	Connection to and from:
1	0	Host 1, HBA 1
	1	Controller port A1
	2	Host 2, HBA 1
	3	Additional host, HBA 1 (optional)
	4	Additional host, HBA 1 (optional)
	5	Additional host, HBA 1 (optional)
2	6	Host 1, HBA 2
	7	Controller port B1
	8	Host 2, HBA 2
	9	Additional host, HBA 2 (optional)
	10	Additional host, HBA 2 (optional)
	11	Additional host, HBA 2 (optional)
3	12	Controller port A2 (dedicated remote-mirror port)

Table 6. Campus configuration connections (Primary site) examples (continued)

Primary site		
4	13	Controller port B2 (dedicated remote-mirror port)
N/A	14	Spare
N/A	15	Uplink with Switch 2

Table 7. Campus configuration connections (Secondary site) examples

Secondary site		
Switch 1B		
Zone	Port	Connection to and from:
1	16	Uplink with Switch 1
	17	Spare
	18	Host port, HBA 1
	19	Controller port A1
	20	Host 4, HBA 1
	21	Additional host, HBA 1 (optional)
	22	Additional host, HBA 1 (optional)
	23	Additional host, HBA 1 (optional)
2	24	Host 3, HBA 2
	25	Controller port B1
	26	Host 4, HBA 2
	27	Additional host, HBA 2 (optional)
	28	Additional host, HBA 2 (optional)
	29	Additional host, HBA 2 (optional)
3	30	Controller port A2 (dedicated remote-mirror port)
4	31	Controller port B2 (dedicated remote-mirror port)

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

## Setting up the Campus configuration

Complete the following procedure to set up the Campus configuration for the Remote Mirror Option.

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

- Do one of the following:
  - If you are adding Remote Mirror Option hardware to an existing storage subsystem environment that stops I/O from all host computers, go to step 2.
  - If this is a new storage subsystem installation, go to step 3.
- Power down all storage subsystems, host computers, Fibre Channel switches, and all other hardware in the storage subsystem environment.
- Ensure that basic cabling between all storage subsystems and drive enclosures is complete.

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

4. Connect the primary host bus adapter (Hx1) for each host at this site to an available port in Zone 1 of Switch 1, as shown in Figure 24.

**Note:** You can connect the cables to any port in the proper zone of the switch.

5. Connect the secondary host bus adapter (Hx2) for each host at this site to an available port in Zone 2 of Switch 1 as shown in Figure 24.

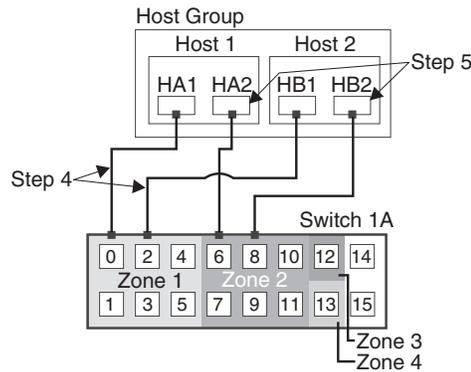


Figure 24. Host bus adapter connections to Fibre Channel switches

6. Connect controller port A1 of the storage subsystem to an available port in Zone 1 of Switch 1 as shown in Figure 25.
7. Connect controller port B1 of the storage subsystem to an available port in Zone 2 of Switch 1 as shown in Figure 25.
8. Connect controller port A2 of the storage subsystem to an available port in Zone 3 of Switch 1 as shown in Figure 25.
9. Connect controller port B2 of the storage subsystem to an available port in Zone 4 of Switch 1 as shown in Figure 25.

**Note:** Controller ports A2 and B2 are reserved for mirror relationship synchronization upon activation of the Remote Mirror Option. For more information, see “Connectivity and I/O” on page 8.

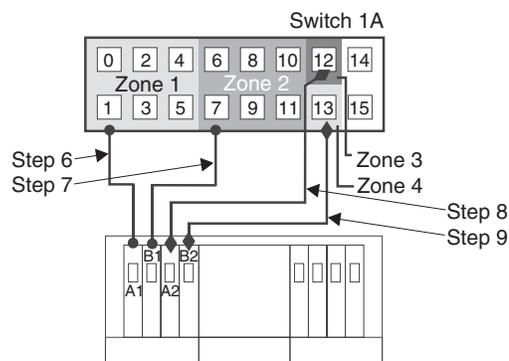


Figure 25. Storage subsystem connections to Fibre Channel switches

10. The primary site cabling is now complete. If the secondary site cabling is complete, go to step 11. Otherwise, repeat steps 1 through 9 for the secondary site.
11. Complete the Fabric 1 environment by connecting Switch 1A with Switch 1B. Connect each end of a long range Fibre Channel cable (that can support a distance of up to 10 Km (6.25 mi)) to an unzoned port in each switch, as shown in Figure 26.

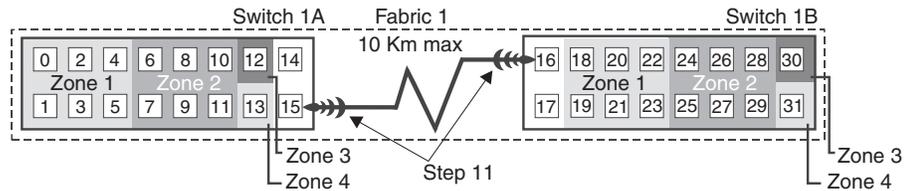


Figure 26. Connecting Fibre Channel switches over a remote network to complete the Fabric 1 environment

12. Cabling for this Campus configuration is complete. Repeat step 4 on page 33 through step 10 for any additional storage subsystems that exist in the same rack that will use the Remote Mirror Option.
13. Power up all storage subsystems, host computers, Fibre Channel switches, and any other hardware at both sites that were powered down in step 2 on page 32.
14. Hardware installation is complete. The next step is to configure the storage management software to support mirror relationships. Go to “Software installation” on page 39.

## Intra-site configuration

This configuration is used in environments where a long distance fabric is not required due to the close proximity of the host computers and storage subsystems. The configuration is still redundant for host bus adapters, controllers, remote logical drive mirroring ports, and Fibre Channel switches, but is a single point of failure for the site since all hardware can be destroyed by a single disaster. For this reason, the Highest Availability Campus configuration is highly preferred for total environment redundancy.

**Important:** A switch failure in this configuration does not affect data access; however, an unsynchronized mirror state might occur as a result.

Figure 27 on page 35 shows the Intra-site configuration after installation is complete.

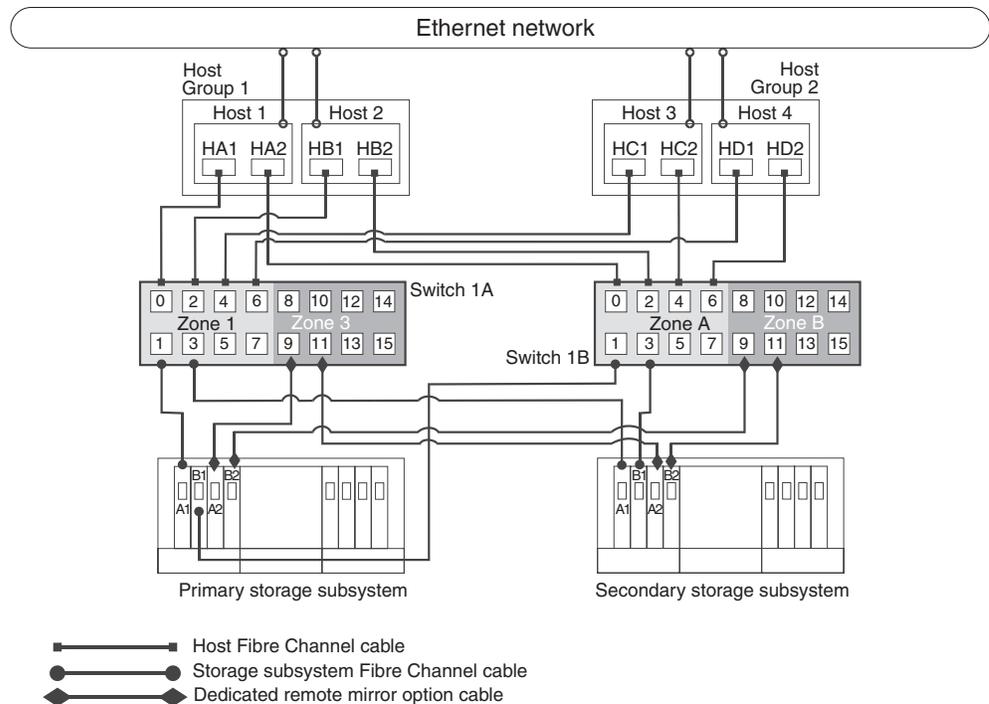


Figure 27. Intra-site configuration

## Switch zoning for Intra-site configuration

Intra-site configuration is designed for switch redundancy. However, the Fibre Channel switches are not cascaded, and therefore are independent of each other. This configuration provides a separate zone for each reserved port for the Remote Mirroring Option.

The Fibre Channel 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.

- The Remote Mirror host port connections must be zones together. For example, you can create one zone consisting all primary and secondary host port A2 and B2. You can create two zones - one zone consists of primary and secondary host ports A2 and the other zone consists of primary and secondary host ports B2. This is required to make sure that the host port of the controller be fully dedicated for remote mirroring operations.
- The uplink port must not be zoned on any Fibre Channel switch.
- There are no zone requirements for the server host bus adapter (HBA) connections. However, depending on the operating system, server HBA connections can be zoned so that a single host adapter can access only one controller per storage subsystem.

**Note:** Figure 28 on page 36 illustrates that there is no relationship between Zone A and Zone B in Switch 2 and Zones 1 and 2 in Switch 1.

The Fibre Channel switches shown in Figure 28 on page 36 contain 16 ports each, which leaves many unused ports per switch. You can distribute the remaining ports among the other zones. However, it is preferred that most remaining ports be

assigned to the zones containing the host connections (Zone 1 and Zone A shown in Figure 28). This provides an easy set up for additional host computers to connect to the environment.

There are 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.

In Figure 28, the Fibre Channel switches use half of the ports for each zone for simplicity, although Zone 2 and Zone B require fewer ports.



Figure 28. Switch zoning for the Intra-site configuration

Before proceeding to the next section, ensure that both Fibre Channel switches are properly zoned according to the requirements and the zoning example shown in Figure 28. For more information on zoning Fibre Channel switches, see “Switch zoning overview” on page 21.

## Cabling examples for the intra-site configuration

Use Table 8 and as a cabling reference before you use the procedure in “Setting up the Intra-site configuration” on page 37.

Table 8. Intra-site configuration connection examples

Switch 1			Switch 2		
Zone	Port	Connection to and from:	Zone	Port	Connection to and from:
1	0	Host 1, HBA 1 (HA1)	A	0	Host 1, HBA 2 (HA2)
	1	Controller port A1 (primary storage subsystem)		1	Controller port B1 (primary storage subsystem)
	2	Host 2, HBA 1 (HB1)		2	Host 2, HBA 2 (HB2)
	3	Controller port A1 (secondary storage subsystem)		3	Controller port B1 (secondary storage subsystem)
	4	Host 3, HBA 1 (HC1)		4	Host 3, HBA 2 (HC2)
	5	Additional host, HBA 1 (optional)		5	Additional host, HBA 2 (optional)
	6	Host 4, HBA 1 (HD1)		6	Host 4, HBA 2 (HD2)
	7	Additional host, HBA 1 (optional)		7	Additional host, HBA 2 (optional)

Table 8. Intra-site configuration connection examples (continued)

Switch 1			Switch 2		
2	8	Unused	B	8	Unused
	9	Controller port A2 (primary storage subsystem - dedicated remote-mirror port)		9	Controller port B2 (primary storage subsystem - dedicated remote-mirror port)
	10	Unused		10	Unused
	11	Controller port A2 (secondary storage subsystem - dedicated remote-mirror port)		11	Controller port B2 (secondary storage subsystem - dedicated remote-mirror port)
	12	Unused		12	Unused
	13	Unused		13	Unused
	14	Unused		14	Unused
	15	Unused		15	Unused

## Setting up the Intra-site configuration

Complete the following procedure to set up the Intra-site configuration for the Remote Mirror Option.

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

- Do one of the following:
  - If you are adding Remote Mirror Option hardware to an existing storage subsystem environment that stops I/O from all host computers, go to step 2.
  - If this is a new storage subsystem installation, go to step 3.
- Power down all storage subsystems, host computers, Fibre Channel switches, and all other hardware in the storage subsystem environment.
- Ensure that basic cabling between all storage subsystems and drive enclosures is complete on both storage subsystems.
- Connect the primary host bus adapter for each host (Hx1) to an available port in Zone 1 of Switch 1, as shown in Figure 29.

**Note:** You can connect the cables to any port in the proper zone of the switch.

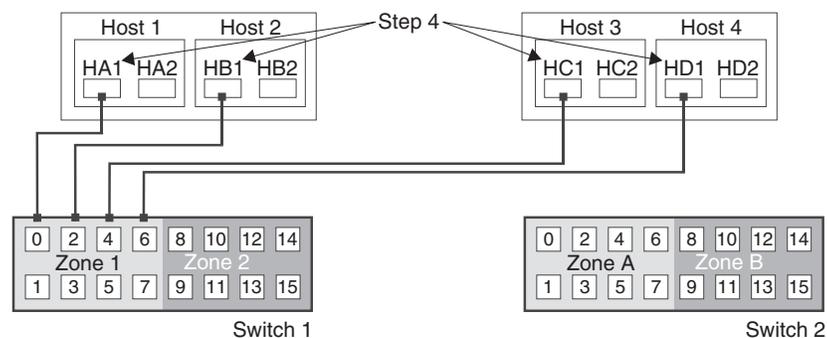


Figure 29. Primary host bus adapter (Hx1) connection to the Fibre Channel switches

5. Connect the secondary host bus adapter (Hx2) for each host to an available port in Zone A of Switch 2, as shown in Figure 30.

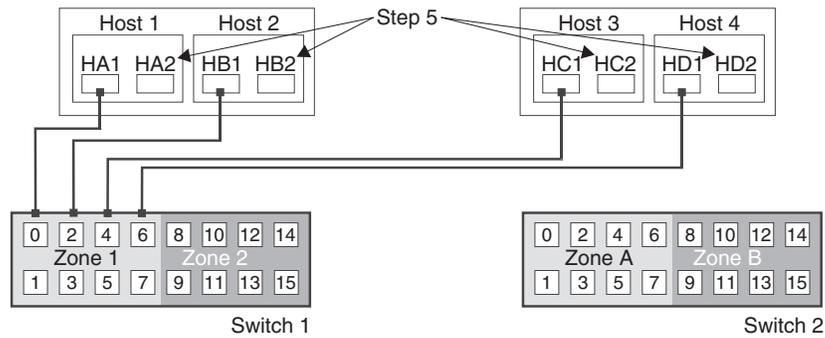


Figure 30. Secondary host bus adapter (Hx2) connection to the Fibre Channel switches

6. Connect controller port A1 of the of the primary storage subsystem to an available port in Zone 1 of Switch 1, as shown in Figure 31.
7. Connect controller port B1 of the of the primary storage subsystem to an available port in Zone A of Switch 2, as shown in Figure 31.
8. Connect controller port A2 of the of the primary storage subsystem to an available port in Zone 2 of Switch 1, as shown in Figure 31.
9. Connect controller port B2 of the of the primary storage subsystem to an available port in Zone B of Switch 2, as shown in Figure 31.

**Note:** Controller Ports A2 and B2 are reserved for mirror relationship synchronization upon activation of the Remote Mirror Option. For more information, see “Connectivity and I/O” on page 8.

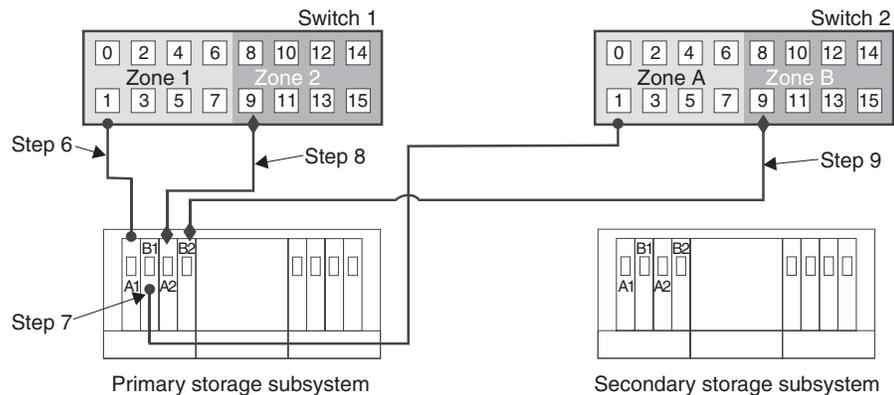


Figure 31. Primary storage subsystem connections to Fibre Channel switches

10. Connect controller port A1 of the of the secondary storage subsystem to an available port in Zone 1 of Switch 1, as shown in Figure 32 on page 39.
11. Connect controller port B1 of the of the secondary storage subsystem to an available port in Zone A of Switch 2, as shown in Figure 32 on page 39.
12. Connect controller port A2 of the of the secondary storage subsystem to an available port in Zone 2 of Switch 1, as shown in Figure 32 on page 39.

- Connect controller port B2 of the secondary storage subsystem to an available port in Zone B of Switch 2, as shown in Figure 32.

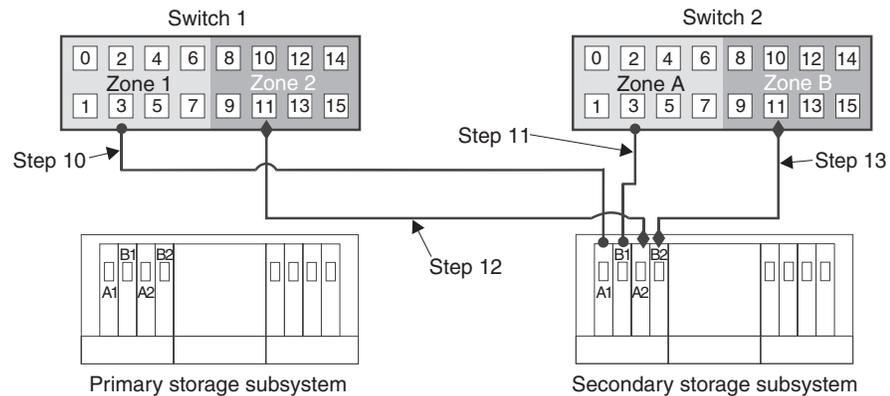


Figure 32. Secondary storage subsystem connections to Fibre Channel switches

- Cabling for this Intra-site configuration is complete. Repeat step 4 on page 37 through step 13 for any additional storage subsystems that exist in the same rack cabinet that uses the Remote Mirror Option.
- Power up all storage subsystems, host computers, Fibre Channel switches and any other hardware that was powered down in step 2 on page 37.
- Hardware installation is complete. The next step is to configure the storage management software to support mirror relationships. Go to “Software installation”.

## Software installation

The Remote Mirror Option is a premium feature that is included as part of the IBM FAST Storage Manager 8.2 installation. However, the option is not enabled or activated by default after installation. You must purchase an IBM Storage Manager Remote Mirror Option for each storage subsystem in your remote mirror configuration. This option contains a GenKey file that will enable the Remote Mirror Option premium feature. If you want to purchase the Remote Mirror Premium Feature Option, contact your IBM technical-support representative.

**Important:** All storage subsystems participating in mirror relationships must have firmware level 05.2x.xx.xx or higher installed. For more information about upgrading firmware and installing the storage-management software, refer to your appropriate *IBM FAST Storage Manager Version 8.2 Installation and Support Guide*.

For more information about enabling or activating the Remote Mirror Option, refer to “Enabling and activating the Remote Mirror Option” on page 43.

## Verifying installation and configuration

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

Complete the following procedure for each storage subsystem that is participating in any aspect of a mirror relationship to verify correct configuration.

- Start the storage-management software.

For more information about starting the storage-management software, refer to your *IBM FAStT Storage Manager Version 8.2 Installation and Support Guide* for operating-system specific procedures.

2. If this is the first time you have started the storage-management software, do the following:
    - Click **OK** when prompted for Automatic Discovery of devices.
    - Ensure that all storage subsystems designated to participate in mirror relationships are displayed in the Device Tree view of the Enterprise Management Window.
- Note:** If the storage subsystems do not appear, refer to Chapter 5, “Troubleshooting” on page 61.
- If this is not the first time you started the storage-management software, do the following:
    - a. From the Enterprise Management Window, click **Tools** → **Automatic Discovery**.
    - b. Click **OK**.
    - c. Verify that all storage subsystems designated to participate in mirror relationships are displayed in the Device Tree view of the Enterprise Management Window.
    - d. If the storage subsystems do not appear, refer to Chapter 5, “Troubleshooting” on page 61.
  3. From the Enterprise Management window, select a storage subsystem that will participate in mirror relationships.
  4. Click **Tools** → **Manage Device** to open the Subsystem Management window for that storage subsystem.
  5. From the Subsystem Management window, click **Help** → **About**.
  6. Verify that the version of the storage-management software is 08.2x.xx.xx or later. If this requirement is not met, refer to your *IBM FAStT Storage Manager Version 8.2 Installation and Support Guide* for storage-management software upgrade procedures.
  7. Click **OK**.
  8. From the Subsystem Management window, click **View** → **Storage subsystem Profile**.
  9. Under the All tab, verify that the current firmware version is 05.2x.xx.xx or later. If this requirement is not met, refer to *IBM FAStT Storage Manager Version 8.2 Installation and Support Guide* for firmware upgrade procedures.
- When your installation is completed, refer to the following online help systems:
- Enterprise Management window help - Use this online help system to learn more about working with the entire management domain.
  - Subsystem Management window help - Use this online help system to learn more about managing individual storage subsystems and remote mirror option.
- You can access these help systems from within the Storage Manager 8.2 Client. From either a Enterprise Management or Subsystem Management window, click **Help** or press F1.
10. Click **Close**.
  11. Observe the Remote Mirror Option icon in the status area. The icon represents the Disabled and Deactivated status of the Remote Mirror Option.

12. To begin working with Mirror Relationships, go to Chapter 3, "Using the Remote Mirror Option" on page 43.



---

## Chapter 3. Using the Remote Mirror Option

This chapter contains the procedures for completing the major tasks associated with the Remote Mirror Option. The chapter is organized sequentially; after the Remote Mirror Option premium feature key is purchased, you can enable and activate the option so you can create and maintain mirror relationships. The final section is provided for reference only and might be useful when a mirror relationship is no longer needed.

---

### Enabling and activating the Remote Mirror Option

The Remote Mirror Option premium feature key must be purchased before you can enable the option. The option must be activated by using a GenKey program before you can create any mirror relationships. First, determine the status of the Remote Mirror Option. Then, enable and activate it.

### Determining Remote Mirror Option status

There are four possible statuses of the Remote Mirror Option: Disabled/Deactivated, Disabled/Activated, Enabled/Deactivated, and Enabled/Activated.

**Important:** The Remote Mirror Option must be in the Enabled/Activated state on the secondary storage subsystem as well as the primary storage subsystem to create and maintain mirror logical drive pairs.

You can determine the current status by hovering the mouse pointer over the Remote Mirror Option icon in status area of the Subsystem Management window, as shown in Figure 33.

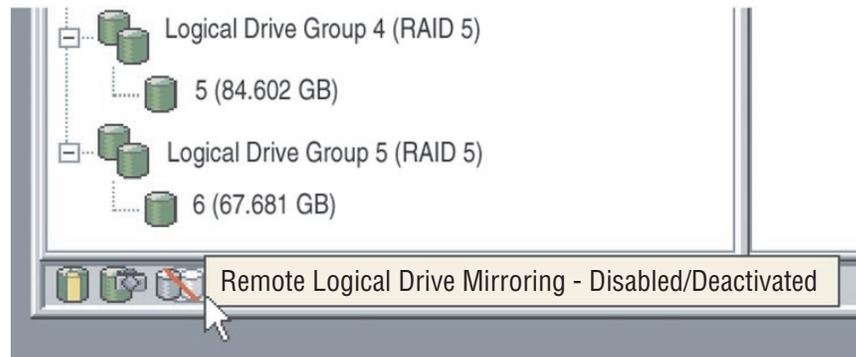


Figure 33. Remote Mirror Option status

**Important:** The Remote Mirror Option status for the primary storage subsystem is managed independently from the secondary storage subsystem. To determine the status for both storage subsystems, select each storage subsystem independently, then determine the status.

Remote Mirror Option statuses are as follows:

- **Disabled and deactivated** - No function of the Remote Mirror Option can be performed. Full Remote Mirror Option functionality is not available until the option 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. An example of this state is illustrated in Figure 33 on page 43. For more information about enabling the Remote Mirror Option, refer “Enabling the Remote Mirror Option”. To activate the option, go to “Activating the Remote Mirror Option”.

- **Disabled and activated** - The Remote Mirror Option is disabled, preventing new mirror relationships from being created. However, any pre-existing mirror relationships are maintained with all functions of the Remote Mirror Option. For more information about enabling the Remote Mirror Option, go to “Enabling the Remote Mirror Option”. The icon displayed for this state is similar to the Disabled/Deactivated state, because the red slash remains to show the option is disabled. However, the cylinder and its reflection now appear green to show the option is active.
- **Enabled and deactivated** - The Remote Mirror Option is enabled, but not activated. To activate the option, go to “Activating the Remote Mirror Option”. 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 to indicate that the option is enabled.
- **Enabled/Activated** - The Remote Mirror Option is enabled and active. You can create and maintain mirror relationships. For more information about creating a mirror relationship, go to “Creating mirror relationships” on page 46. The icon for this state is displayed in the Premium Feature status area as a green cylinder with a mirrored reflection.

## Enabling the Remote Mirror Option

If the current status of the Remote Mirror Option is Disabled/Deactivated or Disabled/Activated, complete the following steps to enable the Remote Mirror Option.

1. From the Subsystem Management window, click **Storage subsystem** → **Features** → **Enable**.

The Select Feature Key File window opens.

**Note:** The Select Feature Key File program filters for files with the *.key* extension. For more information about the feature key, refer to the instructions on the *IBM FASTT Storage Manager Version 8.2 Remote Mirror Option Premium Feature Key CD*.

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

The Enable Feature window opens.

4. Click **Yes**.

The Remote Mirror Option is now enabled. The icon in the Premium Feature status area no longer displays a red slash. To further verify the status of the option, click **Storage subsystem** → **Features** → **List**.

5. Do one of the following:
  - If the Remote Mirror Option has not been activated, go to “Activating the Remote Mirror Option”.
  - If the Remote Mirror Option is activated, go to “Creating mirror relationships” on page 46.

## Activating the Remote Mirror Option

Activating the Remote Mirror Option prepares the storage subsystem to create and configure mirror relationships. When the option is activated, ports A2 and B2 of the

storage controller become reserved and dedicated to Remote Mirror Option usage. In addition, a mirror repository logical drive is created for each controller in the storage subsystem.

If the current status of the Remote Mirror Option is Enabled/Deactivated, complete the following procedure to activate the option:

1. From the Subsystem Management window, click **Storage subsystem** → **Remote Mirror** → **Activate**.

The Activate Remote Logical Drive Mirroring - Introduction window opens.

**Note:** Click **Back** at any time to change information in previous window.

2. Decide where the mirror repository logical drives will reside. Select one of the following.
  - Use free capacity on existing arrays - If this option is selected, then a corresponding logical drive must be selected also.
    - a. Select a logical drive.
    - b. Select **Finish** or **Next**.
    - c. Go to step 6.
  - Create a new array using unconfigured capacity - If this option is selected, more information must be collected about the new logical drive. Go to step 3.
3. In the Create New Array window, select the RAID level for the new logical drive.
4. Under the drive selection choices, select one of the following.
  - **Automatic** - The drives are chosen automatically according to available capacity.
  - **Manual** - This option gives the user the option to specify which drives contain the mirror repository logical drive.
    - a. Press and hold the Ctrl key and click to select the drives you want to include in your array.
    - b. Click **Apply**.

**Important:** If the RAID level for the new array is RAID 1, then the number of drives must be an even number. If an odd number of drives are selected, an error message will display when you click **Apply**.

5. Click **Next**.
6. Review the information in the Preview window and click **Finish** if all information is satisfactory.
7. Do one of the following:
  - If the storage subsystem password is protected, go to step 8.
  - Go to step 9.
8. Enter the password and click **OK**.
9. Review the information in the Completed window and click **OK** to finish the Remote Mirror Option activation.

The Remote Mirror Option must be enabled and activated on all storage subsystems that are part of a remote mirror setup. The icon in the Premium Feature status area changes from grey to green. If this is not the case, repeat the steps in “Enabling and activating the Remote Mirror Option” on page 43 for each storage subsystem that has the remote mirror option disabled and deactivated.

10. Continue with “Creating mirror relationships”.

---

## Creating mirror relationships

Before you create mirror relationships, be sure that the Remote Mirror Option is enabled and activated.

**Note:** The secondary host ports on the storage subsystems are reserved for data synchronization between a primary and secondary logical drive of a mirror relationship.

## Creating logical drives for mirror relationships

Before you create mirror relationships, be sure that logical drives must exist at both the primary and storage subsystems. The logical drive of the remote mirror pair that is presented to the host is the primary logical drive. The storage subsystem that the primary drive resides in is called the primary storage subsystem. Similarly, the logical drive residing in the secondary storage subsystem is the secondary logical drive.

If a primary or secondary logical drive does not exist, you must create one on the corresponding storage subsystem.

Consider the following when creating a logical drive:

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

For more information about creating logical drives, refer to the Subsystem Management window online help.

When logical drives exist at both sites, you can create mirror relationships by using the Remote Logical Drive Mirror Wizard.

## Creating a mirror relationship using the Create Remote Logical Drive Wizard

The Create Remote Logical Drive Mirror Wizard enables a user to create a mirror relationship between a primary logical drive and a secondary logical drive. Before beginning the wizard, ensure the following requirements are met:

- The Remote Mirror Option is enabled on both storage subsystems in which the primary and secondary logical drives will reside.
- The Remote Mirror Option is activated on both subsystems.
- The storage subsystems are connected through a proper Fibre Channel fabric configuration.
- The secondary logical drive must be at equal or greater size than the primary logical drive.
- There must be management connections to both the primary and secondary storage subsystems. The Enterprise Management window must display both primary and secondary storage subsystems in the management domain.
- The remote Fibre Channel switch connections are made between the primary and secondary storage subsystems. The Fibre Channel switches are zoned so that the controller host ports are by themselves.

When these requirements are met, continue with the following procedure to create a mirror relationship:

1. In the Logical/Physical View of the Subsystem Management window, select the logical drive that will become the primary logical drive in the mirror relationship.
2. Click **Logical Drive** → **Remote Mirror** → **Create**.
3. Click **Next**.
4. Follow the instructions in the Select Remote Storage subsystem window.  
The Create Remote Logical Drive Mirror window opens stating requirements similar to those mentioned at the beginning of this section.
  - a. Select the proper storage subsystem. The remote mirror option supports a maximum of two storage subsystems per configuration. The Wizard will display all available storage subsystems within the management domain that has remote mirror option enabled and activated. If you have an existing remote mirror relationship with a given storage subsystem, do not select another storage subsystem from the list.
  - b. Click **Next**.
5. Select the logical drive that will become the secondary logical drive in the mirror relationship. If there are no logical drives listed, the secondary storage subsystem that you selected do not have logical drives with enough capacity available to mirror the selected logical drive.
6. Click **Next**.
7. Select the Synchronization Priority Level.

**Note:** For more information about the Synchronization Priority Level, refer to “Changing the Synchronization Priority Level” on page 49.

8. Click **Finish**.
9. If the remote storage subsystem is password protected, enter the password and click **OK**.
10. If you do not exceed the maximum number of mirrored logical drive pairs that can be created for the storage subsystem, You are prompted to create another mirror logical drive pair by the Create Remote Logical Drive mirror wizard. If you do not want to create another mirror logical drive pair, click **No** and go to step 11. Otherwise, do the following:
  - a. Select the logical drive that will become the next primary logical drive.
  - b. Click **Next**.
  - c. Repeat step 4 through step 10 on page 47 for each additional mirror relationship.
11. Review the information in the Completed window, then Click **OK** to complete the Create Remote Logical Drive Mirror wizard.

The primary and secondary logical drives are now displayed with the mirror relationship icons, which will change slightly upon completion of the data synchronization. The amount of time required for the data to be synchronized between the two logical drives varies proportionally to the size of the logical drive being mirrored and storage subsystem I/O loads. After the synchronization is complete, the icons will change to the optimal state mirror relationship icons. Figure 34 on page 48 shows how the icons appear during and after data synchronization.

**Note:** To view all icons associated with the Remote Mirror Option and a description of their purpose, refer to the Subsystem Management window online help.

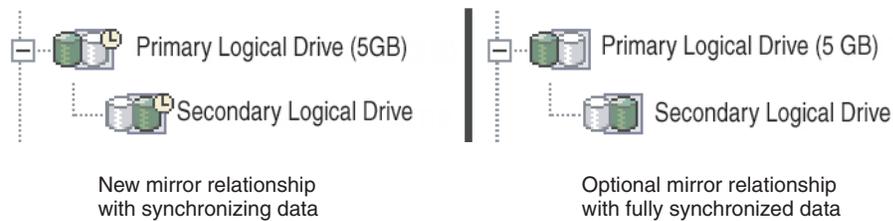


Figure 34. Synchronizing and Optimal Mirror Relationship

The mirror relationship is now created and optimal.

Continue to “Maintaining mirror relationships”.

---

## Maintaining mirror relationships

When a mirror relationship is active, you can modify certain attributes of the relationship at any time. This section describes how to view information about the mirror relationship, how to change the synchronization priority level, how to remove a mirror relationship, and how to delete logical drives participating in a mirror relationship.

### Viewing mirror relationships

The mirror relationship that exists between the primary logical drive and the secondary logical drive can be examined by various methods, such as using the storage subsystem profile, the Mirroring Properties window, and the View Associated Components window.

#### Displaying the storage subsystem profile

The storage subsystem profile is the most efficient way to view information about any or all components of the storage subsystem. Details for all logical drives, such as the primary, secondary, and Mirror Repository logical drives can all be easily viewed through the storage subsystem profile. The storage subsystem profile also contains specific information for components associated with mirror relationships.

Complete the following procedure to display the storage subsystem profile.

1. From the Subsystem Management window click **View** → **Storage subsystem profile**.
2. Click the **Logical Drives** tab.
  - To view information about the mirror relationships that exist on this storage subsystem, click the **Mirrors** tab.
  - To view information about the mirror repository logical drive, click the **Repositories** tab.

**Note:** Click **Save As** to save all of the information shown in the storage subsystem profile as a .txt file. The Save Profile window that opens will provide the option of saving the current window, multiple windows, or the entire Storage subsystem profile.

#### The Mirroring Properties window

The Mirroring Properties window displays all the physical characteristics of a single logical drive in the mirror relationship.

The window displays the same information as the storage subsystem profile for the selected logical drive, but is specific only to that logical drive. In addition, the synchronization progress is displayed if the selected logical drive is synchronizing data with another logical drive in a newly defined mirror relationship or in an existing mirror relationship after the broken mirror link is restored.

Complete the following procedure for each logical drive that needs to be examined in the mirror relationship. You can also use the following procedure to view the synchronization progress of a recently created mirror relationship.

1. Select the primary or secondary logical drive.
2. Click **Logical Drive** → **Properties**.
3. Click the **Mirroring** tab.

### **The View Associated Components window**

The View Associated Components window provides a graphical representation of the logical drives participating in the mirror relationship. In addition, details are provided for all components, rather than just the logical drive initially selected.

Complete the following procedure to view all associated components in a mirror relationship, including primary, secondary, and Mirror Repository logical drives.

1. Select the primary or secondary logical drive in a mirror relationship.
2. From the right mouse pop-up menu, select **View Associated Components**.  
The View Associated Components window opens.
3. Click **Close** to exit the window.

## **Changing the Synchronization Priority Level**

The Synchronization Priority Level of a mirror relationship defines the amount of system resources used to synchronize the data between the primary and secondary logical drives 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 increase mirror performance, but might decrease performance for all other functions, including other mirror relationships. If the lowest synchronization level is selected, there is less impact on complete system performance, but the mirror relationship synchronization might be slower.

To change the Synchronization Priority Level for a mirror relationship, complete the following procedure:

1. In the Logical/Physical view of the Subsystem Management window, select a primary logical drive of a mirror relationship.
2. Click **Logical Drive** → **Remote Mirror** → **Change** → **Synchronization Priority**.  
The Change Synchronization Priority window opens. The primary logical drive chosen in step 1 is selected by default in the Select logical drives selection area.
3. Select one or more logical drives.
4. Select the synchronization priority level. The 5 levels are Lowest, Low, Medium, High, and Highest. All selected logical drives will change to the same synchronization priority level.
5. Click **OK**.
6. Click **Yes** when the Confirmation window opens.
7. Click **OK** when the Completed window opens.

## Removing mirror relationships

Removing a mirror relationship between a primary and secondary logical drive does not affect any of the existing data on either logical drive. The link between the logical drives is removed, but the primary logical drive still continues normal I/O operation. You can perform this action for backup routines, particularly from the secondary logical drive. A mirror relationship between the two logical drives can be recreated unless one of the logical drives is deleted.

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

1. From the Subsystem Management window, select a local primary logical drive or local secondary logical drive of a mirror relationship.
2. Click **Logical Drive** → **Remote Mirror** → **Remove Mirror Relationship**.  
The Remove Mirror Relationship window displays all mirror relationships associated with this storage subsystem.
3. Select one or more mirror relationships to be removed.
4. Carefully review the information presented in the Confirmation window.
5. Click **Yes**.

## Deleting primary and secondary logical drives

Deleting a logical drive participating in a mirror relationship removes the mirror relationship and completely deletes the logical drive from the storage subsystem. The mirror relationship cannot be redefined until a new logical drive is created or an alternate logical drive replaces the deleted logical drive.

To delete a primary or secondary logical drive from a mirror relationship, complete the following procedure:

### Attention:

- If you have data or logical drives that you want to keep, do not click **Configure** → **Reset Configure**. This will reset the controller unit and delete all previously-configured logical drives.
- You must delete operating system logical drives using Disk Administrator before deleting logical drives or resetting the configuration in Storage Manager 8.2. This will avoid damage to your registry information.
- The following steps will permanently remove data from the selected logical drive.
  1. From the Subsystem Management window, select the primary or secondary logical drive that you want to delete.
  2. Click **Logical Drive** → **Delete**.
  3. Carefully review the information. To delete the logical drive, in the text area type:  
Yes
  4. Click **OK**.

---

## Deactivating and disabling the Remote Mirror Option

If no mirror relationships exist and the Remote Mirror Option is no longer required, then deactivating the option will reestablish normal use of dedicated ports on both storage subsystems and will delete both mirror repository logical drives.

The Remote Mirror Option can also be disabled. When the option 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 and Deactivated state, no Remote Mirror Option activity occurs.

## Deactivating the Remote Mirror Option

To change the Remote Mirror Option status from Enabled and Activated to Enabled and Deactivated or from Disabled and Activated to Disabled and Deactivated, complete the following procedure.

1. Verify that all mirror relationships are removed. For more information, refer to “Removing mirror relationships” on page 50.
2. Click **Storage subsystem** → **Remote Mirror** → **Deactivate**.
3. Carefully review the information presented in the Confirmation window.
4. Click **Yes**.

## Disabling the Remote Mirror Option

To change the Remote Mirror Option status from Enabled and Deactivated to Disabled and Deactivated or from Enabled/Activated to Disabled/Activated, complete the following procedure.

**Attention:** When you disable the remote mirror premium feature, you will require the key file generating utility to reenable the feature. Copy the key file to a diskette or directory for later use. The key file is required to reenable the Remote Mirror Option.

1. Complete the procedure in “Deactivating the Remote Mirror Option” prior to disabling the Remote Mirror Option.
2. From the Subsystem Management window, click **Storage subsystem** → **Features** → **Disable**.
3. Click **Remote Mirror**.
4. Click **OK**.
5. Carefully review the information presented in the Confirmation window.
6. Click **Yes**.



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## Chapter 4. Disaster recovery

This chapter describes the actions to take to prepare for a disaster, the actions to take if a hardware component failure occurs, and the actions to take if a complete site failure occurs.

As businesses increasingly require around-the-clock data access, system administrators are required to ensure that critical data is safeguarded against potential disasters.

In preparing for a potential disaster, system administrators must develop a disaster recovery plan that details the procedures to prepare for and prevent disasters, and the actions required to respond to and recover from disasters if they occur.

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### Planning for disaster recovery

This section provides information on steps that must be taken in preparation for a possible disaster or unrecoverable error. Preparation steps include backing up critical data prior to and during remote logical drive mirroring, using host clustering software for failover protection, and preparing the secondary storage subsystem that will participate in the remote logical drive mirror.

Be sure that you complete the checklist in Table 2 on page 19 and Table 3 on page 20 to ensure that your primary and secondary storage subsystems are prepared correctly.

### Backing up critical data

Backing up critical data regularly is vital to insure against disasters or unrecoverable error. Backups must be performed regardless of whether the Remote Mirror Option is in use.

A backup of all critical data on both the primary and secondary storage subsystems participating in remote logical drive mirroring must be performed prior to creating a remote logical drive mirror. Periodic backups of the primary storage subsystem must be carried out when remote logical drive mirrors are in use.

You can make backups to tape or disk while I/O continues using FlashCopy, which captures a point-in-time image of a logical drive. For more information on using FlashCopy logical drives, refer to “FlashCopy logical drives” on page 12 or the Subsystem Management window online help.

### Preparing the secondary storage subsystem

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

Prior to creating a remote logical drive mirror, prepare your secondary storage subsystem to ensure that storage partitions and FlashCopy logical drives are defined and ready to function if the secondary storage subsystem is promoted to the primary role.

#### Defining storage partitioning

The Storage Partitioning feature enables you to define which host computers have access to which logical drives on the storage subsystem and at what logical unit

number. When configuring your secondary storage subsystem, replicate the storage partitions that were previously defined on the primary storage subsystem. This will ensure that if a role reversal is carried out, host computers are able to access their required data. Depending on your operating system and host application software, you might not be able to map the secondary logical drive to the host that the primary logical drive is mapped to.

For more information on the Storage Partitioning feature, refer to the Subsystem Management window online help.

## Ensuring failover protection using the host clustering software

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

You can use the Remote Mirror Option in conjunction with remote host failover to provide complete redundancy of host computers and storage subsystems. If a disaster occurs at the primary storage subsystem, host computers at the secondary storage subsystem will take over the processing and initiate a role change to the secondary storage subsystem.

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 subsystems and depending on manual startup of the remote host computers might be acceptable.

For more information on host cluster software and configuration, refer to the README in your *IBM FAST Storage Manager Version 8.2 CD*.

## Disaster preparation checklist

Complete the tasks listed to ensure access to mirrored data is possible in the event of a disaster or unrecoverable error.

*Table 9. Disaster recovery preparation checklist*

Task description	Validation activity
<p>1. Ensure that all critical data is backed up on both the primary and secondary storage subsystems.</p> <p>2. Ensure that your storage partitioning is in place on the secondary storage subsystem. This will reduce any lag time when promoting a secondary logical drive to the primary logical drive role.</p> <p>For more information on setting up storage partitioning, refer to the Subsystem Management window online help.</p> <p>3. Ensure that, if required, your host clustering software is configured to allow host failover between the primary storage subsystem and secondary storage subsystem participating in remote logical drive mirroring.</p> <p>For more information, refer to your host clustering software documentation.</p>	<p><input type="checkbox"/> Task 1 completed.</p> <p><input type="checkbox"/> Task 2 completed.</p> <p><input type="checkbox"/> Task 3 completed.</p>

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## Recovering from switch failures

The High Availability Campus configuration is the only configuration where 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. The single switch at each site is not only responsible for the communication between the two sites for the Remote Mirror Option, but for all host to storage subsystem I/O as well.

If a switch fails in the High Availability Campus configuration, the system administrator must decide whether or not to do a complete site failover. This decision must 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 is replaced.

- **Direct connection between host computers and storage subsystems** - This will bypass the switch and allow normal I/O to continue. All mirror relationships are suspended until a normal configuration is resumed. Since the storage subsystems have a finite number of host connections, all host computers might not be able to access the storage subsystem. For information on how to directly connect host computers and storage subsystems, refer to your *IBM Netfinity FAST500 Raid Controller Enclosure Unit Installation Guide* or *IBM TotalStorage FAST700 Fibre Channel Storage Server Installation Guide*.
- **Entire site failover** - The switch at the secondary site is still functional, which enables all host computers to access the switch and storage subsystems. Mirror relationships are suspended until the primary storage subsystem is recovered. If a complete site failover is needed to continue normal operations, see “Entire site failover procedure”.

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## Recovering from storage subsystem failures

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

- The primary storage subsystem 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 normal operations can continue. For a secondary site failure, no site failover is necessary. If the primary logical drive is not damaged, then a full synchronization will occur when the site is recovered. If the primary storage subsystem is damaged, follow the procedure in “Rebuild a damaged site procedure” on page 56.

**Attention:** The procedures in this section must be completed in the order presented to ensure that the affected site or storage subsystem 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 an extended period of time.

1. Manually reverse the role of the primary logical drive of the mirror relationship to the secondary role. For more information, see “Reversing the roles of primary and secondary logical drives” on page 57.

2. If storage partitioning is pre-configured so hosts can access the logical drives, go to step 4. Otherwise, continue with step 3.
3. Configure the storage partitioning so that host to logical drive access is identical to the primary site configuration. When configured, continue to step 4. For more information on setting up storage partitioning, refer to the Subsystem Management window online help.
4. If the host computers at the secondary site are properly configured for host failover, go to step 6. Otherwise, continue with step 5.
5. Reinstall host software and reconfigure settings as needed. For more information about installing and configuring host software, refer to the documentation that comes with the software.
6. Run the Hot\_add utility on hosts that have only mapped logical drives from the secondary storage subsystem. Restart all hosts that have logical drive mappings from the primary and secondary storage subsystems; then, Resume normal operation with the secondary site acting as a new, fully-functioning primary site.
7. If storage partitioning is pre-configured so that proper host computers can access appropriate logical drives, go to step 6. Otherwise, go to step 5.
8. The entire site failover is complete. The primary site must now be reconfigured and the Remote Mirror environment must be recreated. The next step will depend on the resulting status of the storage subsystem from the disaster.
9. If the storage subsystem and all of the contained data is recovered and fully operational, go to “Recreate a mirror relationship procedure” on page 57. Otherwise, go to “Rebuild a damaged site procedure”.

## Rebuild a damaged site procedure

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

Complete the following procedure to rebuild a damaged site:

1. Obtain new storage subsystems and any host computers and hardware needed to properly use the Remote Mirror Option. Be sure that the new hardware has the latest level of specifications than the damaged hardware.
2. Depending on the configuration, complete the switch zoning and hardware installation procedure as presented in “Hardware installation” on page 23, for this site only.
3. Define a logical drive to replace the mirrored logical drive damaged on the original storage subsystem. Be sure that the new logical drive is identical to the specifications of the previously damaged logical drive.
4. Ensure storage partitioning is properly defined so that it can take over normal operation from the secondary site. For more information on setting up storage partitioning, see “Using other premium features with the Remote Mirror Option” on page 11.
5. Ensure the host software is properly configured so that the host computers can take over I/O from the secondary site host computers. For more information about installing and configuring host software, refer to the documentation that comes with the software.
6. The site is recovered and is now ready to resume any mirror relationships that were active before the failure. Go to “Recreate a mirror relationship procedure” on page 57.

## Recreate a mirror relationship procedure

When the damaged site is back online and properly configured, mirror relationships can be resumed.

Recreate a mirror relationship by completing the following procedure.

1. From the active secondary site, define a mirror relationship using the logical drive on the recovered primary site as the primary logical drive. For more information, see “Creating mirror relationships” on page 46.
2. Ensure Storage Partitioning is properly defined on the recovered primary site so that it can take over normal operation from the secondary site. For more information on setting up storage partitioning, see “Using other premium features with the Remote Mirror Option” on page 11 or refer to the online help.
3. Ensure the host software is properly configured so that the host computers at the recovered primary site can take over I/O from the secondary site host computers. For more information about installing and configuring host software, refer to the documentation provided with the software.
4. Perform a manual role reversal so that the recovered primary site now possesses the active primary logical drive, and the primary logical drive now exists on the secondary site. For more information, see “Reversing the roles of primary and secondary logical drives”.
5. The Remote Mirror configuration is now optimal.

---

## Reversing the roles of primary and secondary logical drives

A role reversal is the process of promoting the secondary logical drive to be the primary logical drive within the mirrored logical drive pair, and demoting the primary logical drive to be the secondary logical drive.

A role reversal is performed using one of the following methods:

- **Changing a secondary mirrored logical drive to a primary logical drive.** This option promotes a selected secondary logical drive to become the primary logical drive of the mirrored pair, and is used when an unrecoverable error has occurred. For step-by-step instructions, refer to “Changing a secondary logical drive to a primary drive”.
- **Changing a primary mirrored logical drive to a secondary logical drive.** This option demotes a selected primary logical drive to become the secondary logical drive of the mirrored pair, and is used during normal operating conditions. For step-by-step instructions, refer to “Changing a primary logical drive to a secondary drive” on page 58.

Role reversals can also be performed using the Set Command in the Storage Manager Script window or the CLI. For more information, refer to the Enterprise Management window online help.

## Changing a secondary logical drive to a primary drive

A secondary logical drive is usually promoted to a primary logical drive role when an unrecoverable error has occurred on the storage subsystem that contains the primary logical drive, and the primary logical drive needs to be promoted so that host computers can access data and normal operations can continue.

This option is not available unless the Remote Mirror Option is activated.

**Note:** When the secondary logical drive becomes a primary logical drive, any host computers that are accessing the logical drive through a logical drive-to-LUN mapping will now be able to read or write to the logical drive. Note that this condition applies if the host did not have the same logical-drive-to-LUN mapping as the LUN in the primary logical drive that was demoted to secondary logical drive. If it did, you must restart the host for the newly-promote-to-primary (secondary) logical drive to replace the demoted (primary) logical drive.

If a communication problem between the secondary site and primary site prevents the demotion of the primary logical drive, an error message displays. However, you are given the opportunity to proceed with the promotion of the secondary logical drive, even though this will lead to a Dual Primary Remote Mirror status condition. The recovery for the Dual Primary Remote Mirror status condition occurs when remote mirror pairs are recreated. If you attempt to change the role of one of the primary drives, an error will occur.

Complete the following procedure to promote a secondary logical drive to the primary logical drive role:

1. Select the secondary logical drive in the Logical View and then, select either the **Logical Drive** → **Remote Mirror** → **Change** → **Role to Primary** pull-down menu option, or **Change** → **Role to Primary** from the right-mouse pop-up menu. The Change to Primary window opens.
2. Click **Yes**. The secondary logical drive is promoted to be the primary logical drive role in the remote logical drive mirror.

When the controller owner of the primary logical drive is contacted, the primary logical drive is automatically demoted to be the secondary logical drive role in the remote logical drive mirror.

## Changing a primary logical drive to a secondary drive

Changing a primary logical drive to the secondary logical drive role is used for role reversals during normal operating conditions. You can also use this option during a recovery procedure when a dual primary remote mirror status condition occurs.

Role reversal will not occur unless the Remote Mirror Option is activated.

**Important:** Any host computers that are accessing the primary logical drive through a logical drive-to-LUN mapping will no longer be able to read or write to the logical drive. When the primary logical drive becomes a secondary logical drive, only remote writes initiated by the primary controller is written to the logical drive.

If a communication problem between the primary and secondary sites prevents the demotion of the primary logical drive, an error message displays. However, you are given the opportunity to proceed with the demotion of the primary logical drive, even though this will lead to a Dual Secondary Remote logical drive mirror status condition. The recovery for the Dual Primary Remote Mirror status condition occurs when remote mirror pairs are recreated. If you attempt to change the role of one of the primary drives, an error will occur.

**Attention:** If the selected primary logical drive has associated FlashCopy logical drives, demoting this logical drive to a secondary role will cause the associated FlashCopy logical drives to fail.

To demote a primary logical drive to the secondary logical drive role, do the following:

1. Select the primary logical drive in the Logical View; then, select either the **Logical Drive** → **Remote Mirror** → **Change** → **Role to Secondary** pull-down menu option, or **Change** → **Role to Secondary** from the right-mouse pop-up menu. The Change to Secondary window opens.
2. Click **Yes**. The primary logical drive is demoted to be the secondary logical drive in the remote logical drive mirror.

When the controller owner of the primary logical drive is contacted, the secondary logical drive is automatically promoted to be the primary logical drive in the remote logical drive mirror.



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## Chapter 5. Troubleshooting

This chapter provides information about troubleshooting some commonly encountered problems when using the Remote Mirror Option.

Troubleshooting topics include general remote logical drive mirroring problems, inappropriate Fibre Channel fabric configurations, problems with storage subsystem components involved in remote logical drive mirroring, and basic switch troubleshooting. Also provided is a list of the critical events that might 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.

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### General troubleshooting

This section describes some of the usual problems that might be encountered when using the Remote Mirror Option. The information is presented in order from the time the option is enabled and activated, to problems that might be encountered completing normal tasks when using the Remote Mirror Option.

Information about the probable cause and resolution of 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.

Problem	Cause	Resolution
The Remote Mirror menu options in the Subsystem Management window are greyed out and unavailable.	The Remote Mirror Option is not enabled or activated.	<ol style="list-style-type: none"><li>1. Enable the Remote Mirror Option. A premium feature key is required to enable premium features.</li><li>2. Activate the Remote Mirror Option.</li></ol> <p>The Remote Mirror Option is a premium feature option. Contact your IBM Technical Service Representative for purchase information. For step-by-step instructions on enabling and activating the Remote Mirror Option, refer to “Enabling and activating the Remote Mirror Option” on page 43 or to the Subsystem Management window online help.</p>

Problem	Cause	Resolution
<p>The Remote Mirror icon in the premium feature status area is greyed out with a red line.</p>	<p>The Remote Mirror Option is not enabled or activated.</p>	<ol style="list-style-type: none"> <li>1. Enable the Remote Mirror Option. A premium feature key file is required to enable the feature.</li> <li>2. Activate the Remote Mirror Option.</li> </ol> <p>The Remote Mirror Option is a premium feature option. Contact your IBM Technical Service Representative for purchase information. For step-by-step instructions on enabling and activating the Remote Mirror Option, refer to “Enabling and activating the Remote Mirror Option” on page 43 or the Subsystem Management window online help.</p>
<p>When creating a remote logical drive mirror, an error message displaying the following code: INVALID_MIRROR_CANDIDATE_VOL</p>	<p>The secondary logical drive candidate was participating in a mirror relationship with a different logical drive on this storage subsystem. The mirror relationship was successfully removed from the other storage subsystem. However, a communication error prevented the successful removal of the mirror relationship on this storage subsystem.</p>	<p>A logical drive on this storage subsystem still has a mirror relationship defined with the secondary logical drive.</p> <ol style="list-style-type: none"> <li>1. Click the <b>View</b> → <b>Storage subsystem Profile option</b>, and click the <b>Logical Drives</b> tab and then the <b>Mirrors</b> tab.</li> <li>2. Locate the logical drive that is still participating in the mirror relationship with the secondary logical drive candidate and remove the mirror relationship. For step-by-step instructions, refer to “Removing mirror relationships” on page 50 or to the Subsystem Management window online help.</li> <li>3. Re-create the intended remote logical drive mirror using the original candidate logical drives. For step-by-step instructions, refer to “Creating mirror relationships” on page 46 or to the Subsystem Management window online help.</li> </ol>
<p>The primary logical drive is showing a Synchronization-in-Progress status.</p>	<p>A full synchronization, between the primary and secondary logical drives participating in a mirror relationship, is in progress. Data available on the primary logical drive is copied in its entirety to its associated secondary logical drive.</p>	<p>Wait for the full synchronization to complete. When full synchronization has finished copying data from the primary logical drive to the secondary logical drive, the mirrored logical drive pair transitions to a Synchronized status.</p> <p>For more information on monitoring the status of a remote logical drive mirror, refer to the Subsystem Management window online help.</p>

Problem	Cause	Resolution
<p>Both the primary and secondary logical drive are displayed as being the primary logical drive.</p>	<p>A disaster or unrecoverable error has occurred on the storage subsystem containing the primary logical drive, and the secondary logical drive is promoted to the primary logical drive role.</p> <p>The primary storage subsystem is now operational, but unreachable because of a link failure. A forced promotion of the secondary logical drive has resulted in both the primary and secondary logical drives is displayed in the primary logical drive role.</p>	<p>If the mirror logical drive pair status is synchronized, perform steps 1 and 2. Otherwise, perform steps 3 and 4.</p> <ol style="list-style-type: none"> <li>1. Determine which of the logical drives in the mirrored logical drive pair must be the primary logical drive.</li> <li>2. Choose the logical drive that must be in the secondary logical drive role, then click <b>Storage subsystem</b> → <b>Change</b> → <b>Role to Secondary</b> pull-down menu option. A resynchronization will automatically occur.</li> <li>3. Delete the mirror relationship from either storage subsystem by highlighting either primary logical drive in its respective Subsystem Management Window and selecting the <b>Logical Drive</b> → <b>Remote Mirroring</b> → <b>Remove Mirror Relationship</b> menu option. <b>Note:</b> The mirror relationship for the remote logical drive will not be removed if there is a connection problem between the two storage subsystems. If the mirror relationship remains on the remote logical drive after the above action, highlight that logical drive from its respective Subsystem Management Window and select the <b>Logical Drive</b> → <b>Remote Mirroring</b> → <b>Remove Mirror Relationship</b> menu option.</li> <li>4. In its respective Subsystem Management Window, highlight the logical drive you wish to be the primary logical drive and select the <b>Logical Drive</b> → <b>Remote Mirroring</b> → <b>Create</b> menu option. Follow the instructions in the Create Remote Mirror wizard to re-create the mirror relationship</li> </ol> <p>For step-by-step instructions, refer to “Changing a primary logical drive to a secondary drive” on page 58 or to the Subsystem Management window online help.</p>

Problem	Cause	Resolution
<p>Both the primary and secondary logical drives are displayed as being the secondary logical drive.</p>	<p>In response to a dual primary logical drive condition, a role reversal was carried out and the primary logical drive was demoted to the secondary logical drive role. The secondary storage subsystem is operational, but unreachable because of a link failure. The forced demotion of the primary logical drive has resulted in both the primary and secondary logical drives that are displayed in the secondary logical drive role.</p>	<p>If the mirror logical drive pair status is synchronized, perform steps 1 and 2. Otherwise, perform steps 3 and 4.</p> <ol style="list-style-type: none"> <li>1. Determine which of the logical drives in the mirrored logical drive pair must be the primary logical drive.</li> <li>2. Choose the logical drive that must be in the primary logical drive role, then click <b>Storage Subsystem</b> → <b>Change</b> → <b>Role to Primary</b> pull-down menu option. A re-synchronization will automatically occur.</li> <li>3. Delete the mirror relationship from either storage subsystem by highlighting either secondary logical drive in its respective Subsystem Management Window and selecting the <b>Logical Drive</b> → <b>Remote Mirroring</b> → <b>Remove Mirror Relationship</b> menu option. <b>Note:</b> The mirror relationship for the remote logical drive will not be removed if there is a connection problem between the two storage subsystems. If the mirror relationship remains on the remote logical drive after the above action, highlight that logical drive from its respective Subsystem Management Window and select the <b>Logical Drive</b> → <b>Remote Mirroring</b> → <b>Remove Mirror Relationship</b> menu option.</li> <li>4. In its respective Subsystem Management Window, highlight the logical drive you wish to be the secondary logical drive and select the <b>Logical Drive</b> → <b>Remote Mirroring</b> → <b>Create</b> menu option. Follow the instructions in the Create Remote Mirror wizard to re-create the mirror relationship.</li> </ol> <p>For step-by-step instructions, refer to “Changing a secondary logical drive to a primary drive” on page 57 or to the Subsystem Management window online help.</p>

Problem	Cause	Resolution
<p>The primary logical drive/secondary logical drive are displayed as missing.</p>	<p>A physical logical drive on which a remote logical drive mirror depends (primary logical drive, secondary logical drive) is removed, and the logical drive is now displayed under the missing logical drives node in the Logical View of the Subsystem Management window.</p>	<p>If missing logical drives are detected because drives have accidentally been removed, or are detected as missing because of a loss of power to the drive enclosures, recovery of these logical drives is possible by:</p> <ol style="list-style-type: none"> <li>1. Re-inserting the drives back into the drive enclosure.</li> <li>2. Ensuring that the drive enclosure power supplies are properly connected to an operating power source and have an Optimal status.</li> </ol> <p>For more information, refer to Recovery Guru or contact your IBM technical-support representative.</p> <p>If the missing logical drive is no longer required, it can be deleted.</p> <p><b>Attention:</b> Deleting a missing logical drive is a permanent action. Any associated logical drives or logical drive-to-LUN mappings will also be deleted. For more information, refer to the Recovery Guru or to the Subsystem Management window online help.</p>
<p>The mirror relationship was removed successfully from the primary side, but not from the secondary side.</p>	<p>When removing a mirror relationship, a link failure occurred between the primary and secondary storage subsystems and an error message displays.</p>	<p>The Subsystem Management window for the primary storage subsystem indicates that the mirror relationship is removed successfully; however, the Subsystem Management window for the secondary storage subsystem indicates that the mirror relationship still exists.</p> <p>Open the Subsystem Management window for the secondary storage subsystem and remove the mirror relationship.</p> <p>For step-by-step instructions, refer to “Removing mirror relationships” on page 50 or the Subsystem Management window online help.</p>

Problem	Cause	Resolution
<p>The mirror relationship was removed successfully from the secondary side, but not from the primary side.</p>	<p>When removing a mirror relationship, a link failure occurred between the primary and secondary storage subsystems.</p> <p>The Subsystem Management window for the secondary storage subsystem indicates that the mirror relationship is removed successfully; however, the Subsystem Management window for the primary storage subsystem indicates that the mirror relationship still exists, with the primary logical drive showing an Unresponsive status.</p>	<p>Open the Subsystem Management window for the primary storage subsystem and remove the mirror relationship.</p> <p>For step-by-step instructions, refer to “Removing mirror relationships” on page 50 or to the Subsystem Management window online help.</p>
<p>The primary logical drive is showing an Unsynchronized status.</p>	<p>The remote logical drive mirror is in an Unsynchronized status because the data mirrored between the primary logical drive and secondary logical drive is no longer identical. Usual causes for this status include link errors, a failed primary logical drive or secondary logical drive, or a dual primary or dual secondary error condition.</p> <p>While the remote logical drive mirror is in an Unsynchronized status, no mirroring activity will take place.</p> <p><b>Note:</b> The remote mirror link and the mirror logical drive pair status depends on I/O requests, especially I/O write requests to the primary logical drive. If there are no I/O, the displayed status of the mirror link and the mirror logical drive pair in the IBM FASTT Storage Manager client might not be incorrect. Generate I/O write requests to the primary logical drive to force the storage subsystems updating the remote mirror status.</p>	<p>When the controller owner of the primary logical drive can communicate with the controller owner of the secondary logical drive and the logical drive is online and optimal, a full synchronization will automatically take place. When a full synchronization begins, the remote logical drive mirror transitions to a Mirror Synchronization-in-Progress status.</p> <p>For information on monitoring the status of a remote logical drive mirror, refer to the Subsystem Management window online help.</p>

Problem	Cause	Resolution
<p>Error message indicates that the Remote Mirror Option is out of compliance.</p>	<p>The Remote Mirror Option is out of compliance. This normally occurs if a storage subsystem with logical drives participating in remote logical drive mirroring is moved into the primary storage subsystem and one of the following conditions now exists:</p> <ul style="list-style-type: none"> <li>• The Remote Mirror Option is not enabled on the selected storage subsystem.</li> <li>• The Remote Mirror Option is enabled, but the current number of remote logical drive mirrors defined on the primary storage subsystem exceeds the number of mirror relationships allowed for this storage subsystem.</li> </ul>	<p>If the Remote Mirror Option is not enabled for the primary storage subsystem:</p> <ol style="list-style-type: none"> <li>1. Obtain a premium feature key for this feature from your IBM technical-support representative.</li> <li>2. Enable the Remote Mirror Option. For step-by-step instructions, refer to “Enabling the Remote Mirror Option” on page 44, or to the Subsystem Management window online help.</li> </ol> <p>If the Remote Mirror Option is enabled, but the current number of mirror relationships on the storage subsystem exceeds the number of mirror relationships allowed for the storage subsystem, reduce the number of mirror relationships to equal or less than the number of mirror relationships allowed. The maximum number of mirror relationships allowed is 32.</p> <p>For step-by step instructions, refer to “Removing mirror relationships” on page 50 or to the Subsystem Management window online help.</p>
<p>The remote logical drive candidate is unresponsive and cannot be updated.</p>	<p>The primary storage subsystem is unable to notify the secondary storage subsystem that its world wide name (WWN) has changed.</p> <p>This might be the result of a controller in the primary storage subsystem being swapped or removed. Storage subsystem recovery procedures that result in configurations being reset can also cause a change to the WWN.</p> <p>The first write to the primary logical drive will cause the mirrored logical drive pair to transition into an Unsynchronized status.</p>	<ol style="list-style-type: none"> <li>1. Remove all the existing mirror relationships from the primary storage subsystem. For step-by-step instructions, refer to “Removing mirror relationships” on page 50 or to the Subsystem Management window online help.</li> <li>2. Re-establish the required mirror relationships. For step-by step instructions, refer to “Creating mirror relationships” on page 46 or to the Subsystem Management window online help.</li> </ol>

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## Inappropriate Fibre Channel fabric configurations

This section describes Fibre Channel fabric configuration problems that might be encountered after you have configured your storage subsystems and have activated and enabled the Remote Mirror Option.

Information about the probable cause and preferred 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.

Problem	Cause	Resolution
<p>The primary logical drive is unable to contact the Fibre Channel fabric.</p>	<p>Usually, this error occurs because of a failed Fibre Channel fabric or because of cabling problems between the primary and secondary storage subsystems participating in a remote logical drive mirror.</p>	<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 must not go through a hub or be connected directly between storage subsystems. Ensure that the cable is attached through a switch.</li> </ul> <p>For step-by-step instructions on configuring storage subsystems for remote logical drive mirroring, refer to Chapter 2, "Hardware and software installation" on page 21.</p>
<p>The primary logical drive is unable to communicate with the secondary storage subsystem. The primary storage subsystem can still communicate with the fabric.</p>	<p>Usually, this error occurs when the secondary storage subsystem has lost power or when network problems exist between the secondary storage subsystem and the fabric.</p>	<ul style="list-style-type: none"> <li>• The secondary storage subsystem has no power: If the secondary storage subsystem has no power and is not operational, restore power to the storage subsystem. For information on powering on storage subsystems, refer to your hardware documentation.</li> <li>• The secondary storage subsystem has power and is operational: Check the network status. Ensure that the secondary storage subsystem is visible on the network. Ensure that cables are correctly connected.</li> </ul> <p>For step-by-step instructions on configuring storage subsystems for remote logical drive mirroring, refer to Chapter 2, "Hardware and software installation" on page 21.</p>

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## Storage subsystem component failures

This section describes the impact of physical or logical storage subsystem component failures on remote logical drive mirroring functionality. Information about the probable cause and preferred 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.

Problem	Cause	Resolution
<p>A FlashCopy logical drive created for a primary logical drive indicates that it has failed.</p>	<p>The base logical drive for the FlashCopy logical drive is a primary logical drive involved in a mirror relationship. A role reversal was performed, demoting the primary logical drive to secondary logical drive status, resulting in a FlashCopy logical drive on the secondary logical drive.</p> <p>The base logical drive for a FlashCopy logical drive cannot be a candidate for the secondary logical drive role in a remote logical drive mirror, and the FlashCopy logical drive has therefore failed.</p>	<p>Perform a role reversal to promote the secondary logical drive to the primary logical drive role. After the role reversal is complete, the FlashCopy logical drive will return to Optimal status.</p> <p>For step-by-step instruction, refer to “Changing a secondary logical drive to a primary drive” on page 57 or to the Subsystem Management window online help.</p>
<p>The primary storage subsystem controller indicates that it has failed.</p>	<p>Failure of the owning controller on the primary storage subsystem will usually cause the associated multi-path driver on the attached host computer to transfer ownership of the alternate controller on the primary storage subsystem.</p> <p>When this occurs, the alternate controller on the primary storage subsystem begins forwarding newly written data to its peer on the secondary storage subsystem. The secondary controller will take ownership of the logical drive from its (secondary) peer controller. This is a reactive event, which occurs because of the arrival of a write request from the primary storage subsystem to the non-owning controller on the secondary storage subsystem.</p>	<p>Allow the ownership transfer to complete. Operations will continue in a normal fashion, with the alternate (usually the non-preferred) controller on the primary storage subsystem interacting with the alternate controller on the secondary storage subsystem.</p> <p>Failure of the non-owning controller on the primary storage subsystem will have no direct impact on the status of the remote logical drive mirrors.</p>
<p>The secondary storage subsystem controller indicates that it has failed.</p>	<p>One of the following scenarios has occurred:</p> <ul style="list-style-type: none"> <li>• Controller A on the secondary storage subsystem has failed, while Controller A is the owner of the primary logical drive.</li> <li>• Controller B on the secondary storage subsystem has failed while Controller B is the owner of the primary logical drive.</li> </ul> <p>In both scenarios, the mirrored logical drive pair transitions to the Unsynchronized status.</p>	<p>Restore the failed controller. For detailed recovery procedures, refer to the Recovery Guru. Upon restoration of the failed controller, the primary storage subsystem will automatically transition to a Synchronizing status.</p>

---

## General switch troubleshooting

This section describes some common switch-related problems that might be encountered when using the Remote Mirror Option. The troubleshooting information provided relates to switches supported for use with IBM FASiT Storage Manager Version 8.2. For a list of supported switches, refer to “Hardware and software requirements” on page 15.

Information about the probable cause and preferred 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.

Problem	Cause	Resolution
The host is unable to detect primary and secondary storage subsystems participating in remote logical drive mirroring.	When two or more switches are cascaded together and have the same Domain ID, host computers are unable to locate the target device. Each switch must have a unique Domain ID when attempting to cascade two switches together.	Change the Domain ID of one or more of your switches, ensuring that each one is unique. A Domain ID must 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 Domain IDs, refer to your switch user documentation.

---

## Remote Mirror 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 with e-mail, SNMP trap, or other configured devices. Since administrative action is required to correct the problem, the storage subsystem 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 be triggered and the preferred resolution. If your problem is not addressed in this section, refer to the remaining sections in this chapter before contacting technical support.

Problem	Cause	Resolution
Mirrored pair becomes unsynchronized.	This event is logged when a remote logical drive mirror transitions to an Unsynchronized status, from either a Synchronizing or Optimal status.	Refer to the associated Recovery Guru message for specific recovery procedures.
Dual-role conflict detected.	This event is logged when a dual role-conflict is detected, and is usually the result of a role reversal. Since both sides of the mirrored logical drive pair are in the same primary or secondary logical drive role, both the primary and secondary storage subsystems will report this MEL event.	Refer to the associated Recovery Guru message for specific recovery procedures.

Problem	Cause	Resolution
Communication error with the secondary logical drive on the secondary remote storage subsystem.	This event is logged when an interruption in the link that cannot be recovered by the firmware Fibre Channel device driver is detected. Error codes and recovery procedures will assist the user in finding the exact cause of the communication problem between storage subsystems participating in a mirror relationship.	Refer to the associated Recovery Guru message for specific recovery procedures.
World wide name (WWN) change notification failed.	This event is logged when a storage subsystem detects during start-up processing that its world wide name (WWN) has changed. The WWN can only change if both controllers of the array are exchanged while the array is powered off.  When the firmware detects this name change, it attempts to notify any remote storage subsystem that had previously been participating in a mirroring relationship with any logical drive on the array.	Refer to the associated Recovery Guru message for specific recovery procedures.

---

## Controller firmware version 5.2 upgrades

The Remote Mirror Option is designed so that it is not necessary for the primary storage subsystem and the secondary storage to run the same controller firmware level. All inter-controller operations (including those needed for propagation of newly-written data from the primary logical drive to the secondary logical drive) are 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 subsystems without any loss of data.

This section describes the procedure that you must follow to upgrade controller firmware (version 5.20 and higher) to ensure that the Remote Mirror Option works properly. The preferred sequence for performing firmware upgrades on storage subsystems participating in mirror relationships is detailed below.

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

1. Stop I/O to programs that operate on all affected primary logical drives that are temporarily inactive.
2. Download firmware to the secondary storage subsystem.  
Resume program access to primary logical drives. You can operate the primary storage subsystem with a different firmware level than the secondary storage subsystem for a time, but the inter-controller protocols for data replication do not support such interactions.
3. Download the firmware to the primary storage subsystem.
4. Download the firmware to the secondary storage subsystem.

Some configuration operations, such as the establishment of new mirrors and modification of mirror parameters, might not be allowed between storage

subsystems that have different firmware levels and will result in error messages. However, the key data availability operations, including promotion from the secondary logical drive to the primary logical drive, are allowed in such circumstances.

---

## Appendix A. Getting information, help, and service

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This section contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your computer, and whom to call for service should it be necessary.

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### Getting information

Information about your IBM server product and preinstalled software, if any, is available in the documentation that comes with your server. That documentation includes printed books, online books, README files, and help files. In addition, information about IBM products is available on the World Wide Web.

On the World Wide Web, the IBM Web site has up-to-date information about IBM products and support. The address for the IBM Personal Computing home page is <http://www.ibm.com/pc/>.

You can find support information for your IBM products at <http://www.ibm.com/pc/support/>.

If you click **Profile** from the support page, you can create a customized support page that is specific to your hardware, complete with Frequently Asked Questions, Parts Information, Technical Hints and Tips, and Downloadable Files. In addition, you can choose to receive e-mail notifications whenever new information becomes available about your registered products.

You also can order publications through the IBM Publications Ordering System at <http://www.elink.ibm.com/public/applications/publications/cgibin/pbi.cgi>.

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### Getting help and service

If you have a problem with your server product, you will find a wide variety of sources available to help you.

### Using the documentation and diagnostic programs

Many problems can be solved without outside assistance. If you experience a problem with your server product, the first place to start is the troubleshooting information in your IBM documentation. If you suspect a software problem, see the documentation, including README files and online help, that comes with the operating system or application program.

Most IBM server products come with a set of diagnostic programs that you can use to help you identify hardware problems. See the troubleshooting information in your IBM documentation for instructions on using the diagnostic programs.

The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to <http://www.ibm.com/pc/support/> and follow the instructions.

## Calling for service

If you have tried to correct the problem yourself and still need help, during the warranty period, you can get help and information by telephone through the IBM HelpCenter®. The following services are available during the warranty period:

- **Problem determination** - Trained personnel are available to assist you with determining if you have a hardware problem and deciding what action is necessary to fix the problem.
- **IBM hardware repair** - If the problem is determined to be caused by IBM hardware under warranty, trained service personnel are available to provide the applicable level of service.
- **Engineering Change management** - Occasionally, there might be changes that are required after a product has been sold. IBM or your reseller, if authorized by IBM, will make selected Engineering Changes (ECs) available that apply to your hardware.

The following items are not covered:

- Replacement or use of non-IBM parts or nonwarranted IBM parts. All warranted parts contain a 7-character identification in the format IBM FRU XXXXXXX.
- Identification of software problem sources.
- Configuration of BIOS as part of an installation or upgrade.
- Changes, modifications, or upgrades to device drivers.
- Installation and maintenance of network operating systems (NOS).
- Installation and maintenance of application programs.

Refer to your IBM Statement of Limited Warranty for a full explanation of IBM warranty terms. Be sure to retain your proof of purchase to obtain warranty service.

In the U.S. and Canada, these services are available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9:00 a.m. to 6:00 p.m.

**Note:** Response times vary; may exclude some holidays.

Please have the following information ready when you call:

- Machine type and model
- Serial numbers of your IBM hardware products
- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information

## Telephone numbers

Telephone numbers are subject to change without notice. For the most up-to-date phone numbers, go to <http://www.ibm.com/pc/support/> and click **Support Phone List**.

Country		Telephone number
Austria	Österreich	01-24 592 5901
Belgium - Dutch	Belgie	02-210 9820
Belgium - French	Belgique	02-210 9800
Canada	Toronto only	416-383-3344
Canada	Canada - all other	1-800-565-3344
Denmark	Danmark	45 20 82 00
Finland	Suomi	09-459 6960
France	France	02 38 55 74 50
Germany	Deutschland	07032-1549 201
Ireland	Ireland	01-815 9202
Italy	Italia	02-7031 6101
Luxembourg	Luxembourg	298-977 5063
Netherlands	Nederland	020-514 5770
Norway	Norge	66 81 11 00
Portugal	Portugal	21-791 51 47
Spain	España	91-662 49 16
Sweden	Sverige	08-477 4420
Switzerland	Schweiz/Suisse/Svizzera	058-333 0900
United Kingdom	United Kingdom	01475-555 055
U.S.A. and Puerto Rico	U.S.A. and Puerto Rico	1-800-772-2227

In all other countries or regions, contact your IBM reseller or IBM marketing representative.

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## International Warranty Service

If you travel with your server product or relocate it to a country where your server machine type is sold, your server product might be eligible for International Warranty Service, which automatically entitles you to obtain warranty service throughout the warranty period. Service will be performed by IBM or by IBM resellers who are authorized to perform warranty service.

Service methods and procedures vary by country, and some services might not be available in all countries. International Warranty Service is delivered through the method of service (such as depot, carry-in, or on-site service) that is provided in the servicing country. Service centers in certain countries might not be able to service all models of a particular machine type. In some countries, fees and restrictions might apply at the time of service.

To determine whether your server product is eligible for International Warranty Service and to view a list of the countries where service is available, go to <http://www.ibm.com/pc/support/>, and click **Warranty Lookup**. Eligible IBM server products are identified by their four-digit machine types. For more information about International Warranty Service, see Service Announcement 601-034 at <http://www.ibm.com/>. Click **Support & downloads**, click **Announcement letters**, and click **Announcements search**. In the **Search by letter number only** field, type 601-034, and click **Search**.

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## **Purchasing additional services**

During and after the warranty period, you can purchase additional services, such as support for IBM and non-IBM hardware, operating systems, and application programs; network setup and configuration; upgraded or extended hardware repair services; and custom installations. Service availability and service name might vary by country or region.

For more information about these services, contact your IBM marketing representative.

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## Important notes

Processor speeds indicate the internal clock speed of the microprocessor; other factors also affect application performance.

CD-ROM drive speeds list the variable read rate. Actual speeds vary and are often less than the maximum possible.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for approximately 1000 bytes, MB stands for approximately 1 000 000 bytes, and GB stands for approximately 1 000 000 000 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity may vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard disk drive bays with the largest currently supported drives available from IBM.

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Some software may differ from its retail version (if available), and may not include user manuals or all program functionality.



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