hp StorageWorks

HSG80 ACS Solution Software Version 8.7 for Windows NT and Windows 2000 Installation and Configuration Guide

Part Number: AA-RFA9G-TE

Seventh Edition (August 2002)

Product Version: 8.7

This guide provides installation and configuration instructions and reference material for operation of the HSG80 ACS Solution Software Version 8.7 for Windows NT and Windows 2000.

1

Contents

About this Guide

1 Planning a Subsystem

3   Preparing the Host System

4 Installing and Configuring HSG Agent

5 FC Configuration Procedures

6 Using CLI for Configuration

7 Backing Up, Cloning, and Moving Data

A Subsystem Profile Templates

B Installing, Configuring, and Removing the Client

C Configuring Windows NT/Windows 2000 Clusters

Glossary

Index

Figures

Tables

About this Guide

This guide describes how to install and configure the HSG80 ACS Solution Software Version 8.7 for Windows NT and Windows 2000.

This guide describes:

- How to plan the storage array subsystem; and,

- How to install and configure the storage array subsystem on individual operating system platforms.

This book does not contain information about the operating environments to which the controller may be connected; nor does it contain detailed information about subsystem enclosures or their components. See the documentation that accompanied these peripherals for information about them.

Intended Audience

This book is intended for use by system administrators and system technicians who have a basic experience with storage and networking.

Related Documentation

In addition to this guide, corresponding information can be found in:

- ACS v8.7 controller documentation (software delivered via PCMCIA cards)

- HSG80 CLI Reference Guide, EK-G80CL-RA.B01

- HSG80 Maintenance and Service Guide, EK-G80MS-SA.B01

- HSG80 Troubleshooting and Reference Guide, EK-G80TR-SA.B01

- SWCC v2.5 documentation (client software delivered in solutions kits)

- Command Console User Guide, AA-RFA2J-TE

- Command Console Release Notes, AV-RPBKB-TE

- Command Console Help Files, AA-RS20A-TE and AA-RS21A-TE

- Host-specific documentation (SWCC Agent and HBA software delivered in solutions kits)

- Installation and Configuration Guide (platform-specific) - the guide you are reading
- Solution Software Release Notes (platform-specific)
- FC-AL Application Note (AA-RS1ZA-TE) - Solution software host support includes the following platforms:
    — IBM AIX
    — HP-UX
    — Linux (Red Hat x86/Alpha, SuSE x86/Alpha, Caldera x86)
    — Novell NetWare
    — Open VMS
    — Sun Solaris
    — Tru64 UNIX
    — Windows NT/2000

Additional support required by HSG80 ACS Solution Software Version 8.7, but delivered through external programs, include the following:

- Heterogeneous "rules based" SAN configurations
- Host-Bus Adapter (HBA) products
- Applicable Storage Utility Management Suite (SUMS) components
- Vendor-specific switch products
- Secure Path Products (Windows, NetWare, Sun, AIX, HP-UX)
- Data Replication Manager (DRM) under ACS 8.7P
- Enterprise Volume Manager (EVM) under ACS 8.7S
- Enterprise Backup Solution (EBS)
- Additional ACS Variants (W, R)

Document Conventions

The conventions included in Table 1 apply.

Table 1: Document Conventions

Element	Convention
Cross-reference links	Blue text: Figure 1
Key names, menu items, buttons, and dialog box titles	**Bold**
File names, application names, and text emphasis	*Italics*
User input, command names, system responses (output and messages)	`Monospace font` `COMMAND NAMES` are uppercase unless they are case sensitive
Variables	*`Monospace, italic font`*
Website addresses	Sans serif font (http://www.compaq.com)

Configuration Flowchart

A three-part flowchart (Figures 1-3) is shown on the following pages. Refer to these charts while installing and configuring a new storage subsystem. All references in the flowcharts pertain to pages in this guide, unless otherwise indicated.

Table 2 below summarizes the content of the chapters.

Table 2: Summary of Chapter Contents

Chapters	Description
1. Planning a Subsystem	This chapter focuses on technical terms and knowledge needed to plan and implement storage array subsystems.
2. Planning Storage Configurations	Plan the storage configuration of your subsystem, using individual disk drives (JBOD), storageset types (mirrorsets, stripesets, and so on), and/or partitioned drives. This chapter describes addressing conventions, configuration rules, creating storage profiles, and creating storage maps.
3. Preparing the host system	How to prepare your Windows NT and Windows 2000 host computer to accommodate the HSG80 controller storage subsystem.
4. Installing, Configuring the HSG Agent	The Agent for HSG for a specific operating system polls the storage.
5. FC Configuration Procedures	How to configure a subsystem that uses Fibre Channel (FC) fabric topology. In fabric topology, the controller connects to its hosts through switches.
6. Configuration using CLI	How-to example of configuring a storage subsystem using the Command Line Interpreter (CLI).
7. Backup, Clone, Move Data	Description of common procedures that are not mentioned elsewhere in this guide. • Backing Up Subsystem Configuration • Cloning Data for Backup • Moving Storagesets

Table 2: Summary of Chapter Contents (Continued)

Chapters	Description
Appendix A. Subsystem Profile Templates	This appendix contains storageset profiles to copy and use to create your system profiles. It also contains an enclosure template to use to help keep track of the location of devices and storagesets in your shelves. Four (4) templates will be needed for the subsystem.
Appendix B. Install, Configure, Remove the Client	The Client monitors and manages a storage subsystem. The following information is included in this appendix: • Why Install the Client? • Before You Install the Client • Installing the Client • Installing Integration Patch • Troubleshooting the Client Installation • Adding Storage Subsystem and its Host to the Navigation Tree • Removing the Command Console Client • Where to Find Additional Information
Appendix C. Configuring Windows NT/Windows 2000 Clusters	This appendix provides step-by-step instructions for installation of the RAID Array RA/MA8000 and ESA/EMA12000 Fibre Channel Cluster for Windows NT/Windows 2000.

```
                              Unpack           See the unpacking instructions
                             subsystem         on shipping box
                                │
                                ▼
                         Plan a Subsystem
                            Chapter 1
                                │
                                ▼
                     Plan Storage Configurations
                              Chapter 2
                                │
                                ▼
                        Prepare Host System
                             Chapter 3
                                │
                                ▼
                        Make Local Connection
                              Page 5-2
                                │
          Single controller          Controller pair
                 │                         │
                 ▼                         ▼
          Cable Controller          Cable Controllers
             Page 5-3                   Page 5-9
                 │                         │
                 ▼                         ▼
        Configure Controller      Configure Controllers
             Page 5-4                  Page 5-11
                 │                         │
                 └────────────┬────────────┘
                              ▼
                          Installing        Yes        ┌───┐   See Figure 3 on page
                            SWCC        ─────────────▶ │ B │   xxvi
                             ?                          └───┘
                              No
                              ▼
                          ┌───┐   See continuation of figure on next page
                          │ A │
                          └───┘
```

Figure 1: General configuration flowchart (panel 1)
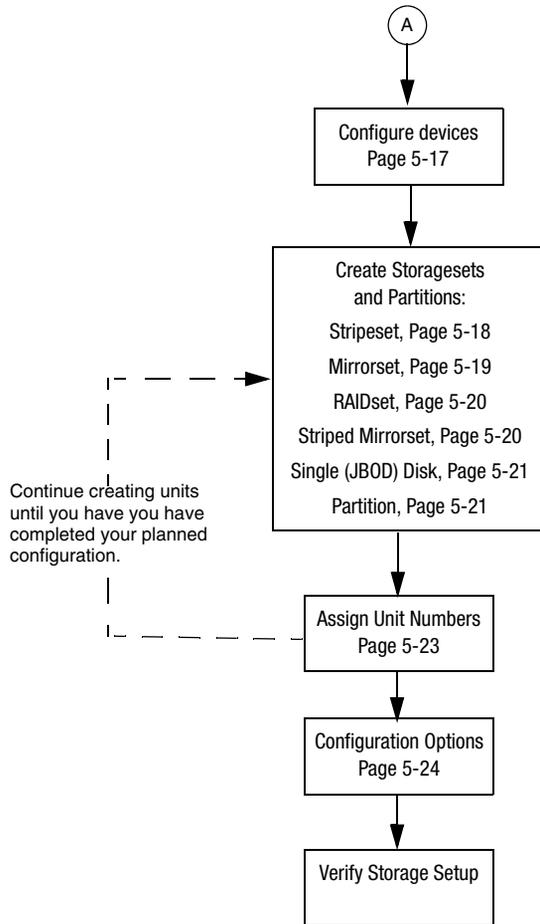
Figure 2: General configuration flowchart (panel 2)
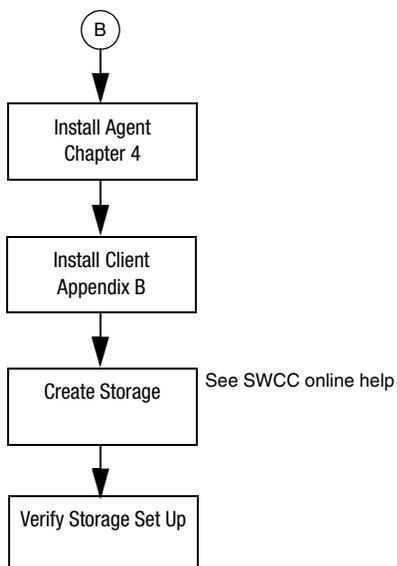
Figure 3: Configuring storage with SWCC

Symbols in Text

These symbols may be found in the text of this guide. They have the following meanings.

WARNING: Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or loss of life.

CAUTION: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or data.

IMPORTANT: Text set off in this manner presents clarifying information or specific instructions.

NOTE: Text set off in this manner presents commentary, sidelights, or interesting points of information.

Symbols on Equipment

Any enclosed surface or area of the equipment marked with these symbols indicates the presence of electrical shock hazards. Enclosed area contains no operator serviceable parts.

WARNING: To reduce the risk of injury from electrical shock hazards, do not open this enclosure.

defined; Any RJ-45 receptacle marked with these symbols indicates a network interface connection.

WARNING: To reduce the risk of electrical shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle.

Any surface or area of the equipment marked with these symbols indicates the presence of a hot surface or hot component. Contact with this surface could result in injury.

WARNING: To reduce the risk of injury from a hot component, allow the surface to cool before touching.

Power supplies or systems marked with these symbols indicate the presence of multiple sources of power.

WARNING: To reduce the risk of injury from electrical shock, remove all power cords to completely disconnect power from the power supplies and systems.

Any product or assembly marked with these symbols indicates that the component exceeds the recommended weight for one individual to handle safely.

WARNING: To reduce the risk of personal injury or damage to the equipment, observe local occupational health and safety requirements and guidelines for manually handling material.

Rack Stability

WARNING: To reduce the risk of personal injury or damage to the equipment, be sure that:

- **The leveling jacks are extended to the floor.**
- **The full weight of the rack rests on the leveling jacks.**
- **In single rack installations, the stabilizing feet are attached to the rack.**
- **In multiple rack installations, the racks are coupled.**
- **Only one rack component is extended at any time. A rack may become unstable if more than one rack component is extended for any reason.**

Getting Help

If you still have a question after reading this guide, contact an authorized service provider or access our website.

Technical Support

In North America, call technical support at 1-800-OK-COMPAQ, available 24 hours a day, 7 days a week.

NOTE: For continuous quality improvement, calls may be recorded or monitored.

Outside North America, call technical support at the nearest location. Telephone numbers for worldwide technical support are listed on the following website: http://www.compaq.com.

Be sure to have the following information available before calling:

• Technical support registration number (if applicable)

• Product serial numbers

• Product model names and numbers

• Applicable error messages

• Operating system type and revision level

• Detailed, specific questions

Storage Website

The Storage website has the latest information on this product, as well as the latest drivers. Access the Storage website at: http://www.compaq.com/storage. From this website, select the appropriate product or solution.

Authorized Reseller

For the name of your nearest Authorized Reseller:

• In the United States, call 1-800-345-1518

• In Canada, call 1-800-263-5868

• Elsewhere, see the Storage website for locations and telephone numbers

---

1

Planning a Subsystem

This chapter provides information that helps you plan how to configure the storage array subsystem. This chapter focuses on the technical terms and knowledge needed to plan and implement storage subsystems.

NOTE: This chapter frequently references the command line interface (CLI). For the complete syntax and descriptions of the CLI commands, see the *StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide*.

The following information is included in this chapter:

- "Defining Subsystems," page 1–2
- "What is Failover Mode?," page 1–5
- "Selecting a Cache Mode," page 1–9
- "Enabling Mirrored Caching," page 1–10
- "What is the Command Console LUN?," page 1–11
- "Determining Connections," page 1–12
- "Assigning Unit Numbers," page 1–16
- "What is Selective Storage Presentation?," page 1–21

IMPORTANT: DILX should be run for ten minutes on all units to delete the 8 MB EISA partition. Refer to *StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide* for details.

Refer to Chapter 2 when planning the types of storage containers you need. Storage containers are individual disk drives (JBOD), storageset types (mirrorsets, stripesets, and so on), and/or partitioned drives.

Defining Subsystems

This section describes the terms *this controller* and *other controller*. It also presents graphics of the Model 2200 and BA370 enclosures.

NOTE: The HSG80 controller uses the BA370 or Model 2200 enclosure.

Controller Designations A and B

The terms A, B, "this controller," and "other controller," respectively are used to distinguish one controller from another in a two-controller (also called dual-redundant) subsystem.

Controllers and cache modules are designated either A or B depending on their location in the enclosure, as shown in Figure 1–1 for the Model 2200 enclosure and in Figure 1–2 for the BA370 enclosure.

Model 2200 Enclosure

CXO6323C

❶ ECBs
❷ Fans
❸ EMU

CXO7365A

❹ Power supplies
❺ I/O modules
❻ Controller A
❼ Controller B
❽ Cache module A
❾ Cache module B
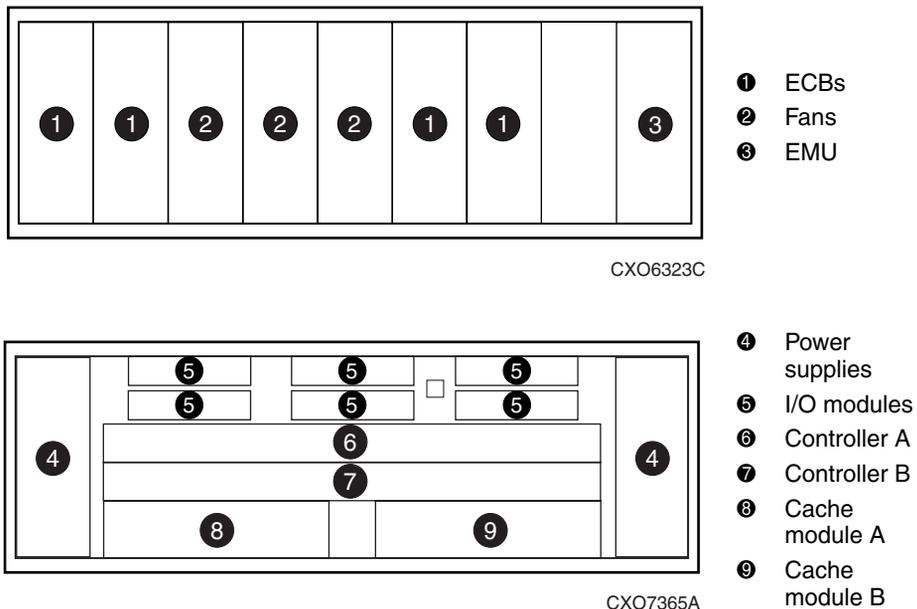
Figure 1–1: Location of controllers and cache modules in a Model 2200 enclosure

BA370 Enclosure

❶	EMU
❷	PVA
❸	Controller A
❹	Controller B
❺	Cache module A
❻	Cache module B

CXO6283B
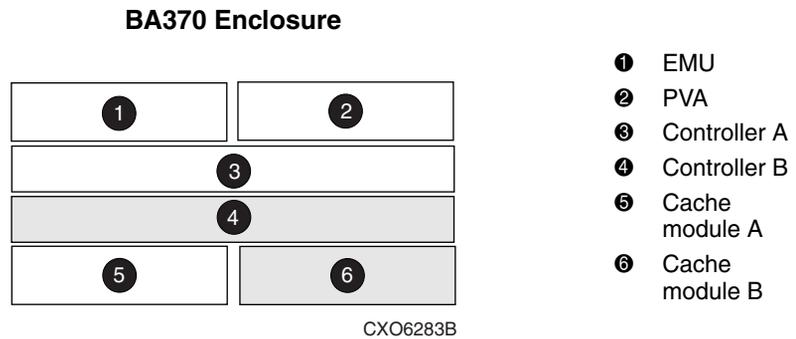
Figure 1–2: Location of controllers and cache modules in a BA370 enclosure

Controller Designations "This Controller" and "Other Controller"

Some CLI commands use the terms "this" and "other" to identify one controller or the other in a dual-redundant pair. These designations are a shortened form of "this controller" and "other controller." These terms are defined as follows:

- "**this controller**"—the controller that is the focus of the CLI session. "This controller" is the controller to which the maintenance terminal is attached and through which the CLI commands are being entered. "This controller" can be abbreviated to "this" in CLI commands.

- "**other controller**"—the controller that is not the focus of the CLI session and through which CLI commands are not being entered. "Other controller" can be abbreviated to "other" in CLI commands.

Figure 1–3 shows the relationship between "this controller" and "other controller" in a Model 2200 enclosure. Figure 1–4 shows the same relationship in a BA370 enclosure.

Model 2200 Enclosure
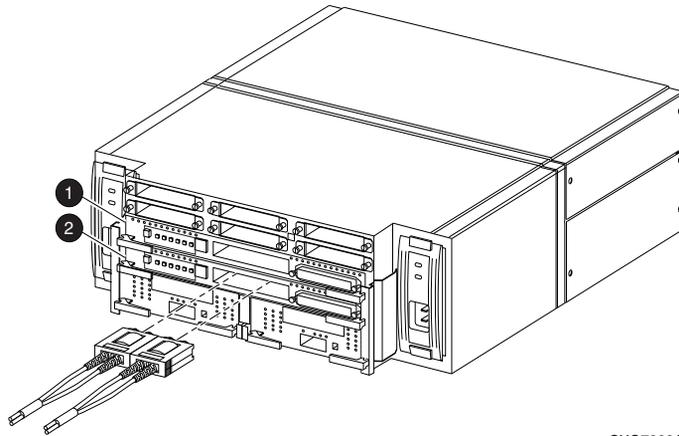
❶ This controller   ❷ Other controller

Figure 1–3: "This controller" and "other controller" for the Model 2200 enclosure
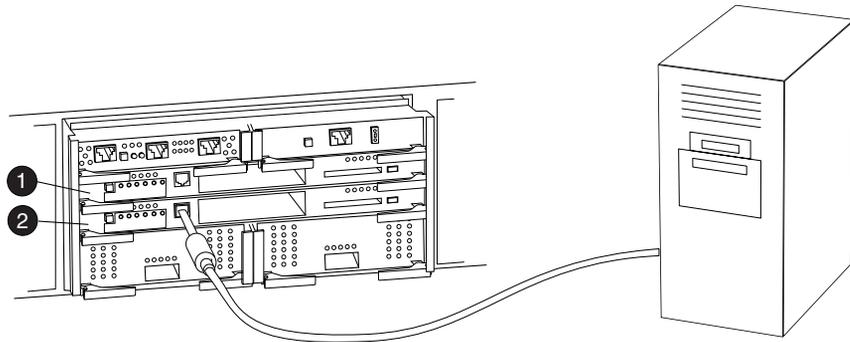
BA370 Enclosure

❶ Other controller   ❷ This controller

Figure 1–4: "This controller" and "other controller" for the BA370 enclosure

What is Failover Mode?

Failover is a way to keep the storage array available to the host if one of the controllers becomes unresponsive. A controller can become unresponsive because of a controller hardware failure or, in multiple-bus mode only, due to a failure of the link between host and controller or host-bus adapter. Failover keeps the storage array available to the hosts by allowing the surviving controller to take over total control of the subsystem.

There are two failover modes:

*   **Transparent**, which is handled by the surviving controller and is invisible (transparent) to the hosts.

*   **Multiple-bus**, which is handled by the surviving controller and which is handled by the hosts through either additional software or as a feature of the operating system.

Either mode of failover can work with loop or fabric topology.

NOTE: Multiple-bus failover mode is only supported when Secure Path is used. Refer to the Secure Path documentation for more information on using multiple-bus mode.

Transparent Failover Mode

Transparent failover mode has the following characteristics:

*   Hosts do not know failover has taken place

*   Units are divided between host ports 1 and 2

A unit or storageset is a physical or virtual device of the subsystem. It is typically assigned a logical unit number (LUN) and is managed by the HSG80 controller and presented to a server through the Fibre Channel bus and the server's host bus adapter. Disks that are set up as independent disks (JBODs) or RAIDsets are referred to as storagesets.

In transparent failover mode, host port 1 of controller A and host port 1 of controller B must be on the same Fibre Channel link. Host port 2 of controller A and host port 2 of controller B must also be on the same Fibre Channel link. Depending on operating system restrictions and requirements, the port 1 link and the port 2 link can be separate links, or they can be the same link.

At any time, host port 1 is active on only one controller, and host port 2 is active on only one controller. The other ports are in standby mode. In normal operation, both host port 1 on controller A and host port 2 on controller B are active. A representative

configuration is shown in Figure 1–5. The active and standby ports share port identity, enabling the standby port to take over for the active one. If one controller fails, its companion controller (known as the surviving controller) takes control by making both its host ports active, as shown in Figure 1–6.

Units are divided between the host ports:

- Units 0-99 are on host port 1 of both controllers (but accessible only through the active port).

- Units 100-199 are on host port 2 of both controllers (but accessible only through the active port).

Transparent failover only compensates for a controller failure, and not for failures of either the Fibre Channel link or host Fibre Channel adapters.
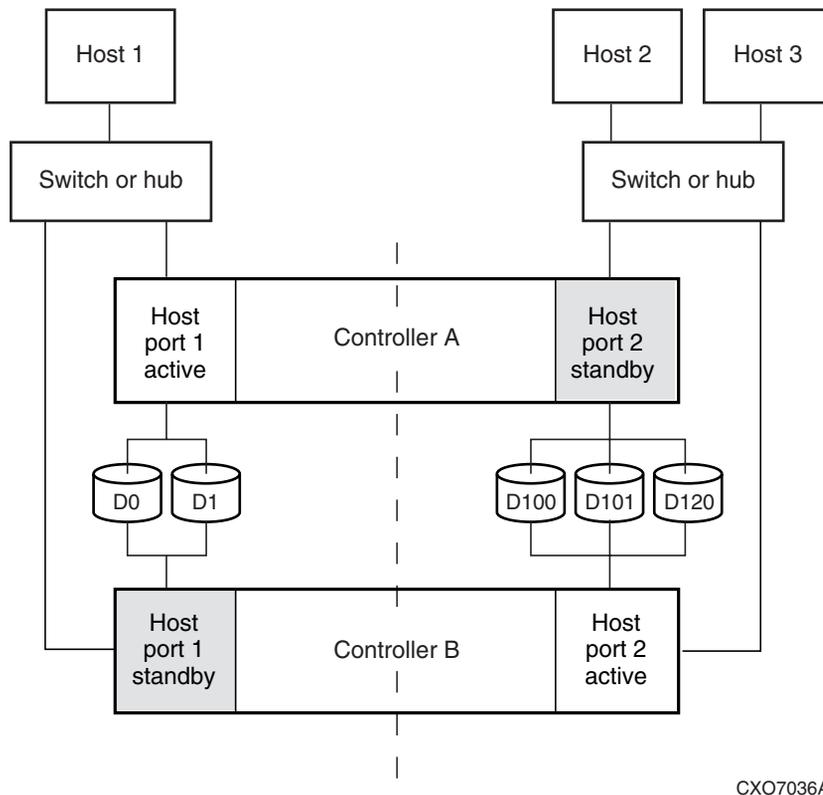
CXO7036A

Figure 1–5: Transparent failover—normal operation
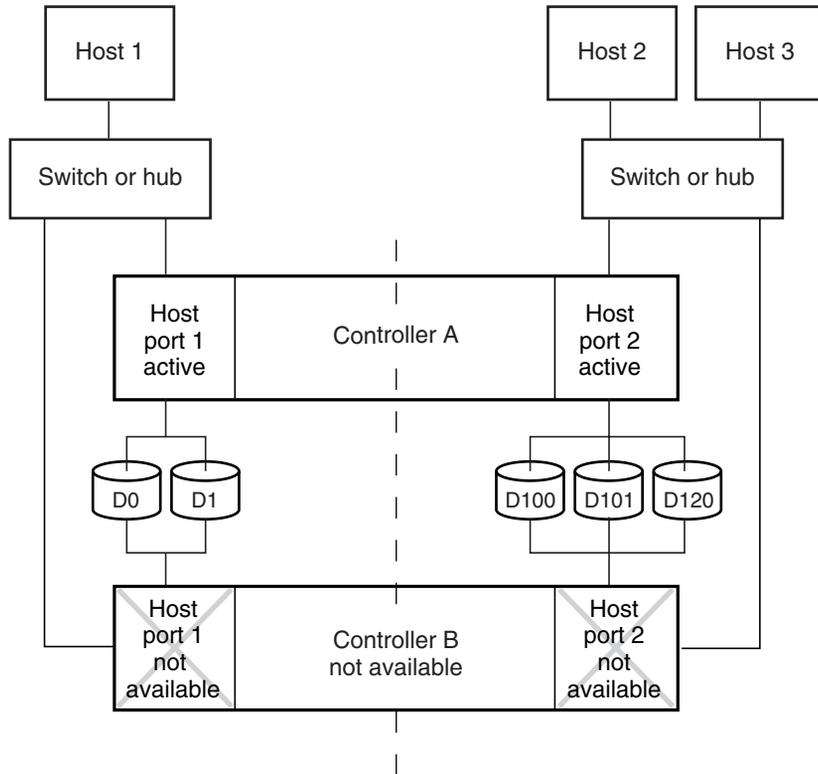
CXO7035A

Figure 1–6: Transparent failover—after failover from controller B to controller A

Multiple-Bus Failover Mode

Multiple-bus failover mode has the following characteristics:

- Host controls the failover process by moving the units from one controller to another

- All units (0 through 199) are visible at all host ports

- Each host has two or more paths to the units

All hosts must have operating system software that supports multiple-bus failover mode. With this software, the host sees the same units visible through two (or more) paths. When one path fails, the host can issue commands to move the units from one path to another. A typical multiple-bus failover configuration is shown in Figure 1–7.

In multiple-bus failover mode, you can specify which units are normally serviced by a specific controller of a controller pair. Units can be preferred to one controller or the other by the *PREFERRED_PATH* switch of the ADD UNIT (or SET *unit*) command. For example, use the following command to prefer unit D101 to "this controller":

```
SET D101 PREFERRED_PATH=THIS_CONTROLLER
```

NOTE: This is an initial preference, which can be overridden by the hosts.

Keep the following points in mind when configuring controllers for multiple-bus failover:

- Multiple-bus failover can compensate for a failure in any of the following:
  — Controller
  — Switch or hub
  — Fibre Channel link
  — Host Fibre Channel adapter
- A host can redistribute the I/O load between the controllers
- All hosts must have operating system software that supports multiple-bus failover mode

```
         ┌─────────────┐      ┌─────────────┐      ┌─────────────┐
         │   Host 1    │      │   Host 2    │      │   Host 3    │
         │   "RED"     │      │   "GREY"    │      │   "BLUE"    │
         │ FCA1 │ FCA2 │      │ FCA1 │ FCA2 │      │ FCA1 │ FCA2 │
         └─────────────┘      └─────────────┘      └─────────────┘
```
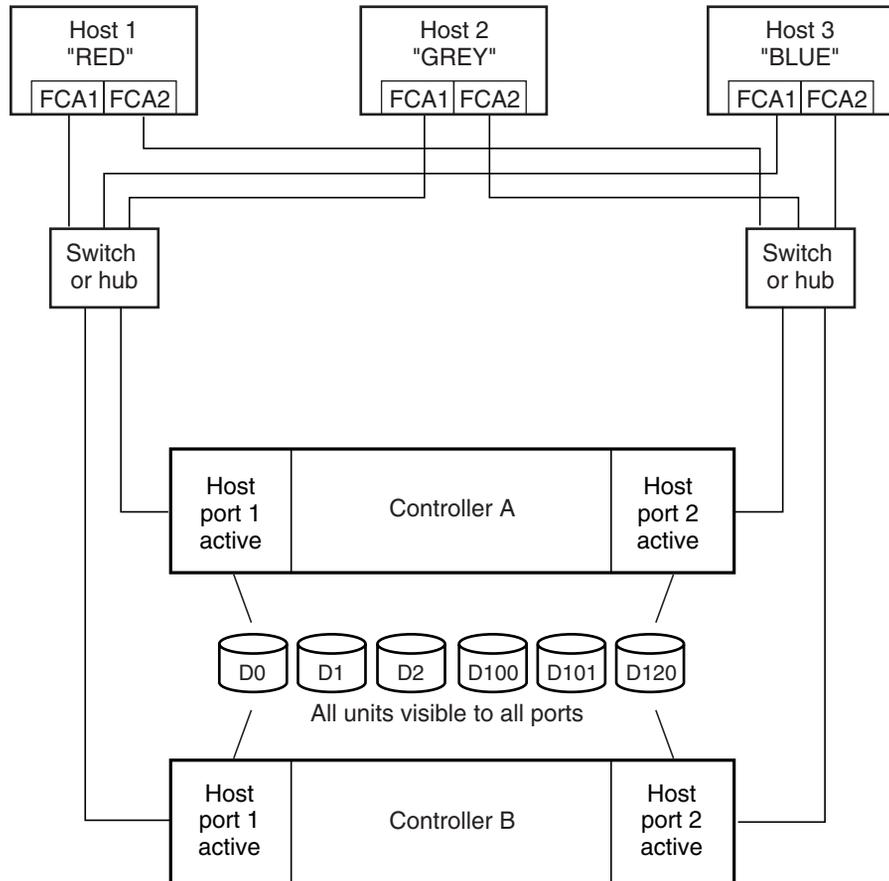
NOTE: FCA = Fibre Channel Adapter

CXO7094B

Figure 1–7: Typical multiple-bus configuration

Selecting a Cache Mode

The cache module supports read, read-ahead, write-through, and write-back caching techniques. The cache technique is selected separately for each unit. For example, you can enable only read and write-through caching for some units while enabling only write-back caching for other units.

Read Caching

When the controller receives a read request from the host, it reads the data from the disk drives, delivers it to the host, and stores the data in its cache module. Subsequent reads for the same data will take the data from cache rather than accessing the data from the disks. This process is called read caching.

Read caching can improve response time to many of the host's read requests. By default, read caching is enabled for all units.

Read-Ahead Caching

During read-ahead caching, the controller anticipates subsequent read requests and begins to prefetch the next blocks of data from the disks as it sends the requested read data to the host. This is a parallel action. The controller notifies the host of the read completion, and subsequent sequential read requests are satisfied from the cache memory. By default, read-ahead caching is enabled for all units.

Write-Back Caching

Write-back caching improves the subsystem's response time to write requests by allowing the controller to declare the write operation complete as soon as the data reaches cache memory. The controller performs the slower operation of writing the data to the disk drives at a later time.

By default, write-back caching is enabled for all units, but only if there is a backup power source for the cache modules (either batteries or an uninterruptable power supply).

Write-Through Caching

Write-through caching is enabled when write-back caching is disabled. When the controller receives a write request from the host, it places the data in its cache module, writes the data to the disk drives, then notifies the host when the write operation is complete. This process is called write-through caching because the data actually passes through—and is stored in—the cache memory on its way to the disk drives.

Enabling Mirrored Caching

In mirrored caching, half of each controller's cache mirrors the companion controller's cache, as shown in Figure 1–8.

The total memory available for cached data is reduced by half, but the level of protection is greater.

Cache module A   Cache module B

CXO5729A
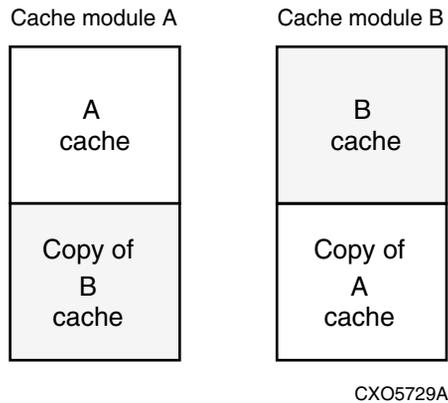
Figure 1–8: Mirrored caching

Before enabling mirrored caching, make sure the following conditions are met:

- Both controllers support the same size cache.

- Diagnostics indicate that both caches are good.

- No unit errors are outstanding, for example, lost data or data that cannot be written to devices.

- Both controllers are started and configured in failover mode.

What is the Command Console LUN?

StorageWorks Command Console (SWCC) software communicates with the HSG80 controllers through an existing storage unit, or logical unit number (LUN). The dedicated LUN that SWCC uses is called the Command Console LUN (CCL). The CCL serves as the communication device for the HS-Series Agent and identifies itself to the host by a unique identification string. By default, a CCL device is enabled within the HSG80 controller on host port 1. The HSG80 uses both SCSI-2 or SCSI-3 with your platform. The CCL behaves differently for each and Windows NT and Windows 2000 have specific requirements for CCL behavior. See Chapter 3 for a more detailed explanation.

The CCL does the following:

- Allows the RAID Array to be recognized by the host as soon as it is attached to the SCSI bus and configured into the operating system.

- Serves as a communications device for the HS-Series Agent. The CCL identifies itself to the host by a unique identification string.

In dual-redundant controller configurations, the commands described in the following sections alter the setting of the CCL on both controllers. The CCL is enabled only on host port 1. At least one storage device of any type must be configured on host port 2 before installing the Agent on a host connected to host port 2.

Select a storageset that you plan to configure and that is not likely to change. This storageset can be used by the Agent to communicate with the RAID Array. Deleting this storageset (LUN) later breaks the connection between the Agent and the RAID Array.

Determining the Address of the CCL

CCL is enabled by default. Its address can be determined by entering the following CLI command:

```
HSG80 > SHOW THIS_CONTROLLER
```

Enabling/Disabling CCL in SCSI-3 Mode

The CCL is enabled all the time. There is no option to enable/disable.

Determining Connections

The term "connection" applies to every path between a Fibre Channel adapter in a host computer and an active host port on a controller.

NOTE: In ACS Version 8.7, the maximum number of supported connections is 96.

Naming Connections

It is highly recommended that you assign names to connections that have meaning in the context of your particular configuration. One system that works well is to name each connection after its host, its adapter, its controller, and its controller host port, as follows:

HOST1A1

HOST
NAME
PORT
CONTROLLER
ADAPTER
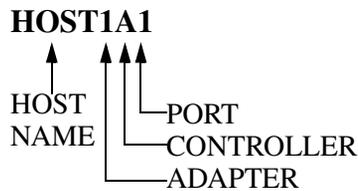
Examples:

A connection from the first adapter in the host named RED that goes to port 1 of controller A would be called RED1A1.

A connection from the third adapter in host GREEN that goes to port 2 of controller B would be called GREEN3B2.

NOTE: Connection names can have a maximum of 9 characters.

Numbers of Connections

The number of connections resulting from cabling one adapter into a switch or hub depends on failover mode and how many links the configuration has:

- If a controller pair is in transparent failover mode and the port 1 link is separate from the port 2 link (that is, ports 1 of both controllers are on one loop or fabric, and port 2 of both controllers are on another), each adapter will have one connection, as shown in Figure 1–9.

- If a controller pair is in transparent failover mode and port 1 and port 2 are on the same link (that is, all ports are on the same loop or fabric), each adapter will have two connections, as shown in Figure 1–10.

- If a controller pair is in multiple-bus failover mode, each adapter has two connections, as shown in Figure 1–11.
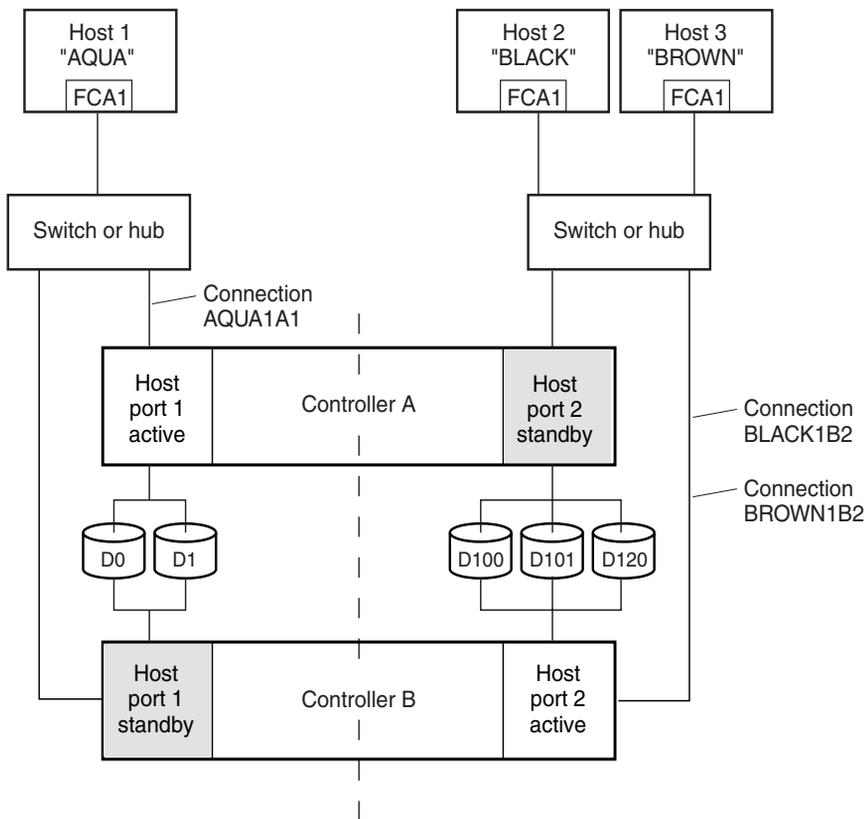
NOTE: FCA = Fibre Channel Adapter

CXO7081B

Figure 1−9: Connections in separate-link, transparent failover mode configurations
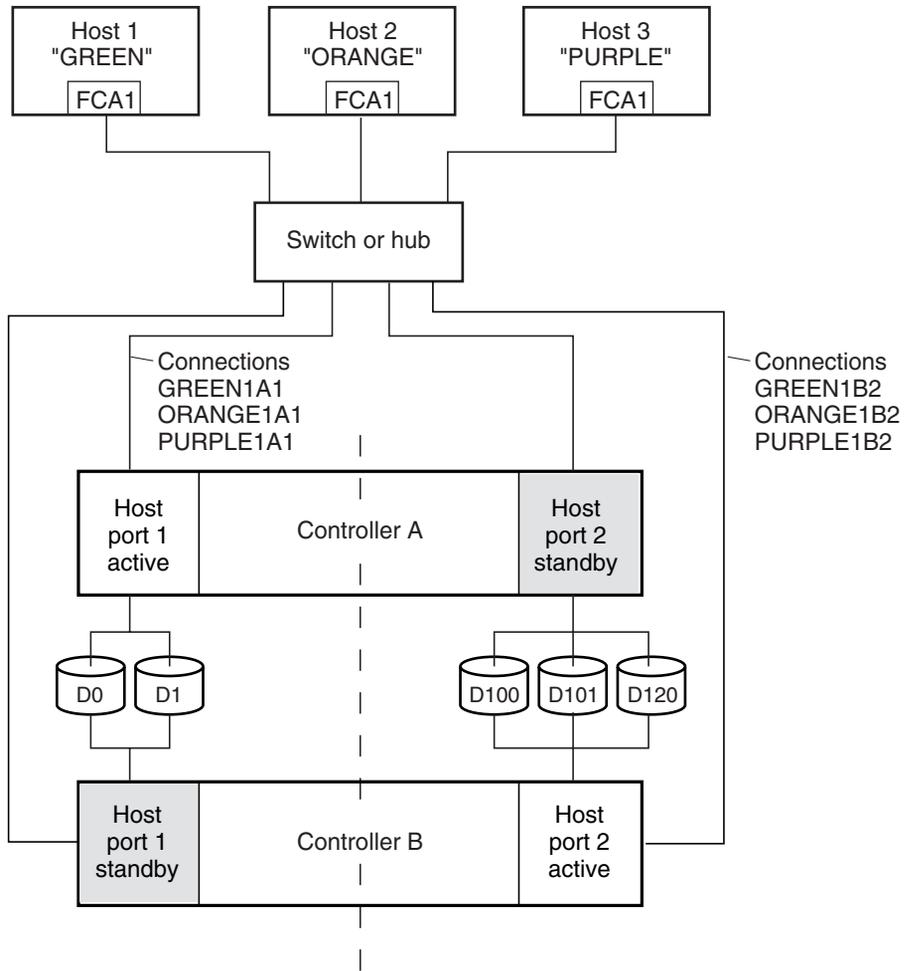
NOTE: FCA = Fibre Channel Adapter

CXO7079B

Figure 1–10: Connections in single-link, transparent failover mode configurations
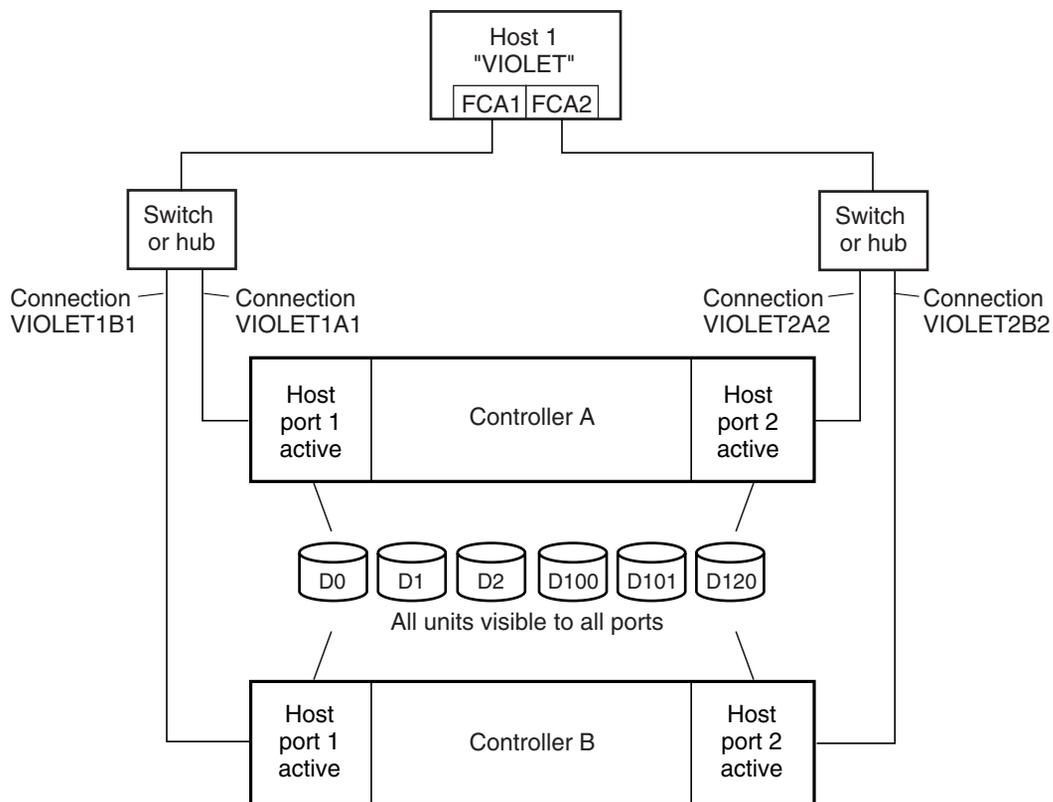
NOTE: FCA = Fibre Channel Adapter

CXO7080B

Figure 1–11: Connections in multiple-bus failover mode

Assigning Unit Numbers

The controller keeps track of the unit with the unit number. The unit number can be from 0–199 prefixed by a D, which stands for disk drive. A unit can be presented as different LUNs to different connections. The interaction of a unit and a connection is determined by several factors:

- Failover mode of the controller pair

- The *ENABLE_ACCESS_PATH* and *PREFERRED_PATH* switches in the ADD UNIT (or SET *unit*) commands

- The *UNIT_OFFSET* switch in the ADD CONNECTIONS (or SET *connections*) commands

- The controller port to which the connection is attached

- The *SCSI_VERSION* switch of the SET *THIS_CONTROLLER/OTHER_CONTROLLER* command

The considerations for assigning unit numbers are discussed in the following sections.

Matching Units to Host Connections in Transparent Failover Mode

In transparent failover mode, the ADD UNIT command creates a unit for host connection to access and assigns it to either port 1 or port 2 of both controllers.

Unit numbers are assigned to ports as follows:

- 0–99 are assigned to host port 1 of both controllers.

- 100–199 are assigned to host port 2 of both controllers.

For example, unit D2 is on port 1, and unit D102 is available through port 2.

The LUN number that a host connection assigns to a unit is a function of the *UNIT_OFFSET* switch of the ADD (or SET) CONNECTIONS command. The relationship of offset, LUN number, and unit number is shown in the following equation:

LUN number = unit number – offset

Where...

— LUN number is relative to the host (what the host sees the unit as)

— Unit number is relative to the controller (what the controller sees the unit as)

If no value is specified for offset, then connections on port 1 have a default offset of 0 and connections on port 2 have a default offset of 100.

For example, if all host connections use the default offset values, unit D2 will be presented to a port 1 host connection as LUN 2 (unit number of 2 minus offset of 0). Unit D102 will be presented to a port 2 host connection as LUN 2 (unit number of D102 minus offset of 100).

Figure 1–12 shows how units are presented as different LUNs, depending on the offset of the host. In this illustration, host connection 1 and host connection 2 would need to be on host port 1; host connection 3 would need to be on host port 2.

Controller units	Host connection 1 Offset: 0	Host connection 2 Offset: 20	Host connection 3 Offset: 100
D0	LUN 0		
D1	LUN 1		
D2	LUN 2		
D3	LUN 3		
D20	LUN 20	LUN 0	
D21	LUN 21	LUN 1	
D100			LUN 0
D101			LUN 1
D102			LUN 2
D130			LUN 30
D131			LUN 31

CXO6455B

Figure 1–12: LUN presentation to hosts, as determined by offset

Offsets other than the default values can be specified. For example, unit D17 would be visible to a host connection on port 1 that had an offset of 10 as LUN 7 (unit number of 17 minus offset of 10). The unit would not be visible to a host connection with a unit offset of 18 or greater, because that offset is not within the unit's range (unit number of 17 minus offset of 18 is a negative number).

Similarly, unit D127 would be visible to a host connection on port 2 that had an offset of 120 as LUN 7 (unit number of 127 minus offset of 120). The unit would not be visible to a host connection with a unit offset of 128 or greater, because that offset is not within the unit's range (unit number of 127 minus offset of 128 is a negative number).

An additional factor to consider when assigning unit numbers and offsets is SCSI version. If the SCSI_VERSION switch of the SET *THIS_CONTROLLER/OTHER_CONTROLLER* command is set to SCSI-3, the CCL is presented as LUN 0 to every connection, superseding any unit assignments. The interaction between SCSI version and unit numbers is explained further in the next section.

In addition, the access path to the host connection must be enabled for the connection to access the unit. See "Restricting Host Access in Transparent Failover Mode," page 1–21.

Matching Units to Host Connections in Multiple-Bus Failover Mode

In multiple-bus failover mode, the ADD UNIT command creates a unit for host connections to access. All unit numbers (0 through 199) are potentially visible on all four controller ports, but are accessible only to those host connections for which access path is enabled and which have offsets in the unit's range.

The LUN number a host connection assigns to a unit is a function of the *UNIT_OFFSET* switch of the ADD (or SET) CONNECTIONS command. The default offset is 0. The relationship of offset, LUN number, and unit number is shown in the following equation:

LUN number = unit number – offset

Where...

— LUN number is relative to the host (number the host sees the unit as)

— Unit number is relative to the controller (number the controller sees the unit as)

For example, unit D7 would be visible to a host connection with an offset of 0 as LUN 7 (unit number of 7 minus offset of 0). Unit D17 would be visible to a host connection with an offset of 10 as LUN 7 (unit number of 17 minus offset of 10). The unit would not be visible at all to a host connection with a unit offset of 18 or greater, because that offset is not within the units range (unit number of 17 minus offset of 18 is a negative number).

In addition, the access path to the host connection must be enabled for the connection to access the unit. This is done through the *ENABLE_ACCESS_PATH* switch of the ADD UNIT (or SET *unit*) command.

The *PREFERRED_PATH* switch of the ADD UNIT (or SET *unit*) command determines which controller of a dual-redundant pair initially accesses the unit. Initially, *PREFERRED_PATH* determines which controller presents the unit as Ready. The other controller presents the unit as Not Ready. Hosts can issue a SCSI Start Unit command to move the unit from one controller to the other.

Assigning Unit Numbers Depending on SCSI_VERSION

The SCSI_VERSION switch of the SET *THIS_CONTROLLER/OTHER_CONTROLLER* command determines how the CCL is presented. There are two choices: SCSI-2 and SCSI-3. The choice for SCSI_VERSION affects how certain unit numbers and certain host connection offsets interact.

Assigning Host Connection Offsets and Unit Numbers in SCSI-3 Mode

If SCSI_VERSION is set to SCSI-3, the CCL is presented as LUN 0 to all connections. The CCL supersedes any other unit assignment. Therefore, in SCSI-3 mode, a unit that would normally be presented to a connection as LUN 0 is not visible to that connection at all.

The following methods are recommended for assigning host connection offsets and unit numbers in SCSI-3 mode:

- Offsets should be divisible by 10 (for consistency and simplicity).

- Unit numbers should not be assigned at connection offsets (to avoid being masked by the CCL at LUN 0).

For example, if a host connection has an offset of 20 and SCSI-3 mode is selected, the connection will see LUNs as follows:

LUN 0 - CCL

LUN 1 - unit 21

LUN 2 - unit 22, etc.

In this example, if a unit 20 is defined, it will be superseded by the CCL and invisible to the connection.

Assigning Host Connection Offsets and Unit Numbers in SCSI-2 Mode

Some operating systems expect or require a disk unit to be at LUN 0. In this case, it is necessary to specify SCSI-2 mode.

If *SCSI_VERSION* is set to SCSI-2 mode, the CCL floats, moving to the first available LUN location, depending on the configuration.

StorageWorks recommends to use the following conventions when assigning host connection offsets and unit numbers in SCSI-2 mode:

- Offsets should be divisible by 10 (for consistency and simplicity).

- Unit numbers should be assigned at connection offsets (so that every host connection has a unit presented at LUN 0).

Table 1–1 summarizes the recommendations for unit assignments based on the SCSI_VERSION switch.

Table 1–1: Unit Assignments and SCSI_VERSION

SCSI_VERSION	Offset	Unit Assignment	What the connection sees LUN 0 as
SCSI-2	Divisible by 10	At offsets	Unit whose number matches offset
SCSI-3	Divisible by 10	Not at offsets	CCL

What is Selective Storage Presentation?

Selective Storage presentation is a feature of the HSG80 controller that enables the user to control the allocation of storage space and shared access to storage across multiple hosts. This is also known as *Restricting Host Access*.

In a subsystem that is attached to more than one host or if the hosts have more than one adapter, it is possible to reserve certain units for the exclusive use of certain host connections.

For a controller pair, the method used to restrict host access depends on whether the controllers are in transparent or multiple-bus failover mode. For a single controller, the methods are the same as for a controller pair in transparent failover.

NOTE: The default condition is ENABLE_ACCESS_PATH=ALL. This specifies that access paths to ALL hosts are enabled. StorageWorks recommends that the user restrict host access and that the access path be carefully specified to avoid providing undesired host connections access to the unit.

Restricting Host Access in Transparent Failover Mode

Three methods can be used to restrict host access to storage units in transparent failover mode:

- Using separate Fibre Channel links (either loop or fabric)

- Enabling the access path of selected host connections on a shared loop or fabric

- Setting offsets

NOTE: These techniques also work for a single controller.

Restricting Host Access by Separate Links

In transparent failover mode, host port 1 of controller A and host port 1 of controller B share a common Fibre Channel link. Host port 2 of controller A and host port 2 of controller B also share a common Fibre Channel link. If the host 1 link is separate from the host 2 link, the simplest way to limit host access is to have one host or set of hosts on the port 1 link, and another host or set of hosts on the port 2 link. Each host can then see only units assigned to its respective controller port. This separation of host buses is shown in Figure 1–13. This method applies only if the host 1 link and host 2 link are separate links.

NOTE: It is highly recommended that you provide access to only specific connections. This way, if new connections are added, they will not have automatic access to all units. See the following section Restricting Host Access by Disabling Access Paths.
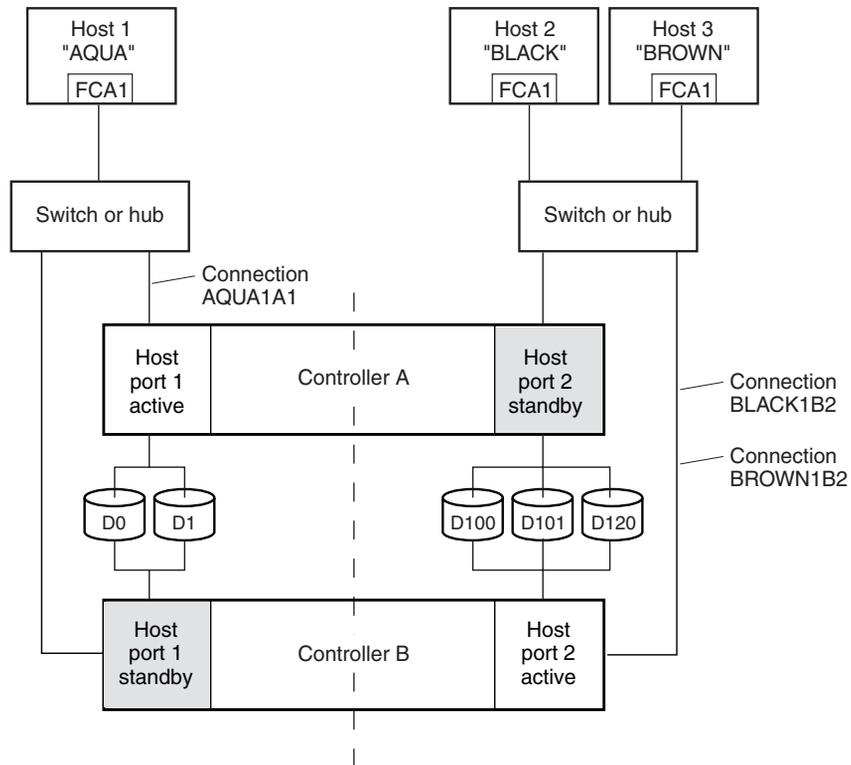
NOTE: FCA = Fibre Channel Adapter

CXO7081B

Figure 1–13: Limiting host access in transparent failover mode

Restricting Host Access by Disabling Access Paths

If more than one host is on a link (that is, attached to the same port), host access can be limited by enabling the access of certain host connections and disabling the access of others. This is done through the *ENABLE_ACCESS_PATH* and *DISABLE_ACCESS_PATH* switches of the ADD UNIT (or SET *unit*) commands. The access path is a unit switch, meaning it must be specified for each unit. Default access enables the unit to be accessible to all hosts.

For example:

In Figure 1–14, restricting the access of unit D101 to host 3, the host named BROWN can be done by enabling only the connection to host 3. Enter the following commands:

```
SET D101 DISABLE_ACCESS_PATH=ALL
SET D101 ENABLE_ACCESS_PATH=BROWN1B2
```

If the storage subsystem has more than one host connection, carefully specify the access path to avoid providing undesired host connections access to the unit. The default condition for a unit is that access paths to all host connections are enabled. To restrict host access to a set of host connections, specify *DISABLE_ACCESS_PATH=ALL* for the unit, then specify the set of host connections that are to have access to the unit.

Enabling the access path to a particular host connection does not override previously enabled access paths. All access paths previously enabled are still valid; the new host connection is simply added to the list of connections that can access the unit.

NOTE: The procedure of restricting access by enabling all access paths then disabling selected paths is **not recommended** because of the potential data/security breach that occurs when a new host connection is added.

Restricting Host Access by Offsets

Offsets establish the start of the range of units that a host connection can access.

For example:

In Figure 1–13, assume both host connections on port 2 (connections BLACK1B2 and BROWN1B2) initially have the default port 2 offset of 100. Setting the offset of connection BROWN1B2 to 120 will present unit D120 to host BROWN as LUN 0.

```
SET BROWN1B2 UNIT_OFFSET=120
```

Host BROWN cannot see units lower than its offset, so it cannot access units D100 and D101. However, host BLACK can still access D120 as LUN 20 if the operating system permits. To restrict access of D120 to only host BROWN, enable only host BROWN's access, as follows:

```
SET D120 DISABLE_ACCESS_PATH=ALL
SET D120 ENABLE_ACCESS_PATH=BROWN1B2
```

NOTE: StorageWorks recommends that you provide access to only specific connections, even if there is just one connection on the link. This way, if new connections are added, they will not have automatic access to all units.

Restricting Host Access in Multiple-Bus Failover Mode

In multiple-bus mode, the units assigned to any port are visible to all ports. There are two ways to limit host access in multiple-bus failover mode:

- Enabling the access path of selected host connections
- Setting offsets

Enable the Access Path of Selected Host Connections

Host access can be limited by enabling the access of certain host connections and disabling the access of others. This is done through the *ENABLE_ACCESS_PATH* and *DISABLE_ACCESS_PATH* switches of the ADD UNIT (or SET *unit*) commands. Access path is a unit switch, meaning it must be specified for each unit. Default access means that the unit is accessible to all hosts. It is important to remember that at least two paths between the unit and the host must be enabled in order for multiple-bus failover to work.
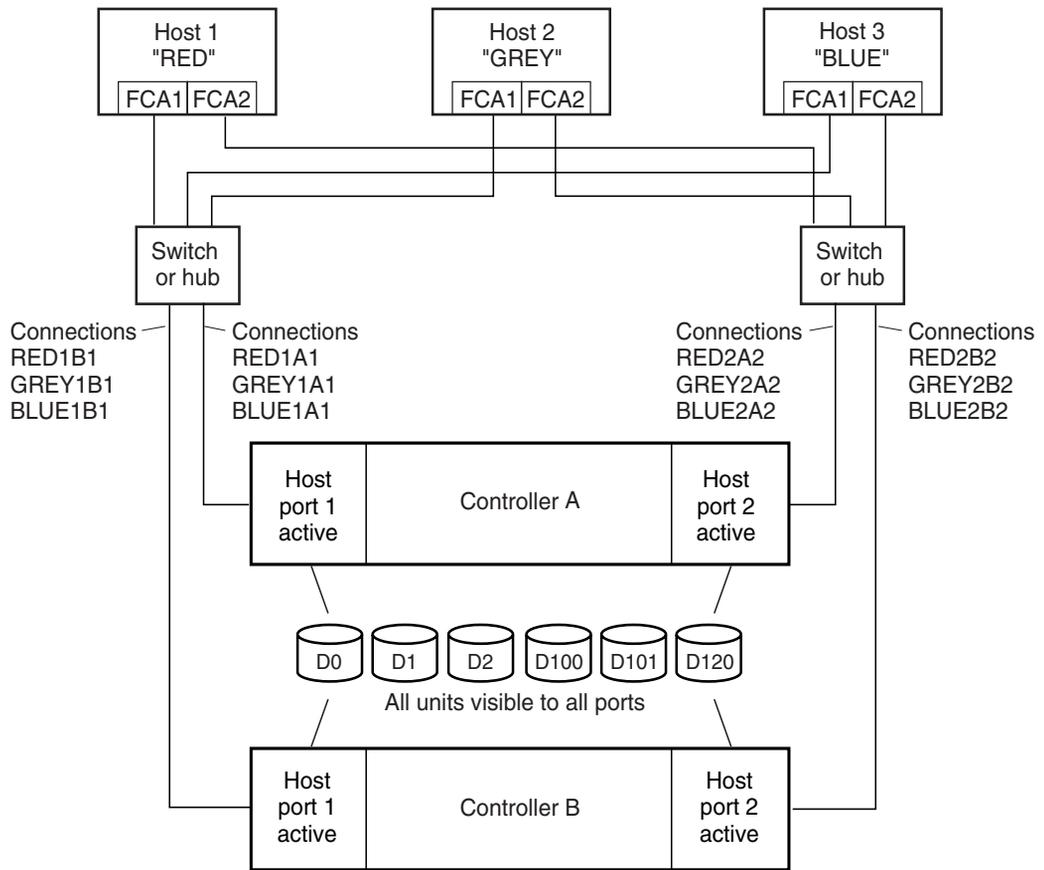
NOTE: FCA = Fibre Channel Adapter

CXO7078B

Figure 1–14: Limiting host access in multiple-bus failover mode

For example:

Figure 1–14 shows a representative multiple-bus failover configuration. Restricting the access of unit D101 to host BLUE can be done by enabling only the connections to host BLUE. At least two connections must be enabled for multiple-bus failover to work. For most operating systems, it is desirable to have all connections to the host enabled. To enable all connections for host BLUE, enter the following commands:

```
SET D101 DISABLE_ACCESS_PATH=ALL
SET D101 ENABLE_ACCESS_PATH=BLUE1A1,BLUE1B1,BLUE2A2,BLUE2B2
```

To enable only two connections for host BLUE (if it is a restriction of the operating system), select two connections that use different adapters, different switches or hubs, and different controllers:

```
SET D101 DISABLE_ACCESS_PATH=ALL
SET D101 ENABLE_ACCESS_PATH=(BLUE1A1, BLUE2B2)
```

or

```
SET D101 DISABLE_ACCESS_PATH=ALL
SET D101 ENABLE_ACCESS_PATH=(BLUE1B1, BLUE2A2)
```

If the storage subsystem has more than one host connection, the access path must be specified carefully to avoid giving undesirable host connections access to the unit. The default condition for a unit is that access paths to all host connections are enabled. To restrict host access to a set of host connections, specify *DISABLE_ACCESS_PATH=ALL* when the unit is added, then use the SET *unit* command to specify the set of host connections that are to have access to the unit.

Enabling the access path to a particular host connection does not override previously enabled access paths. All access paths previously enabled are still valid; the new host connection is simply added to the list of connections that can access the unit.

IMPORTANT: The procedure of restricting access by enabling all access paths then disabling selected paths is **not recommended** because of the potential data/security breach that occurs when a new host connection is added.

Restricting Host Access by Offsets

Offsets establish the start of the range of units that a host connection can access. However, depending on the operating system, hosts that have lower offsets may be able to access the units in the specified range.

NOTE: All host connections to the same host computer must be set to the same offset.

For example:

In Figure 1–14, assume all host connections initially have the default offset of 0. Giving all connections access to host BLUE, an offset of 120 will present unit D120 to host BLUE as LUN 0. Enter the following commands:

```
SET BLUE1A1 UNIT_OFFSET=120
SET BLUE1B1 UNIT_OFFSET=120
SET BLUE2A2 UNIT_OFFSET=120
SET BLUE2B2 UNIT_OFFSET=120
```

Host BLUE cannot see units lower than its offset, so it cannot access any other units. However, the other two hosts can still access D120 as LUN 20 if their operating system permits. To restrict access of D120 to only host BLUE, enable only host BLUE's access, as follows:

```
SET D120 DISABLE_ACCESS_PATH=ALL
SET D120 ENABLE_ACCESS_PATH=(BLUE1A1,BLUE1B1,BLUE12A2,BLUE2B2)
```

NOTE: StorageWorks recommends that you always provide access to only specific connections. This way, if new connections are added, they will not have automatic access to all units.

NOTE: See "Restricting Host Access by Disabling Access Paths," page 1–23.

Worldwide Names (Node IDs and Port IDs)

A worldwide name—also called a node ID—is a unique, 64-bit number assigned to a subsystem prior to shipping. The node ID belongs to the subsystem itself and never changes.

Each subsystem's node ID ends in zero, for example 5000-1FE1-FF0C-EE00. The controller port IDs are derived from the node ID.

In a subsystem with two controllers in transparent failover mode, the controller port IDs are incremented as follows:

- Controller A and controller B, port 1—worldwide name + 1, for example 5000-1FE1-FF0C-EE01

- Controller A and controller B, port 2—worldwide name + 2, for example 5000-1FE1-FF0C-EE02

In multiple-bus failover mode, each of the host ports has its own port ID:

- Controller B, port 1—worldwide name + 1, for example 5000-1FE1-FF0C-EE01

- Controller B, port 2—worldwide name + 2, for example 5000-1FE1-FF0C-EE02

- Controller A, port 1—worldwide name + 3, for example 5000-1FE1-FF0C-EE03

- Controller A, port 2—worldwide name + 4, for example 5000-1FE1-FF0C-EE04

Use the CLI command, SHOW *THIS_CONTROLLER/OTHER_CONTROLLER* to display the subsystem's worldwide name.

Restoring Worldwide Names (Node IDs)

If a situation occurs that requires you to restore the worldwide name, you can restore it using the worldwide name and checksum printed on the sticker on the frame into which the controller is inserted.

Figure 1–15 shows the placement of the worldwide name label for the Model 2200 enclosure, and Figure 1–16 for the BA370 enclosure.
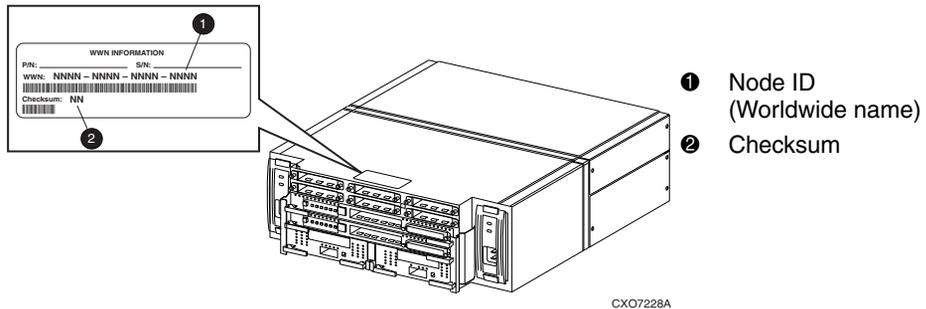
Figure 1–15: Placement of the worldwide name label on the Model 2200 enclosure
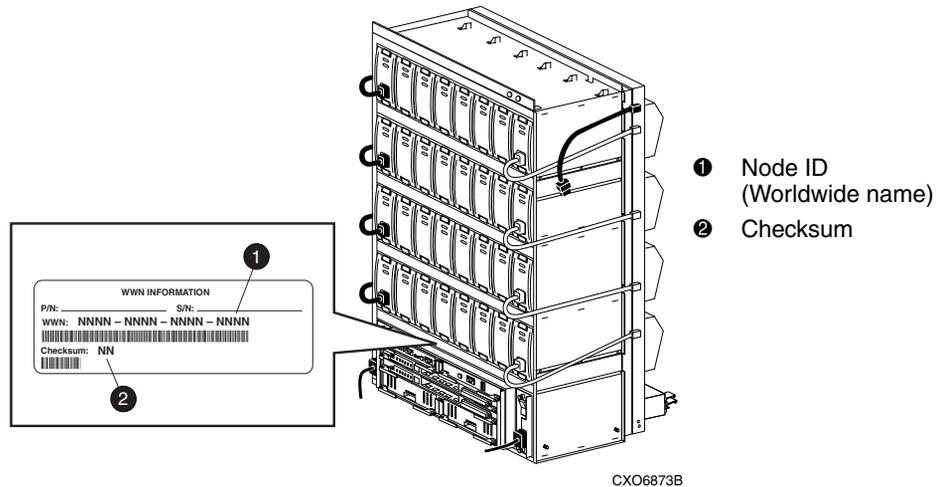
Figure 1–16: Placement of the worldwide name label on the BA370 enclosure

△ **CAUTION:** Each subsystem has its own unique worldwide name (node ID). If you attempt to set the subsystem worldwide name to a name other than the one that came with the subsystem, the data on the subsystem will not be accessible. Never set two subsystems to the same worldwide name, or data corruption will occur.

Unit Worldwide Names (LUN IDs)

In addition, each unit has its own worldwide name, or LUN ID. This is a unique, 128-bit value that the controller assigns at the time of unit initialization. It cannot be altered by the user but does change when the unit is reinitialized. Use the SHOW command to list the LUN ID.

2

Planning Storage Configurations

This chapter provides information to help you plan the storage configuration of your subsystem. Storage containers are individual disk drives (JBOD), storageset types (mirrorsets, stripesets, and so on), and/or partitioned drives. Use the guidelines found in this section to plan the various types of storage containers needed.

This chapter also focuses on the required design and implementation aspects, such as addressing conventions, configuration rules, creating storage profiles, and creating storage maps.

The following storage configuration information can be found in this chapter:

- "Where to Start," page 2–2
- "Determining Storage Requirements," page 2–3
- "Configuration Rules for the Controller," page 2–3
- "Addressing Conventions for Device PTL," page 2–4
- "Choosing a Container Type," page 2–14
- "Creating a Storageset Profile," page 2–16
- "Planning Considerations for Storageset," page 2–18
- "Changing Characteristics through Switches," page 2–27
- "Specifying Storageset and Partition Switches," page 2–28
- "Specifying Initialization Switches," page 2–29
- "Specifying Unit Switches," page 2–33
- "Creating Storage Maps," page 2–33

Refer to Chapter 3 for instructions on how to prepare your host computer to accommodate the HSG80 controller storage subsystem.

Where to Start

The following procedure outlines the steps to follow when planning your storage configuration.

See Appendix A to locate the blank templates for keeping track of the containers being configured.

1. Determine your storage requirements. Use the questions in "Determining Storage Requirements," page 2–3, to help you.

2. Review configuration rules. See "Configuration Rules for the Controller," page 2–3.

3. Familiarize yourself with the current physical layout of the devices and their addressing scheme. See "Addressing Conventions for Device PTL," page 2–4.

4. Choose the type of storage containers you need to use in your subsystem. See "Choosing a Container Type," page 2–14, for a comparison and description of each type of storageset.

5. Create a storageset profile (described in "Creating a Storageset Profile," page 2–16). Fill out the storageset profile while you read the sections that pertain to your chosen storage type:

   — "Planning Considerations for Storageset," page 2–18

   — "Mirrorset Planning Considerations," page 2–21

   — "RAIDset Planning Considerations," page 2–22

   — "Partition Planning Considerations," page 2–26

   — "Striped Mirrorset Planning Considerations," page 2–24

6. Decide which switches you need for your subsystem. General information on switches is detailed in "Specifying Storageset and Partition Switches," page 2–28.

   — Determine the unit switches you want for your units ("Specifying Unit Switches," page 2–33).

   — Determine the initialization switches you want for your planned storage containers ("Specifying Initialization Switches," page 2–29).

7. Create a storage map ("Creating Storage Maps," page 2–33).

8. Configure the storage you have now planned using one of the following methods:

   — Use SWCC. See the SWCC documentation for details.

— Use the Command Line Interpreter (CLI) commands. This method allows you flexibility in defining and naming your storage containers. See the *StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide*.

Determining Storage Requirements

It is important to determine your storage requirements. Here are a few of the questions you should ask yourself regarding the subsystem usage:

- What applications or user groups will access the subsystem? How much capacity do they need?

- What are the I/O requirements? If an application is data transfer-intensive, what is the required transfer rate? If it is I/O request-intensive, what is the required response time? What is the read/write ratio for a typical request?

- Are most I/O requests directed to a small percentage of the disk drives? Do you want to keep it that way or balance the I/O load?

- Do you store mission-critical data? Is availability the highest priority or would standard backup procedures suffice?

Configuration Rules for the Controller

The following list defines maximum configuration rules for the controller:

- 128 visible LUNs/200 assignable unit numbers

  — In SCSI-2 mode, the CCL is disabled, resulting in 128 visible LUNs.

  — In SCSI-3 mode, the CCL is enabled, resulting in 127 visible LUNs for multiple-bus (126 visible LUNs for transparent failover) and one CCL.

- 1.024 TB storageset size

- 96 host connections

- 84 physical devices

- 20 RAID 3/5 storagesets

- 30 RAID 3/5 and RAID 1 storagesets (see note)

- 45 RAID 3/5, RAID 1, and RAID 0 storagesets (see note)

NOTE: For the previous two storageset configurations, this is a combined maximum, limited to no more than 20 RAID 3/5 storagesets in the individual combination.

- 8 partitions of a storageset or individual disk

- 6 physical devices per RAID 1 storageset (mirrorset)

- 14 physical devices per RAID 3/5 storageset (RAIDset)

- 24 physical devices per RAID 0 storageset (stripeset)

- 45 physical devices per RAID 0+1 storageset (striped mirrorset)

Addressing Conventions for Device PTL

The HSG80 controller has six SCSI device ports, each of which connects to a SCSI bus. In dual-controller subsystems, these device buses are shared between the two controllers. (The *StorageWorks* Command Console calls the device ports "channels.") The standard BA370 enclosure provides a maximum of four SCSI target identifications (ID) for each device port. If more target IDs are needed, expansion enclosures can be added to the subsystem. For an example of how units are mapped to physical disk drives, see Figure 2–1.
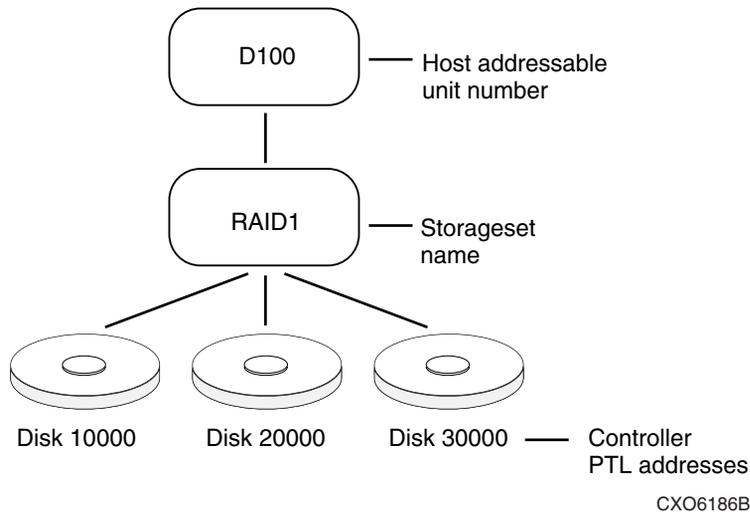
Figure 2–1: Mapping a unit to physical disk drives

The HSG80 controller identifies devices based on a Port-Target-LUN (PTL) numbering scheme, shown in Figure 2–2. The physical location of a device in its enclosure determines its PTL.

- P—Designates the controller's SCSI device port number (1 through 6).

- T—Designates the target ID number of the device. Valid target ID numbers for a single-controller configuration and dual-redundant controller configuration are 0 - 3 and 8 - 15, respectively. (This applies to the BA370 cabinet only.)

- L—Designates the logical unit (LUN) of the device. For disk devices the LUN is always 0.

1 02 00

```
          LUN 00
          Target 02
          Port 1
```
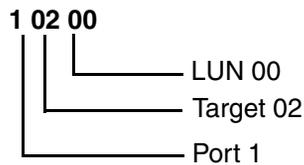
Figure 2–2: PTL naming convention

The controller can either operate with a BA370 enclosure or with a Model 2200 controller enclosure combined with Model 4214R, Model 4254, Model 4310R, Model 4350R, Model 4314R, or Model 4354R disk enclosures.

The controller operates with BA370 enclosures that are assigned ID numbers 0, 2, and 3. These ID numbers are set through the PVA module. Enclosure ID number 1, which assigns devices to targets 4 through 7, is not supported. Figure 2–3 shows how data is laid out on disks in an extended configuration.
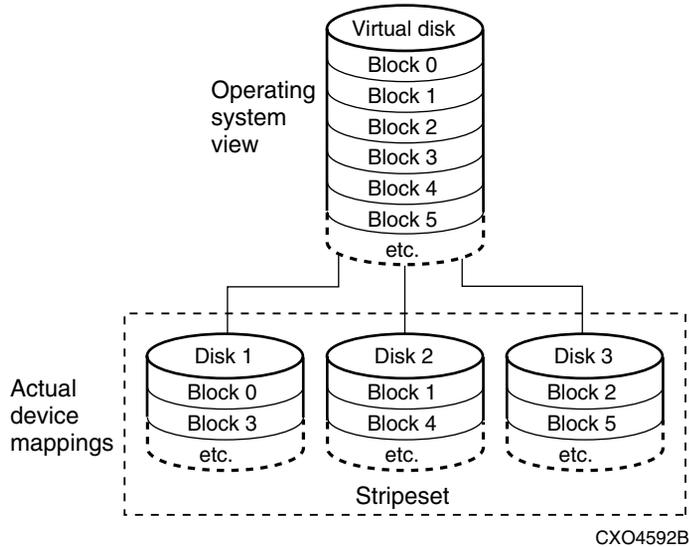
Figure 2–3: How data is laid out on disks in BA370 enclosure configuration

Examples - Model 2200 Storage Maps, PTL Addressing

The Model 2200 controller enclosure can be combined with the following:

- **Model 4214R disk enclosure** — Ultra2 SCSI with 14 drive bays, single-bus I/O module.

- **Model 4254 disk enclosure** — Ultra2 SCSI with 14 drive bays, dual-bus I/O module.

NOTE: The Model 4214R uses the same storage maps as the Model 4314R, and the Model 4254 uses the same storage maps as the Model 4354R disk enclosures.

- **Model 4310R disk enclosure** — Ultra3 SCSI with 10 drive bays, single-bus I/O module. Table 2–1 shows the addresses for each device in a six-shelf, single-bus configuration. A maximum of six Model 4310R disk enclosures can be used with each Model 2200 controller enclosure.

NOTE: The storage map for the Model 4310R reflects the disk enclosure's physical location in the rack. Disk enclosures 6, 5, and 4 are stacked above the controller enclosure, and disk enclosures 1, 2, and 3 are stacked below the controller enclosure.

- **Model 4350R disk enclosure** — Ultra3 SCSI with 10 drive bays, single-bus I/O module. Table 2–2 shows the addresses for each device in a three-shelf, single-bus configuration. A maximum of three Model 4350R disk enclosures can be used with each Model 2200 controller enclosure.

- **Model 4314R disk enclosure** — Ultra3 SCSI with 14 drive bays, single-bus I/O module. Table 2–3 shows the addresses for each device in a six-shelf, single-bus configuration. A maximum of six Model 4314R disk enclosures can be used with each Model 2200 controller enclosure.

NOTE: The storage map for the Model 4314R reflects the disk enclosure's physical location in the rack. Disk enclosures 6, 5, and 4 are stacked above the controller enclosure, and disk enclosures 1, 2, and 3 are stacked below the controller enclosure.

- **Model 4354R disk enclosure** — Ultra3 SCSI with 14 drive bays, dual-bus I/O module. Table 2–4 shows the addresses for each device in a three-shelf, dual-bus configuration. A maximum of three Model 4354R disk enclosures can be used with each Model 2200 controller enclosure.

NOTE: Appendix A contains storageset profiles you can copy and use to create your own system profiles. It also contains an enclosure template you can use to help you keep track of the location of devices and storagesets in your shelves.

Table 2–1: PTL addressing, single-bus configuration, six Model 4310R enclosures

Model 4310R Disk Enclosure Shelf 6 (single-bus)									
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk60000	Disk60100	Disk60200	Disk60300	Disk60400	Disk60500	Disk60800	Disk61000	Disk61100	Disk61200

Model 4310R Disk Enclosure Shelf 5 (single-bus)									
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk50000	Disk50100	Disk50200	Disk50300	Disk50400	Disk50500	Disk50800	Disk51000	Disk51100	Disk51200

Model 4310R Disk Enclosure Shelf 4 (single-bus)									
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk40000	Disk40100	Disk40200	Disk40300	Disk40400	Disk40500	Disk40800	Disk41000	Disk41100	Disk41200

Model 4310R Disk Enclosure Shelf 1 (single-bus)									
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk10000	Disk10100	Disk10200	Disk10300	Disk10400	Disk10500	Disk10800	Disk11000	Disk11100	Disk11200

Model 4310R Disk Enclosure Shelf 2 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk20000	Disk20100	Disk20200	Disk20300	Disk20400	Disk20500	Disk20800	Disk21000	Disk21100	Disk21200

Model 4310R Disk Enclosure Shelf 3 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk30000	Disk30100	Disk30200	Disk30300	Disk30400	Disk30500	Disk30800	Disk31000	Disk31100	Disk31200

Table 2–2: PTL addressing, dual-bus configuration, three Model 4350R enclosures

Model 4350R Disk Enclosure Shelf 1 (single-bus)

	SCSI Bus A					SCSI Bus B				
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SCSI ID	00	01	02	03	04	00	01	02	03	04
DISK ID	Disk10000	Disk10100	Disk10200	Disk10300	Disk10400	Disk20000	Disk20100	Disk20200	Disk20300	Disk20400

Model 4350R Disk Enclosure Shelf 2 (single-bus)

	SCSI Bus A					SCSI Bus B				
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SCSI ID	00	01	02	03	04	00	01	02	03	04
DISK ID	Disk30000	Disk30100	Disk30200	Disk30300	Disk30400	Disk40000	Disk40100	Disk40200	Disk40300	Disk40400

Model 4350R Disk Enclosure Shelf 3 (single-bus)

	SCSI Bus A					SCSI Bus B				
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SCSI ID	00	01	02	03	04	00	01	02	03	04
DISK ID	Disk50000	Disk50100	Disk50200	Disk50300	Disk50400	Disk60000	Disk60100	Disk60200	Disk60300	Disk60400

Table 2–3: PTL addressing, single-bus configuration, six Model 4314R enclosures

Model 4314R Disk Enclosure Shelf 6 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15
DISK ID	Disk60000	Disk60100	Disk60200	Disk60300	Disk60400	Disk60500	Disk60800	Disk60900	Disk61000	Disk61100	Disk61200	Disk61300	Disk61400	Disk61500

Model 4314R Disk Enclosure Shelf 5 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15
DISK ID	Disk50000	Disk50100	Disk50200	Disk50300	Disk50400	Disk50500	Disk50800	Disk50900	Disk51000	Disk51100	Disk51200	Disk51300	Disk51400	Disk51500

Model 4314R Disk Enclosure Shelf 4 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15
DISK ID	Disk40000	Disk40100	Disk40200	Disk40300	Disk40400	Disk40500	Disk40800	Disk40900	Disk41000	Disk41100	Disk41200	Disk41300	Disk41400	Disk41500

Model 4314R Disk Enclosure Shelf 1 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15
DISK ID	Disk10000	Disk10100	Disk10200	Disk10300	Disk10400	Disk10500	Disk10800	Disk10900	Disk11000	Disk11100	Disk11200	Disk11300	Disk11400	Disk11500

Model 4314R Disk Enclosure Shelf 2 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15
DISK ID	Disk20000	Disk20100	Disk20200	Disk20300	Disk20400	Disk20500	Disk20800	Disk20900	Disk21000	Disk21100	Disk21200	Disk21300	Disk21400	Disk21500

Model 4314R Disk Enclosure Shelf 3 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15
DISK ID	Disk30000	Disk30100	Disk30200	Disk30300	Disk30400	Disk30500	Disk30800	Disk30900	Disk31000	Disk31100	Disk31200	Disk31300	Disk31400	Disk31500

Table 2–4: PTL addressing, dual-bus configuration, three Model 4354A enclosures.

Model 4354R Disk Enclosure Shelf 1 (dual-bus)

	SCSI Bus A							SCSI Bus B						
Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	00	01	02	03	04	05	08
DISK ID	Disk10000	Disk10100	Disk10200	Disk10300	Disk10400	Disk10500	Disk10800	Disk20000	Disk20100	Disk20200	Disk20300	Disk20400	Disk20500	Disk20800

Model 4354R Disk Enclosure Shelf 2 (dual-bus)

	SCSI Bus A							SCSI Bus B						
Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	00	01	02	03	04	05	08
DISK ID	Disk30000	Disk30100	Disk30200	Disk30300	Disk30400	Disk30500	Disk30800	Disk40000	Disk40100	Disk40200	Disk40300	Disk40400	Disk40500	Disk40800

Model 4354R Disk Enclosure Shelf 3 (dual-bus)

	SCSI Bus A							SCSI Bus B						
Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	00	01	02	03	04	05	08
DISK ID	Disk50000	Disk50100	Disk50200	Disk50300	Disk50400	Disk50500	Disk50800	Disk60000	Disk60100	Disk60200	Disk60300	Disk60400	Disk60500	Disk60800

Choosing a Container Type

Different applications may have different storage requirements. You probably want to configure more than one kind of container within your subsystem.

In choosing a container, you choose between independent disks (JBODs) or one of several storageset types, as shown in Figure 2–4. The independent disks and the selected storageset may also be partitioned.

The storagesets implement RAID (Redundant Array of Independent Disks) technology. Consequently, they all share one important feature: each storageset, whether it contains two disk drives or ten, looks like one large, virtual disk drive to the host.

CXO6677A
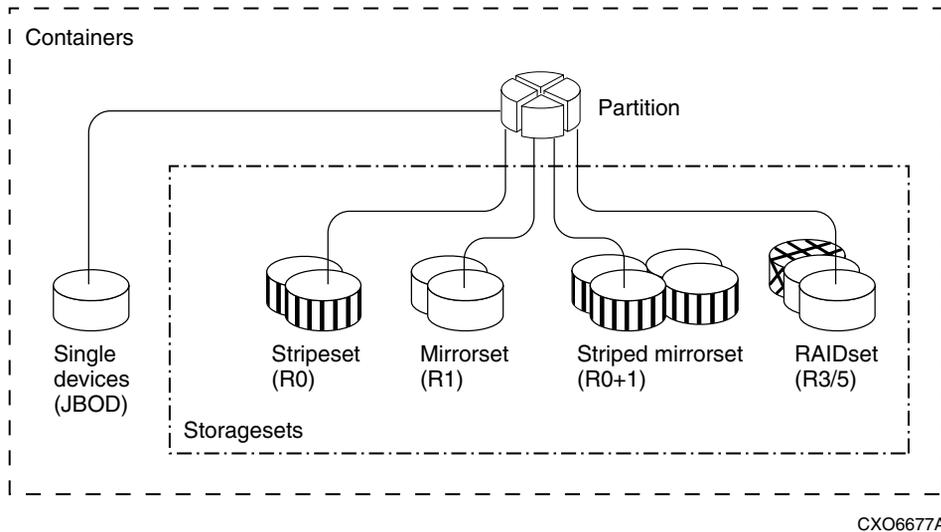
Figure 2–4: Storage container types

Table 2–5 compares the different kinds of containers to help you determine which ones satisfy your requirements.

Table 2–5: Comparison of Container Types

Container Name	Relative Availability	Request Rate (Read/Write) I/O per second	Transfer Rate (Read/Write) MB per second	Applications
Independent disk drives (JBOD)	Equal to number of JBOD disk drives	Comparable to single disk drive	Comparable to single disk drive	—
Stripeset (RAID 0)	Proportionate to number of disk drives; worse than single disk drive	Excellent if used with large chunk size	Excellent if used with small chunk size	High performance for non-critical data
Mirrorset (RAID1)	Excellent	Good/Fair	Good/Fair	System drives; critical files
RAIDset (RAID 3/5)	Excellent	Excellent/good	Read: excellent (if used with small chunk sizes) Write: good (if used with small chunk sizes)	High request rates, read-intensive, data lookup
Striped Mirrorset (RAID 0+1)	Excellent	Excellent if used with large chunk size	Excellent if used with small chunk size	Any critical response-time application

For a comprehensive discussion of RAID, refer to *The RAIDBOOK—A Source Book for Disk Array Technology.*

Creating a Storageset Profile

Creating a profile for your storagesets, partitions, and devices can simplify the configuration process. Filling out a storageset profile helps you choose the storagesets that best suit your needs and to make informed decisions about the switches you can enable for each storageset or storage device that you configure in your subsystem.

For an example of a storageset profile, see Table 2–6. This table contains blank profiles that you can copy and use to record the details for your storagesets. Use the information in this chapter to help you make decisions when creating storageset profiles.

Table 2–6: Example of Storageset Profile

Type of Storageset:

_____ Mirrorset	__X_ RAIDset	_____ Stripeset	_____ Striped Mirrorset	____ JBOD

Storageset Name *R1.* **Disk Drives** *D10300, D20300, D10400, D20400*

Unit Number *D101*

Partitions:

Unit #	Unit #	Unit #	Unit #	Unit #	Unit #	Unit #	Unit #
%	%	%	%	%	%	%	%

RAIDset Switches:

Reconstruction Policy	Reduced Membership	Replacement Policy
_X_ Normal (default)	_X_ No (default)	_X_ Best performance (default)
___Fast	___Yes, missing:	___Best fit
		___None

Mirrorset Switches:

Replacement Policy	Copy Policy	Read Source
___Best performance (default)	___Normal (default)	___Least busy (default)
___Best fit	___Fast	___Round robin
___None		___Disk drive:

Initialize Switches:

Chunk size	Save Configuration	Metadata
_X_ Automatic (default)	___No (default)	_X_ Destroy (default)
___ 64 blocks	_X_ Yes	___Retain
___ 128 blocks		
___ 256 blocks		

Unit Switches:

Caching	Access by following hosts enabled
Read caching_____X___	_ALL_____
Read-ahead caching_____	_____
Write-back caching___X___	_____
Write-through caching____	_____
	_____

Planning Considerations for Storageset

This section contains the guidelines for choosing the storageset type needed for your subsystem:

- "Stripeset Planning Considerations," page 2–18
- "Mirrorset Planning Considerations," page 2–21
- "RAIDset Planning Considerations," page 2–22
- "Striped Mirrorset Planning Considerations," page 2–24
- "Storageset Expansion Considerations," page 2–26
- "Partition Planning Considerations," page 2–26

Stripeset Planning Considerations

Stripesets (RAID 0) enhance I/O performance by spreading the data across multiple disk drives. Each I/O request is broken into small segments called "chunks." These chunks are then simultaneously "striped" across the disk drives in the storageset, thereby enabling several disk drives to participate in one I/O request.

For example, in a three-member stripeset that contains disk drives Disk 10000, Disk 20000, and Disk 10100, the first chunk of an I/O request is written to Disk 10000, the second to Disk 20000, the third to Disk 10100, the fourth to Disk 10000, until all of the data has been written to the drives (Figure 2–5).

CXO7287A
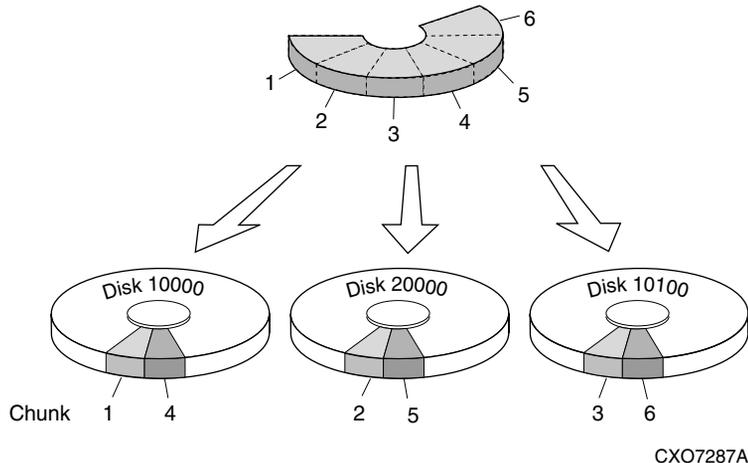
Figure 2–5: 3-member RAID 0 stripeset (example 1)

The relationship between the chunk size and the average request size determines if striping maximizes the request rate or the data-transfer rate. You can set the chunk size or use the default setting (see "Chunk Size," page 2–30, for information about setting the chunk size). Figure 2–6 shows another example of a three-member RAID 0 stripeset.

A major benefit of striping is that it balances the I/O load across all of the disk drives in the storageset. This can increase the subsystem performance by eliminating the hot spots (high localities of reference) that occur when frequently accessed data becomes concentrated on a single disk drive.
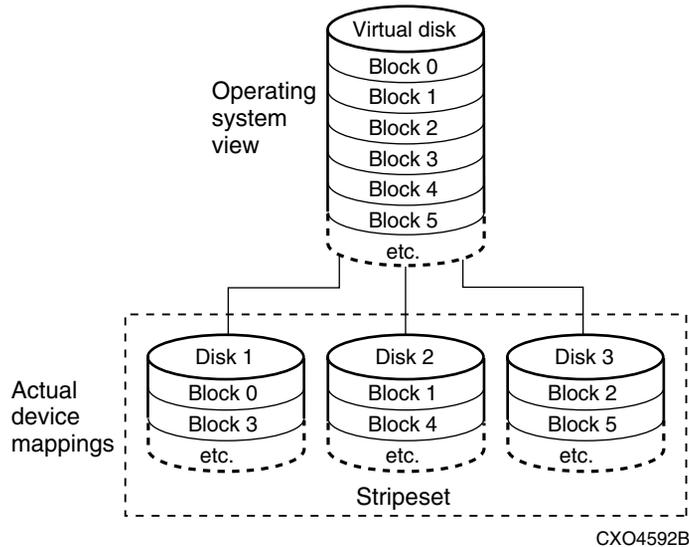
Figure 2–6: 3-member RAID 0 stripeset (example 2)

Keep the following points in mind as you plan your stripesets:

- Reporting methods and size limitations prevent certain operating systems from working with large stripesets.

- A storageset should only contain disk drives of the same capacity. The controller limits the effective capacity of each member to the capacity of the smallest member in the storageset (base member size) when the storageset is initialized. Thus, if you combine 9 GB disk drives with 4 GB disk drives in the same storageset, you waste 5 GB of capacity on each 9 GB member.

  If you need high performance and high availability, consider using a RAIDset, striped-mirrorset, or a host-based shadow of a stripeset.

- Striping does not protect against data loss. In fact, because the failure of one member is equivalent to the failure of the entire stripeset, the likelihood of losing data is higher for a stripeset than for a single disk drive.

  For example, if the mean time between failures (MTBF) for a single disk is l hour, then the MTBF for a stripeset that comprises N such disks is l/N hours. As another example, if the MTBF of a a single disk is 150,000 hours (about 17 years), a stripeset comprising four of these disks would only have an MTBF of slightly more than 4 years.

  For this reason, you should avoid using a stripeset to store critical data. Stripesets are more suitable for storing data that can be reproduced easily or whose loss does not prevent the system from supporting its critical mission.

- Evenly distribute the members across the device ports to balance the load and provide multiple paths.

- Stripesets may contain between two and 24 members.

- If you plan to use mirror members to replace failing drives, then create the original stripeset as a stripeset of 1-member mirrorsets.

- Stripesets are well-suited for the following applications:

  — Storing program image libraries or run-time libraries for rapid loading.

  — Storing large tables or other structures of read-only data for rapid application access.

  — Collecting data from external sources at very high data transfer rates.

- Stripesets are not well-suited for the following applications:

  — A storage solution for data that cannot be easily reproduced or for data that must be available for system operation.

  — Applications that make requests for small amounts of sequentially located data.

  — Applications that make synchronous random requests for small amounts of data.

Spread the member drives as evenly as possible across the six I/O device ports.

Mirrorset Planning Considerations

Mirrorsets (RAID 1) use redundancy to ensure availability, as illustrated in Figure 2–7. For each primary disk drive, there is at least one mirror disk drive. Thus, if a primary disk drive fails, its mirror drive immediately provides an exact copy of the data. Figure 2–8 shows a second example of a Mirrorset.
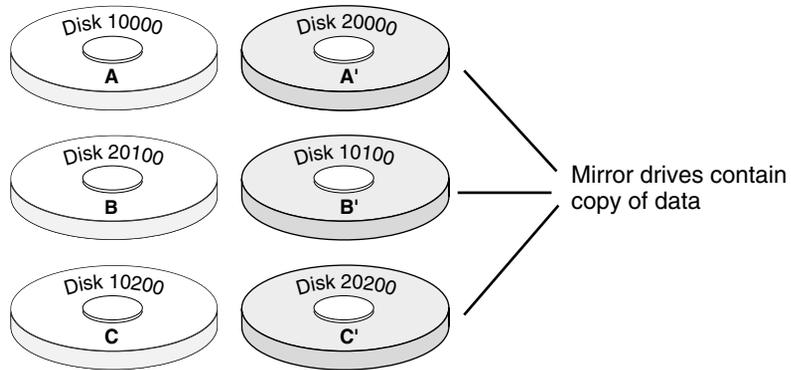
CXO7288A

Figure 2–7: Mirrorsets maintain two copies of the same data
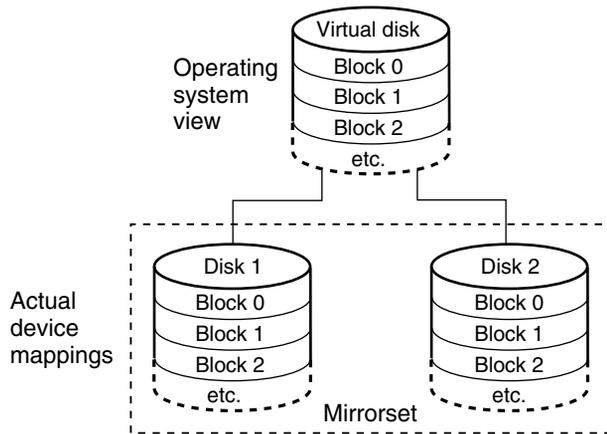
CXO4594B

Figure 2–8: Mirrorset example 2

Keep these points in mind when planning mirrorsets

- Data availability with a mirrorset is excellent but comes with a higher cost—you need twice as many disk drives to satisfy a given capacity requirement. If availability is your top priority, consider using dual-redundant controllers and redundant power supplies.

- You can configure up to a maximum of 20 RAID 3/5 mirrorsets per controller or pair of dual-redundant controllers. Each mirrorset may contain up to 6 members. Refer to "Configuration Rules for the Controller" on page 2–3, for detailed information on maximum numbers. 30 RAID 3/5 and RAID 1 mirrorsets are permitted, however, there is limit of no more than 20 RAID 3/5 mirrorsets in such a configuration.

- Both write-back cache modules must be the same size.

- A mirrorset should only contain disk drives of the same capacity.

- Spread mirrorset members across different device ports (drive bays).

- Mirrorsets are well-suited for the following:

  — Any data for which reliability requirements are extremely high

  — Data to which high-performance access is required

  — Applications for which cost is a secondary issue

- Mirrorsets are not well-suited for the following applications:

  — Write-intensive applications (a performance hit of 10 percent will occur)

  — Applications for which cost is a primary issue

RAIDset Planning Considerations

RAIDsets (RAID 3/5) are enhanced stripesets—they use striping to increase I/O performance and distributed-parity data to ensure data availability. Figure 2–9 shows an example of a RAIDset that uses five members.

CXO6463B
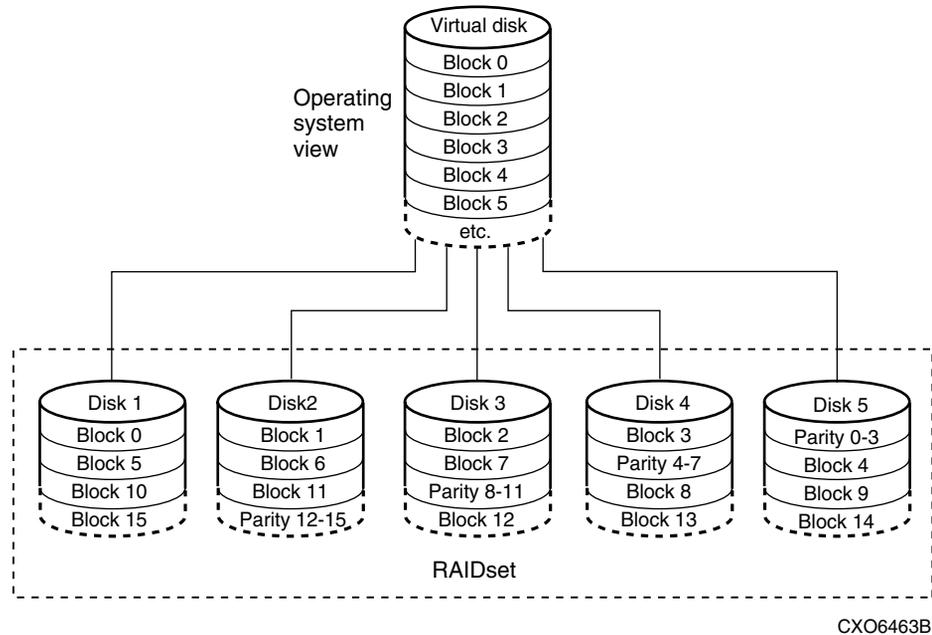
Figure 2–9: 5-member RAIDset using parity

RAIDsets are similar to stripesets in that the I/O requests are broken into smaller "chunks" and striped across the disk drives. RAIDsets also create chunks of parity data and stripe them across all the members of the RAIDset. Parity data is derived mathematically from the I/O data and enables the controller to reconstruct the I/O data if a single disk drive fails. Thus, it becomes possible to lose a disk drive without losing access to the data it contained. Data could be lost if a second disk drive fails before the controller replaces the first failed disk drive and reconstructs the data.

The relationship between the chunk size and the average request size determines if striping maximizes the request rate or the data-transfer rates. You can set the chunk size or use the default setting. See "Chunk Size," page 2–30, for information about setting the chunk size.

Keep these points in mind when planning RAIDsets

- Reporting methods and size limitations prevent certain operating systems from working with large RAIDsets.

- Both cache modules must be the same size.

- A RAIDset must include at least 3 disk drives, but no more than 14.

- A storageset should only contain disk drives of the same capacity. The controller limits the capacity of each member to the capacity of the smallest member in the storageset. Thus, if you combine 9 GB disk drives with 4 GB disk drives in the same storageset, you waste 5 GB of capacity on each 9 GB member.

- RAIDsets are particularly well-suited for the following:

  — Small to medium I/O requests

  — Applications requiring high availability

  — High read request rates

  — Inquiry-type transaction processing

- RAIDsets are not particularly well-suited for the following:

  — Write-intensive applications

  — Database applications in which fields are continually updated

  — Transaction processing

Striped Mirrorset Planning Considerations

Striped mirrorsets (RAID 0+1) are a configuration of stripesets whose members are also mirrorsets (Figure 2–10). Consequently, this kind of storageset combines the performance of striping with the reliability of mirroring. The result is a storageset with very high I/O performance and high data availability. Figure 2–11 shows a second example of a striped mirrorset using six members.

CXO7289A
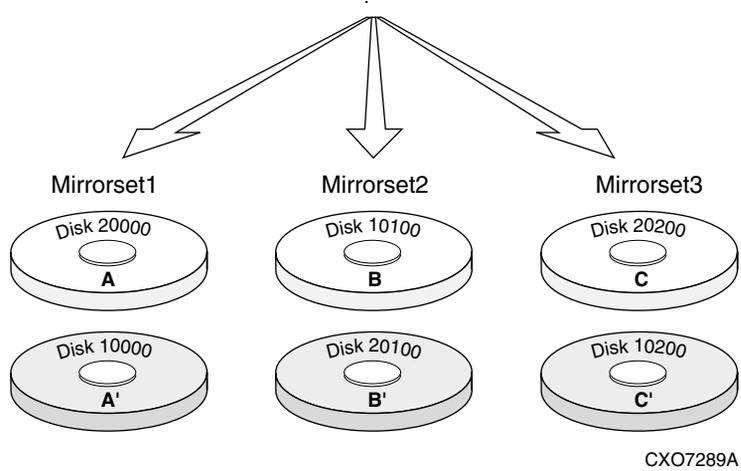
Figure 2–10: Striped mirrorset (example 1)

The failure of a single disk drive has no effect on the ability of the storageset to deliver data to the host. Under normal circumstances, a single disk drive failure has very little effect on performance. Because striped mirrorsets do not require any more disk drives than mirrorsets, this storageset is an excellent choice for data that warrants mirroring.

CXO6462A
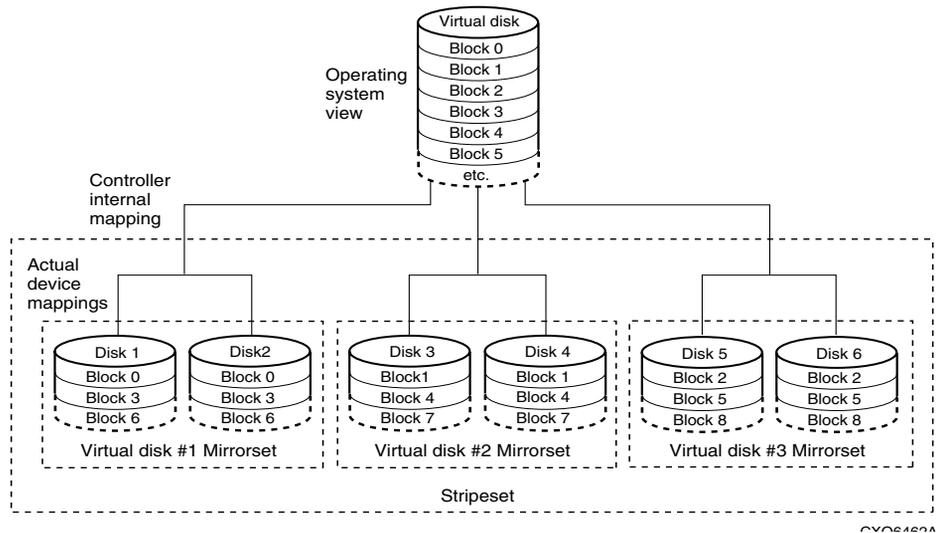
Figure 2–11: Striped mirrorset (example 2)

Plan the mirrorset members, and plan the stripeset that will contain them. Review the recommendations in "Planning Considerations for Storageset," page 2–18, and "Mirrorset Planning Considerations," page 2–21.

Storageset Expansion Considerations

Storageset Expansion allows for the joining of two of the same kind of storage containers by concatenating RAIDsets, Stripesets, or individual disks, thereby forming a larger virtual disk which is presented as a single unit. The StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide describes the CLI command: ADD CONCATSETS which is used to perform concatenation.

⚠ **CAUTION:** Use the ADD CONCATSETS command only with host operating systems that support dynamic volume expansion. Use of this command could result in inacessible data, if the operating system cannot handle one of its disks increasing in size.

Partition Planning Considerations

Use partitions to divide a container (storageset or individual disk drive) into smaller pieces, each of which can be presented to the host as its own storage unit. Figure 2–12 shows the conceptual effects of partitioning a single-disk container.

❶ Partition 1
❷ Partition 2
❸ Partition 3

CXO7056A
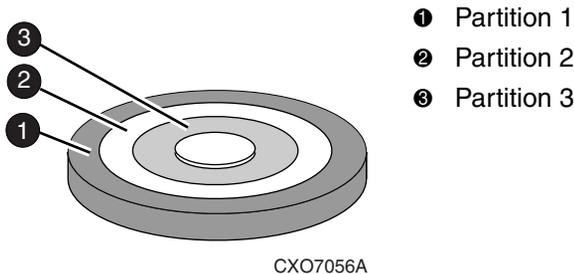
Figure 2–12: One example of a partitioned single-disk unit

You can create up to eight partitions per storageset (disk drive, RAIDset, mirrorset, stripeset, or striped mirrorset). Each partition has its own unit number so that the host can send I/O requests to the partition just as it would to any unpartitioned storageset or device. Partitions are separately addressable storage units; therefore, you can partition a single storageset to service more than one user group or application.

Defining a Partition

Partitions are expressed as a percentage of the storageset or single disk unit that contains them:

- Mirrorsets and single disk units—the controller allocates the largest whole number of blocks that are equal to or less than the percentage you specify.

- RAIDsets and stripesets—the controller allocates the largest whole number of stripes that are less than or equal to the percentage you specify.

    — Stripesets—the stripe size = chunk size × number of members.

    — RAIDsets—the stripe size = chunk size × (number of members minus 1)

An unpartitioned storage unit has more capacity than a partition that uses the whole unit because each partition requires a small amount of disk space for metadata.

Guidelines for Partitioning Storagesets and Disk Drives

Keep these points in mind when planning partitions for storagesets and disks:

- Each storageset or disk drive may have up to eight partitions.

- In transparent failover mode, all partitions of a particular container must be on the same host port. Partitions cannot be split across host ports.

- In multiple-bus failover mode, all the partitions of a particular container must be on the same controller. Partitions cannot be split across controllers.

- Partitions cannot be combined into storagesets. For example, you cannot divide a disk drive into three partitions, then combine those partitions into a RAIDset.

- Just as with storagesets, you do not have to assign unit numbers to partitions until you are ready to use them.

- The CLONE utility cannot be used with partitioned mirrorsets or partitioned stripesets. (See "Creating Clones for Backup," page 7–2 for details about cloning.)

Changing Characteristics through Switches

CLI command switches allow the user another level of command options. There are three types of switches that modify the storageset and unit characteristics:

- Storageset switches

- Initialization switches

- Unit switches

The following sections describe how to enable/modify switches. They also contain a description of the major CLI command switches.

Enabling Switches

If you use SWCC to configure the device or storageset, you can set switches from SWCC during the configuration process, and SWCC automatically applies them to the storageset or device. See the SWCC online help for information about using SWCC.

If you use CLI commands to configure the storageset or device manually, the configuration procedure found in Chapter 5 of this guide indicates when and how to enable each switch. The StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide contains the details of the CLI commands and their switches.

Changing Switches

You can change the RAIDset, mirrorset, device, and unit switches at any time. You cannot change the initialize switches without destroying data on the storageset or device. These switches are integral to the formatting and can only be changed by re-initializing the storageset.

$\triangle$ **CAUTION:** Initializing a storageset is similar to formatting a disk drive; all data is destroyed during this procedure.

Specifying Storageset and Partition Switches

The characteristics of a particular storageset can be set by specifying switches when the storageset is added to the controllers' configuration. Once a storageset has been added, the switches can be changed by using a SET command. Switches can be set for partitions and the following types of storagesets:

• RAIDset

• Mirrorset

Stripesets have no specific switches associated with their ADD and SET commands.

RAIDset Switches

Use the following types of switches to control how a RAIDset ensures data availability:

- Replacement policy

- Reconstruction policy

- Remove/replace policy

For details on the use of these switches refer to SET RAIDSET and SET *RAIDset-name* commands in the *StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide*.

Mirrorset Switches

Use the following switches to control how a mirrorset behaves to ensure data availability:

- Replacement policy

- Copy speed

- Read source

- Membership

For details on the use of these switches refer to ADD MIRRORSET and SET *mirrorset-name* commands in the *StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide*.

Partition Switches

The following switches are available when creating a partition:

- Size

- Geometry

For details on the use of these switches refer to CREATE_PARTITION command in the *StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide*.

Specifying Initialization Switches

Initialization switches set characteristics for established storagesets before they are made into units. The following kinds of switches effect the format of a disk drive or storageset:

- Chunk Size (for stripesets and RAIDsets only)

- Save Configuration

- Destroy/Nodestroy

- Geometry

Each of these switches is described in the following sections.

NOTE: After initializing the storageset or disk drive, you cannot change these switches without reinitializing the storageset or disk drive.

Chunk Size

With ACS software, a parameter for chunk size (chunksize=default or n) on some storagesets can be set. However, unit performance may be negatively impacted if a non-default value is selected as the chunksize.

If a non-default chunk size has been calculated, verify that the chunk size value is divisible by 8, with no remainder. If the value is not aligned with this rule, adjust the chunk size value upward until it divisible by 8, with no remainder.

Specify the chunk size of the data to be stored to control the stripesize used in RAIDsets and stripesets:

- *CHUNKSIZE=DEFAULT* lets the controller set the chunk size based on the number of disk drives (d) in a stripeset or RAIDset. If number of drives is less or equal to 9, then chunk size = 256. If the number of drives is greater than 9, then chunk size = 128.

- *CHUNKSIZE=n* lets you specify a chunk size in blocks. The relationship between chunk size and request size determines whether striping increases the request rate or the data-transfer rate.

Increasing the Request Rate

A large chunk size (relative to the average request size) increases the request rate by enabling multiple disk drives to respond to multiple requests. If one disk drive contains all of the data for one request, then the other disk drives in the storageset are available to handle other requests. Thus, separate I/O requests can be handled in parallel, which increases the request rate. This concept is shown in Figure 2–13.

Request A

Chunk size = 128k (256 blocks)

Request B
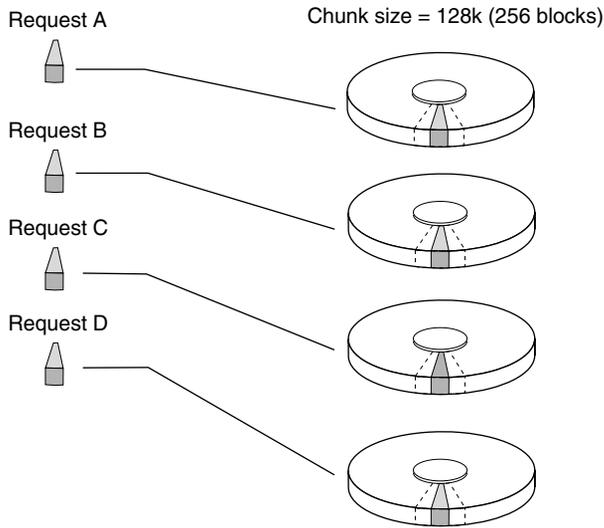
Request C

Request D

CXO-5135A-MC

Figure 2–13: Large chunk size increases request rate

Large chunk sizes also tend to increase the performance of random reads and writes. StorageWorks recommends that you use a chunk size of 10 to 20 times the average request size, rounded to the closest prime number.

To calculate the chunk size that should be used for your subsystem, you must first analyze the types of requests that are being made to the subsystem:

- Many parallel I/Os that use a small area of disk should use a chunk size of 10 times the average transfer request rate.

- Random I/Os that are scattered over all the areas of the disks should use a chunk size of 20 times the average transfer request rate.

- If you do not know, then you should use a chunk size of 15 times the average transfer request rate.

- If you have mostly sequential reads or writes (like those needed to work with large graphic files), make the chunk size for RAID 0 and RAID 0+1 a small number (for example: 67 sectors). For RAID 5, make the chunk size a relatively large number (for example: 253 sectors).

Table 2–7 shows a few examples of chunk size selection.

Table 2–7: Example Chunk Sizes

Transfer Size (KB)	Small Area of I/O Transfers	Unknown	Random Areas of I/O Transfers
2	41	59	79
4	79	113	163
8	157	239	317

Increasing Sequential Data Transfer Performance

RAID 0 and RAID 0+1 sets intended for high data transfer rates should use a relatively low chunk size (for example: 67 sectors). RAID 5 sets intended for high data rate performance should use a relatively large number (for example: 253 sectors).

Save Configuration

The *SAVE CONFIGURATION* switch is for a **single-controller configuration only**. This switch reserves an area on each of the disks for the container being initialized. The controller can write subsystem configuration data on this area. If the controller is replaced, the new controller can read the subsystem configuration from the reserved areas of disks.

If you specify *SAVE_CONFIGURATION* for a multi-device storageset, such as a stripeset, the complete subsystem configuration is periodically written on each disk in the storageset.

The SHOW DEVICES *FULL* command shows which disks are used to backup configuration information.

IMPORTANT: DO NOT use SAVE_CONFIGURATION in dual redundant controller installations. It is not supported and may result in unexpected controller behavior.

Destroy/Nodestroy

Specify whether to destroy or retain the user data and metadata when a disk is initialized after it has been used in a mirrorset or as a single-disk unit.

NOTE: The *DESTROY* and *NODESTROY* switches are only valid for mirrorsets and striped mirrorsets.

- *DESTROY* (default) overwrites the user data and forced-error metadata when a disk drive is initialized.

- *NODESTROY* preserves the user data and forced-error metadata when a disk drive is initialized. Use *NODESTROY* to create a single-disk unit from any disk drive that has been used as a member of a mirrorset. See the REDUCED command in the StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide for information on removing disk drives from a mirrorset.

  NODESTROY is ignored for members of a RAIDset.

Geometry

The geometry parameters of a storageset can be specified. The geometry switches are:

- *CAPACITY*—the number of logical blocks. The range is from 1 to the maximum container size.

- *CYLINDERS*—the number of cylinders used. The range is from 1 to 16777215.

- *HEADS*—the number of disk heads used. The range is from 1 to 255.

- *SECTORS_PER_TRACK*—the number of sectors per track used. The range is from 1 to 255.

Specifying Unit Switches

Several switches control the characteristics of units. The unit switches are described under the SET *unit-number* command in the StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide.

One unit switch, *ENABLE/DISABLE_ACCESS_PATH*, determines which host connections can access the unit, and is part of the larger topic of matching units to specific hosts. This complex topic is covered in the first Chapter under the following heading:

- "Determining Connections," page 1–12

Creating Storage Maps

Configuring a subsystem will be easier if you know how the storagesets, partitions, and JBODs correspond to the disk drives in your subsystem. You can more easily see this relationship by creating a hardcopy representation, also known as a storage map.

To make a storage map, fill out the templates provided in Appendix A as you add storagesets, partitions, and JBOD disks to the configuration and assign them unit numbers. Label each disk drive in the map with the higher levels it is associated with, up to the unit level.

Using LOCATE Command to Find Devices

If you want to complete a storage map at a later time but do not remember where the disk drives and partitions are located, use the CLI command LOCATE. The LOCATE command flashes the (fault) LED on the drives associated with the specific storageset or unit. To turn off the flashing LEDs, enter the CLI command LOCATE CANCEL.

The following procedure is an example of the commands to locate all the disk drives that make up unit D104:

1. Enter the following command:

   LOCATE D104

   The LEDs on the disk drives that make up unit D104 will flash.

2. Note the position of all the drives contained within D104.

3. Enter the following command to turn off the flashing LEDs:

   LOCATE CANCEL

The following procedure is an example command to locate all the drives that make up RAIDset R1:

1. Enter the following command:

   LOCATE R1

2. Note the position of all the drives contained within R1.

3. Enter the following command to turn off the flashing LEDs:

   LOCATE CANCEL

Example Storage Map - Model 4310R Disk Enclosure

Table 2–8 shows an example of four Model 4310R disk enclosures (single-bus I/O).

Table 2–8: Model 4310R disk enclosure, example of storage map

Model 4310R Disk Enclosure Shelf 4 (single-bus)									
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	D100 R1 Disk40000	D101 S1 M2 Disk40100	D103 M4 Disk40200	D105 Disk40300	D107 Disk40400	D108 S3 Disk40500	D1 S4 M6 Disk40800	D2 R3 Disk41000	D3 S5 Disk41100	spare Disk41200

Model 4310R Disk Enclosure Shelf 1 (single-bus)									
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	D100 R1 Disk10000	D101 S1 M1 Disk10100	D102 M3 Disk10200	D104 S2 Disk10300	D106 R2 Disk10400	D108 S3 Disk10500	D1 S4 M5 Disk10800	D2 R3 Disk11000	D3 S5 Disk11100	D4 M7 Disk11200

Model 4310R Disk Enclosure Shelf 2 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	D100 R1 Disk20000	D101 S1 M1 Disk20100	D102 M3 Disk20200	D104 S2 Disk20300	D106 R2 Disk20400	D108 S3 Disk20500	D1 S4 M5 Disk20800	D2 R3 Disk21000	D3 S5 Disk21100	D4 M7 Disk21200

Model 4310R Disk Enclosure Shelf 3 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	D100 R1 Disk30000	D101 S1 M2 Disk30100	D103 M4 Disk30200	D104 S2 Disk30300	D106 R2 Disk30400	D108 S3 Disk30500	D1 S4 M6 Disk30800	D2 R3 Disk31000	D3 S5 Disk31100	spare Disk31200

The following explains the table in words:

- Unit D100 is a 4-member RAID 3/5 storageset named R1. R1 consists of Disk10000, Disk20000, Disk30000, and Disk40000.

- Unit D101 is a 2-member striped mirrorset named S1. S1 consists of M1 and M2:

  — M1 is a 2-member mirrorset consisting of Disk10100 and Disk20100.

  — M2 is a 2-member mirrorset consisting of Disk30100 and Disk40100.

- Unit D102 is a 2-member mirrorset named M3. M3 consists of Disk10200 and Disk20200.

- Unit D103 is a 2-member mirrorset named M4. M4 consists of Disk30200 and Disk40200.

- Unit D104 is 3-member stripeset named S2. S2 consists of Disk10300, Disk20300, and Disk30300.

- Unit D105 is a single (JBOD) disk named Disk40300.

- Unit D106 is a 3-member RAID 3/5 storageset named R2. R2 consists of Disk10400, Disk20400, and Disk30400.

- Unit D107 is a single (JBOD) disk named Disk40400.

- Unit D108 is a 4-member stripeset named S3. S3 consists of Disk10500, Disk20500, Disk30500, and Disk40500.

- Unit D1 is a 2-member striped mirrorset named S4. S4 consists of M4 and M5:

    — M5 is a 2-member mirrorset consisting of Disk10800 and Disk20800.

    — M6 is a 2-member mirrorset consisting of Disk30800 and Disk40800.

- Unit D2 is a 4-member RAID 3/5 storageset named R3. R3 consists of Disk11000, Disk21000, Disk31000, and Disk41000.

- Unit D3 is a 4-member stripeset named S5. S5 consists of Disk11100, Disk21100, Disk31100, and Disk41100.

- Unit D4 is a 2-member mirrorset named M7. M7 consists of Disk11200 and Disk21200.

- Disk31200 and Disk41200 are spareset members.

3

Preparing the Host System

This chapter describes how to prepare your Windows NT and Windows 2000 host computer to accommodate the HSG80 controller storage subsystem.

The following information is included in this chapter:

- "Installing RAID Array Storage System," page 3–1

- "Making a Physical Connection," page 3–6

- "Installing RAID Windows NT and Windows 2000 Device Driver," page 3–9

- "Installing SWCC Client and Creating Your First Virtual Disk," page 3–12

- "Verifying/Installing Required Versions," page 3–18

- "Completing a New RAID Array Configuration," page 3–19

- "Solution Software Upgrade Procedures," page 3–24

- "Solution Software Silent Install," page 3–32

Refer to Chapter 4 for instructions on how to install and configure the HSG Agent. The Agent for HSG is operating system-specific and polls the storage.

Installing RAID Array Storage System

> ⚠ **WARNING: A shock hazard exists at the backplane when the controller enclosure bays or cache module bays are empty.**
>
> **Be sure the enclosures are empty, then mount the enclosures into the rack. DO NOT use the disk enclosure handles to lift the enclosure. The handles cannot support the weight of the enclosure. Only use these handles to position the enclosure in the mounting brackets.**
>
> **Use two people to lift, align, and install any enclosure into a rack. Failure to use two people might cause personal injury and/or equipment damage.**

⚠ **CAUTION:** Controller and disk enclosures have no power switches. Make sure the controller enclosures and disk enclosures are physically configured before turning the PDU on and connecting the power cords. Failure to do so can cause equipment damage.

1. Be sure the enclosures are empty before mounting them into the rack. If necessary, remove the following elements from the controller enclosure:

   — Environmental Monitoring Unit (EMU)

   — Power Supplies

   — External Cache Batteries (ECBs)

   — Fans

   If necessary, remove the following elements from the disk enclosure:

   — Power Supply/Blower Assemblies

   — Disk Drives

   — Environmental Monitoring Unit (EMU)

   — I/O Modules

   Refer to the *StorageWorks Model 2100 and 2200 Ultra SCSI Controller Enclosures User Guide* and *StorageWorks Model 4300 Family Ultra3 LVD Disk Enclosures User Guide* the for further information.

2. Install brackets onto the controller enclosure and disk enclosures. Using two people, mount the enclosures into the rack. Refer to the mounting kit documentation for further information.

3. Install the elements. Install the disk drives. Make sure you install blank panels in any unused bays.

   Fibre channel cabling information is shown to illustrate supported configurations. In a dual-bus disk enclosure configuration, disk enclosures 1, 2, and 3 are stacked below the controller enclosure—two SCSI Buses per enclosure (see Figure 3–1). In a single-bus disk enclosure configuration, disk enclosures 6, 5, and 4 are stacked above the controller enclosure and disk enclosures 1, 2, and 3 are stacked below the controller enclosure—one SCSI Bus per enclosure (see Figure 3–2).

4. Connect the six VHDCI UltraSCSI bus cables between the controller and disk enclosures as shown in Figure 3–1 for a dual bus system and Figure 3–2 for a single bus system. Note that the supported cable lengths are 1, 2, 3, 5, and 10 meters.

5. Connect the AC power cords from the appropriate rack AC outlets to the controller and disk enclosures.
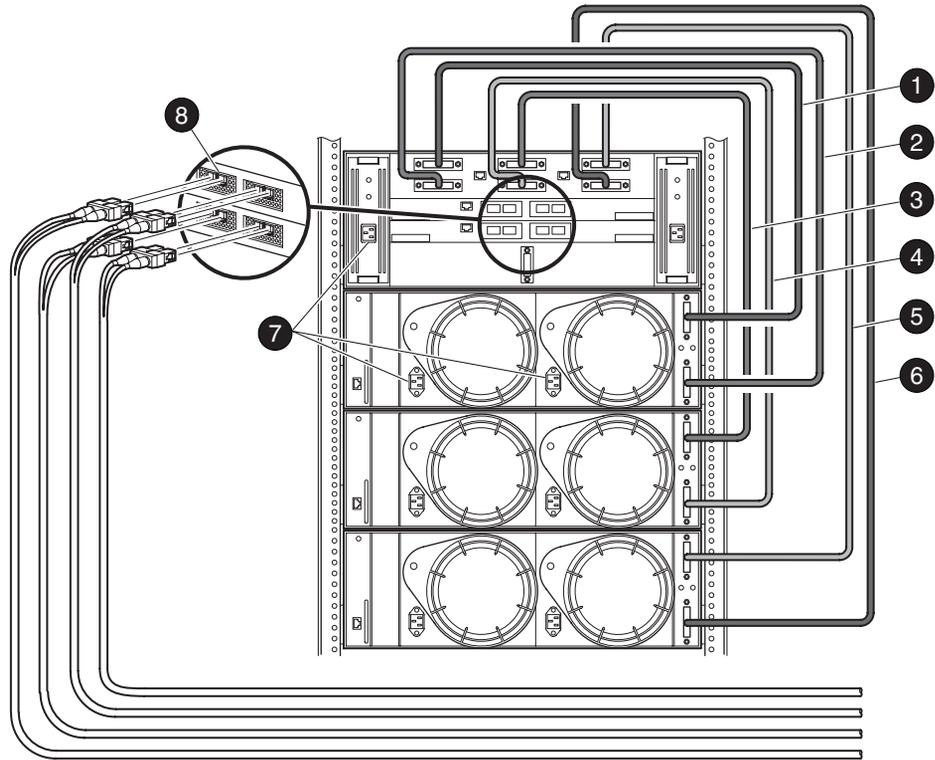
CXO7383A

❶ SCSI Bus 1 Cable ❷ SCSI Bus 2 Cable
❸ SCSI Bus 3 Cable ❹ SCSI Bus 4 Cable
❺ SCSI Bus 5 Cable ❻ SCSI Bus 6 Cable
❼ AC Power Inputs ❽ Fibre Channel Ports

Figure 3–1: Dual-Bus Enterprise Storage RAID Array Storage System
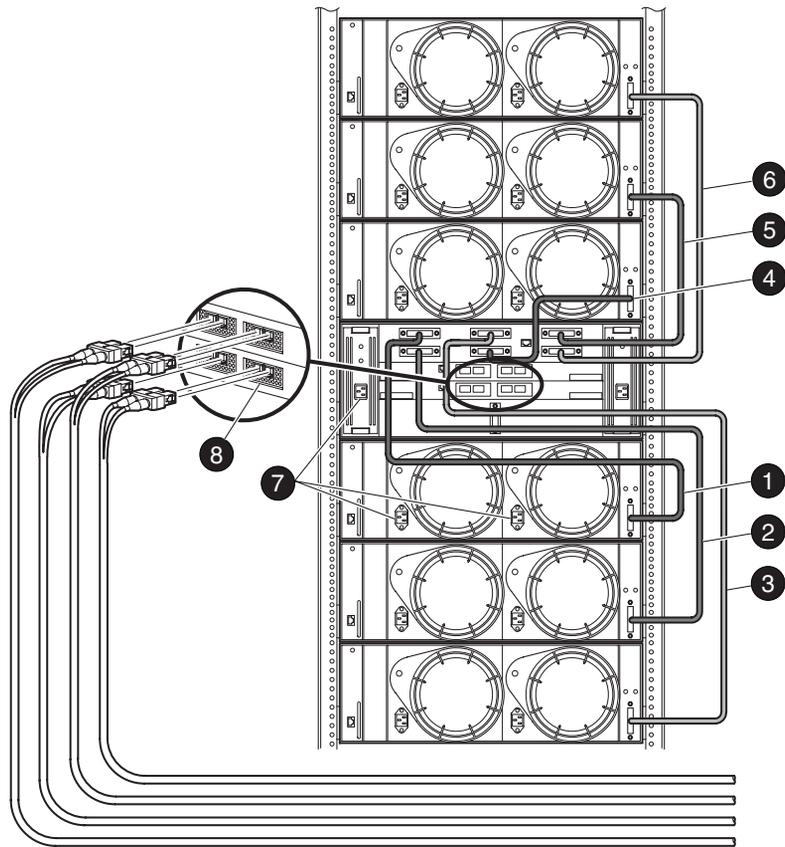
CXO7382A

❶	SCSI Bus 1 Cable	❷	SCSI Bus 2 Cable
❸	SCSI Bus 3 Cable	❹	SCSI Bus 4 Cable
❺	SCSI Bus 5 Cable	❻	SCSI Bus 6 Cable
❼	AC Power Inputs	❽	Fibre Channel Ports

Figure 3–2: Single-Bus Enterprise Storage RAID Array Storage System

Making a Physical Connection

To attach a host computer to the storage subsystem, install one or more host bus adapters into the computer. A Fibre Channel (FC) cable goes from the host bus adapter to an FC switch.

Preparing to Install Host Bus Adapter

Before installing the host bus adapter, perform the following steps:

1. Perform a complete backup of the entire system.

2. Shut down the computer system or perform a hot addition of the adapter based upon directions for that server.

Installing Host Bus Adapter

To make a physical connection, first install a host bus adapter.

$\triangle$ **CAUTION:** Protect the host bus adapter board from electrostatic discharge by wearing an ESD wrist strap. DO NOT remove the board from the antistatic cover until you are ready to install it.

You need the following items to begin:

• Host bus adapter board

• The computer hardware manual

• Appropriate tools to service your computer

The host bus adapter board plugs into a standard PCI slot in the host computer. Refer to the system manual for instructions on installing PCI devices.

NOTE: Take note of the worldwide name (WWN) of each adapter. Do not power on anything yet. For the FC switches to autoconfigure, power on equipment in a certain sequence. Also, the controllers in the subsystem are not yet configured for compatibility with Windows NT and Windows 2000.

In order for Windows NT or Windows 2000 to recognize new Enterprise Storage RAID Array Fibre Channel subsystem devices or changes to existing configurations, you must restart your system.

Installing FCA Adapter Device Driver

Your adapter package provides the required adapter-specific software on a diskette. Use only the adapters and drivers supplied with the adapter kit since these are tested and certified to function with the HSG80 Array Controller.

The FCA Adapter Device Driver must be installed first. Otherwise, improper FCA driver registry settings will result.

For Windows NT 4.0

To install the FCA adapter device driver:

1. From the Windows NT Start Menu, select Settings, then open *Control Panel*.

2. Open *SCSI Adapters* from the *Control Panel*.

3. Select *Drivers* tab and click **Add**.

4. Select *Have Disk*.

5. Insert the diskette labeled FCA *NT DEVICE DRIVER AND DOWNLOAD UTILITY* into the floppy diskette drive.

6. Specify the path to the NT driver, type: A:\, and click **OK**.

7. Select *Emulex LP6000/LP7000/LP8000, PCI-Fibre Channel Adapter* from the *SCSI Adapter List* and click **OK**.

8. Answer *No* to the *Restart* question, and proceed to "Solution Software Upgrade Procedures," page 3–24.

For Windows 2000

To manually install the FCA adapter device driver:

NOTE: Windows 2000 plug and play technology will automatically install a default driver for the 1-GB FCA adapter, but not the 2-GB FCA adapter.

1. From the Windows 2000 Start Menu, select *Setting*s, then open *Control Panel*.

2. From *Administrative Tools*, select *Computer Management*, then open *Device Manager*.

3. Once *Device Manger* is open, select *SCSI and RAID controllers* to select the driver type. Select *Emulex LP6000/7000/8000/9000/850/950, PCI-Fibre Channel Adapter*.

4. Open the *Properties* screen by right-clicking and selecting *Properties,* once *Properties* is open, select the *Driver* tab.

5. From the *Driver* screen, select the *Update Driver* button to begin the *Upgrade Device Driver Wizar*d.

6. From the second screen of the wizard, select *Display a list of the known drivers for this device so that I can choose a specific driver.*

7. In the third screen of the wizard, click the *Have Disk* button, then the *Install From Disk Box* will appear. Select *Brows*e.

8. From *Brows*e, select *CD-ROM*. Then, from the CD that came with your kit, open the FCA folder.

9. Once the FCA folder opens, select the *WIN2K* folder for OEM set up. Proceed through the remaining steps of the wizard to complete the driver installation.

Initial Setup Settings

Windows Settings

Your new storage system components must be initially configured using a serial cable connection to the HSG80 array controllers. You may change one or more of the following settings: SCSI-2 or SCSI-3 mode, CCL enabled or disabled, transparent or multiple-bus failover mode, and arbitrated loop or fabric mode.

The controllers are preset with the following settings:

- SCSI-2 mode
- CCL enabled
- Transparent Failover mode
- Arbitrated Loop mode (fixed addresses)

For Windows NT 4.0 or Windows 2000, you can use either SCSI-2 or SCSI-3 mode with the ACS 8.7 version of HSG80 controller software. However, if you intend to use your storage system in a heterogeneous system environment, you may need to use a specific SCSI mode depending on what is required for the other, connected operating systems. Also, for Windows NT 4.0/Windows 2000, if you use the preset SCSI-2 mode, then you must change CCL to the disabled state.

You will need to use serial for your initial set up to define how your server and storage system interact. The HSG80 controller comes shipped with a setting of SCSI-2 and CCL enabled. This means the storage controller can communicate using SCSI-2 protocols and its Command Console LUN feature is enabled. With ACS V8.7, SCSI-3 protocol is also supported. If you choose to use SCSI-3, then CCL is permanently enabled. The choices you have for Windows NT are to use either SCSI-3 with CCL permanently enabled, or SCSI-2 with CCL disabled.

IMPORTANT: StorageWorks recommends that customers use SCSI-3. If you choose SCSI-2 with CCL enabled, you will get Disk Administrator errors. Therefore, at initial set up, you will need to either: leave the controller set to SCSI-2 protocol but disable CCL, or set the controller to SCSI-3 protocol

Your choice will depend on how you later intend to use your storage system. In certain heterogeneous environments, you may be required to use SCSI-3 protocols (for example, if sharing your storage system with an OpenVMS-based server). You may choose to use SCSI-2 protocol if you are sharing your storage system with a server that requires SCSI-2 protocols. In this case, whether or not CCL is required may become an issue. Choosing either disabling CCL under SCSI-2 or enabling SCSI-3 will require you to make an initial serial line connection to your HSG80 controller.

For the HSG80 controllers and FCA adapter driver, if you plan to connect to a Fibre Channel fabric switch, change to Fabric mode.

If you plan to install Secure Path software, select multiple-bus failover mode in both of your HSG80 controllers. Instructions are available in the Secure Path software kit.

Installing RAID Windows NT and Windows 2000 Device Driver

The Fibre Channel Software and RAID Windows NT (HszDisk.sys) or Windows 2000 (HsxDisk.sys) Device Driver software is installed on your host server from the RAID Array Software Solution CD-ROM. After you insert the CD-ROM, the program should start automatically.

NOTE: If the program does not start automatically after inserting the CD-ROM, go to the CD-ROM drive directory and click install.bat. in the root directory.

The software installation program provides one main option: Solution Software for ACS Version 8.7.

1. Select the Solution Software option.

2. Select the FCA Upgrade option.

NOTE: The driver upgrade can be skipped by selecting Skip Driver upgrade at the bottom of the screen, although this is not recommended.

3. Select the Fibre Channel Software Setup option from the menu that appears after the driver upgrade is completed.

4. Choose the setup that matches your system configuration from the four options that are presented.

The Fibre Channel Software performs as follows:

• Automatically installs the Hsz/HsxDisk SCSI Driver.

• Automatically sets registry for proper operational use of the FCA Fibre Channel host adapter with the Enterprise Storage RAID Array Fibre Channel system.

• Enables "Extended Configuration" settings to be specified in a Fibre Channel Switch (FC-SW) topology and Fibre Channel Arbitrated Loop (FC-AL) topology.

• Enables Arbitrated Loop Physical Address (ALPA) settings to be specified for the FCA adapter in a Fibre Channel Arbitrated Loop (FC-AL) topology.

• Copies the appropriate driver to the%systemroot%\system32\drivers folder.

• Checks for SCSI related error log events since the last system boot.

• Reports SCSI driver revision information.

Hsz/HsxDisk Driver

NOTE: HsxDisk refers to the Windows 2000 device driver. HszDisk refers to the Windows NT device driver.

The Hsz/HsxDisk driver works with the Hsz/HSG-family of RAID controllers to enhance the Windows 2000/Windows NT online storage availability and fault-tolerance.

Hsz/HsxDisk works in single-host and cluster environments to maintain optimum subsystem performance during storageset error recovery conditions *(For example*: the failure of a RAID 3/5 or mirrorset drive member).

Hsz/HsxDisk also works in single-host and cluster environments to assist the subsystem during controller failover and failback operations. In Windows NT/Windows 2000 cluster environments, Hsz/HsxDisk works to facilitate Hsz-/HSG-based storageset migration during host failover and failback events.

Hsz/HsxDisk will only service Hsz and HSG based storage devices and will not affect the operation or performance of other storage devices on the system. The driver makes use of the Windows NT/Windows 2000 system event log and will post error and

informational events when required. If the driver loads successfully during boot time, it will post an informational message in the log reporting that it claimed available Hsz- and HSG-based storagesets.

Fibre Channel Software Setup utility supports driver un-installation with Windows NT 4.0 or Windows 2000. Hsz/HsxDisk may be uninstalled using the Add/Remove program applet from the control panel. However, you should not uninstall the driver unless you have disconnected the subsystem from the servers. HSG-family RAID controllers should never be installed without Hsz/HsxDisk.sys configured.

FCA Driver Support

The FCA is the PCI Fibre Channel adapter that is supported with the Enterprise Storage RAID Array Fibre Channel RAID System. Because the Fibre Channel Software Setup utility can only modify existing FCA registry settings, the driver from the supplied floppy must be installed prior to running the Fibre Channel Setup Utility.

The Fibre Channel Setup Utility changes the FCA driver registry settings and copies an updated version of the driver to the driver's directory to ensure proper operational use of the FCA Fibre Channel host adapter with the Enterprise Storage RAID Array Fibre Channel system. These registry settings are required for both single host and Windows NT/Windows 2000 Cluster configurations.

Fibre Channel Switch

The Fibre Channel Setup Utility makes all the driver changes to support fabric topology automatically.

Fibre Channel Hub

Fibre Channel Software Setup also requires you to select an Arbitrated Loop Physical Address (ALPA) when configured in a FC-AL Topology. *StorageWorks* supports up to four servers on the same Arbitrated Loop and recommends using the low numbers ALPAs for each Windows NT/Windows 2000 Server (or FCA adapter). Each server must have a unique ALPA. The recommendation follows:

NT/2000 Server	ALPA Assignment
Server 1	1
Server 2	2
Server 3	4
Server 4	8

NOTE: ALPA assignments are not applicable to a Fibre Channel Switch configuration.

Installing SWCC Client and Creating Your First Virtual Disk

This section contains instructions for installing *StorageWorks* Command Console (SWCC), configuring the HSG80 array controller for Windows NT and Windows 2000 operation, and creating your first virtual disk.

NOTE: For more information, use the online HELP in the SWCC Storage and CLI Windows.

This section provides the instructions required to accomplish the following tasks:

- Install the HSG80 *StorageWorks* Command Console (SWCC) software.

- Launch Command Console Client.

- Establish communications with the HSG80 controller over the serial port.

- Configure the HSG80 controller for Windows NT or Windows 2000 operation.

- Create your first virtual disk.

Connection Methods

There are three connection methods for SWCC:

- Serial

- SCSI

- Network

Serial Port Connection

This method is required to set up your controller and create your first virtual disk. This chapter shows you how to use Command Line Interpreter (CLI) to disable CCL in SCSI-2. You will also use CLI to create an initial virtual disk that enables subsequent SWCC communications using one of the other two methods. The serial port method provides a local, direct connection to your storage array.

NOTE: The rest of this chapter describes controller set up assuming you will retain SCSI-2 mode and disable CCL.

Other Communication Methods

After initial set up, you will be able to connect and communicate with your Enterprise Storage RAID Array Fibre Channel system over a network or the SCSI bus.

- SCSI Bus Connection. A local connection method allows you to connect to your Enterprise Storage RAID Array Fibre Channel system over the SCSI bus.

- Network Connection. You can communicate with your Enterprise Storage RAID Array Fibre Channel system over a TCP/IP network.

Installing StorageWorks Command Console Client

The minimum requirements to run *StorageWorks* Command Console Client are:

- PC Requirements: Pentium, 120 MHz, 64 MB memory, 10 MB free disk space, and CD-ROM drive

- Operating System: Microsoft Windows NT 4.0 or Windows 2000.

Verify that you have SNMP service installed. Refer to Chapter 2 of the *Compaq StorageWorks Command Console Version 2.5, User Guide* for further instructions.

The Command Console Client software is installed on your host system from the *StorageWorks* Command Console CD-ROM. After you insert the CD-ROM, the program should start automatically.

NOTE: If the program does not start automatically after inserting the CD-ROM, go to the CD-ROM drive directory and click LAUNCH.EXE.

The installation program provides one primary option: Solution Software for ACS version 8.7. Select it to install the software.

From the Fibre Channel Solution Software menu that appears, select the *StorageWorks Command Console* option. The StorageWorks Command Console software will be automatically installed.

Launching Command Console Client

To start Command Console from the Windows Start menu, click the HSG80 Storage Window name. The choices provided at startup are:

- CLI Window: HS-series controllers provide a feature called the Command Line Interpreter (CLI) for configuring and monitoring your storage controllers using text-based commands. With the CLI, you can connect a maintenance terminal directly to your controller and manage it using the complete set of CLI commands. You can also use a host-based, virtual terminal, such as Command Console's CLI Window, to make the connection.

- *StorageWorks* Command Console HSG80 ACS V8.7 Storage: Displays the Storage window. This choice lets you monitor and configure one storage subsystem using Client's graphical user interface. All connection choices are provided: serial line, SCSI bus and network (TCP/IP).

- *StorageWorks* Command Console: Displays the Navigation Window. The Navigation Window is a network navigation tool used to manage and monitor storage subsystems over a TCP/IP network. This choice lets you monitor and configure one or many storage subsystems over a network using Client's graphical tools. Refer to Appendix B, Adding Storage Subsystem and its Host to Navigation Tree, for details.

To disable CCL and establish a CLI connection, perform the following actions:

1. Invoke a CLI Window from the Command Console Client's Start menu by performing the following actions:

   a. Select *Command Console*.

   b. Select *CLI Window.*

2. The Connection Selection Window appears. Select **Serial.**

3. At the next window select *9600 baud rate* and click **Connect** to open the CLI Window.

4. Type the following command to disable the Communication LUN:

   ```
   set this_controller nocommand_console_lun
   ```

5. Close the CLI Window.

Establishing a Serial Connection to the HSG80 Storage Window

To set up your HSG80 controller and create your first virtual disk, establish a serial cable connection from one of the PC's COM ports to the storage subsystem's CTR TOP or CTR BOTTOM configuration port, and proceed as follows:

1. Click the **Start** button on the taskbar.

2. Click *Programs*.

3. Click *Command Console*.

4. Select *StorageWorks CC HSG80 ACS V8.5 or newer*.

5. When the Connection Selection dialog box displays, click the **Serial** radio button, then click **OK** to display the Connect Serial dialog box.

6. On the Connect Serial dialog box perform the following actions:

   a. From the drop-down menu, select the PC COM port your HSG80 controller is connected to.

   b. Select the baud rate (controller default is 9600).

   c. Click the **Connect** button to display the Storage Window.

You are now connected to your storage subsystem. The next step is to configure the controller.

NOTE: The top window pane displays the virtual disks you create. The bottom window pane shows the devices you have installed in the Enterprise Storage RAID Array Fibre Channel Subsystem. At startup, Command Console finds installed drives and displays them in a grid by channel and SCSI ID number.

Controller Properties

NOTE: This section discusses one method for setting controller properties. Controller properties can also be set using the CLI.

The controller's operating parameters are stored in property sheets. Controller property sheets are accessed by double-clicking on a controller icon in the Storage Window or right clicking on the icon and selecting Properties. Property sheets are tabbed. To access a sheet, click its tab.

Changes in all fields causes a controller restart to place the changes in effect. The program prompts you for confirmation before it restarts your controller.

NOTE: After you change a parameter that causes a controller restart, there is approximately a 90-second delay while the controller reinitializes.

1. Access the controller's property sheets by double-clicking the controllers' icon in the Storage Window. When you double-click a controller's icon the General controller properties sheet displays. The controller has five property sheets. Each sheet is accessed by clicking on its tab.

2. Confirm the following:

   — Allocation class is 0

   — SCSI Version is SCSI-2 or SCSI-3

3. Set time and date properties.

4. Select the *Host Ports* tab to display the host port operating parameters. For FC hub configurations, verify that the "Requested Topology" and "Actual Topology" settings appear on Port 1, as follows:

   — Requested Topology should show LOOP_HARD.

   — Actual Topology for the Top Controller should show Loop Up on Port 1.

   — The Bottom Controller should show Standby.

   On Port 2, the settings should read as follows:

   — The Bottom Controller should show LOOP_UP.

   — The Top Controller should show Standby.

   For FC switch configurations, verify that the "Requested Topology" fields read FABRIC, and the "Actual Topology" field reads "fabric up". (The "Requested Port" and "Actual Port" Address fields will not exist, and the words "REMOTE COPY = none" appears at the bottom of the window). For more details regarding host port settings, reference the *Compaq StorageWorks Command Console Version 2.5, User Guide.*

5. Select the *Cache* tab to check cache size.
   Confirm the following:

   — Cache flush_time: (seconds): is 10.

   — Respond to internal cache battery condition is selected.

6. Select the *Communications LUN* tab.

   The Communications LUN is not used with Windows NT/Windows 2000 in SCSI-2 mode. It should be disabled (grayed out). If the Communications LUN is enabled, you must disable it using the CLI window. First close the Storage Window, and establish a CLI connection. To invoke a CLI Window from the Command Console Client's Start menu, select *Command Console*, then the *CLI Window* option.

   The Connection Selection Window appears. Select Serial. At the next window select 9600 baud rate and click Connect to invoke the CLI window. Enter the following command to disable the Communication LUN:

   ```
   set this_controller nocommand_console_lun
   ```

   Close the CLI Window. Return to the Windows Start Menu and select the HSG80 Storage Window option to re-open the storage window.

7. Select the *Connections* tab.
   Confirm the following:

   — WINNT is selected

   — Unit Offset should be between 0-99 for Host Port 1, and between 100-199 for Host Port 2 (if connected)

7. Select the *Battery* tab.

NOTE: Confirm that the battery is fully charged. If not, wait until it is fully charged before using the system.

Creating Your First Virtual Disk

With SWCC, you can create a number of different types of logical storage units called virtual disks on your Enterprise Storage RAID Array Fibre Channel Subsystem. These include the following:

- Single-device virtual disks (JBODs).

- Striped virtual disks (RAID 0).

- Mirrored virtual disks (RAID 1).

- Striped mirrored virtual disks (RAID 0+1).

- Striped parity virtual disks with floating parity disk (RAID 3/5).

Virtual disks are created using Command Console Virtual Disk Wizard.

Start the Wizard

To start the Command Console Virtual Disk Wizard perform the following actions:

1. Establish a serial connection to your Enterprise Storage RAID Array Fibre Channel Subsystem.

2. Access the subsystem's Storage Window.

3. Select Add Virtual Disk from the Storage menu.

Create the Virtual Disk

1. Click the radio button of the RAID level you want, then click **Next**.

2. Select the devices you want to include in the virtual disk from a list of available storage devices. You select devices by clicking on them in the Available Storage window in the dialog box. As you click them, they are listed in the Selected devices: windowpane.

3. Select the capacity for the virtual disk, then click **Next**.

4. The wizard offers you the option of using only a portion of the capacity of the devices you have selected for your new virtual disk. It displays the total, available capacity of the devices you have selected in the capacity box. Enter the size of the virtual disk you want to create in the box, then click **Next**.

5. If you want to create multiple partitions, complete all steps for this partition. Then, access the wizard again, and enter the same choices to create another partitioned disk. When finished, click **Next**.

6. Enter the virtual disk name. Windows NT/Windows 2000 recognizes the following disk names:

   — D0 to D7 on Host Port 1 and D100 to D107 on Host Port 2 in SCSI-2

   — D1-D7, D101-D107 in SCSI-3 where D0 is the CCL LUN.

7. Enter the maximum cache transfer blocks, then click **Next**. Host Access controls which servers are allowed to access your storage system's virtual disk.

8. The final Virtual Disk Wizard window, Step 5, recaps the choices you have made in Steps 1 through 4. If you are satisfied with your choices, click **Finish**.

9. The storage set will start initialization. You can view the virtual disks you have created by returning to the Storage Window.

Verifying/Installing Required Versions

NOTE: HsxDisk refers to the Windows 2000 device driver. HszDisk refers to the Windows NT device driver.

Before you run Disk Administrator or Disk Management, verify that Hsz/HsxDisk recognizes the volumes that you created in the Fibre Channel as follows:

1. Open the *Event Viewer* in the *Administrative Tools* group.

2. Look for an entry for Hsz/HsxDisk in the Event Viewer window.

—If an entry for Hsz/HsxDisk appears with 0 in the *Event* column, the Hsz/HsxDisk loaded successfully and connected to at least one logical volume.

—If no entry for the Hsz/HsxDisk appears in the Event View window, reinstall Hsz/HsxDisk and reboot.

—If an entry for Hsz/HsxDisk appears with a 1 in the *Event* column, Hsz/HsxDisk did not load because it did not find any logical drives. Ensure that you have added logical units correctly.

Completing a New RAID Array Configuration

This section summarizes how to use the Windows NT Disk Administrator and Windows 2000 Disk Management to complete a new subsystem configuration. For additional information, refer to your Windows NT and Windows 2000 documentation.

IMPORTANT: Before you begin, remember to back up your system using normal back up procedures.

Understanding the Disk Administrator and Disk Management Displays

Windows 2000 uses the Disk Management program, while Windows NT uses the Disk Administrator program. They both create a "Bar Chart" display of your disk configuration. Windows NT and Windows 2000 names the various devices that were created using the subsystem. Each disk device found by Windows NT and Windows 2000 is given a name; for example, Disk 0, Disk 1, etc. There should be an entry shown for each disk (JBOD) or storageset created.

Windows NT or Windows 2000 assigns disk names based on the order in which the system drivers "find" disks during Windows NT and Windows 2000 boot. The Windows NT host system uses a special disk class driver (HszDisk.SYS) that connects to all HSG80 disks *before* any other disks present in the system are connected. Therefore, the first entries in the Disk Administrator display should represent all your subsystem logical volumes.

Verifying your Configuration

• To verify your configuration in Windows 2000 check in the Windows Event Viewer that the Hsz/HsxDisk successfully loaded.

- To verify your configuration with the Disk Management program perform the following actions:

    — Verify that there is an entry in the Disk Management display for each of your subsystem volumes. If there is not, you should go back and recheck your configuration.

    — Verify that the capacity shown matches the size of the physical disk or subsystem. If it does not match, recheck the logical configuration for the Enterprise Storage RAID Array Fibre Channel system and its members.

NOTE: Disk Administrator and Disk Management displays the "usable" capacity of a RAIDset and MIRRORset, not the combined total of the physical members.

Creating Partitions in Windows 2000 using Disk Management

The Create Partition Wizard enables you to create, format and assign drive letters to partitions from your Windows 2000 desktop. The Create Partition Wizard is started from the Disk Management program. To start Disk Management in Windows 2000 perform the following steps:

1. Right click *My Computer.*

2. Select *Manage*.

3. Double-click *Disk Management*.

To format a partition using the Create Partition Wizard, perform the following actions:

1. For each disk shown, click the partition that you want to create.

2. From the *Action* pull-down menu, choose *All Tasks, Create Partition.* This action launches the Create Partition Wizard.

3. Click **Next.**

    a. Select **Primary Partition**.

    b. Specify a partition size or the accept the default, which is the total capacity available.

    c. Assign a drive letter.

    d. Select the format parameters such as NTFS, volume label of your choice, quick or complete format (default).

    The partition is now formatted.

4. Close the Disk Management program.

Creating Partitions in Windows NT Using the Disk Administrator

NOTE: To create format and assign drive letters to partitions from your Windows NT desktop perform the following procedures.See the CREATE_PARTITION command in the StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide for a description of the partition switches.

Starting the Disk Administrator Program

To start the Disk Administrator in Windows NT perform the following steps:

1. Select *Start>Programs/Administrative Tools (Common)/Disk Administrator.*

2. Click *Disk Administrator.*

NOTE: The first time you run Disk Administrator after adding new disks, one or more messages may appear asking you to confirm whether you want to have Disk Administrator provide its "signature" on the new disks. Click **Yes** to have Disk Administrator recognize these new disks. For more information on this subject, refer to your Windows NT or Windows 2000 documentation.

Creating Partitions

1. For each disk shown, click the partition area that you want to create.

2. From the *Partition* pull-down menu, choose *Create* to display the *Create Primary Partition* window.

NOTE: A disk cannot be accessed unless it contains at least one valid partition that was created under disk administrator.

3. In the *Create Primary Partition* window, enter the size partition you want.

4. Click **OK**. Depending on the partition size you choose, a message window may appear asking you to confirm your selection.

5. Continue to create new partitions until all disks have been partitioned.

Making Drive Letters Permanent

The process of creating partitions assigns a logical name (letter "C", "D", and so forth) to each partition. These letter assignments, under Windows NT will normally "float". As an option, you can make the drive letters permanent. If you want to make the letter assignments permanent, starting from the Disk Administrator perform the following actions:

1. Access the *Tools* pull-down menu.

2. Select *Drive Letter* then choose *To Assign*. This process must be repeated for each partition (drive letter) that you wish to make "permanent."

Committing the Changes

When you have created all your partitions, commit the changes by starting at the Disk Administrator window and performing the following actions:

1. Access the *Partition* pull-down menu.

2. Click **Commit Changes Now**. A message window appears asking you to confirm the changes. Confirm the changes if they are correct.

NOTE: A message window will appear following this step asking you if you wish to save a copy of the configuration to a floppy. You may do so at this time, as prompted by the screen display.

Formatting the Newly Created Partitions

To format newly created partitions, starting from the Disk Administrator perform the following actions:

1. Click the *Tools* pull-down menu, and select *Format* to access the Format menu. The Format menu options allow you to choose the file system type, *FAT* or *NTFS*, and the *Quick Format* option.

2. Select a file system and click **Start** to begin the format process. A message window appears advising you when the formatting is complete.

3. Continue to format each new partition until all partitions have been formatted.

4. When all partitions have been formatted, close Disk Administrator. At this point, the configuration has been completed, and is recognized by Windows NT or Windows 2000.

5. Changes to RAID Array Configuration

6. Before making changes, backup your system.

Removing Disk Partitions

NOTE: Before making changes, back up your system.

When making changes to an existing RAID Array configuration, any existing disk partitions to be changed (or removed) must first be deleted using Windows NT Disk Administrator or Windows 2000 Disk Management. After they have been deleted, you may use the CLI to create new Storagesets.

1. From *Disk Administrator* or *Disk Management*, click the partition you wish to delete.

2. Access the *Partition* menu and choose **Delete**.

3. Continue selecting and deleting the partitions until you have deleted all the partitions you wish. When finished, click **Commit Changes Now**. You may now reconfigure the subsystem using the CLI.

4. Restart your system so Windows NT will recognize the changes. In Windows 2000, you can rescan from *Disk Management*, to avoid a reboot.

Solution Software Upgrade Procedures

Use the following procedures for upgrades to your Solution Software. It is considered best practice to follow this order of procedures:

1. Perform backups of data prior to upgrade;

2. Verify operating system versions, upgrade operating systems to supported versions and patch levels;

3. Quiesce all I/O and unmount all file systems before proceeding;

4. Upgrade switch firmware;

5. Upgrade Solution Software

6. If installing an operating system that uses Secure Path (AIX, HP-UX, Netware, Sun or Windows), upgrade Secure Path to the latest version at this time;

7. Upgrade ACS software.

There is also a "Silent Install" procedure available. See "Solution Software Silent Install," page 3–32 for this information.

NOTE: Solely for the purpose of performing upgrades to the ACS firmware, this Solution Software Kit supports previous ACS Version 8.6. It is not recommended mixing ACS versions in the same SAN.

NOTE: For upgrades in a SAN that includes HSG80 array controllers and Enterprise Virtual 2.0 Arrays controllers, the following are required:

- ACS 8.7 and VCS 2.0 require Solution Software 8.7 (SWCC 2.5) - Retrieve Solution Software drivers from EVA kit, retrieve SWCC drivers from ACS 8.7 kit
- ACS 8.6 and VCS 2.0 require Solution Software 8.6 (SWCC 2.4)
- ACS 8.7 and ACS 8.6 require Solution Software 8.7 (SWCC 2.5)

Refer to the *StorageWorks HSG60/HSG80 Array Controller ACS Version 8.7 Maintenance and Service Guide* and the *Solution Software Release Notes* for the latest information on upgrades.

IMPORTANT: If updating ACS firmware, complete the upgrade after all Windows server upgrades. Be sure to back up data before updating servers.

NOTE: Disconnect fiber cables before proceeding.

These procedures are only applicable to Secure Path Version 3.x products and upgrades, and require Secure Path Version 3.1A Service Pack 2 or Secure Path 4.0.

To obtain Service Pack 2 for Secure Path Version 3.1A, visit the website:

http://www.compaq.com/products/sanworks/secure-path/index.html

Setup-exe Paths

Fibre Channel Install

```
<path>\ACS_87\FC Install\setup.exe
```

Driver Update

```
<path>\ACS_87\Update_utility\setup.exe
```

SWCC Agent

```
<path>\ACS_87|SWCC\Agent\nt intel\hs series agent\setup.exe
```

SWCC HSG80 Client

```
<path>\ACS_87|SWCC\CLIENT\hsg80 acs85\setup.exe
```

SWCC HSG60 Client

```
<path>\ACS_87|SWCC\CLIENT\HSG60 \setup.exe
```

New Installations

NOTE: FCA should not be connected at this time.

NOTE: For Silent Installation, see "Solution Software Silent Install," page 3–32.

1. Using your Solution Software CD-ROM, click the **Solution Software v8.7 for Windows NT/2000** link.

   a. Click the **Perform FCA Driver Update** link to install the HBA driver.

   b. Click the **Fibre Channel Software Setup** link, then choose one of the Multi-Bus Fibre Channel setups, based on your configuration.

   c. Click the **SWCC** link (optional) to install SWCC components.

IMPORTANT: Do Not Restart the server at this time.

2. Using your Secure Path Software CD-ROM, install Secure Path 3.1A or Secure Path 4.0 in accordance with the instructions provided with that product. Then apply the Secure Path 3.1A Service Pack 2 download.

3. Restart the server.

4. Connect FCA to switch.

Updating Windows NT/2000 Server Running Secure Path

The following procedures demonstrate how to upgrade your Solution Software in a multiple-bus failover environment, without changing the existing Secure Path Software.

IMPORTANT: When updating a Windows NT or Windows 2000 server configuration, Secure Path must also be updated to Version 3.1A Service Pack 2 or Version 4.0 to successfully update the FCA HBA driver.

NOTE: Secure Path will not be removed during this process. For updating instructions regarding Secure Path only, see the latest Secure Path Release Notes or Web release, found on the website.

```
http://www.compaq.com/products/sanworks/secure-path/index.html
```

Updating an Existing Standalone Server

Be sure you login to an account with administrator privileges.

1. Stop all applications that access Secure Path storage.

2. Stop Steam Agent (SWCC) in **Services**.

3. Using the **Add/Remove Program** in Control Panel, uninstall:

   a. StorageWorks Command Console (SWCC)

   b. Large LUN Utility (if installed)

IMPORTANT: Do not Restart the server at this time.

4. Using your Solution Software CD-ROM, click the **Solution Software v8.7 for Windows NT/2000** link.

   a. Click the **Perform FCA Driver Update** link to install the HBA driver.

   b. Click the **Fibre Channel Software Setup** link, then choose one of the Multi-Bus Fibre Channel setups, based on your configuration.

   c. Click the **SWCC** link (optional) to install SWCC components.

NOTE: The latest Large LUN utility must be installed if the storage system will be used prior to upgrading ACS to Version 8.7, and a Large LUN configuration was previously employed.

5. Restart the server.

Updating an Existing Cluster

Be sure you login to the server with no disk resources, using an account with administrator privileges.

1. Using **Cluster Administrator**, make note of your original configuration, then move disk resources to the other cluster node. The node being updated should not have any disk resources online. Using Cluster Manager, set all Cluster Groups to **Prevent Failback** while the upgrade is taking place.

IMPORTANT: Cluster Service must continue to run on all nodes. Stopping the Cluster Service during this procedure could result in a Cluster Service failure, and subsequent reinstallation.

2. Stop Steam Agent (SWCC) in **Services**.

3. Using the **Add/Remove Program** in Control Panel, uninstall:

   a. StorageWorks Command Console (SWCC).

   b. Large LUN Utility (if installed)

IMPORTANT: Do not Restart the system at this time.

4. Using your Solution Software CD-ROM, click the **Solution Software v8.7 for Windows NT/2000** link.

   a. Click the **Perform FCA Driver Update** link to install the HBA driver.

   b. Click the **Fibre Channel Software Setup** link, then choose one of the Fibre Channel setups, based on your configuration.

   c. Click the **SWCC** link (optional) to install SWCC components.

NOTE: The latest Large LUN utility must be installed if the storage system will be used prior to upgrading ACS to Version 8.7, and a Large LUN configuration was previously employed.

5. Restart the updated cluster node.

6. Repeat *Step 1* through *Step 5* for the next cluster node.

7. Once all cluster nodes have been upgraded, using **Cluster Administrator**, restore all Cluster Groups to their original **Prevent Failback** setting, and restore storage groups to their original configuration.

Updating Software and Secure Path on Windows NT/2000 Server

The following procedures demonstrate how to upgrade your Solution Software, in conjunction with your Secure Path Software, in a multiple-bus failover environment.

Updating an Existing Standalone Server

Be sure you login to an account with administrator privileges.

1. Stop all applications that access Secure Path storage.

2. Stop Steam Agent (SWCC) in **Services**.

3. Using the **Add/Remove Program** in Control Panel, uninstall:

   a. StorageWorks Command Console (SWCC)

   b. Large LUN Utility (if installed)

IMPORTANT: Do not Restart the server at this time.

4. Using your Secure Path Software CD-ROM, install Secure Path 3.1A or 4.0 in accordance with the instructions provided with that product. Then apply the Secure Path 3.1A Service Pack 2 download.

5. Reboot the server.

6. Using your Solution Software CD-ROM, click the **Solution Software v8.7 for Windows NT/2000** link.

   a. Click the **Perform FCA Driver Update** link to install the HBA driver.

   b. Click the **Fibre Channel Software Setup** link, then choose one of the Multi-Bus Fibre Channel setups, based on your configuration.

   c. Click the **SWCC** link (optional) to install SWCC components.

NOTE: The latest Large LUN utility must be installed if the storage system will be used prior to upgrading ACS to Version 8.7, and a Large LUN configuration was previously employed.

7. Restart the server.

Updating an Existing Cluster

Be sure you login to the server with no disk resources, using an account with administrator privileges.

1. Using **Cluster Administrator**, make note of your original configuration, then move disk resources to the other cluster node. The node being updated should not have any disk resources online. Using Cluster Manager, set all Cluster Groups to **Prevent Failback** while the upgrade is taking place.

IMPORTANT: Cluster Service must continue to run on all nodes. Stopping the Cluster Service during this procedure could result in a Cluster Service failure, and subsequent reinstallation.

2. Stop Steam Agent (SWCC) in **Services**.

3. Using the **Add/Remove Program** in Control Panel, uninstall:

   a. StorageWorks Command Console (SWCC).

   b. Large LUN Utility (if installed)

IMPORTANT: Do not Restart the system at this time.

4. Using your Secure Path Software CD-ROM, install Secure Path 3.1A or 4.0 in accordance with the instructions provided with that product. Then apply the Secure Path 3.1A Service Pack 2 download.

5. Using your Solution Software CD-ROM, click the **Solution Software v8.7 for Windows NT/2000** link.

   a. Click the **Perform FCA Driver Update** link to install the HBA driver.

   b. Click the **Fibre Channel Software Setup** link, then choose one of the Multi-Bus Fibre Channel setups, based on your configuration.

   c. Click the **SWCC** link (optional) to install SWCC components.

NOTE: The latest Large LUN utility must be installed if the storage system will be used prior to upgrading ACS to Version 8.7, and a Large LUN configuration was previously employed.

6. Restart the updated cluster node.

7. Repeat *Step 1* through *Step 6* for the next cluster node.

8. Once all cluster nodes have been upgraded, using **Cluster Administrator**, restore all Cluster Groups to their original **Prevent Failback** setting, and restore storage groups to their original configuration.

Transparent Failover Configurations

The following procedures are applicable to transparent failover configurations only.

New Installations

NOTE: For Silent Installation, see "Solution Software Silent Install," page 3–32.

1. Using your Solution Software CD-ROM, click the **Solution Software v8.7 for Windows NT/2000** link.

   a. Click the **Perform FCA Driver Update** link to install the HBA driver.

   b. Click the **Fibre Channel Software Setup** link, then choose one of the Transparent Fibre Channel setups, based on your configuration.

   c. Click the **SWCC** link (optional) to install SWCC components.

2. Restart the server.

Updating an Existing Standalone Server

Be sure you login to an account with administrator privileges.

1. Stop all applications that access storage.

2. Stop Steam Agent (SWCC) in **Services**.

3. Using the **Add/Remove Program** in Control Panel, uninstall:

   a. StorageWorks Command Console (SWCC)

   b. Large LUN Utility (if installed)

IMPORTANT: Do not Restart the server at this time.

4. Using your Solution Software CD-ROM, click the **Solution Software v8.7 for Windows NT/2000** link.

   a. Click the **Perform FCA Driver Update** link to install the HBA driver.

   b. Click the **Fibre Channel Software Setup** link, then choose one of the Transparent Fibre Channel setups, based on your configuration.

   c. Click the **SWCC** link (optional) to install SWCC components.

NOTE: The latest Large LUN utility must be installed if the storage system will be used prior to upgrading ACS to Version 8.7, and a Large LUN configuration was previously employed.

5. Restart the server.

Updating an Existing Cluster

Be sure you login to the server with no disk resources, using an account with administrator privileges.

1. Using **Cluster Administrator**, make note of your original configuration, then move disk resources to the other cluster node. The node being updated should not have any disk resources online. Using Cluster Manager, set all Cluster Groups to **Prevent Failback** while the upgrade is taking place.

IMPORTANT: Keep Cluster Service running on all nodes. Stopping the Cluster Service during this procedure could result in a Cluster Service failure, and force a subsequent reinstallation.

2. Stop Steam Agent (SWCC) in **Services**.

3. Using the **Add/Remove Program** in Control Panel, uninstall:

   a. StorageWorks Command Console (SWCC).

   b. Large LUN Utility (if installed)

IMPORTANT: Do not Restart the system at this time.

4. Using your Solution Software CD-ROM, click the **Solution Software v8.7 for Windows NT/2000** link.

   a. Click the **Perform FCA Driver Update** link to install the HBA driver.

   b. Click the **Fibre Channel Software Setup** link, then choose one of the Transparent Fibre Channel setups, based on your configuration.

   c. Click the **SWCC** link (optional) to install SWCC components.

NOTE: The latest Large LUN utility must be installed if the storage system will be used prior to upgrading ACS to Version 8.7, and a Large LUN configuration was previously employed.

5. Restart the updated cluster node.

6. Repeat *Step 1* through *Step 5* for the next cluster node.

7. Once all cluster nodes have been upgraded, using **Cluster Administrator**, restore all Cluster Groups to their original **Prevent Failback** setting, and restore storage groups to their original configuration.

Solution Software Silent Install

The Solution Software Solution for Windows has a "Silent Installation" option.

This "Silent Installation" is a method of creating an installation process best suited to the functional needs of a system and, through that process, creates a default script that can be utilized on other systems that need the same installation. This same installation has the output of that first install but without all the steps to get to that solution.

The Silent Install can be used for:

- Fibre Channel Software Setup for Transparent Switch

- Fibre Channel Software Setup for Multibus Switch

- Fibre Channel Adapter (FCA) Driver Update Utility

- Storageworks Command Console Client/Agent (While creating the response file for the Agent, choose Exit during the Agent Configuration of the installation. Use the HS Series Agent Configurator to setup agent)

The following are instructions on how to setup and create this method of install to simplify the job on other systems. For specific installation order, refer to the "Installing RAID Array Storage System," page 3–1.

Steps

1. Open the Command Prompt and go to the directory where *setup.exe* is located.

2. At the Command Prompt, type "setup.exe -r" (without the quotes) and complete the install to record the desired installation choices. This will generate the setup.iss file.

3. Locate the "setup.iss" file in the WINNT folder. You can copy this file to the location of choice (copying to the same location of setup.exe is preferred).

4. To run the silent install, open the Command Prompt and change to the directory where the setup.exe that generated the silent setup file (setup.iss) is located.

5. Type "setup.exe -s" (without the quotes). The "-s" switch will direct the install process to use the choices that were recorded in the setup.iss file. This will produce a "setup.log" file in the folder where the setup.exe file is located. Setup.exe -s can be used if the setup.iss is located in the same folder.

Options

There are additional command line switches that can be used with "-s".

- -f1<path>\setup.iss (Specifies an alternate location and name of the response file (.iss file))

- -f2<path>\setup.log (Specifies an alternate location and name of the log file created)

At the Command Prompt (or from a batch file), the command should look like"setup.exe -s -f1<path>\setup.iss -f2<path>\setup.log" where the path after -f1 is to the Windows or Winnt directory and the path after -f2 is to where you want the setup.log to be generated.

To check the success of the installation, view the setup.log file. Under the ResponseResult" section, a successful install shows "ResultCode=0."

If running setup.exe from the CD-ROM, the setup.log file will not be generated unless the -f2 switch is used. Also, the -f1 switch will be required to point to the setup.iss file.

Refer to Secure Path documentation for instructions regarding silent install for that product.

IMPORTANT: If updating ACS firmware, complete the upgrade after all Windows server upgrades. Be sure to back up data before updating servers.

NOTE: Disconnect fiber cables before proceeding.

These procedures are only applicable to Secure Path Version 3.x products and upgrades, and require Secure Path Version 3.1A Service Pack 2 or Secure Path 4.0.

To obtain Service Pack 2 for Secure Path Version 3.1A, visit the website:

http://www.compaq.com/products/sanworks/secure-path/index.html

Component Identifier Program

Figure 3–3 demonstrates this program. The screen shot illustrates many of the details of the Component Identifier Program, with the exception of the following addtitional information:

- *Component.exe* is installed to the \WINNT\System32 folder with the Fibre Channel Software setup

- *Component.exe* can also be run from the CD \ACS_8.7\fcinstall folder

- The data can be saved to a text file to the location of choice.

Figure 3–3: Component Identifier Program

4
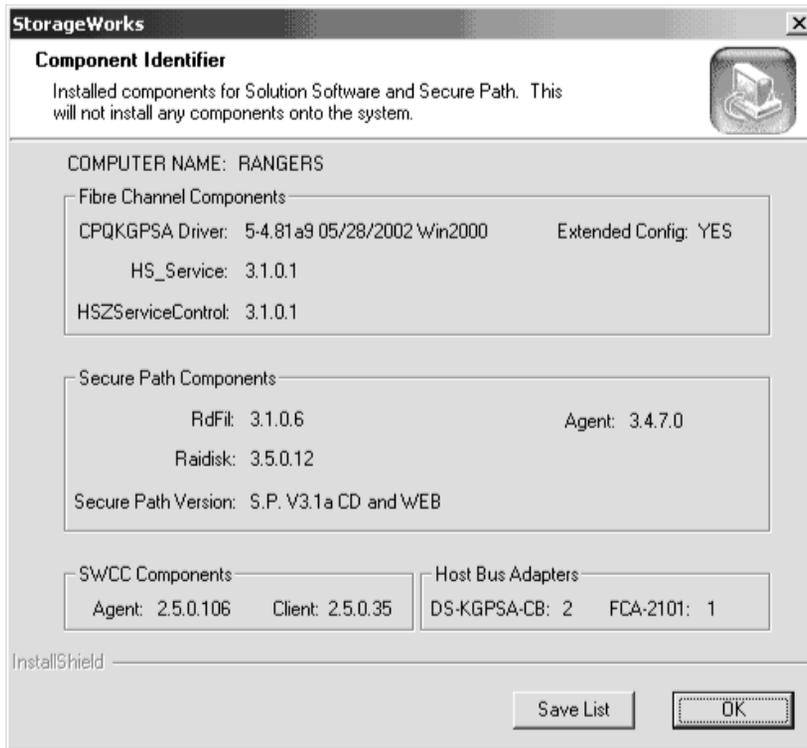
Installing and Configuring HSG Agent

StorageWorks Command Console (SWCC) enables real-time configuration of the storage environment and permits the user to monitor and configure the storage connected to the HSG80 controller.

The following information is included in this chapter:

- "Why Use StorageWorks Command Console (SWCC)?," page 4–1
- "Installation and Configuration Overview," page 4–2
- "About the Network Connection for the Agent," page 4–3
- "Before Installing the Agent," page 4–5
- "Removing the Agent," page 4–16

Refer to Chapter 5 for a description of how to configure a subsystem that uses Fibre Channel fabric topology.

Why Use StorageWorks Command Console (SWCC)?

StorageWorks Command Console (SWCC) enables you to monitor and configure the storage connected to the HSG80 controller. SWCC consists of Client and Agent.

- The client provides pager notification and lets you manage your virtual disks. The client runs on Windows 2000 with Service Pack 2 and 3 and Windows NT 4.0 with Service Pack 6A or above.
- The agent obtains the status of the storage connected to the controller. It also passes the status of the devices connected to the controller to other computers.

To receive information about the devices connected to your HSG80 controller over a TCP/IP network, you must install the Agent on a computer that is connected to a controller.

The Agent can also be used as a standalone application without Client. In this mode, which is referred to as Agent only, Agent monitors the status of the subsystem and provides local and remote notification in the event of a failure. A subsystem includes the HSG80 controller and its devices. Remote and local notification can be made by SNMP messages to an SNMP monitoring program.

Table 4–1: SWCC Features and Components

Features	Agent Required?	Client Required?
Creation of RAID sets: ■ Striped device group (RAID 0) ■ Mirrored device group (RAID 1) ■ Striped mirrored device group (RAID 0+1) ■ Striped parity device group (RAID 3/5) ■ Individual device (JBOD)	Yes	Yes
Monitor multiple subsystems at once	Yes	No
Event logging	Yes	No
Pager notification	Yes	Yes

NOTE: For serial and SCSI connections, the Agent is not required for creating virtual disks.

Installation and Configuration Overview

Table 4–2 provides an overview of the installation.

Table 4–2: Installation and Configuration Overview

Step	Procedure
1	Verify that your hardware has been set up correctly. See the previous chapters in this guide.
2	Verify that you have a network connection for the Client and Agent systems.

Table 4–2: Installation and Configuration Overview (Continued)

Step	Procedure
3	■ If you plan to connect the HSG80 to a computer running Windows NT 4.0 or Windows 2000 in SCSI-2 mode, you must disable the Command Console LUN (CCL) and create a virtual disk by using the command line interface (CLI). For information on how to disable the CCL, See "What is the Command Console LUN?" on page 1–11 in Chapter 1. For information on how to create a virtual disk, see "Add Unit" in the *StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide.* ■ For all other connections, verify that the Command Console LUN has been enabled. See "What is the Command Console LUN?" on page 1–11 in Chapter 1.
4	Install the Agent (TCP/IP network connections) on a system connected to the HSG80 controller. See Chapter 3 for agent installation.
5	Add the name of the Client system to the Agent's list of Client system entries (TCP/IP network connections). This can be done during installation or when reconfiguring the Agent.
6	Install the Client software on Windows 2000 with Service Pack 2 or 3 or Windows NT 4.0 with Service Pack 6A. See Appendix B.
7	Add the name of the Agent system to the Navigation Tree of each Client system that is on the Agent's list of Client system entries (TCP/IP network connections). See Appendix B.
8	Set up pager notification (TCP/IP network connections). Refer to "Setting Up Pager Notification" in the *StorageWorks Command Console Version 2.5, User Guide.*

About the Network Connection for the Agent

The network connection, shown in Figure 4–1, displays the subsystem connected to a hub or a switch. SWCC can consist of any number of Clients and Agents in a network. However, it is suggested that you install only one Agent on a computer.

By using a network connection, you can configure and monitor the subsystem from anywhere on the LAN. If you have a WAN or a connection to the Internet, monitor the subsystem with TCP/IP.

IMPORTANT: SWCC does not support the dynamic host configuration protocol (DHCP) or the Windows Internet Name Service (WINS).
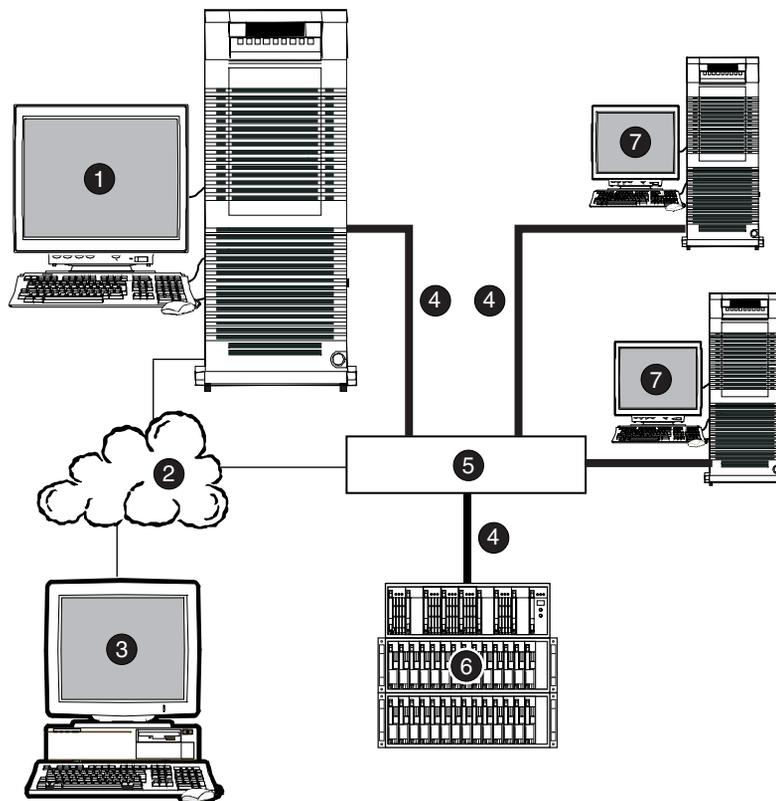
CXO7240A

Figure 4–1: An example of a network connection

❶ Agent system (has the Agent software)

❷ TCP/IP Network

❸ Client system (has the Client software)

❹ Fibre Channel cable

❺ Hub or switch

❻ HSG80 controller and its device subsystem

❼ Servers

Before Installing the Agent

The Agent requires the minimum system requirements, as defined in the release notes for your operating system. The program is designed to operate with the Client version 2.5 on Windows 2000 or Windows NT.

1. Log into an account that is a member of the administrator group. All Agent installations on Windows NT must be done locally. Do not attempt to install the Agent over the network.

2. Remove previous versions of the Agent from your computer.

3. Read the release notes.

4. If any of your shortcuts point to a floppy drive, a CD-ROM drive, or a removable drive, verify that the floppy or CD-ROM drives are not empty and that the removable drive is present. The installation will check the shortcuts on the desktop and in the Start menu. The installation will check the shortcuts of all users for that computer, even if they are not currently logged on.

Installing and Configuring the Agent

The Command Console Agent software is installed on your host system from the StorageWorks Command Console CD-ROM.

1. Insert the Solution Software CD-ROM into the host system. A menu appears on your screen.

NOTE: If the program does not start automatically after inserting the CD-ROM, go to the CD-ROM drive directory and click install.bat.

2. The installation program provides one primary option: Solution Software for ACS version 8.7. If you are just installing SWCC, skip the driver upgrade screen. Select SWCC to install.

3. Click **Next**. Follow the instructions on the screen.

After the computer installs the software, you are asked if you want to configure the Agent.

4. Click **Continue** to configure your Agent. The Windows NT Agent Configuration Step 1 of 3 window appears.

5. Enter your password in the New field, and retype it in the Verification field. The password must have 4 to 16 characters.

6. Click **Next** to continue. The following message appears:

    ```
    Password Validation Successful.
    ```

7. Click **OK** to continue. The Windows NT Agent Configuration Step 2 of 3 window appears.

8. In the Selected Client field, enter the name of the client system entry that you want to receive updates from this Agent. In addition, adding a client system entry allows you to access the agent system from the Navigation Tree on that client system. Choose TCP/IP and/or SNMP for your notification scheme.

NOTE: Put your most important client systems at the top of this list and the client systems that are connected infrequently to the network at the bottom. The Agent first contacts the client systems that are located at the top of the list.

The following describes how the Transmission Control Protocol/Internet Protocol (TCP/IP) and the Simple Network Management Protocol (SNMP) work with SWCC:

Table 4–3: Client System Notification Options

Options	SWCC Function
Transmission Control Protocol/Internet Protocol (TCP/IP)	■ Automatically updates the Storage Window of subsystem changes ■ Required for event logging and pager notification ■ If you do not select TCP/IP, you will need to refresh the Storage Window (depending on the subsystem) to obtain the latest status of a subsystem.
Simple Network Management Protocol (SNMP)	Requires you to use an SNMP-monitoring program to view SNMP traps

9. Select one of the following for your access privileges: overall status, detailed status, and configuration. The access privilege level controls the client system's level of access to the storage subsystems. The following explains the client system access options:

Table 4–4: Client System Access Options

Options	SWCC Function
Overall Status	■ Can use the Client to add a system to a Navigation Tree, set up a pager, and view properties of the controller and the system ■ Cannot use Client to open a Storage Window
Detailed Status	Can use the Client to open a Storage Window, but you cannot make modifications in that window
Configuration	Can use the Client to make changes in a Storage Window to modify a subsystem configuration

10. Click **Add Client** to add the client system entry to the Client list. For more information on adding, deleting, or modifying a Client, See "You can change the configuration you created when you installed the Agent by using the HS Series Agent Configurator, which can be accessed from the Start menu." on page 8.

11. Click **Next** to continue. If the Windows NT Agent Configuration Step 3 of 3 window appears, go to step 13.

    If you had previously added a subsystem, the following message appears:

    ```
    A previous storage list is detected. Would you like to scan the
    subsystem to update the information? The subsystem names will
    revert to default settings.
    ```

    If you click **Yes,** the software will automatically add entries for the new subsystems and restore default subsystem information for the existing entries.

    Or

    If you click **No**, the software will keep the current settings.

    The Windows NT Agent Configuration Step 3 of 3 window appears.

12. The configuration wizard should have created an entry for the subsystems attached to this system. To modify the name or other settings for a subsystem, see *You can change the configuration you created when you installed the Agent by using the HS Series Agent Configurator, which can be accessed from the Start menu.* presented in the next section.

13. Click **Finish**. A message, warning you to restart your Agent, appears.

14. Click **OK**. The computer asks the following:

    ```
    Would you like to start the Windows NT Agent service now?
    ```

15. Click **Yes.** The Agent starts.

16. Add this system to the Navigation Tree of each client system that you added to the Agent's list (*File > Add System* in the Command Console Client). Refer to the Command Console Client Help.

You can change the configuration you created when you installed the Agent by using the HS Series Agent Configurator, which can be accessed from the Start menu.

Changing the Agent Access Password

The password controls access to the Agent configuration.

1. Open the HS Series Agent Configurator.

2. Click **Continue**. The NT Agent Configuration Step 1 of 3 window appears.

3. Enter your new password in the New field, and retype it in the Verification field. The password must have 4 to 16 characters.

4. Click **Next** to continue. The following message appears:

   ```
   Password Validation Successful.
   ```

5. Click **OK** to continue. The NT Agent Configuration Step 2 of 3 window appears.

6. Click **Next** to continue. If the NT Agent Configuration Step 3 of 3 window appears, go to step 7.

   The following message appears if you had previously added a subsystem:

   ```
   A previous storage list is detected. Would you like to scan the
   subsystem to update the information? (Subsystem names will revert
   to default settings.)
   ```

   If you click *Yes*, the software will automatically add entries for the new subsystems and restore default subsystem information for the existing entries.

   Or

   If you click **No,** the software will keep the current settings.

   The NT Agent Configuration Step 3 of 3 window appears.

7. Click **Finish.** The following message appears:

   ```
   No subsystem information was added to the subsystem list. Subsystem
   list will not be created or modified.
   ```

8. Click **OK**. The Welcome NT Agent Configuration Utility window appears.

9. Click **Exit** to quit the NT Agent Configuration Utility.

10. You must stop and restart the Agent for your changes to take effect. For instructions, see "Stopping and Starting the Agent," page 4–15.

Adding a Client System Entry

For a client system to receive updates from the Agent, you must add the client system to the Agent's list of client systems. The Agent will only send information to client systems that are on this list. In addition, adding a client system entry allows you to access the agent system from the Navigation Tree on that client system.

NOTE: Put your most important client systems at the top of this list and the client systems that are connected infrequently to the network at the bottom. The Agent first contacts the client systems that are located at the top of the list.

1. Open the HS Series Agent Configurator.

   The Welcome NT Agent Configuration Utility window appears.

2. Click **Continue**. The NT Agent Configuration Step 1 of 3 window appears.

3. Click **Next** to continue. You do not need to enter your password. The NT Agent Configuration Step 2 of 3 window appears.

4. Enter the name of the client system entry that you want to have access to this Agent in the Selected Client field.

5. Select TCP/IP and/or SNMP for your notification scheme. For a definition of the notification scheme, see Table 4–3 on page 6.

6. Select one of the following for your access privileges: overall status, detailed status, and configuration. For a definition of each access privilege level, see Table 4–4 on page 7.

7. Click **Add Client** to add the client system entry to the list of client system entries.

8. Click **Next** to continue. If the NT Agent Configuration Step 3 of 3 window appears, go to step 9.

   The following message appears if you had previously added a subsystem:

   ```
   A previous storage list is detected. Would you like to scan the
   subsystem to update the information? (Subsystem names will revert
   to default settings.)
   ```

   If you click **Yes**, the software will automatically add entries for the new subsystems and restore default subsystem information for the existing entries.

   Or

If you click **No**, the software will keep the current settings.

The NT Agent Configuration Step 3 of 3 window appears.

9. Click **Finish**. The following message appears:

```
No subsystem information was added to the subsystem list. Subsystem
list will not be created or modified.
```

10. Click **OK**. The Welcome NT Agent Configuration Utility window appears.

11. Click **Exit** to quit the NT Agent Configuration Utility.

12. You must stop and restart the Agent for your changes to take effect. For instructions, see "Stopping and Starting the Agent," page 4–15.

Modifying a Client System Entry

1. Open the HS Series Agent Configurator.

   The Welcome NT Agent Configuration Utility window appears.

2. Click **Continue**. The NT Agent Configuration Step 1 of 3 window appears.

3. Click **Next** to continue. You do not need to enter your password. The NT Agent Configuration Step 2 of 3 window appears.

4. Select the client system entry that you want to modify. You can change your notification scheme and/or your access privileges.

5. Click **Modify Client** to confirm your changes.

6. Click **Next** to continue. If the NT Agent Configuration Step 3 of 3 window appears, go to step 7.

   The following message appears if you had previously added a subsystem:

```
A previous storage list is detected. Would you like to scan the
subsystem to update the information? (Subsystem names will revert
to default settings.)
```

   If you click **Yes**, the software will automatically add entries for the new subsystems and restore default subsystem information for the existing entries.

   Or

   If you click **No**, the software will keep the current settings.

   The NT Agent Configuration Step 3 of 3 window appears.

7. Click **Finish**. The following message appears:

   ```
   No subsystem information was added to the subsystem list. Subsystem
   list will not be created or modified.
   ```

8. Click **OK**. The Welcome NT Agent Configuration Utility window appears.

9. Click **Exit** to quit the NT Agent Configuration Utility.

10. You must stop and restart the Agent for your changes to take effect. For instructions, see "Stopping and Starting the Agent," page 4–15.

Deleting a Client System Entry

When a you delete client system entry from the Agent's list, the following occurs:

- The Agent stops sending updates to that client system
- You are unable to access this agent system from the Navigation Tree.

1. Open the HS Series Agent Configurator.

   The Welcome NT Agent Configuration Utility window appears.

2. Click **Continue**. The NT Agent Configuration Step 1 of 3 window appears.

3. Click **Next** to continue. You do not need to enter your password. The NT Agent Configuration Step 2 of 3 window appears.

4. Select the client system entry that you want to delete in the Selected Client field. Click **Delete Client**.

5. Click **Next** to continue. If the NT Agent Configuration Step 3 of 3 window appears, go to step 6.

   The following message appears if you had previously added a subsystem:

   ```
   A previous storage list is detected. Would you like to scan the
   subsystem to update the information? (Subsystem names will revert
   to default settings.)
   ```

   If you click **Yes**, the software will automatically add entries for the new subsystems and restore default subsystem information for the existing entries.

   Or

   If you click **No**, the software will keep the current settings.

   The NT Agent Configuration Step 3 of 3 window appears.

6. Click **Finish**. The following message appears:

   ```
   No subsystem information was added to the subsystem list. Subsystem
   list will not be created or modified.
   ```

7. Click **OK**. The Welcome NT Agent Configuration Utility window appears.

8. Click **Exit** to quit the NT Agent Configuration Utility.

9. You must stop and restart the Agent for your changes to take effect. For instructions, see "Stopping and Starting the Agent," page 4–15.

Adding a Subsystem Entry

You must tell the Agent which subsystems to monitor.

<div>

△ **CAUTION:** Verify that you have the correct communication drive before you manually add a subsystem.

</div>

1. Open the HS Series Agent Configurator.

   The Welcome NT Agent Configuration Utility window appears.

2. Click **Continue**. The NT Agent Configuration Step 1 of 3 window appears.

3. Click **Next** to continue. You do not need to enter your password. The NT Agent Configuration Step 2 of 3 window appears.

4. Click **Next** to continue. If the NT Agent Configuration Step 3 of 3 window appears, go to step 5.

   The following message appears if you had previously added a subsystem:

   ```
   A previous storage list is detected. Would you like to scan the
   subsystem to update the information? (Subsystem names will revert
   to default settings.)
   ```

   If you click **Yes**, the software will automatically add entries for the new subsystems and restore default subsystem information for the existing entries.

   Or

   If you click **No**, the software will keep the current settings.

   The NT Agent Configuration Step 3 of 3 window appears.

5. Enter the name of the subsystem in the Selected Subsystem field. Enter the communication drive letter and monitoring interval in seconds. The monitoring interval is the rate at which the Agent queries the specified subsystem for status. A reasonable monitoring interval in seconds would be 120.

   When you select Subsystem Enabled, the subsystem is included in the Agent's scans. When Subsystem Enabled is selected, the software configures the storage.ini file so that the subsystem selected in the dialog box is visible to the host. The storage.ini file holds information about the RAID devices connected to your server.

6. Click **Add Subsystem**. The name of the added subsystem appears in the Storage Subsystems field.

7. Click **Finish**. A message, warning you to restart your Agent, appears.

8. Click **OK.** You exit the NT Agent Configuration Utility.

9. You must stop and restart the Agent for your changes to take effect. For instructions, see "Stopping and Starting the Agent," page 4–15.

Modifying a Subsystem Entry

1. Open the HS Series Agent Configurator.

   The Welcome NT Agent Configuration Utility window appears.

2. Click **Continue**. The NT Agent Configuration Step 1 of 3 window appears.

3. Click **Next** to continue. You do not need to enter your password. The NT Agent Configuration Step 2 of 3 window appears.

4. Click **Next** to continue. If the NT Agent Configuration Step 3 of 3 window appears, go to step 5.

   The following message appears if you had previously added a subsystem:

   ```
   A previous storage list is detected. Would you like to scan the
   subsystem to update the information? (Subsystem names will revert
   to default settings.)
   ```

   If you click **Yes**, the software will automatically add entries for the new subsystems and restore default subsystem information for the existing entries.

   Or

   If you click **No**, the software will keep the current settings.

   The NT Agent Configuration Step 3 of 3 window appears.

5. Select the subsystem that you want to modify in the Subsystems field. You may change the communication drive letter, the monitoring interval, and the subsystem's name. The monitoring interval is the rate at which the Agent queries the specified subsystem for status. A reasonable monitoring interval in seconds would be 120.

   When you select Subsystem Enabled, the subsystem is included in the Agent's scans. When Subsystem Enabled is selected, the subsystem is visible in the Client GUI.

   When you select the subsystem, the following properties are shown: controller enter, devices, EMU enter, firmware version, serial number of controller 1, serial number of controller 2, and total number of devices.

6. Click **Modify Subsystem** to confirm your changes.

7. Click **Finish**. A message, warning you to restart your Agent, appears.

8. Click **OK**. You exit the NT Agent Configuration Utility.

9. You must stop and restart the Agent for your changes to take effect. For instructions, see "Stopping and Starting the Agent," page 4–15.

Deleting a Subsystem Entry

When you delete a subsystem entry, the Agent stops monitoring that subsystem.

1. Open the HS Series Agent Configurator.

   The Welcome NT Agent Configuration Utility window appears.

2. Click **Continue**. The NT Agent Configuration Step 1 of 3 window appears.

3. Click **Next** to continue. You do not need to enter your password. The NT Agent Configuration Step 2 of 3 window appears.

4. Click **Next** to continue. If the NT Agent Configuration Step 3 of 3 window appears, go to step 5.

   The following message appears if you had previously added a subsystem:

   ```
   A previous storage list is detected. Would you like to scan the
   subsystem to update the information? (Subsystem names will revert
   to default settings.)
   ```

   If you click **Yes**, the software will automatically add entries for the new subsystems and restore default subsystem information for the existing entries.

Or

If you click **No**, the software will keep the current settings.

The NT Agent Configuration Step 3 of 3 window appears.

5. Select the subsystem that you want to delete in the Storage Subsystems field. Click **Delete Subsystem**.

6. Click **Finish**. A message, warning you to restart your Agent, appears.

7. Click **OK**. You exit the NT Agent Configuration Utility.

8. You must stop and restart the Agent for your changes to take effect. For instructions, see "Stopping and Starting the Agent," page 4–15.

Stopping and Starting the Agent

The Agent runs as a service in the background. When you stop the Agent, you are telling the software to stop monitoring the tape controllers that were added to the Tape Controller Management page.

From Windows NT

1. Double click **Services** in *Control Panel*.

2. Click **Steam**.

3. Click **Stop** or **Start**, then click **Close**.

4. Refresh the open Storage Windows for the HSG and HSZ controllers.

From Windows 2000

1. Click *Start > Settings > Control Panel > Administrative Tools > Component Services*.

2. Under Console Root, select **Services (Local)**.

3. Under Services (Local), right-click **Steam**.

4. Click **Stop** or **Start**.

5. Refresh the open Storage Windows for the HSG and HSZ controllers.

Disabling and Enabling the Agent Startup at System Boot

The default is for the Agent to start at system boot; however, you may want to change this option. For example, if you need to check your system, you may not want the Agent to start at system boot.

NOTE: If you want to enable the Agent to start at system boot, change the startup type to automatic.

From Windows NT

1. Double click **Services** in *Control Panel*.

2. Double click **Steam**. The Service window appears. Select *Manual* under Startup Type, and click **OK**.

From Windows 2000

1. Click *Start > Settings > Control Panel > Administrative Tools > Component Services*.

2. Under Console Root, select *Services (Local)*.

3. Under *Services (Local)*, right-click **Steam**.

4. From the drop-down menu, select *Properties*. The Steam (Local Computer) window appears.Under the General tab, select *Manual* from the Startup Type drop-down menu and then Click **OK**.

Removing the Agent

1. On Windows NT 4.0, double click the Add/ Remove Programs icon in the Control Panel. The Add/Remove Program Properties window appears.

2. On Windows 2000, click *Start > Settings > Control Panel > Add/Remove Programs*. The Add/ Remove Program window appears.

3. Select *StorageWorks CC HS Series Agent* in the window.

4. On Windows NT 4.0, click **Add/Remove**.

5. On Windows 2000, click **Change/Remove**.

6. Follow the instructions on the screen. The HS Series Agent is removed.

5

FC Configuration Procedures

This chapter describes procedures to configure a subsystem that uses Fibre Channel
(FC) fabric topology. In fabric topology, the controller connects to its hosts through
switches.

The following information is included in this chapter:

- "Establishing a Local Connection," page 5–2

- "Setting Up a Single Controller," page 5–3

- "Setting Up a Controller Pair," page 5–10

- "Configuring Devices," page 5–17

- "Configuring Storage Containers," page 5–17

- "Assigning Unit Numbers and Unit Qualifiers," page 5–23

- "Configuration Options," page 5–24

Use the command line interpreter (CLI) or *StorageWorks* Command Console (SWCC)
to configure the subsystem. This chapter uses CLI to connect to the controller. To use
SWCC for configuration, see the SWCC online help for assistance.

IMPORTANT: These configuration procedures assume that controllers and cache modules are
installed in a fully functional and populated enclosure and that the PCMCIA cards are installed.

To install a controller or cache module and the PCMCIA card, see the *StorageWorks
HSG60/HSG80 Array Controller ACS Version 8.7 Maintenance and Service Guide*.

Establishing a Local Connection

A local connection is required to configure the controller until a command console LUN (CCL) is established using the CLI. Communication with the controller can be through the CLI or SWCC.

The maintenance port, shown in Figure 5–1, provides a way to connect a maintenance terminal. The maintenance terminal can be an EIA-423 compatible terminal or a computer running a terminal emulator program. The maintenance port accepts a standard RS-232 (RJ45) jack. The maintenance port cable shown in Figure 5–1 has a 9-pin connector molded onto the end for a PC connection. If you need a terminal connection or a 25-pin connection, you can order optional cabling.

CXO7181A
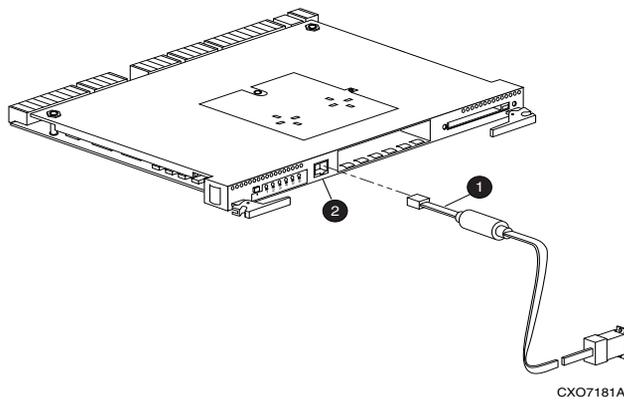
❶ Maintenance Port Cable   ❷ Maintenance Port

Figure 5–1: Maintenance port connection

⚠ **CAUTION:** The maintenance port generates, uses, and can radiate radio-frequency energy through its cables. This energy may interfere with radio and television reception. Disconnect all maintenance port cables when not communicating with the controller through the local connection.

Setting Up a Single Controller

Power On and Establish Communication

1. Connect the computer or terminal to the controller as shown in Figure 5–1. The connection to the computer is through the COM1 or COM2 port.

2. Turn on the computer or terminal.

3. Apply power to the storage subsystem.

4. Verify that the computer or terminal is configured as follows:
   — 9600 baud
   — 8 data bits
   — 1 stop bit
   — no parity
   — no flow control

5. Press **Enter**. A copyright notice and the CLI prompt appear, indicating that you established a local connection with the controller.

Cabling a Single Controller

The cabling for a single controller is shown in Figure 5–2.

NOTE: It is a good idea to plug only the controller cables into the switch. The host cables are plugged into the switch as part of the configuration procedure ("Configuring a Single Controller Using CLI," page 5–4).

CXO6881B
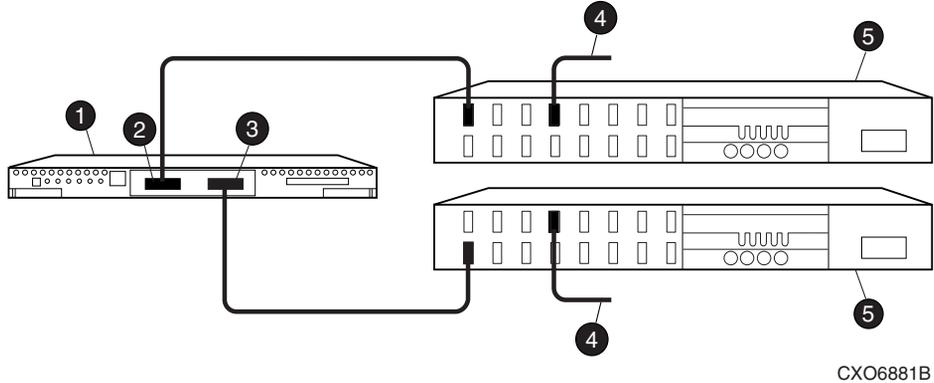
❶ Controller   ❹ Cable from the switch to the host Fibre Channel
adapter

❷ Host port 1

❸ Host port 2   ❺ FC switch

Figure 5–2: Single controller cabling

Configuring a Single Controller Using CLI

To configure a single controller using CLI involves the following processes:

- Verify the Node ID and Check for Any Previous Connections.

- Configure Controller Settings.

- Restart the Controller.

- Set Time and Verify all Commands.

- Plug in the FC Cable and Verify Connections.

- Repeat Procedure for Each Host Adapter.

- Verify Installation.

Verify the Node ID and Check for Any Previous Connections

1. Enter a SHOW THIS command to verify the node ID:

   SHOW THIS

   See "Worldwide Names (Node IDs and Port IDs)," page 1–27, for the location of
   the sticker.

The node ID is located in the third line of the SHOW THIS result:

```
HSG80> SHOW THIS
Controller:
   HSG80 ZG80900583 Software V8.7, Hardware E11
   NODE_ID           = 5000-1FE1-0001-3F00
   ALLOCATION_CLASS = 0
```

If the node ID is present, go to step 5.
If the node ID is all zeroes, enter node ID and checksum, which are located on a sticker on the controller enclosure. Use the following syntax to enter the node ID:

```
SET THIS NODE_ID=NNNN-NNNN-NNNN-NNNN nn
```

Where:*NNNN-NNNN-NNNN-NNNN* is the node ID, and *nn* is the checksum.

2. When using a controller that is not new from the factory, enter the following command to take it out of any failover mode that may have been configured previously:

```
SET NOFAILOVER
```

If the controller did have a failover mode previously set, the CLI may report an error. Clear the error with this command:

```
CLEAR_ERRORS CLI
```

3. Enter the following command to remove any previously configured connections:

```
SHOW CONNECTIONS
```

A list of named connections, if any, is displayed.

4. Delete these connections by entering the following command:

```
DELETE !NEWCON01
```

Repeat the Delete command for each of the listed connections. When completed, no connections will be displayed.

Configure Controller Settings

5. Set the SCSI version using the following command syntax:

```
SET THIS SCSI_VERSION=SCSI-2, or
SET THIS SCSI_VERSION=SCSI-3
```

NOTE: If SCSI-2 is selected, you must disable CCL using the command:

```
SET THIS NOCOMMAND_CONSOLE_LUN
```

6. Set the topology for the controller. If both ports are used, set topology for both ports:

   ```
   SET THIS PORT_1_TOPOLOGY=FABRIC
   ```

   ```
   SET THIS PORT_2_TOPOLOGY=FABRIC
   ```

   If the controller is not factory-new, it may have another topology set, in which case these commands will result in an error message. If this happens, take both ports offline first, then reset the topology:

   ```
   SET THIS PORT_1_TOPOLOGY=OFFLINE
   ```

   ```
   SET THIS PORT_2_TOPOLOGY=OFFLINE
   ```

   ```
   SET THIS PORT_1_TOPOLOGY=FABRIC
   ```

   ```
   SET THIS PORT_2_TOPOLOGY=FABRIC
   ```

7. Set Allocation class to a decimal number between 0 and 999. The number must be unique across the fabric. Set allocation class using the following syntax:

   ```
   SET THIS ALLOCATION_CLASS=N
   ```

Restart the Controller

8. Restart the controller, using the following command:

   ```
   RESTART THIS
   ```

9. Assign an identifier for the communication LUN (also called the command console LUN, or CCL). The CCL must have a unique identifier that is a decimal number in the range 1 to 32767, and which is different from the identifiers of all units. Use the following syntax:

   ```
   SET THIS IDENTIFIER=N
   ```

   Identifier must be unique among all the controllers attached to the fabric within the specified allocation class.

Set Time and Verify all Commands

1. Set the time on the controller by entering the following syntax:

   ```
   SET THIS TIME=DD-MMM-YYYY:HH:MM:SS
   ```

2. Use the FRUTIL utility to set up the battery discharge timer. Enter the following command to start FRUTIL:

   ```
   RUN FRUTIL
   ```

When FRUTIL asks if you intend to replace the battery, answer "**Y**":

```
Do you intend to replace this controller's cache battery? Y/N [N] Y
```

FRUTIL will print out a procedure, but will not give you a prompt. Ignore the procedure and press the **Enter** key.

3. Set up any additional optional controller settings, such as changing the CLI prompt. See the SET *THIS CONTROLLER/OTHER CONTROLLER* command in the StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide for the format of optional settings.

4. Verify that all commands have taken effect. Use the following command:

```
SHOW THIS
```

Verify node ID, allocation class, SCSI version, failover mode, identifier, and port topology.

The following sample is a result of a SHOW THIS command, with the areas of interest in bold.

```
Controller:
   HSG80 ZG94214134 Software V8.7, Hardware 0000
   NODE_ID           = 5000-1FE1-0007-9750
   ALLOCATION_CLASS = 01
   SCSI_VERSION     = SCSI-3
   Configured for dual-redundancy with ZG9421461
   In dual-redundant configuration
Device Port SCSI address 7
   Time: 10-Mar-2002:12:30:34
   Command Console LUN is disabled
   Smart Error Eject Disabled(IDENTIFIER = 88)
Host PORT_1:
   Reported PORT_ID = 5000-1FE1-0007-9751
    PORT_1_TOPOLOGY = FABRIC (fabric up)
   Address         = 7D4000
Host PORT_2:
   Reported PORT_ID = 5000-1FE1-0007-9752
    PORT_2_TOPOLOGY = FABRIC (standby)
   Address         = 210513
NOREMOTE_COPY
Cache:
   512 megabyte write cache, version 0022
   Cache is GOOD
   No unflushed data in cache
   CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
Mirrored Cache:
   Not enabled
Battery:
   NOUPS
   FULLY CHARGED
   Expires: 25-JUN-2003
.......
```

5. Turn on the switches, if not done previously.

   If you want to communicate with the Fibre Channel switches through Telnet, set an IP address for each switch. See the manuals that came with the switches for details.

Plug in the FC Cable and Verify Connections

6. Plug the Fibre Channel cable from the first host bus adapter into the switch. Enter the SHOW CONNECTIONS command to view the connection table:

   ```
   SHOW CONNECTIONS
   ```

7. Rename the connections to something meaningful to the system and easy to remember. For example, to assign the name ANGEL1A1 to connection !NEWCON01, enter:

   ```
   RENAME !NEWCON01 ANGEL1A1
   ```

   For a recommended naming convention, see "Naming Connections," page 1–12.

8. Specify the operating system for the connection:

   ```
   SET ANGEL1A1 OPERATING_SYSTEM=WINNT
   ```

9. Verify the changes:

   ```
   SHOW CONNECTIONS
   ```

   Mark or tag all Fibre Channel cables at both ends for ease of maintenance.

Repeat Procedure for Each Host Adapter

10. Repeat step 7, 8, and 9 for each of that adapter's host connections, or delete the unused connections from the table.

11. For each host adapter, repeat steps 6 through 10.

Verify Installation

To verify installation for your Windows NT and Windows 2000 host, enter the following command:

```
SHOW DEVICES
```

Setting Up a Controller Pair

Power Up and Establish Communication

1. Connect the computer or terminal to the controller as shown in Figure 5–1. The connection to the computer is through the COM1 or COM2 ports.

2. Turn on the computer or terminal.

3. Apply power to the storage subsystem.

4. Configure the computer or terminal as follows:

   — 9600 baud

   — 8 data bits

   — 1 stop bit

   — no parity

   — no flow control

5. Press **Enter**. A copyright notice and the CLI prompt appear, indicating that you established a local connection with the controller.

Cabling a Controller Pair

The cabling for a controller pair is shown in Figure 5–3.

NOTE: It is a good idea to plug only the controller cables into the switch. The host cables are plugged into the switch as part of the configuration procedure ("Configuring a Controller Pair Using CLI," page 5–11).

Figure 5–3 shows a controller pair with failover cabling showing one HBA per server with HSG80 controller in transparent failover mode.

CXO6887B
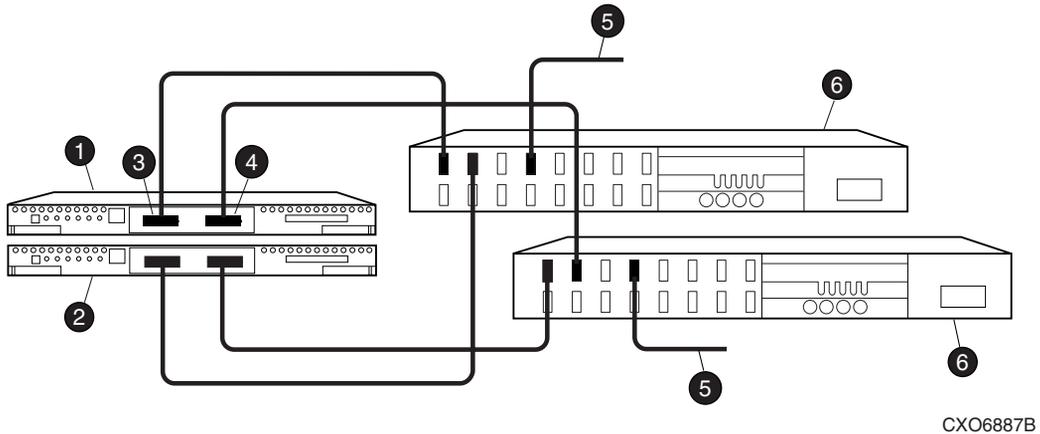
❶	Controller A	❹	Host port 2
❷	Controller B	❺	Cable from the switch to the host FC adapter
❸	Host port 1	❻	FC switch

Figure 5–3: Controller pair failover cabling

Configuring a Controller Pair Using CLI

To configure a controller pair using CLI involves the following processes:

- Configure Controller Settings.
- Restart the Controller.
- Set Time and Verify All Commands.
- Plug in the FC Cable and Verify Connections.
- Repeat Procedure for Each Host Adapter.
- Verify Installation.

1. Enter a SHOW THIS command to verify the node ID:

   SHOW THIS

   See "Worldwide Names (Node IDs and Port IDs)," page 1–27, for the location of the sticker.

The node ID is located in the third line of the SHOW THIS result:

```
HSG80> show this
Controller:
    HSG80 ZG80900583 Software V8.7, Hardware E11
    NODE_ID         = 5000-1FE1-0001-3F00
    ALLOCATION_CLASS = 0
```

If the node ID is present, go to step 5.
If the node ID is all zeroes, enter the node ID and checksum, which are located on a sticker on the controller enclosure. Use the following syntax to enter the node ID:

```
SET THIS NODE_ID=NNNN-NNNN-NNNN-NNNN nn
```

Where: *NNNN-NNNN-NNNN-NNNN* is the node ID and *nn* is the checksum.

2. If the controller is not new from the factory, enter the following command to take it out of any failover mode that may have been previously configured:

```
SET NOFAILOVER
```

If the controller did have a failover mode previously set, the CLI may report an error. Clear the error with this command:

```
CLEAR_ERRORS CLI
```

3. Enter the following command to remove any previously configured connections:

```
SHOW CONNECTIONS
```

A list of named connections, if any, is displayed.

4. Delete these connections by entering the following command:

```
DELETE !NEWCON01
```

Repeat the Delete command for each of the listed connections. When completed, no connections will be displayed.

Configure Controller Settings

5. Set the SCSI version to SCSI-3 using the following command:

```
SET THIS SCSI_VERSION=SCSI-3
```

NOTE: Setting the SCSI version to SCSI-3 does not make the controller fully compliant with the SCSI-3 standards.

6. Assign an identifier for the communication LUN (also called the command console LUN, or CCL). The CCL must have a unique identifier that is a decimal number in the range 1 to 32767, and which is different from the identifiers of all units. Use the following syntax:

   ```
   SET THIS IDENTIFIER=N
   ```

   Identifier must be unique among all the controllers attached to the fabric within the specified allocation class.

7. Set the topology for the controller. If both ports are used, set topology for both ports:

   ```
   SET THIS PORT_1_TOPOLOGY=FABRIC
   ```
   ```
   SET THIS PORT_2_TOPOLOGY=FABRIC
   ```

   If the controller is not factory-new, it may have another topology set, in which case these commands will result in an error message. If this happens, first take both ports offline, then reset the topology:

   ```
   SET THIS PORT_1_TOPOLOGY=OFFLINE
   ```
   ```
   SET THIS PORT_2_TOPOLOGY=OFFLINE
   ```
   ```
   SET THIS PORT_1_TOPOLOGY=FABRIC
   ```
   ```
   SET THIS PORT_2_TOPOLOGY=FABRIC
   ```

8. Set Allocation class to a decimal number between 0 and 999. The number must be unique across the fabric. Set allocation class using the following syntax:

   ```
   SET THIS ALLOCATION_CLASS=N
   ```

Restart the Controller

9. Restart the controller, using the following command:

   ```
   RESTART THIS
   ```

   It takes about a minute for the CLI prompt to come back after a RESTART command.

Set Time and Verify All Commands

10. Set the time on the controller by entering the following syntax:

    ```
    SET THIS TIME=DD-MMM-YYYY:HH:MM:SS
    ```

11. Use the FRUTIL utility to set up the battery discharge timer. Enter the following command to start FRUTIL:

    ```
    RUN FRUTIL
    ```

When FRUTIL asks if you intend to replace the battery, answer "**Y**":

```
Do you intend to replace this controller's cache battery? Y/N [N] Y
```

FRUTIL will print out a procedure, but will not give you a prompt. Ignore the procedure and press **Enter**.

12. Set up any additional optional controller settings, such as changing the CLI prompt. See the SET *THIS CONTROLLER/OTHER CONTROLLER* command in the StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide for the format of optional settings. Perform this step on both controllers.

13. Verify that all commands have taken effect by entering the following command:

```
SHOW THIS
```

14. Verify node ID, allocation class, SCSI version, failover mode, identifier, and port topology. The following display is a sample result of a SHOW THIS command, with the areas of interest in bold.

```
Controller:
    HSG80 ZG94214134 Software V8.7, Hardware 0000
    NODE_ID         = 5000-1FE1-0007-9750
    ALLOCATION_CLASS = 01
    SCSI_VERSION    = SCSI-3
    Configured for dual-redundancy with ZG9421461
    In dual-redundant configuration
Device Port SCSI address 7
    Time: 10-Mar-2002:12:30:34
    Command Console LUN is disabled
    Smart Error Eject Disabled(IDENTIFIER = 88)
Host PORT_1:
    Reported PORT_ID = 5000-1FE1-0007-9751
    PORT_1_TOPOLOGY = FABRIC (fabric up)
    Address         = 7D4000
Host PORT_2:
    Reported PORT_ID = 5000-1FE1-0007-9752
    PORT_2_TOPOLOGY = FABRIC (standby)
    Address         = 210513
NOREMOTE_COPY
Cache:
    512 megabyte write cache, version 0022
    Cache is GOOD
    No unflushed data in cache
    CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
Mirrored Cache:
    Not enabled
Battery:
    NOUPS
    FULLY CHARGED
    Expires: 25-JUN-2003
```

15. Turn on the switches if not done previously.

    If you want to communicate with the FC switches through Telnet, set an IP address for each switch. See the manuals that came with the switches for details.

Plug in the FC Cable and Verify Connections

16. Plug the FC cable from the first host adapter into the switch. Enter a SHOW CONNECTIONS command to view the connection table:

    SHOW CONNECTIONS

    The first connection will have one or more entries in the connection table. Each connection will have a default name of the form !NEWCONxx, where xx is a number representing the order in which the connection was added to the connection table.

    For a description of why plugging in one adapter can result in multiple connections, see "Numbers of Connections," page 1–13.

17. Rename the connections to something meaningful to the system and easy to remember. For example, to assign the name ANGEL1A1 to connection !NEWCON01, enter:

    RENAME !NEWCON01 ANGEL1A1

    StorageWorks recommends using a naming convention, see "Naming Connections," page 1–12.

18. Specify the operating system for the connection:

    SET ANGEL1A1 OPERATING_SYSTEM=WINNTAIX_CAMBEX

19. Verify the changes:

    SHOW CONNECTIONS

    Mark or tag all Fibre Channel cables at both ends for ease of maintenance.

Repeat Procedure for Each Host Adapter Connection

20. Repeat steps 17, 18, and 19 for each of that adapter's host connections or delete the unwanted connections from the table.

21. For each host adapter, repeat steps 16 through 20.

Verify Installation

To verify installation for your Windows NT and Windows 2000 host, enter the following command:

```
SHOW DEVICES
```

Configuring Devices

The disks on the device bus of the HSG80 can be configured manually or with the CONFIG utility. The CONFIG utility is easier. Invoke CONFIG with the following command:

```
RUN CONFIG
```

> ⚠ **WARNING: It is highly recommended to use the CONFIG utility only at reduced I/O loads.**

CONFIG takes about two minutes to discover and to map the configuration of a completely populated storage system.

Configuring Storage Containers

For a technology refresher on this subject, refer to "Choosing a Container Type," page 2–14.

In choosing a container, you choose between independent disks (JBODs) or one of several storageset types, as shown in Figure 5–4. The independent disks and the selected storageset may also be partitioned.

The following configurations are detailed in the following section:

- "Configuring a Stripeset" on page 5–18
- "Configuring a Mirrorset" on page 5–19
- "Configuring a RAIDset" on page 5–20
- "Configuring a Striped Mirrorset" on page 5–20
- "Configuring a Single-Disk Unit (JBOD)" on page 5–21
- "Configuring a Partition" on page 5–21
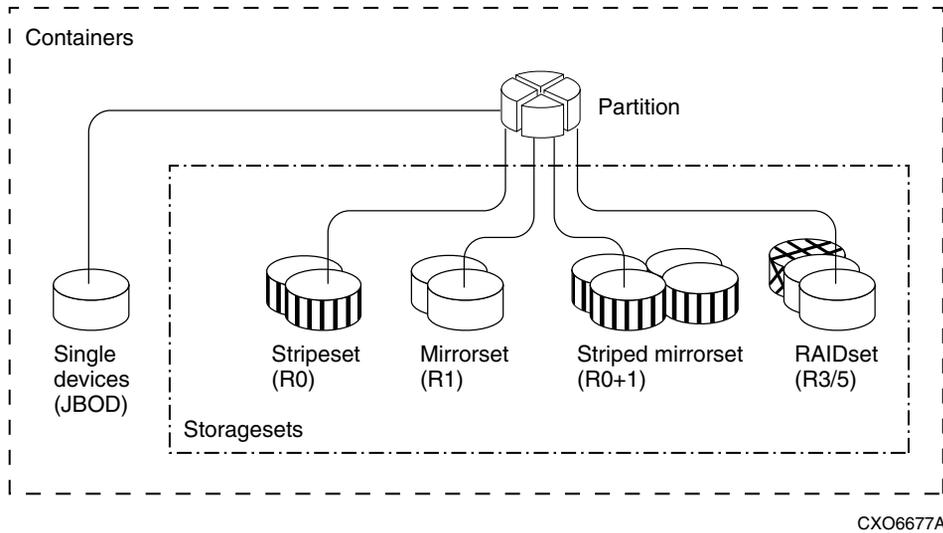
CXO6677A

Figure 5–4: Storage container types

Configuring a Stripeset

1. Create the stripeset by adding its name to the controller's list of storagesets and by specifying the disk drives it contains. Use the following syntax:

   ADD STRIPESET *STRIPESET-NAME DISKNNNNN DISKNNNNN.......*

2. Initialize the stripeset, specifying any desired switches:

   INITIALIZE *STRIPESET-NAME SWITCHES*

   See "Specifying Initialization Switches" on page 2–29 for a description of the initialization switches.

3. Verify the stripeset configuration:

   SHOW *STRIPESET-NAME*

4. Assign the stripeset a unit number to make it accessible by the hosts. See "Assigning Unit Numbers and Unit Qualifiers" on page 5–23.

For example:

The commands to create Stripe1, a stripeset consisting of three disks (DISK10000, DISK20000, and DISK10100) and having a chunksize of 128:

```
ADD STRIPESET STRIPE1 DISK10000 DISK20000 DISK30000
INITIALIZE STRIPE1 CHUNKSIZE=128
SHOW STRIPE1
```

Configuring a Mirrorset

1. Create the mirrorset by adding its name to the controller's list of storagesets and by specifying the disk drives it contains. Optionally, you can append mirrorset switch values:

   ```
   ADD MIRRORSET MIRRORSET-NAME DISKNNNNN DISKNNNNN SWITCHES
   ```

   NOTE: See the ADD MIRRORSET command in the StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide for a description of the mirrorset switches.

2. Initialize the mirrorset, specifying any desired switches:

   ```
   INITIALIZE MIRRORSET-NAME SWITCHES
   ```

   See "Specifying Initialization Switches" on page 2–29 for a description of the initialization switches.

3. Verify the mirrorset configuration:

   ```
   SHOW MIRRORSET-NAME
   ```

4. Assign the mirrorset a unit number to make it accessible by the hosts. See "Assigning Unit Numbers and Unit Qualifiers" on page 5–23.

For example:

The commands to create Mirr1, a mirrorset with two members (DISK10000 and DISK20000), and to initialize it using default switch settings:

```
ADD MIRRORSET MIRR1 DISK10000 DISK20000
INITIALIZE MIRR1
SHOW MIRR1
```

Configuring a RAIDset

1. Create the RAIDset by adding its name to the controller's list of storagesets and by specifying the disk drives it contains. Optionally, you can specify RAIDset switch values:

   ```
   ADD RAIDSET RAIDSET-NAME DISKNNNNN DISKNNNNN DISKNNNNN SWITCHES
   ```

   NOTE: See the ADD RAIDSET command in the StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide for a description of the RAIDset switches.

2. Initialize the RAIDset, specifying any desired switches:

   ```
   INITIALIZE RAIDSET-NAME SWITCH
   ```

   NOTE: StorageWorks recommends that you allow initial reconstruct to complete before allowing I/O to the RAIDset. Not doing so may generate forced errors at the host level. To determine whether initial reconstruct has completed, enter SHOW RAIDSET FULL.

   See "Specifying Initialization Switches" on page 2–29 for a description of the initialization switches.

3. Verify the RAIDset configuration:

   ```
   SHOW RAIDSET-NAME
   ```

4. Assign the RAIDset a unit number to make it accessible by the hosts. See "Assigning Unit Numbers and Unit Qualifiers" on page 5–23.

For example:
The commands to create RAID1, a RAIDset with three members (DISK10000, DISK20000, and DISK10100) and to initialize it with default values:

```
ADD RAIDSET RAID1 DISK10000 DISK20000 DISK30000

INITIALIZE RAID1

SHOW RAID1
```

Configuring a Striped Mirrorset

1. Create, but do not initialize, at least two mirrorsets.

   See "Configuring a Mirrorset" on page 5–19.

2. Create a stripeset and specify the mirrorsets it contains:

   ```
   ADD STRIPESET STRIPESET-NAME MIRRORSET-1 MIRRORSET-2....MIRRORSET-N
   ```

3. Initialize the striped mirrorset, specifying any desired switches:

   ```
   INITIALIZE STRIPESET-NAME SWITCH
   ```

See "Specifying Initialization Switches" on page 2–29 for a description of the initialization switches.

4. Verify the striped mirrorset configuration:

   ```
   SHOW STRIPESET-NAME
   ```

5. Assign the stripeset mirrorset a unit number to make it accessible by the hosts. See "Assigning Unit Numbers and Unit Qualifiers" on page 5–23.

For example**:**
The commands to create Stripe1, a striped mirrorset that comprises Mirr1, Mirr2, and Mirr3, each of which is a two-member mirrorset:

```
ADD MIRRORSET MIRR1 DISK10000 DISK20000

ADD MIRRORSET MIRR2 DISK20100 DISK10100

ADD MIRRORSET MIRR3 DISK10200 DISK20200

ADD STRIPESET STRIPE1 MIRR1 MIRR2 MIRR3

INITIALIZE STRIPE1

SHOW STRIPE1
```

Configuring a Single-Disk Unit (JBOD)

1. Initialize the disk drive, specifying any desired switches:

   ```
   INITIALIZE DISK-NAME SWITCHES
   ```

   See "Specifying Initialization Switches" on page 2–29 for a description of the initialization switches.

2. Verify the configuration by entering the following command:

   ```
   SHOW DISK-NAME
   ```

3. Assign the disk a unit number to make it accessible by the hosts. See "Assigning Unit Numbers and Unit Qualifiers" on page 5–23.

Configuring a Partition

1. Initialize the storageset or disk drive, specifying any desired switches:

   ```
   INITIALIZE STORAGESET-NAME SWITCHES
   ```

   or

   ```
   INITIALIZE DISK-NAME SWITCHES
   ```

See "Specifying Initialization Switches" on page 2–29 for a description of the initialization switches.

2. Create each partition in the storageset or disk drive by indicating the partition's size. Also specify any desired switch settings:

    ```
    CREATE_PARTITION STORAGESET-NAME SIZE=N SWITCHES
    ```

    or

    ```
    CREATE_PARTITION DISK-NAME SIZE=N SWITCHES
    ```

    where N is the percentage of the disk drive or storageset that will be assigned to the partition. Enter SIZE=LARGEST, on the last partition only, to let the controller assign the largest free space available to the partition.

    NOTE: See the CREATE_PARTITION command in the StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide for a description of the partition switches.

3. Verify the partitions:

    ```
    SHOW STORAGESET-NAME
    ```

    or

    ```
    SHOW DISK-NAME
    ```

    The partition number appears in the first column, followed by the size and starting block of each partition.

4. Assign the partition a unit number to make it accessible by the hosts. See "Assigning Unit Numbers and Unit Qualifiers" on page 5–23.

For example:
The commands to create RAID1, a three-member RAIDset, then partition it into two storage units are shown below.

```
ADD RAIDSET RAID1 DISK10000 DISK20000 DISK30000
INITIALIZE RAID1
CREATE_PARTITION RAID1 SIZE=25
CREATE_PARTITION RAID1 SIZE=LARGEST
SHOW RAID1
```

Assigning Unit Numbers and Unit Qualifiers

Each storageset, partition, or single (JBOD) disk must be assigned a unit number for the host to access. As the units are added, their properties can be specified through the use of command qualifiers, which are discussed in detail under the ADD UNIT command in the StorageWorks HSG80 Array Controller ACS Version 8.7 CLI Reference Guide.

Because of different SCSI versions, refer to the section "Assigning Unit Numbers Depending on SCSI_VERSION," page 1–19. The choice for SCSI_VERSION effects how certain unit numbers and host connection offsets interact.

Each unit can be reserved for the exclusive use of a host or group of hosts. See "Restricting Host Access in Transparent Failover Mode," page 1–21 and "Restricting Host Access in Multiple-Bus Failover Mode," page 1–24.

Assigning a Unit Number to a Storageset

To assign a unit number to a storageset, use the following syntax:

```
ADD UNIT UNIT-NUMBER STORAGESET-NAME
```

For example**:**
To assign unit D102 to RAIDset R1, use the following command:

```
ADD UNIT D102 R1
```

Assigning a Unit Number to a Single (JBOD) Disk

To assign a unit number to a single (JBOD) disk, use the following syntax:

```
ADD UNIT UNIT-NUMBER DISK-NAME
```

For example**:**
To assign unit D4 to DISK20300, use the following command:

```
ADD UNIT D4 DISK20300
```

Assigning a Unit Number to a Partition

To assign a unit number to a partition, use the following syntax:

```
ADD UNIT UNIT-NUMBER STORAGESET-NAME PARTITION=PARTITION-NUMBER
```

For example:
To assign unit D100 to partition 3 of mirrorset mirr1, use the following command:

```
ADD UNIT D100 MIRR1 PARTITION=3
```

Preferring Units

In multiple-bus failover mode, individual units can be preferred to a specific controller. For example, to prefer unit D102 to "this controller," use the following command:

```
SET D102 PREFERRED_PATH=THIS
```

RESTART commands must be issued to both controllers for this command to take effect:

```
RESTART OTHER_CONTROLLER

RESTART THIS_CONTROLLER
```

NOTE: The controllers need to restart together for the preferred settings to take effect. The RESTART *this_controller* command must be entered immediately after the RESTART *other_controller* command.

Configuration Options

Changing the CLI Prompt

To change the CLI prompt, enter a 1- to 16- character string as the new prompt, according to the following syntax:

```
SET THIS_CONTROLLER PROMPT = "NEW PROMPT"
```

If you are configuring dual-redundant controllers, also change the CLI prompt on the "other controller." Use the following syntax:

```
SET OTHER_CONTROLLER PROMPT = "NEW PROMPT"
```

NOTE: It is suggested that the prompt name reflect some information about the controllers. For example, if the subsystem is the third one in a lab, name the top controller prompt, LAB3A and the bottom controller, LAB3B.

Mirroring cache

To specify mirrored cache, use the following syntax:

```
SET THIS MIRRORED_CACHE
```

Adding Disk Drives

If you add new disk drives to the subsystem, the disk drives must be added to the controllers' list of known devices:

- To add one new disk drive to the list of known devices, use the following syntax:

  ```
  ADD DISK DISKNNNNN P T L
  ```

- To add several new disk drives to the list of known devices, enter the following command:

  ```
  RUN CONFIG
  ```

Adding a Disk Drive to the Spareset

The spareset is a collection of spare disk drives that are available to the controller should it need to replace a failed member of a RAIDset or mirrorset.

NOTE: This procedure assumes that the disks that you are adding to the spareset have already been added to the controller's list of known devices.

To add the disk drive to the controller's spareset list, use the following syntax:

```
ADD SPARESET DISKNNNNN
```

Repeat this step for each disk drive you want to add to the spareset:

For example**:**
The following example shows the syntax for adding DISK11300 and DISK21300 to the spareset.

```
ADD SPARESET DISK11300
ADD SPARESET DISK21300
```

Removing a Disk Drive from the Spareset

You can delete disks in the spareset if you need to use them elsewhere in your subsystem.

1. Show the contents of the spareset entering the following command:

   ```
   SHOW SPARESET
   ```

2. Delete the desired disk drive entering the following command:

   ```
   DELETE SPARESET DISKNNNNN
   ```

   The RUN CONFIG command does not delete disks from the controllers' device table if a disk has been physically removed or replaced. In this case, you must use the command: DELETE *DISKNNNNN*.

3. Verify the contents of the spareset by entering the following command:

   ```
   SHOW SPARESET
   ```

Enabling Autospare

With AUTOSPARE enabled on the failedset, any new disk drive that is inserted into the PTL location of a failed disk drive is automatically initialized and placed into the spareset. If initialization fails, the disk drive remains in the failedset until you manually delete it from the failedset.

To enable autospare, use the following command:

```
SET FAILEDSET AUTOSPARE
```

To disable autospare, use the following command:

```
SET FAILEDSET NOAUTOSPARE
```

During initialization, AUTOSPARE checks to see if the new disk drive contains metadata. Metadata is information the controller writes on the disk drive when the disk drive is configured into a storageset. Therefore, the presence of metadata indicates that the disk drive belongs to, or has been used by, a storageset. If the disk drive contains metadata, initialization stops. (A new disk drive will not contain metadata but a repaired or reused disk drive might. To erase metadata from a disk drive, add it to the controller's list of devices, then set it to be nontransportable and initialize it.)

Deleting a Storageset

NOTE: If the storageset you are deleting is partitioned, you must delete each partitioned unit before you can delete the storageset.

1. Show the storageset's configuration:

    ```
    SHOW STORAGESET-NAME
    ```

2. Delete the unit number that uses the storageset. Use the following command:

    ```
    DELETE UNIT-NUMBER
    ```

3. Delete the storageset. Use the following command:

    ```
    DELETE STORAGESET-NAME
    ```

4. Verify the configuration:

    ```
    SHOW STORAGESET-NAME
    ```

Changing Switches for a Storageset or Device

You can optimize a storageset or device at any time by changing the switches that are associated with it. Remember to update the storageset profile when changing its switches.

Displaying the Current Switches

To display the current switches for a storageset or single-disk unit, enter a SHOW command, specifying the FULL switch:

```
SHOW STORAGESET-NAME
```

or

```
SHOW DEVICE-NAME
```

NOTE: FULL is not required when showing a particular device. It is used when showing all devices, for example, SHOW DEVICES FULL.

Changing RAIDset and Mirrorset Switches

Use the SET *storageset-name* command to change the RAIDset and Mirrorset switches associated with an existing storageset.

For example, the following command changes the replacement policy for RAIDset RAID1 to BEST_FIT:

```
SET RAID1 POLICY=BEST_FIT
```

Changing Device Switches

Use the SET *device-name* command to change the device switches.

For example, to request a data transfer rate of 20 MHz for DISK10000:

```
SET DISK10000 TRANSFER_RATE_REQUESTED=20MHZ
```

Changing Initialize Switches

The initialization switches cannot be changed without destroying the data on the storageset or device. These switches are integral to the formatting and can only be changed by reinitializing the storageset. Initializing a storageset is similar to formatting a disk drive; all data is destroyed during this procedure.

Changing Unit Switches

Use the SET *unit-name* command to change the characteristics of a unit.

For example, the following command enables write protection for unit D100:

```
SET D100 WRITE_PROTECT
```

6

Using CLI for Configuration

This chapter presents an example of how to configure a storage subsystem using the Command Line Interpreter (CLI). The CLI configuration example shown assumes:

- A normal, new controller pair, which includes:

  — NODE ID set

  — No previous failover mode

  — No previous topology set

- Full array with no expansion cabinet

- PCMCIA cards installed in both controllers

A storage subsystem example is shown in Figure 6–1. The example system contains three non-clustered WINNT hosts, as shown in Figure 6–3. From the hosts' point of view, each host will have four paths to its own virtual disks. The resulting virtual system, from the host's point of view, is shown in Figure 6–4.

Figure 6–1 shows an example storage system map for the BA370 enclosure. Details on building your own map are described in Chapter 2. Templates to help you build your storage map are supplied in Appendix A.

	Port						
	1	2	3	4	5	6	
Power Supply	D2 S2 DISK103 00	D2 S2 DISK203 00	D2 S2 DISK303 00	D2 S2 DISK403 00	D2 D101 DISK503 00	spareset member DISK603 00	Power Supply	3
Power Supply	D0 S1 MI DISK102 00	D0 S1 M1 DISK202 00	D0 S1 M2 DISK302 00	D0 S1 M2 DISK402 00	D1 M3 DISK502 00	D1 M3 DISK602 00	Power Supply	2
Power Supply	D120 R2 DISK101 00	D120 R2 DISK201 00	D120 R2 DISK301 00	D120 R2 DISK401 00	D120 R2 DISK501 00	D120 R2 DISK601 00	Power Supply	1
Power Supply	D102 R1 DISK100 00	D102 R1 DISK200 00	D102 R1 DISK300 00	D102 R1 DISK400 00	D102 R1 DISK500 00	D102 R1 DISK600 00	Power Supply	0

(Column at far right labeled "Targets")

Figure 6–1: Example storage map for the BA370 Enclosure

Figure 6–3 shows a representative multiple-bus failover configuration. Restricting the access of unit D101 to host BLUE can be done by enabling only the connections to host BLUE. At least two connections must be enabled for multiple-bus failover to work. For most operating systems, it is desirable to have all connections to the host enabled. The example system, shown in Figure 6–3, contains three non-clustered

Windows NT/Windows 2000 hosts. Port 1 link is separate from port 2 link (that is, ports 1 of both controllers are on one loop or fabric, and port 2 of both controllers are on another) therefore, each adapter has two connections.
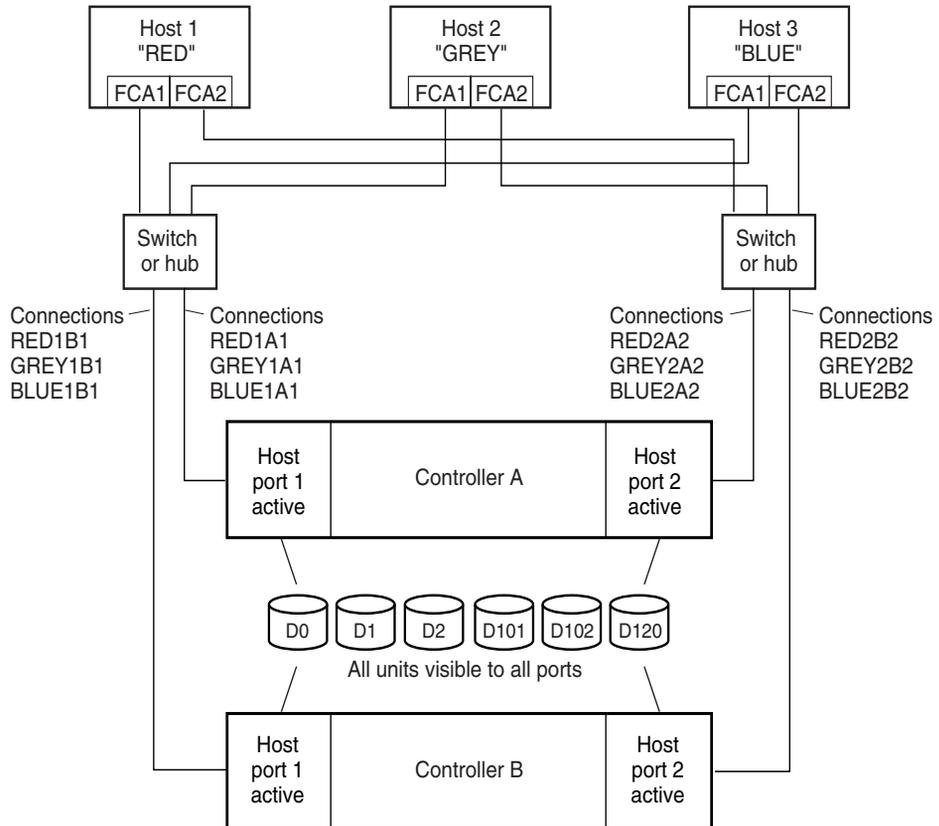
NOTE: FCA = Fibre Channel Adapter

CXO7109B

Figure 6–2: Representative multiple-bus failover

Figure 6–3: Example, three non-clustered host systems

Figure 6–4 represents units that are logical or virtual disks comprised of storagesets configured from physical disks.

CXO7110B
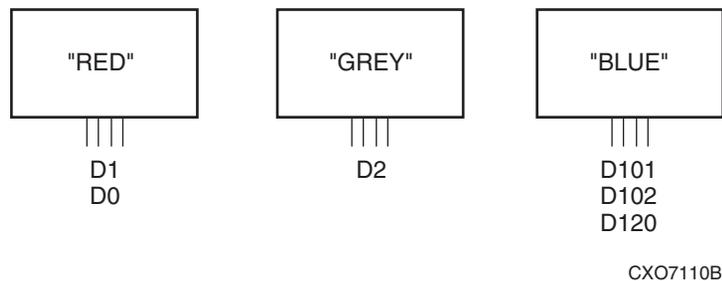
Figure 6–4: Example, logical or virtual disks comprised of storagesets

CLI Configuration Example

Text conventions used in this example are listed below:

- Text in *italics* indicates an action you take.

- Text in THIS FORMAT, indicates a command you type. Be certain to press **Enter** after each command.

- Text enclosed within a box, indicates information that is displayed by the CLI interpreter.

NOTE: "This" controller is top controller (A).

Plug serial cable from maintenance terminal into top controller.

```
CLEAR CLI
SET MULTIBUS COPY=THIS
CLEAR CLI
```

```
SET THIS SCSI_VERSION=SCSI-3
SET THIS PORT_1_TOPOLOGY=FABRIC
SET THIS PORT_2_TOPOLOGY=FABRIC
SET OTHER PORT_1_TOPOLOGY=FABRIC
SET OTHER PORT_2_TOPOLOGY=FABRIC
SET THIS ALLOCATION_CLASS=1
RESTART OTHER
RESTART THIS
SET THIS TIME=10-Mar-2001:12:30:34
RUN FRUTIL
```

```
Do you intend to replace this controller's cache
battery? Y/N [Y]
```

```
Y
```

Plug serial cable from maintenance terminal into bottom controller.

NOTE: Bottom controller (B) becomes "this" controller.

```
RUN FRUTIL
```

```
Do you intend to replace this controller's cache
battery? Y/N [Y]
```

```
Y
SET THIS MIRRORED_CACHE
```

NOTE: This command causes the controllers to restart.

```
SET THIS PROMPT="BTVS BOTTOM"
SET OTHER PROMPT="BTVS TOP"
SHOW THIS
SHOW OTHER
```

Plug in the Fibre Channel cable from thefirst adapter in host "RED."

```
SHOW CONNECTIONS

RENAME !NEWCON00 RED1B1
SET RED1B1 OPERATING_SYSTEM=WINNT
RENAME !NEWCON01 RED1A1
SET RED1A1 OPERATING_SYSTEM=WINNT
SHOW CONNECTIONS
```

NOTE: Connection table sorts alphabetically.

Connection Name	Operating System	Controller	Port	Address	Status	Unit Offset
RED1A1	WINNT	OTHER	1	XXXXX X	OL other	0
HOST_ID=XXXX-XXXX-XXXX-XXXX			ADAPTER_ID=XXXX-XXXX-XXXX-XXXX			
RED1B1	WINNT	THIS	1	XXXXX X	OL this	0
HOST_ID=XXXX-XXXX-XXXX-XXXX			ADAPTER_ID=XXXX-XXXX-XXXX-XXXX			

Mark or tag both ends of Fibre Channel cables.

Plug in the Fibre Channel cable from the second adapter in host "RED."

```
SHOW CONNECTIONS
```

Connection Name	Operating System	Controller	Port	Address	Status	Unit Offset
!NEWCON02	WINNT	THIS	2	XXXXXX	OL this	0
HOST_ID=XXXX-XXXX-XXXX-XXXX		ADAPTER_ID=XXXX-XXXX-XXXX-XXXX				
!NEWCON03	WINNT	OTHER	2	XXXXXX	OL other	0
HOST_ID=XXXX-XXXX-XXXX-XXXX		ADAPTER_ID=XXXX-XXXX-XXXX-XXXX				
RED1A1	WINNT	OTHER	1	XXXXXX	OL other	0
...						

```
RENAME !NEWCON02 RED2B2
SET RED2B2 OPERATING_SYSTEM=WINNT
RENAME !NEWCON02 RED2A2
SET RED2A2 OPERATING_SYSTEM=WINNT
SHOW CONNECTIONS
```

Connection Name	Operating System	Controller	Port	Address	Status	Unit Offset
RED1A1	WINNT	OTHER	1	XXXXXX	OL other	0
HOST_ID=XXXX-XXXX-XXXX-XXXX			ADAPTER_ID=XXXX-XXXX-XXXX-XXXX			
RED1B1	WINNT	THIS	1	XXXXXX	OL this	0
HOST_ID=XXXX-XXXX-XXXX-XXXX			ADAPTER_ID=XXXX-XXXX-XXXX-XXXX			
RED2A2	WINNT	OTHER	2	XXXXXX	OL other	0
HOST_ID=XXXX-XXXX-XXXX-XXXX			ADAPTER_ID=XXXX-XXXX-XXXX-XXXX			
RED2B2	WINNT	THIS	2	XXXXXX	OL this	0
HOST_ID=XXXX-XXXX-XXXX-XXXX			ADAPTER_ID=XXXX-XXXX-XXXX-XXXX			

Mark or tag both ends of Fibre Channel cables

Repeat this process to add connections from the other two hosts. The resulting connection table should appear similar to the following:

Connection Name	Operating System	Controller	Port	Address	Status	Unit Offset
GREY1A1	WINNT	OTHER	1	XXXXXX	OL other	0
HOST_ID=XXXX-XXXX-XXXX-XXXX				ADAPTER_ID=XXXX-XXXX-XXXX-XXXX		
GREY1B1	WINNT	THIS	1	XXXXXX	OL this	0
HOST_ID=XXXX-XXXX-XXXX-XXXX				ADAPTER_ID=XXXX-XXXX-XXXX-XXXX		
GREY2A2	WINNT	OTHER	2	XXXXXX	OL other	0
HOST_ID=XXXX-XXXX-XXXX-XXXX				ADAPTER_ID=XXXX-XXXX-XXXX-XXXX		
GREY2B2	WINNT	THIS	2	XXXXXX	OL this	0
HOST_ID=XXXX-XXXX-XXXX-XXXX				ADAPTER_ID=XXXX-XXXX-XXXX-XXXX		
BLUE1A1	WINNT	OTHER	1	XXXXXX	OL other	0
HOST_ID=XXXX-XXXX-XXXX-XXXX				ADAPTER_ID=XXXX-XXXX-XXXX-XXXX		
BLUE1B1	WINNT	THIS	1	XXXXXX	OL this	0
HOST_ID=XXXX-XXXX-XXXX-XXXX				ADAPTER_ID=XXXX-XXXX-XXXX-XXXX		
BLUE2A2	WINNT	OTHER	2	XXXXXX	OL other	0
HOST_ID=XXXX-XXXX-XXXX-XXXX				ADAPTER_ID=XXXX-XXXX-XXXX-XXXX		
BLUE2B2	WINNT	THIS	2	XXXXXX	OL this	0

```
HOST_ID=XXXX-XXXX-XXXX-XX        ADAPTER_ID=XXXX-XXXX-XXXX-XX
             XX                                  XX
   RED1A1    WINNT    OTHER       1      XXXXX  OL other      0
                                            X

HOST_ID=XXXX-XXXX-XXXX-XX        ADAPTER_ID=XXXX-XXXX-XXXX-XX
             XX                                  XX
   RED1B1    WINNT    THIS        1      XXXXX   OL this      0
                                            X

HOST_ID=XXXX-XXXX-XXXX-XX        ADAPTER_ID=XXXX-XXXX-XXXX-XX
             XX                                  XX
  RED2A2     WINNT    OTHER       2      XXXXX  OL other      0
                                            X

HOST_ID=XXXX-XXXX-XXXX-XX        ADAPTER_ID=XXXX-XXXX-XXXX-XX
             XX                                  XX
  RED2B2     WINNT    THIS        2      XXXXX   OL this      0
                                            X

HOST_ID=XXXX-XXXX-XXXX-XX        ADAPTER_ID=XXXX-XXXX-XXXX-XX
             XX                                  XX
```

```
SET CONNECTION BLUE1A1 UNIT_OFFSET=100

SET CONNECTION BLUE1B1 UNIT_OFFSET=100

SET CONNECTION BLUE2A2 UNIT_OFFSET=100

SET CONNECTION BLUE2B2 UNIT_OFFSET=100

RUN CONFIG

ADD RAIDSET R1 DISK10000 DISK20000 DISK30000 DISK40000 DISK50000
DISK60000

INITIALIZE R1

ADD UNIT D102 R1 DISABLE_ACCESS_PATH=ALL

SET D102 ENABLE_ACCESS_PATH=(RED1A1, RED1B1, RED2A2, RED2B2)

ADD RAIDSET R2 DISK10100 DISK20100 DISK30100 DISK40100 DISK50100
DISK60100

INITIALIZE R2

ADD UNIT D120 R2 DISABLE_ACCESS_PATH=ALL

SET D120 ENABLE_ACCESS_PATH=(BLUE1A1, BLUE1B1, BLUE2A2, BLUE2B2)

ADD MIRRORSET MI DISK10200 DISK20200

ADD MIRRORSET M2 DISK30200 DISK40200

ADD STRIPESET S1 M1 M2

INITIALIZE S1

ADD UNIT D0 S1 DISABLE_ACCESS_PATH=ALL

SET D0 ENABLE_ACCESS_PATH=(GREY1A1, GREY1B1, GREY2A2, GREY2B2)

ADD MIRRORSET M3 DISK50200 DISK60200

INITIALIZE M3

ADD UNIT D1 M3 DISABLE_ACCESS_PATH=ALL

SET D1 ENABLE_ACCESS_PATH=(BLUE1A1, BLUE1B1, BLUE2A2, BLUE2B2)

ADD STRIPESET S2 DISK10300 DISK20300 DISK30300 DISK40300

INITIALIZE S2

ADD UNIT D2 S2 DISABLE_ACCESS_PATH=ALL

SET D2 ENABLE_ACCESS_PATH=(GREY1A1, GREY1B1, GREY2A2, GREY2B2)

INITIALIZE DISK50300

ADD UNIT D101 DISK50300 DISABLE_ACCESS_PATH=ALL

SET D101 ENABLE_ACCESS_PATH=(BLUE1A1, BLUE1B1, BLUE2A2, BLUE2B2)

ADD SPARESET DISK60300

SHOW UNITS FULL
```

7

Backing Up, Cloning, and Moving Data

This chapter includes the following topics:

- "Backing Up Subsystem Configurations," page 7–1
- "Creating Clones for Backup," page 7–2
- "Moving Storagesets," page 7–5

Backing Up Subsystem Configurations

The controller stores information about the subsystem configuration in its nonvolatile memory. This information could be lost if the controller fails or when you replace a module in the subsystem.

Use the following command to produce a display that shows if the save configuration feature is active and which devices are being used to store the configuration.

```
SHOW THIS_CONTROLLER FULL
```

The resulting display includes a line that indicates status and how many devices have copies of the configuration. The last line shows on how many devices the configuration is backed up.

IMPORTANT: DO NOT use SAVE_CONFIGURATION in dual redundant controller installations. It is not supported and may result in unexpected controller behavior.

The SHOW *DEVICES* FULL command shows which disk drives are set up to back up the configuration. The syntax for this command is shown below:

```
SHOW DEVICES FULL
```

Creating Clones for Backup

Use the CLONE utility to duplicate the data on any unpartitioned single-disk unit, stripeset, mirrorset, or striped mirrorset in preparation for backup. When the cloning operation is complete, you can back up the clones rather than the storageset or single-disk unit, which can continue to service its I/O load. When you are cloning a mirrorset, CLONE does not need to create a temporary mirrorset. Instead, it adds a temporary member to the mirrorset and copies the data onto this new member.

The CLONE utility creates a temporary, two-member mirrorset for each member in a single-disk unit or stripeset. Each temporary mirrorset contains one disk drive from the unit you are cloning and one disk drive onto which CLONE copies the data. During the copy operation, the unit remains online and active so that the clones contain the most up-to-date data.

After the CLONE utility copies the data from the members to the clones, it restores the unit to its original configuration and creates a clone unit you can back up. The CLONE utility uses steps shown in Figure 7–1 to duplicate each member of a unit.
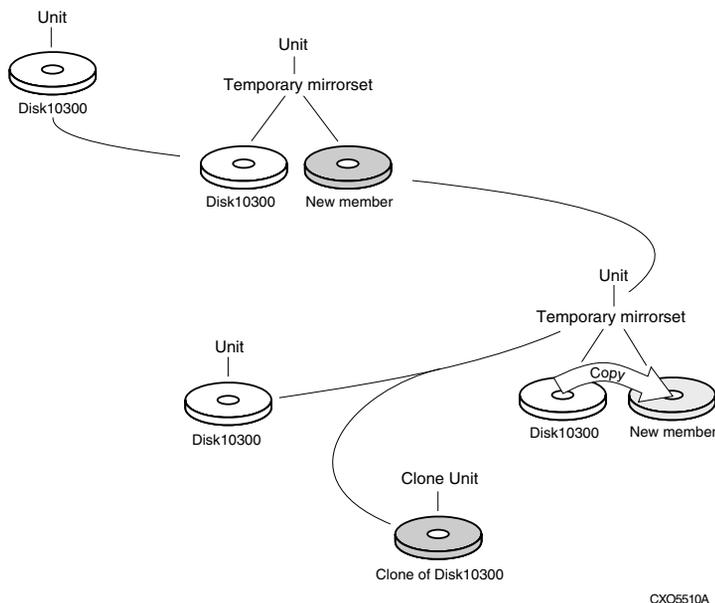

Figure 7–1: CLONE utility steps for duplicating unit members

Use the following steps to clone a single-disk unit, stripeset, or mirrorset:

1. Establish a connection to the controller that accesses the unit you want to clone.

2. Start CLONE using the following command:

   ```
   RUN CLONE
   ```

3. When prompted, enter the unit number of the unit you want to clone.

4. When prompted, enter a unit number for the clone unit that CLONE will create.

5. When prompted, indicate how you would like the clone unit to be brought online: either automatically or only after your approval.

6. When prompted, enter the disk drives you want to use for the clone units.

7. Back up the clone unit.

The following example shows the commands you would use to clone storage unit D6. The clone command terminates after it creates storage unit D33, a clone or copy of D6.

```
RUN CLONE

CLONE LOCAL PROGRAM INVOKED

UNITS AVAILABLE FOR CLONING:
                98

ENTER UNIT TO CLONE? 98

CLONE WILL CREATE A NEW UNIT WHICH IS A COPY OF UNIT 98.

ENTER THE UNIT NUMBER WHICH YOU WANT ASSIGNED TO THE NEW UNIT? 99

THE NEW UNIT MAY BE ADDED USING ONE OF THE FOLLOWING METHODS:

1. CLONE WILL PAUSE AFTER ALL MEMBERS HAVE BEEN COPIED. THE USER
MUST THEN PRESS RETURN TO CAUSE THE NEW UNIT TO BE ADDED.

2. AFTER ALL MEMBERS HAVE BEEN COPIED, THE UNIT WILL BE ADDED
AUTOMATICALLY.

UNDER WHICH ABOVE METHOD SHOULD THE NEW UNIT BE ADDED[ ]?1

DEVICES AVAILABLE FOR CLONE TARGETS:

DISK20200 (SIZE=832317)

DISK20300 (SIZE=832317)

USE AVAILABLE DEVICE DISK20200(SIZE=832317) FOR MEMBER
DISK10300(SIZE=832317) (Y,N) [Y]? Y

MIRROR DISK10300 C_MA

SET C_MA NOPOLICY

SET C_MA MEMBERS=2

SET C_MA REPLACE=DISK20200

DEVICES AVAILABLE FOR CLONE TARGETS:

DISK20300 (SIZE=832317)
```

```
USE AVAILABLE DEVICE DISK20300(SIZE=832317) FOR MEMBER
DISK10000(SIZE=832317) (Y,N) [Y]? Y
MIRROR DISK10000 C_MB
SET C_MB NOPOLICY
SET C_MB MEMBERS=2
SET C_MB REPLACE=DISK20300
COPY IN PROGRESS FOR EACH NEW MEMBER. PLEASE BE PATIENT...
.
.
COPY FROM DISK10300 TO DISK20200 IS 100% COMPLETE
COPY FROM DISK10000 TO DISK20300 IS 100% COMPLETE
PRESS RETURN WHEN YOU WANT THE NEW UNIT TO BE CREATED
REDUCE DISK20200 DISK20300
UNMIRROR DISK10300
UNMIRROR DISK10000
ADD MIRRORSET C_MA      DISK20200
ADD MIRRORSET C_MB      DISK20300
ADD STRIPESET C_ST1 C_MA C_MB
INIT C_ST1    NODESTROY
ADD UNIT D99 C_ST1
D99 HAS BEEN CREATED. IT IS A CLONE OF D98.
CLONE - NORMAL TERMINATION
```

Moving Storagesets

You can move a storageset from one subsystem to another without destroying its data. You also can follow the steps in this section to move a storageset to a new location within the same subsystem.

<div>

△ **CAUTION:** Move only normal storagesets. Do not move storagesets that are reconstructing or reduced, or data corruption will result.

</div>

See the release notes for the version of your controller software for information on which drives can be supported.

> △ **CAUTION:** Never initialize any container or this procedure will not protect data in the storageset.

Use the following procedure to move a storageset, while maintaining the data the storageset contains:

1. Show the details for the storageset you want to move. Use the following command:

   ```
   SHOW STORAGESET-NAME
   ```

2. Label each member with its name and PTL location.

   If you do not have a storageset map for your subsystem, you can enter the LOCATE command for each member to find its PTL location. Use the following command:

   ```
   LOCATE DISK-NAME
   ```

   To cancel the locate command, enter the following:

   ```
   LOCATE CANCEL
   ```

3. Delete the unit number shown in the "Used by" column of the SHOW *storageset-name* command. Use the following syntax:

   ```
   DELETE UNIT-NUMBER
   ```

4. Delete the storageset shown in the "Name" column of the SHOW *storageset-name* command. Use the following syntax:

   ```
   DELETE STORAGESET-NAME
   ```

5. Delete each disk drive, one at a time, that the storageset contained. Use the following syntax:

   ```
   DELETE DISK-NAME
   DELETE DISK-NAME
   DELETE DISK-NAME
   ```

6. Remove the disk drives and move them to their new PTL locations.

7. Again add each disk drive to the controller's list of valid devices. Use the following syntax:

   ```
   ADD DISK DISK-NAME PTL-LOCATION
   ADD DISK DISK-NAME PTL-LOCATION
   ADD DISK DISK-NAME PTL-LOCATION
   ```

8. Recreate the storageset by adding its name to the controller's list of valid storagesets and by specifying the disk drives it contains. (Although you have to recreate the storageset from its original disks, you do not have to add the storagesets in their original order.) Use the following syntax to recreate the storageset:

```
ADD STORAGESET-NAME DISK-NAME DISK-NAME
```

9. Represent the storageset to the host by giving it a unit number the host can recognize. You can use the original unit number or create a new one. Use the following syntax:

```
ADD UNIT UNIT-NUMBER STORAGESET-NAME
```

The following example moves unit D100 to another cabinet. D100 is the RAIDset RAID99 that consists of members DISK10000, DISK20000, and DISK10100.

Old cabinet

```
DELETE D100
DELETE RAID99
DELETE DISK10000
DELETE DISK10100
DELETE DISK20000
DELETE DISK20100
```

New cabinet

```
ADD DISK DISK10000
ADD DISK DISK10100
ADD DISK DISK20000
ADD DISK DISK20100
ADD RAIDSET RAID99 DISK10000 DISK10100 DISK20000 DISK20100
ADD UNIT D100 RAID99
```

A

Subsystem Profile Templates

This appendix contains storageset profiles to copy and use to create your profiles. It also contains an enclosure template to use to help keep track of the location of devices and storagesets in your shelves. Four (4) templates will be needed for the subsystem.

NOTE: The storage map templates for the Model 4310R and Model 4214R or 4314R reflect the physical location of the disk enclosures in the rack. Disk enclosures 6, 5, and 4 are stacked above the controller enclosure and disk enclosures 1, 2, and 3 are stacked below the controller enclosure.

- "Storageset Profile," page A–2

- "Storage Map Template 1 for the BA370 Enclosure," page A–4

- "Storage Map Template 2 for the second BA370 Enclosure," page A–5

- "Storage Map Template 3 for the third BA370 Enclosure," page A–6

- "Storage Map Template 4 for the Model 4214R Disk Enclosure," page A–7

- "Storage Map Template 5 for the Model 4254 Disk Enclosure," page A–9

- "Storage Map Template 6 for the Model 4310R Disk Enclosure," page A–11

- "Storage Map Template 7 for the Model 4350R Disk Enclosure," page A–14

- "Storage Map Template 8 for the Model 4314R Disk Enclosure," page A–16

- "Storage Map Template 9 for the Model 4354R Disk Enclosure," page A–19

Storageset Profile

Type of Storageset:

_____ Mirrorset	__X_ RAIDset	_____ Stripeset	_____ Striped Mirrorset	____ JBOD

Storageset Name

Disk Drives

Unit Number

Partitions:

Unit #	Unit #	Unit #	Unit #	Unit #	Unit #	Unit #	Unit #

RAIDset Switches:

Reconstruction Policy	**Reduced Membership**	**Replacement Policy**
__Normal (default)	___No (default)	__Best performance (default)
___Fast	___Yes, missing:	___Best fit
		___None

Mirrorset Switches:

Replacement Policy	**Copy Policy**	**Read Source**
___Best performance (default)	___Normal (default)	___Least busy (default)
___Best fit	___Fast	___Round robin
___None		___Disk drive:

Initialize Switches:

Chunk size	**Save Configuration**	**Metadata**
__ Automatic (default)	___No (default)	__Destroy (default)
___ 64 blocks	__Yes	___Retain
___ 128 blocks		
___ 256 blocks		
___ Other:		

Unit Switches:

Caching	Access by following hosts enabled
Read caching_____ ___	_____
Read-ahead caching_____	_____
Write-back caching____ ___	_____
Write-through caching____	_____
	_____
	_____
	_____
	_____

Storage Map Template 1 for the BA370 Enclosure

Use this template for:

- BA370 single-enclosure subsystems
- first enclosure of multiple BA370 enclosure subsystems

	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6		
Power Supply	D10300	D20300	D30300	D40300	D50300	D60300	Power Supply	3
Power Supply	D10200	D20200	D30200	D40200	D50200	D60200	Power Supply	2
Power Supply	D10100	D20100	D30100	D40100	D50100	D60100	Power Supply	1
Power Supply	D10000	D20000	D30000	D40000	D50000	D60000	Power Supply	0

Targets

Storage Map Template 2 for the second BA370 Enclosure

Use this template for the second enclosure of multiple BA370 enclosure subsystems.

	Port							
	1	**2**	**3**	**4**	**5**	**6**		
Power Supply							Power Supply	11
	D11100	D21100	D31100	D41100	D51100	D61100		
Power Supply							Power Supply	10
	D11000	D21000	D31000	D41000	D51000	D61000		
Power Supply							Power Supply	9
	D10900	D20900	D30900	D40900	D50900	D60900		
Power Supply							Power Supply	8
	D10800	D20800	D30800	D40800	D50800	D60800		

Targets

Storage Map Template 3 for the third BA370 Enclosure

Use this template for the third enclosure of multiple BA370 enclosure subsystems.

Port						
1	**2**	**3**	**4**	**5**	**6**	

	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6		Targets
Power Supply	D11500	D21500	D31500	D41500	D51500	D61500	Power Supply	15
Power Supply	D11400	D21400	D31400	D41400	D51400	D61400	Power Supply	14
Power Supply	D11300	D21300	D31300	D41300	D51300	D61300	Power Supply	13
Power Supply	D11200	D21200	D31200	D41200	D51200	D61200	Power Supply	12

Storage Map Template 4 for the Model 4214R Disk Enclosure

Use this template for a subsystem with a three-shelf Model 4214R disk enclosure (single-bus). You can have up to six Model 4214R disk enclosures per controller shelf.

Model 4214R Disk Enclosure Shelf 1 (single-bus)														
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1 0**	**1 1**	**1 2**	**1 3**	**1 4**
SCSI ID	0 0	0 1	0 2	0 3	0 4	0 5	0 8	0 9	1 0	1 1	1 2	1 3	1 4	1 5
DISK ID	Disk10000	Disk10100	Disk10200	Disk10300	Disk10400	Disk10500	Disk10800	Disk10900	Disk11000	Disk11100	Disk11200	Disk11300	Disk11400	Disk11500

Model 4214R Disk Enclosure Shelf 2 (single-bus)														
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1 0**	**1 1**	**1 2**	**1 3**	**1 4**
SCSI ID	0 0	0 1	0 2	0 3	0 4	0 5	0 8	0 9	1 0	1 1	1 2	1 3	1 4	1 5
DISK ID	Disk20000	Disk20100	Disk20200	Disk20300	Disk20400	Disk20500	Disk20800	Disk20900	Disk21000	Disk21100	Disk21200	Disk21300	Disk21400	Disk21500

Model 4214R Disk Enclosure Shelf 3 (single-bus)														
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1 0**	**1 1**	**1 2**	**1 3**	**1 4**
SCSI ID	0 0	0 1	0 2	0 3	0 4	0 5	0 8	0 9	1 0	1 1	1 2	1 3	1 4	1 5
DISK ID	Disk30000	Disk30100	Disk30200	Disk30300	Disk30400	Disk30500	Disk30800	Disk30900	Disk31000	Disk31100	Disk31200	Disk31300	Disk31400	Disk31500

Storage Map Template 5 for the Model 4254 Disk Enclosure

Use this template for a subsystem with a three-shelf Model 4254 disk enclosure (dual-bus). You can have up to three Model 4254 disk enclosures per controller shelf.

Model 4254 Disk Enclosure Shelf 1 (dual-bus)													
Bus A							Bus B						
Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	00	01	02	03	04	05	08
DISK ID	Disk10000	Disk10100	Disk10200	Disk10300	Disk10400	Disk10500	Disk10800	Disk20000	Disk20100	Disk20200	Disk20300	Disk20400	Disk20500	Disk20800

Model 4254 Disk Enclosure Shelf 2 (dual-bus)													
Bus A							Bus B						
Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	00	01	02	03	04	05	08
DISK ID	Disk30000	Disk30100	Disk30200	Disk30300	Disk30400	Disk30500	Disk30800	Disk40000	Disk40100	Disk40200	Disk40300	Disk40400	Disk40500	Disk40800

continued from previous page

Model 4254 Disk Enclosure Shelf 3 (dual-bus)														
Bus A								**Bus B**						
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1 0**	**1 1**	**1 2**	**1 3**	**1 4**
SCSI ID	0 0	0 1	0 2	0 3	0 4	0 5	0 8	0 0	0 1	0 2	0 3	0 4	0 5	0 8
DISK ID	Disk50000	Disk50100	Disk50200	Disk50300	Disk50400	Disk50500	Disk50800	Disk60000	Disk60100	Disk60200	Disk60300	Disk60400	Disk60500	Disk60800

Storage Map Template 6 for the Model 4310R Disk Enclosure

Use this template for a subsystem with a six-shelf Model 4310R disk enclosure (single-bus). You can have up to six Model 4310R disk enclosures per controller shelf.

Model 4310R Disk Enclosure Shelf 6 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk60000	Disk60100	Disk60200	Disk60300	Disk60400	Disk60500	Disk60800	Disk61000	Disk61100	Disk61200

Model 4310R Disk Enclosure Shelf 5 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk50000	Disk50100	Disk50200	Disk50300	Disk50400	Disk50500	Disk50800	Disk51000	Disk51100	Disk51200

Model 4310R Disk Enclosure Shelf 4 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk40000	Disk40100	Disk40200	Disk40300	Disk40400	Disk40500	Disk40800	Disk41000	Disk41100	Disk41200

Model 4310R Disk Enclosure Shelf 1 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk10000	Disk10100	Disk10200	Disk10300	Disk10400	Disk10500	Disk10800	Disk11000	Disk11100	Disk11200

Model 4310R Disk Enclosure Shelf 2 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk20000	Disk20100	Disk20200	Disk20300	Disk20400	Disk20500	Disk20800	Disk21000	Disk21100	Disk21200

Model 4310R Disk Enclosure Shelf 3 (single-bus)										
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk30000	Disk30100	Disk30200	Disk30300	Disk30400	Disk30500	Disk30800	Disk31000	Disk31100	Disk31200

Storage Map Template 7 for the Model 4350R Disk Enclosure

Use this template for a subsystem with a three-shelf Model 4350R disk enclosure (single-bus). You can have up to three Model 4350R disk enclosures per controller shelf.

Model 4350R Disk Enclosure Shelf 6 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk60000	Disk60100	Disk60200	Disk60300	Disk60400	Disk60500	Disk60800	Disk61000	Disk61100	Disk61200

Model 4350R Disk Enclosure Shelf 5 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk50000	Disk50100	Disk50200	Disk50300	Disk50400	Disk50500	Disk50800	Disk51000	Disk51100	Disk51200

Model 4350R Disk Enclosure Shelf 4 (single-bus)									
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SCSI ID	00	01	02	03	04	05	08	10	11	12
DISK ID	Disk40000	Disk40100	Disk40200	Disk40300	Disk40400	Disk40500	Disk40800	Disk41000	Disk41100	Disk41200

Storage Map Template 8 for the Model 4314R Disk Enclosure

Use this template for a subsystem with a six-shelf Model 4314R disk enclosure. You can have a maximum of six Model 4314R disk enclosures with each Model 2200 controller enclosure.

Model 4314R Disk Enclosure Shelf 6 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15
DISK ID	Disk60000	Disk60100	Disk60200	Disk60300	Disk60400	Disk60500	Disk60800	Disk60900	Disk61000	Disk61100	Disk61200	Disk61300	Disk61400	Disk61500

Model 4314R Disk Enclosure Shelf 5 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15
DISK ID	Disk50000	Disk50100	Disk50200	Disk50300	Disk50400	Disk50500	Disk50800	Disk50900	Disk51000	Disk51100	Disk51200	Disk51300	Disk51500	Disk51500

Model 4314R Disk Enclosure Shelf 4 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15
DISK ID	Disk40000	Disk40100	Disk40200	Disk40300	Disk40400	Disk40500	Disk40800	Disk40900	Disk41000	Disk41100	Disk41200	Disk41300	Disk41400	Disk41500

continued from previous page

Model 4314R Disk Enclosure Shelf 1 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15
DISK ID	Disk10000	Disk10100	Disk10200	Disk10300	Disk10400	Disk10500	Disk10800	Disk10900	Disk11000	Disk11100	Disk11200	Disk11300	Disk11400	Disk11500

Model 4314R Disk Enclosure Shelf 2 (single-bus)

Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15
DISK ID	Disk20000	Disk20100	Disk20200	Disk20300	Disk20400	Disk20500	Disk20800	Disk20900	Disk21000	Disk21100	Disk21200	Disk21300	Disk21400	Disk21500

Model 4314R Disk Enclosure Shelf 3 (single-bus)													
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15
DISK ID	Disk30000	Disk30100	Disk30200	Disk30300	Disk30400	Disk30500	Disk30800	Disk30900	Disk31000	Disk31100	Disk31200	Disk31300	Disk31400	Disk31500

Storage Map Template 9 for the Model 4354R Disk Enclosure

Use this template for a subsystem with a three-shelf Model 4354R disk enclosure (dual-bus). You can have up to three Model 4354R disk enclosures per controller shelf.

Model 4354R Disk Enclosure Shelf 1 (dual-bus)

	SCSI Bus A							SCSI Bus B						
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
SCSI ID	00	01	02	03	04	05	08	00	01	02	03	04	05	08
DISK ID	Disk10000	Disk10100	Disk10200	Disk10300	Disk10400	Disk10500	Disk10800	Disk20000	Disk20100	Disk20200	Disk20300	Disk20400	Disk20500	Disk20800

Model 4354R Disk Enclosure Shelf 2 (dual-bus)

	SCSI Bus A							SCSI Bus B						
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
SCSI ID	00	01	02	03	04	05	08	00	01	02	03	04	05	08
DISK ID	Disk30000	Disk30100	Disk30200	Disk30300	Disk30400	Disk30500	Disk30800	Disk40000	Disk40100	Disk40200	Disk40300	Disk40400	Disk40500	Disk40800

Model 4354R Disk Enclosure Shelf 3 (dual-bus)														
	SCSI Bus A							SCSI Bus B						
Bay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
SCSI ID	00	01	02	03	04	05	08	00	01	02	03	04	05	08
DISK ID	Disk50000	Disk50100	Disk50200	Disk50300	Disk50400	Disk50500	Disk50800	Disk60000	Disk60100	Disk60200	Disk60300	Disk60400	Disk60500	Disk60800

B

Installing, Configuring, and Removing the Client

The following information is included in this appendix:

- "Why Install the Client?," page B–2
- "Before You Install the Client," page B–2
- "Installing the Client," page B–4
- "Installing the Integration Patch," page B–5
- "Troubleshooting Client Installation," page B–8
- "Adding Storage Subsystem and its Host to Navigation Tree," page B–10
- "Removing Command Console Client," page B–12
- "Where to Find Additional Information," page B–13

Why Install the Client?

The Client monitors and manages a storage subsystem by performing the following tasks:

- Create mirrored device group (RAID 1)

- Create striped device group (RAID 0)

- Create striped mirrored device group (RAID 0+1)

- Create striped parity device group (3/5)

- Create an individual device (JBOD)

- Monitor many subsystems at once

- Set up pager notification

Before You Install the Client

1. Verify you are logged into an account that is a member of the administrator group.

2. Check the software product description that came with the software for a list of supported hardware.

3. Verify that you have the SNMP service installed on the computer. SNMP must be installed on the computer for this software to work properly. The Client software uses SNMP to receive traps from the Agent. The SNMP service is available on the Windows NT or Windows 2000 installation CD-ROM. To verify that you have the SNMP service:

   — For Windows NT, double-click Services in *Start > Settings > Control Panel*. The entry for SNMP is shown in this window. If you install the SNMP service and you already have Windows NT Service Pack 6A on the computer, reinstall the service pack after installing the SNMP service.

   — For Windows 2000, click *Start > Settings > Control Panel > Administrative Tools > Component Services*. The entry for SNMP is shown in the Component Services window.

4. Read the release notes.

5. Read "Installing the Integration Patch," page B–5 in this appendix.

6. If you have the Command Console Client open, exit the Command Console Client.

7. If you have Command Console Client version 1.1b or earlier, remove the program with the Windows Add/Remove Programs utility.

8. If you have a previous version of Command Console, you can save the Navigation Tree configuration by copying the *SWCC2.MDB* file to another directory. After you have installed the product, move *SWCC2.MDB* to the directory to which you installed SWCC.

9. Install the HS-Series Agent. For more information, see Chapter 4.

Installing the Client

The following restriction should be observed when installing SWCC on Windows NT 4.0 Workstations.

If you select all of the applets during installation, the installation will fail on the HSG60 applet and again on one of the HSG80 applets. The workaround is to install all of the applets you want except for the HSG60 applet and the HSG80 ACS 8.5 applet. You can then return to the setup program and install the one that you need.

1. In a SAN environment where you would need both HSG60 and HSG80 subsystems, StorageWorks recommends you install both, but one at a time. This problem is not seen under Windows NT 4.0 Server.

2. Insert the CD-ROM into a computer running Windows 2000 with Service Pack 2 or Windows NT 4.0 (Intel) with Service Pack 6.0A.

3. A dialog box should automatically appear.

4. One of the items in the dialog box should say "SWCC Client Software" and has a button that says "INSTALL" next to it. Click on the button to start the SWCC client installation procedure.

5. Select "HSG80 Controller for ACS87 or newer" menu option to properly install SWCC client, and click **Next**.

If this method does not work, go to the \windows directory on the CD-ROM and run the *setup.exe* program.

NOTE: If the computer does not find a previous installation, it will install the SWCC Navigation Window and the CLI Window.

6. Follow the instructions on the screen. After you install the software, the Asynchronous Event Service (AES) starts. AES is a service that runs in the background. It collects and passes traps from the subsystems to the Navigation Tree and to individual pagers (for example, to show that a disk has failed). AES needs to be running for the client system to receive updates.

NOTE: For more information on AES, see *StorageWorks Command Console Version 2.5, User Guide.*

Installing the Integration Patch

The integration patch determines which version of firmware the controller is using and launches the appropriate StorageWorks Command Console (SWCC) Storage Window within Insight Manager (CIM) version 4.23.

Should I Install the Integration Patch?

Install this patch if your HSG80 controller uses ACS 8.6 or later. This patch enables you to use the controller's SWCC Storage Window within CIM to monitor and manage the controller.

How to Install the Integration Patch

Perform the following steps to install the integration patch.

1. Verify that you have installed the HSG80 Storage Window for ACS 8.6 or later in the Add/Remove Programs in the Windows Control Panel. The HSG80 Storage Window for ACS 8.6 or later is needed to display the correct Storage Window for your version of the firmware.

2. Verify that you have installed HSG80 Storage Window version 2.1 in the Add/Remove Programs (StorageWorks HSG80 V2.1) in the Windows Control Panel. The HSG80 Storage Window version 2.1 is required to run the integration patch.

3. Verify that you have installed CIM version 4.23.

4. Install the integration patch from the Solution Software CD-ROM by double-clicking on setup.exe in the following directory:

   `\SWCC\Client\HSG80shim`

   The patch is installed in the same location as the original SWCC installation.

IMPORTANT: IMPORTANT: Do not remove the HSG80 Client from your computer. If you remove the HSG80 Client, you will no longer be able to access its Storage Window.

Integrating Controller's SWCC Storage Window with CIM

You can open the controller's Storage Window from within the Windows-based CIM version 4.23 by doing the following:

1. Verify that you have installed the following by looking in Add/Remove Programs in Control Panel:

   • The HSG80 Storage Window for ACS 8.6 or later (Required to open the correct Storage Window for your firmware).

   • The HSG80 Storage Window version 2.1 (StorageWorks HSG80 V2.1) The CIM integration patch uses files in this program.

   • CIM version 4.23.

   • CIM integration patch (HSG80 Insight Manager Shim).

2. Verify that you have installed the CIM Agent and the StorageWorks Command Console HS-Series Agent on the same computer.

3. Add the name of the client system that has CIM to the Agent's list of client system entries and choose SNMP as a notification scheme.

4. Open Insight Manager.

5. To open the Server window, click on the device you want to observe in the CIM Navigation window.

6. Click on the Mass Storage button in the Server window. The CIM Navigation Tree is displayed.

7. Click on the + symbol next to RAID Storage System. The Navigation Tree expands to display a listing called Storage System Information.

8. Double-click Storage System Information. You are given the status of the system.

9. Click Launch. The controller's Storage Window is displayed.

Insight Manager Unable to Find Controller's Storage Window

If you installed Insight Manager before SWCC, Insight Manager will be unable to find the controller's Storage Window. To find the controller's Storage Window, perform the following procedure:

1. Double-click the Insight Agents icon (Start > Settings > Control Panel). A window appears showing you the active and inactive Agents under the Services tab.

2. Highlight the entry for Fibre Array Information and click Add. The Fibre Array Information entry is moved from Inactive Agents to Active Agents.

Removing the Integration Patch Will Corrupt Storage Window

If you remove the integration patch, HSG80 Storage Windows version 2.1 will no longer work and you will need to reinstall HSG80 Storage Windows version 2.1. The integration patch uses some of the same files as the HSG80 Storage Window version 2.1.

Troubleshooting Client Installation

This section provides information on how to resolve some of the problems that may appear when installing the Client software:

- Invalid Network Port Assignments During Installation
- "There is no disk in the drive" Message

Invalid Network Port Assignments During Installation

SWCC Clients and Agents communicate by using sockets. The SWCC installation attempts to add entries into each system list of services (services file or for UCX, the local services database). If the SWCC installation finds an entry in the local services file with the same name as the one it wants to add, it assumes the one in the file is correct.

The SWCC installation may display a message, stating that it cannot upgrade the services file. This happens if it finds an entry in the local services file with the same number as the one it wants to add, but with a different name. In that case, appropriate port numbers must be obtained for the network and added manually to the services file.

There are two default port numbers, one for Command Console (4998) and the other for the device-specific Agent and Client software, such as the Fibre Channel Interconnect Client and Agent (4989). There are two exceptions. The following software has two default port numbers:

- The KZPCC Agent and Client, (4991 and 4985)
- The RA200 Agent and Client, (4997 and 4995)

If the Network Information Services (NIS) are being used to provide named port lookup services, contact the network administrator to add the correct ports.

The following shows how the network port assignments appear in the services file:

spgui	4998/tcp	#Command Console
ccdevmgt	4993/tcp	#Device Management Client and Agent
kzpccconnectport	4991/tcp	#KZPCC Client and Agent
kzpccdiscoveryport	4985/tcp	#KZPCC Client and Agent
ccfabric	4989/tcp	#Fibre Channel Interconnect Agent
spagent	4999/tcp	#HS-Series Client and Agent
spagent3	4994/tcp	#HSZ22 Client and Agent
ccagent	4997/tcp	#RA200 Client and Agent
spagent2	4995/tcp	#RA200 Client and Agent

"There is no disk in the drive" Message

When you install the Command Console Client, the software checks the shortcuts on the desktop and in the Start menu. The installation will check the shortcuts of all users for that computer, even if they are not currently logged on. You may receive an error message if any of these shortcuts point to empty floppy drives, empty CD-ROM drives, or missing removable disks. Do one of the following:

- Ignore the error message by clicking **Ignore**.

- Replace the removable disks, and place a disk in the floppy drive and a CD-ROM in the CD-ROM drive. Then, click **Retry**.

Adding Storage Subsystem and its Host to Navigation Tree

The Navigation Tree enables you to manage storage over the network by using the Storage Window. If you plan to use pager notification, you must add the storage subsystem to the Navigation Tree.

1. Verify that you have properly installed and configured the HS-Series Agent on the storage subsystem host.

2. Click *Start > Programs > Command Console > StorageWorks Command Console*. Client displays the Navigation Window. The Navigation Window lets you monitor and manage many storage subsystems over the network.
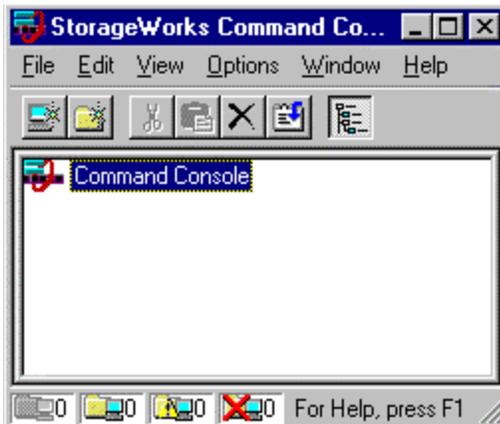
Figure B–1: Navigation Window

3. Click *File > Add System*. The Add System window appears.

4. Type the host name or its TCP/IP address and click *Apply*.

5. Click *Close*.

Figure B–2: Navigation window showing storage host system "Atlanta"

6. Click the plus sign to expand the host icon. When expanded, the Navigation Window displays an icon for the storage subsystem. To access the Storage Window for the subsystem, double-click the Storage Window icon.

Figure B–3: Navigation window showing expanded "Atlanta" host icon

NOTE: You can create virtual disks by using the Storage Window. For more information on the Storage Window, refer to StorageWorks Command Console Version 2.5, User Guide.

Removing Command Console Client

Before you remove the Command Console Client (CCL) from the computer, remove AES. This will prevent the system from reporting that a service failed to start every time the system is restarted. Steps 2 through 5 describe how to remove the CCL.

NOTE: When you remove the CCL, the *SWCC2.MDB* file is deleted. This file contains the Navigation Tree configuration. If you want to save this information, move the file to another directory.

1. Click *Start > Programs > Command Prompt* and change to the directory to which you installed the CCL.

2. Enter the following command:

   ```
   C:\Program Files\Compaq\SWCC>   AsyncEventService -remove
   ```

3. Do one of the following:

   — On Windows NT 4.0, click *Start > Settings > Control Panel*, and double-click the Add/Remove Programs icon in the Control Panel. The Add/Remove Program Properties window appears.

   — On Windows 2000, click *Start > Settings > Control Panel > Add/Remove Programs*. The Add/Remove Program window appears.

4. Select Command Console in the window.

5. Do one of the following:

   — On Windows NT 4.0, click *Add/Remove*.

   — On Windows 2000, click *Change/Remove*.

6. Follow the instructions on the screen.

NOTE: This procedure removes only the Command Console Client (SWCC Navigation Window). You can remove the HSG80 Client by using the Add/Remove program.

Where to Find Additional Information

You can find additional information about SWCC by referring to the online Help and to StorageWorks Command Console Version 2.5, User Guide.

About the User Guide

StorageWorks Command Console Version 2.5, User Guide contains additional information on how to use SWCC. Some of the topics in the user guide are the following:

- About AES

- Adding Devices

- Adding Virtual Disks

- Setting Up Pager Notification

- How to Integrate SWCC with Insight Manager

- Troubleshooting Information

About the Online Help

Most of the information about the Client is provided in the online Help. Online Help is provided in two places:

- Navigation Window – Online Help provides information on pager notification and a tour of the Command Console Client, in addition to information on how to add a system to the Navigation Tree.

- Storage Window – Online Help provides detailed information about the Storage Window, such as how to create virtual disks.

C

Configuring Windows NT/Windows 2000 Clusters

This appendix provides step-by-step instructions for installation of the RAID Array RA/MA8000 and ESA/EMA12000 (Enterprise/Modular Storage RAID Array) Fibre Channel Cluster for Windows NT/Windows 2000.

Included in this appendix are the following subsections:

- "Cluster Configuration Guidelines" on page C–2
- "Installing Software for a Fibre Channel Cluster" on page C–11
- "Assigning/Removing Drive Letters for Windows 2000" on page C–17
- "Assigning/Removing Drive Letters for Windows NT" on page C–21
- "Troubleshooting" on page C–30

Fiber Channel technology employs several physical topologies for *node* connectivity. Two of these topologies, the Fibre Channel Arbitrated Loop (FC-AL) and the Fibre Channel Switch Fabric (FC-SW) are well suited for Windows NT cluster configurations.

These Fibre Channel topologies simplify cluster configurations by eliminating many of the pitfalls that restrict the SCSI parallel bus when configured with multiple initiators. Issues such as bus termination, unfair arbitration, restrictive cable lengths and device addressibility are alleviated using the FC-AL topology. In short, the use of FC-AL or FC-SW in a cluster configuration is much more intuitive and practical for the NT Cluster solution.

This section discusses the basic Fibre Channel NT cluster configurations and software installation requirements to support the StorageWorks RAID Array Subsystems.

A Windows NT/Windows 2000 Fibre Channel cluster enables two host servers configured with the Windows NT/Windows 2000 cluster software to share a Fibre Channel storage subsystem through a FC-AL. Should a failure on a server occur, the failure is detected and the storage I/O is re-routed through to the functioning server. This process, called failover, requires no resource downtime - ensuring the high availability of data. The failed component(s) can be warm-swapped or serviced while functioning components remain active.
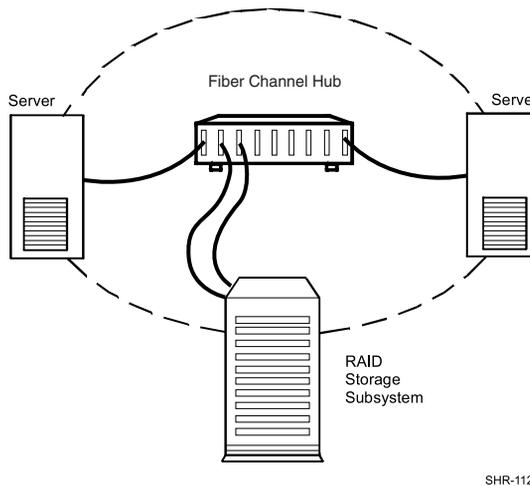
Figure C–1: Storage RAID Array Fibre Channel Cluster Concept

Cluster Configuration Guidelines

The RAID Array 8000 (RA8000) and Enterprise Storage Array 12000 (ESA12000) are Fibre Channel RAID systems that support Storage Area Network (SAN) constructs using Fibre Channel Switch and Arbitrated Loop topologies.

These storage systems can be configured in high availability configurations using Microsoft Cluster Server and Secure Path Software. These high availability Windows NT/Windows 2000 software products coupled with standard fault tolerant features supported by the Enterprise/Modular Storage RAID Array provide a no-single-point-of-failure solution.

Servers

The Enterprise/Modular Storage RAID Array are supported in a Microsoft Windows NT/Windows 2000 Cluster by a wide range of servers including ProLiant, and Multivendor Intel servers. Reference the Microsoft cluster hardware compatibility list available from the Microsoft Web site at http://www.microsoft.com/hcl/default.asp for a complete list of supported servers for the Enterprise/Modular Storage RAID Array systems.

Fibre Channel Host Bus Adapter

The FCA is a Microsoft certified cluster Fibre Channel adapter supported with the Enterprise/Modular Storage RAID Array. The FCA supports both Fibre Channel Arbitrated Loop and Fibre Channel Switch topologies. It is supplied with a GLM fiber-optic module for connectivity to your Fibre Channel hub or switch.

Cables

The media supported by the Enterprise/Modular Storage RAID Array system is a 50-micron multimode fibre optic cable. The maximum cable length is 500 meters from the host bus adapter to the Fibre Channel hub or switch and an additional 500 meters from the Fibre Channel hub to the Storage Array. At least one Fibre Channel hub or Fibre Channel switch is required for each MSCS configuration.

Fibre Channel Storage Hubs and Switches

The StorageWorks Fibre Channel Storage Hub 7 or the Fibre Channel Storage Hub 12 is the supported hubs for the Enterprise/Modular Storage RAID Array. These are active hubs that provide the necessary Fibre Channel Loop connectivity for the required MSCS configuration. Refer to your *The RAIDBOOK - A Source for RAID Technology RAID Advisory Board Fibre Channel Storage Hub 12 Installation Guide (340662-001)* for details on hub configuration and setup.

The StorageWorks Fibre Channel Storage Switch is a 16 port Fibre Channel switch supported with the Enterprise/Modular Storage RAID Array. Refer to your *Fibre Channel Switch Installation Guide* for details on switch configuration and setup

All fiber optic cables that originate from the Fibre Channel host bus adapter and your Enterprise/Modular Storage RAID Array subsystem must connect to either a hub or a switch. Reference Figure C–2.
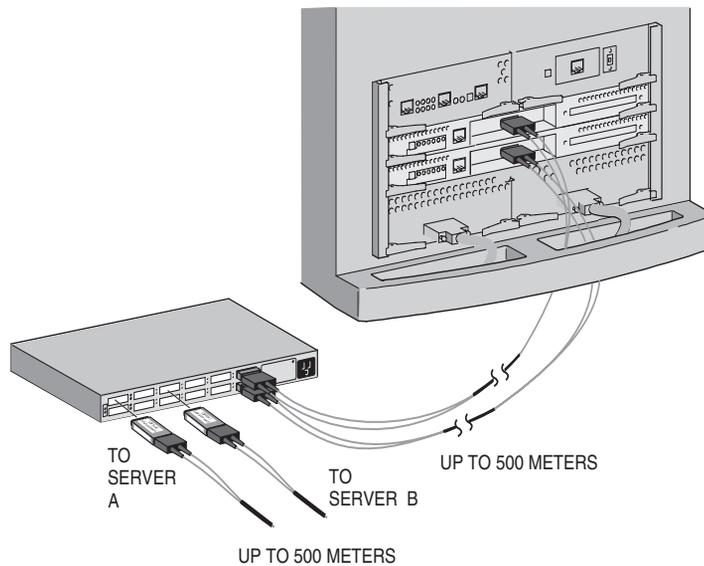
SHR-1181mr-98.AI

Figure C–2: Cable Connection – Storage RAID Array to Fibre Channel Hub

Cluster Configurations

This section highlights some of the possible Windows NT/Windows 2000 Cluster configurations that can be realized using either of these Fibre Channel topologies. Use the configuration maximums outlined in this section to determine the viability of Windows NT/Windows 2000 Cluster configurations that are not shown.

The Enterprise/Modular Storage RAID Array can be used in various configurations in a Fibre Channel Arbitrated Loop (FC-AL) topology. The following list highlights Fibre Channel Arbitrated Loop configuration limits with emphasis on MSCS Configurations.

Single Windows NT/Windows 2000 Cluster Fibre Channel Configuration

A single Windows NT/Windows 2000 cluster Fibre Channel configuration requires that all Fibre Channel components reside on the same Fibre Channel Loop. This cluster configuration allocates all storage partitions to one Windows NT/Windows 2000 Cluster and supports a maximum of two Enterprise/Modular Storage RAID Array systems on one Fibre Channel loop. Figure C–3 illustrates a single Windows NT/Windows 2000 Cluster Fiber Channel configuration with one Enterprise/Modular Storage RAID Array Fibre Channel system.

A single cluster supports the use of both HSG80 fibre channel host ports. This allows you to create an additional eight storage units. A single Windows NT/Windows 2000 Cluster configuration, when configured with multiple Storage Arrays and expansion storage cabinets, can accommodate more than two terabytes of data.

SHR-2240A
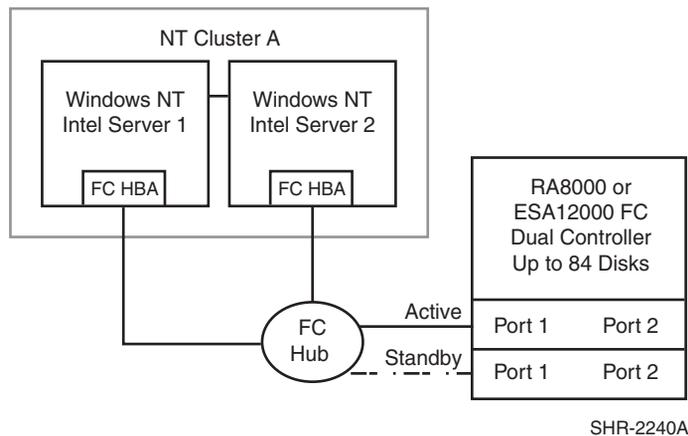
Figure C–3: Single Cluster Fibre Channel Configuration

The Configuration in Figure C–3 features the following attributes:

- One Windows NT/Windows 2000 Cluster (MSCS)
- Single Fibre Channel Loop
- Up to 84 UltraSCSI drives with optional expansion enclosures
- Dual-redundant HSG80 RAID controllers operating in transparent failover mode

- Scalable to add a second Enterprise/Modular Storage RAID Array and both HSG80 host ports

Adding a redundant I/O path to your Enterprise/Modular Storage RAID Array system enhances the previous configuration by increasing data throughput, load balancing your storage and eliminating the I/O bus as a single-point-of-failure. This high availability and no-single-point-of-failure configuration requires Secure Path software for Windows NT/Windows 2000 value-added software and requires you to change the operating mode of your Enterprise/Modular Storage RAID Array to multiple-bus failover mode. Figure C–4 illustrates a Fibre Channel Windows NT/Windows 2000 Cluster configuration with a redundant I/O path.

SHR-2241A
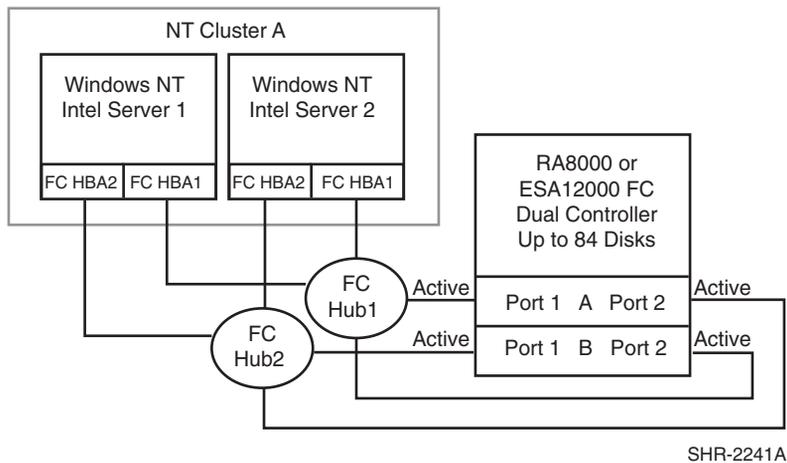
Figure C–4: Single Cluster Fibre Channel Configuration with Secure Path

The Configuration in Figure C–4 features the following attributes:

- One Windows NT/Windows 2000 Cluster (MSCS)

- Secure Path V3.1a and Secure Path 4.0

- Two Fibre Channel Loops

- 2x the data transfer rate compared to Figure 1–2

- I/O load balance capability across data paths and servers

- Up to 84 UltraSCSI drives with optional expansion enclosures

- Dual-redundant HSG80 RAID controllers operating in Multibus mode

Two-Cluster Fibre Channel Configuration

A two–cluster Fibre Channel configuration allows two Windows NT/Windows 2000 Clusters to share one Enterprise/Modular Storage RAID Array subsystem by utilizing both HSG80 host ports. This configuration requires you to partition your Fibre Channel storage across two separate Windows NT/Windows 2000 clusters.

This is accomplished by utilizing both Fibre Channel host ports on each of your HSG80 controllers. Storage partitions configured on one HSG80 host port are exclusive to one Windows NT/Windows 2000 cluster while storage partitions on the other HSG80 host port are exclusive to the other Windows NT/Windows 2000 cluster.

The two–cluster Fibre Channel configuration promotes an expansive use of your Fibre Channel storage capabilities and provides greater accessibility of your data by segmenting your storage requirements across multiple Windows NT/Windows 2000 Clusters.

NOTE: Refer to the *StorageWorks HSG80 Array Controller CLI Reference Guide* for details on creating storage units that are exclusive to a host connection.
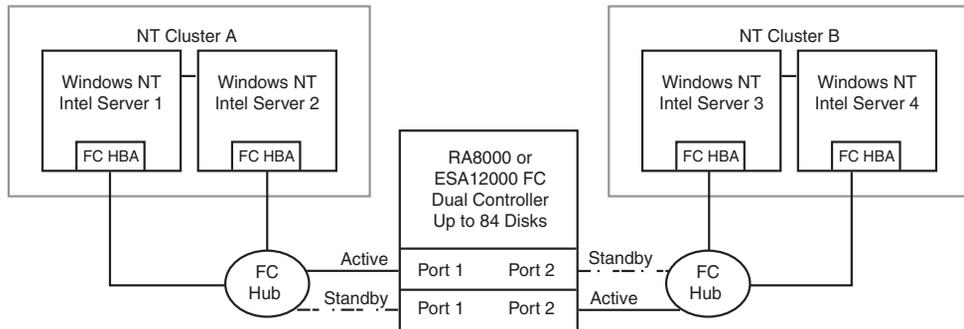
Figure C–5: Two-Cluster Fibre Channel Configuration

The Configuration in Figure C–5 features the following attributes:

- Two Windows NT/Windows 2000 Clusters (MSCS)

- Two Fibre Channel Loops

- Dual-redundant HSG80 RAID controllers operating in transparent failover mode

- Up to 84 UltraSCSI drives with optional expansion enclosures

- Up to 128 LUNs total. 64LUNs per cluster with 2 active controller host ports

The configuration in Figure C–6 builds on the previous Windows NT/Windows 2000 cluster configuration by adding a redundant I/O path from each server to the Enterprise/Modular Storage RAID Array. This configuration requires Secure Path software and changing the Enterprise/Modular Storage RAID Array to run in multiple-bus failover mode. This configuration significantly improves I/O performance by utilizing all HSG80 host ports. Secure Path also gives you the added benefits of load balancing your storage and eliminates the I/O bus as a single point of failure.

NOTE: Refer to the Secure Path documentation for detail instructions on configuring Windows NT/Windows 2000 clusters with Secure Path.
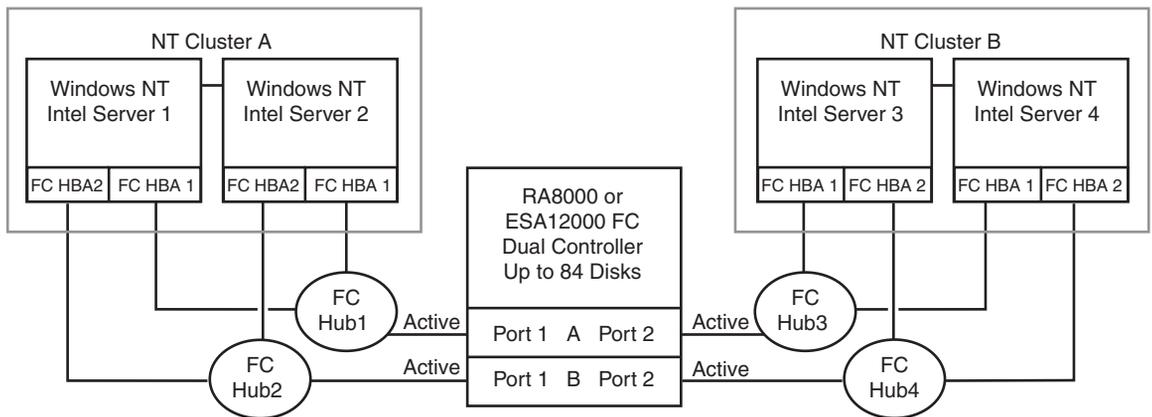
Figure C–6: Two-Cluster Fibre Channel Configuration with Secure Path

The Configuration in Figure C–6 features the following attributes:

- Two Windows NT/Windows 2000 Clusters (MSCS)
- Secure Path V3.1a and Secure Path 4.0
- Four Fibre Channel Loops
- 2x the data transfer rate compared to Figure 2-4
- I/O load balance capability across data paths
- Up to 84 UltraSCSI drives with optional expansion enclosures
- Dual-redundant HSG80 RAID controllers operating in multiple-bus failover mode

Windows NT/Windows 2000 Cluster Fibre Channel Switch Configurations

The Fibre Channel Switch topology offers greater configuration flexibility and more server and storage connectivity then the Arbitrated Loop topology. The potential Windows NT/Windows 2000 Cluster configurations are too numerous to illustrate. Use the following configuration rules to determine the viability of an Windows NT/Windows 2000 Cluster configuration.

NOTE: Refer to the StorageWorks Application note, Enterprise/Modular Storage RAID Array FC-Fabric Configurations for Windows NT/Windows 2000, for an overview of Fibre Channel Switch Fabric configuration guidelines.

Fibre Channel Switch Configuration Rules

Any combination of Windows NT/Windows 2000 servers and Enterprise/Modular Storage RAID Array Fibre Channel Storage Systems can be configured on the StorageWorks Fibre Channel switch providing that the following rules are met:

- A maximum of 8 Windows NT/Windows 2000 servers can have access to one Enterprise/Modular Storage RAID Array HSG80 controller port. Five or more servers (up to 8) connected to one HSG80 controller port is considered an *Extended Configuration*. See the note below for more information concerning an Extended Configuration.

- There are no limits of Enterprise/Modular Storage RAID Array on a Fibre Channel Storage Switch when configured in Transparent Failover mode. A maximum of four Enterprise/Modular Storage RAID Array s (with one HSG80 controller pair) can be configured on the Fibre Channel switch when configured in multiple-bus failover mode and using Secure Path V2.2.

- The maximum number of FC HBAs per server is 4 (or total allowed in the server if less than 4.)

- 500 meters per optical cable segment, 1 kilometer distance between server and storage.

NOTE: Extended Configuration - If you configure 5 or more (up to 8) Windows NT/Windows 2000 servers for access to a single HSG80 controller host port on an Enterprise/Modular Storage RAID Array Fibre Channel storage system, you must select the "Extended Configuration" check box in the StorageWorks Fibre Channel Software Setup utility custom installation setup. Each Windows NT/Windows 2000 server that comprises this configuration must have the option selected.

Figure C–7 shows two Windows NT/Windows 2000 Clusters configured on a Fibre Channel Switch. Three Enterprise/Modular Storage RAID Arrays configured in transparent failover mode are also connected to the switch. Each cluster has access to each Enterprise/Modular Storage RAID Array via storage access control primitives.
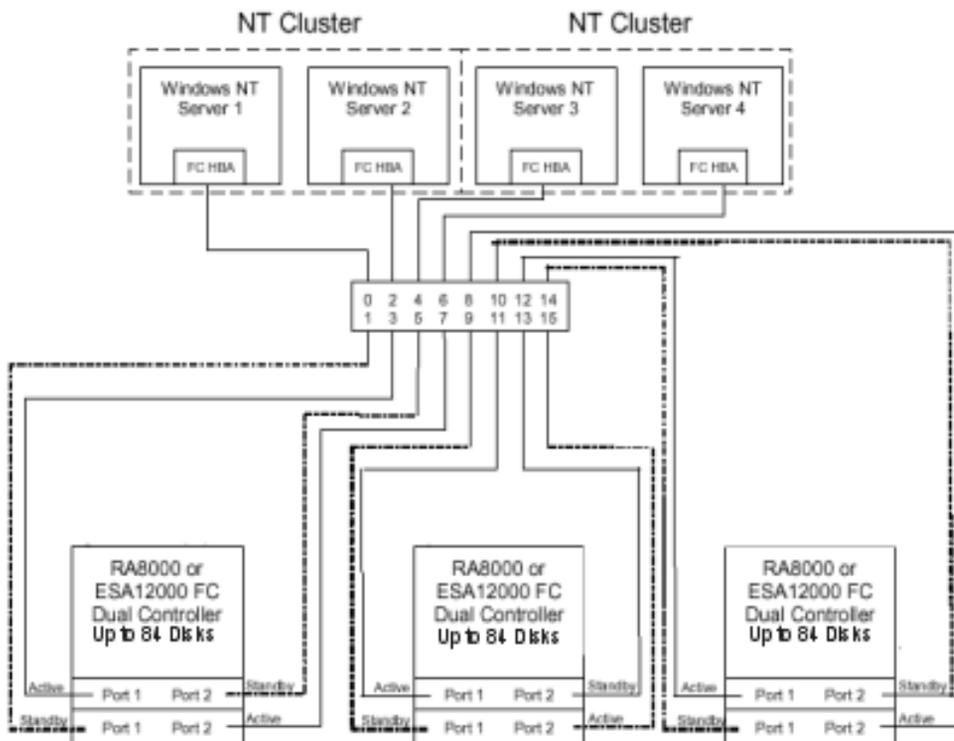
Figure C–7: Two Windows NT/Windows 2000 Clusters – Fibre Channel Switch

The Configuration in Figure C–7 features the following attributes:

- Switch Fabric configuration using all 16 Switch Ports

- Two Windows NT/Windows 2000 Clusters (MSCS)

- Three Enterprise/Modular Storage RAID Array s with storage units partition across both Windows NT/Windows 2000 Clusters

- Dual-redundant HGS80 controllers running in Transparent failover mode

- Up to 252 UltraSCSI drives with optional expansion enclosures

Installing Software for a Fibre Channel Cluster

This section describes the procedures and order to install software on a Fibre Channel Cluster.

Designating Servers as Host A and Host B

Performing the installation of an Windows NT/Windows 2000 Cluster requires a series of software procedures to be performed one host server at a time. Therefore, the servers must be clearly designated as Host A and Host B prior to the setup process. If both servers are new, either one can be designated as Host A, and the other, Host B.

However, if you are adding a second server (only) to an existing RAID subsystem environment, this documentation assumes it will be designated as Host B, and the existing server as Host A.

Server designation must remain constant through the configuration process.

Software Setup Summary for a Fibre Channel Cluster

The software setup procedures required for a cluster are presented in this section in the order that they must occur, which is as follows:

1. Prepare the fibre channel RAID subsystem for a cluster.

2. Prepare Host A for a cluster.

3. Prepare Host B for a cluster.

4. Install and configure Windows NT/Windows 2000 Cluster software on *both* host servers.

Preparing the Enterprise/Modular Storage RAID Array Hosts for a FC Cluster

The procedures for preparing the Enterprise/Modular Storage RAID Array and each host server for a cluster are provided below.

Preparing the Enterprise/Modular Storage RAID Array Subsystem

1. Verify that your storage subsystem and FC host bus adapter settings are correct for your Windows NT/Windows 2000 Cluster configuration and Fibre Channel Topology.

2. Verify that your storage units are accessible to the servers in your Windows NT/Windows 2000 Cluster configuration.

3. Restart the Enterprise/Modular Storage RAID Array subsystem if you have made changes to the HSG80 controllers.

Preparing Host A with Host B Powered Down

1. Install the FCA Fibre channel host bus adapter device driver.

2. [If Needed] Temporarily de-assign drive letters on all NTFS partition on your Enterprise/Modular Storage RAID Array. This step is required only when you have created NTFS partitions on your Enterprise/Modular Storage RAID Array system **before** installing the HSZDISK class driver. The HSZDISK class driver is installed during step 3.

3. Run the Fibre Channel Software Setup Utility for Transparent Failover.

4. Restart the server (Host A).

5. [If Needed] Reassign previous NTFS Partition Drive Letters from step 2.

Preparing Host B (Host A can remain powered up)

1. Install the FCA Fibre Channel Host Adapter Device Driver.

2. [If needed] Temporarily de-assign drive letters on all NTFS partition on your Enterprise/Modular Storage RAID Array. This step is required only when you have created NTFS partitions on your Enterprise/Modular Storage RAID Array system **before** installing the HSZDISK class driver. The HSZDISK class driver is installed during step 3.

3. Run the Fibre Channel Software Setup Utility

4. Restart the server (Host B).

5. [If Needed] Reassign previous NTFS Partition Drive Letters from step 2.

Preparing the Enterprise/Modular Storage RAID Array for an FC Cluster

Your RA8000, IMA8000, ESA/EMA 12000 Fibre Channel system is preconfigured with specific parameters based on either the Fibre Channel Arbitrated Loop or Switch Fabric topology. You may need to change these parameters when implementing certain Windows NT/Windows 2000 Cluster configurations in a Fibre Channel Arbitrated Loop. This section will review the required steps to make these changes.

Verifying FC Storage Settings for FC-AL Topology

You will need to verify that your Fibre Channel storage system and host bus adapters are configured with the required settings to support your Windows NT/Windows 2000 Fibre Channel Cluster.

Your HSG80 RAID system is preset to a port topology of LOOP_HARD and your HSG80 hosts ports are preset to ALPA (Arbitrated Loop Physical Address) settings 71 and 72. These settings are recommended for Windows NT/Windows 2000 cluster configurations. If your HSG80 RAID controller is not configured with these settings then you will need to make the appropriate corrections. Refer to the *StorageWorks HSG80 ACS Array Controller V8.7 CLI Reference Guide* for details on changing these setting.

Your fibre channel hosts adapters (FCAs) require specific settings for your Windows NT/Windows 2000 Cluster configuration. This is accomplished by running the Fibre Channel Software Setup Utility. Refer to "Preparing Both Host Servers for a FC Cluster," page C–16 for more information.

StorageWorks recommends using the settings in Table C–1 for your Windows NT/Windows 2000 Cluster configuration when configured for FC-AL topology.

Table C–1: Recommended HSG80 and FC Host Adapter Settings

FC-AL Component	FC Topology	ALPA Setting
FC Host Adapter - Server 1 (Windows NT/Windows 2000 Cluster A)	FC-AL	1 (recommended)
FC Host Adapter - Server 2 (Windows NT/Windows 2000 Cluster A)	FC-AL	2 (recommended)
FC Host Adapter - Server 3 (Windows NT/Windows 2000 Cluster B)	FC-AL	4 (recommended)
FC Host Adapter - Server 4 (Windows NT/Windows 2000 Cluster B)	FC-AL	8 (recommended)
Enterprise/Modular Storage RAID Array Subsystem		
HSG80 host port 1	Loop Hard	71 (preset)
HSG80 host port 2	Loop Hard	72 (preset)
Second Enterprise/Modular Storage RAID Array Subsystem (Optional)		
HSG80 host port 1	Loop Hard	73 (recommended)
HSG80 host port 2	Loop Hard	74 (recommended)

Adding a Second Storage RAID Array to a Fibre Channel Loop

Your Windows NT/Windows 2000 Fibre Channel Cluster configuration may include an additional Enterprise/Modular Storage RAID Array on the same Fibre Channel loop. Adding an additional subsystem will require you to change the AL_PA settings for host port 1 and host port 2 to AL_PA settings 73 and 74 respectively. See Example 1 on changing your AL_PA settings and refer to Figure C–8.

Example 1 – Changing arbitrated loop physical address settings

```
HSG80>Set This_Controller Port_1_AL_PA=73
HSG80>Set This_Controller Port_2_AL_PA=74
```

NOTE: You must restart both of your HSG80 controllers if you change the port topology or AL_PA settings.

Figure C–8: Controllers Settings for Second Storage RAID Array System

Verifying Storage Unit Access for A Cluster Configuration

In a Windows NT/Windows 2000 cluster configuration, you need to enable multiple host access to all storage units that will be shared by both Windows NT/Windows 2000 cluster servers. You can either specify the hosts connection names of the two cluster servers when using the StorageWorks Command Console or you can enable access to all hosts on a per LUN basis using the Command Line Interface (CLI). To enable access to the servers comprising your Windows NT/Windows 2000 cluster, refer to Example 2.

Example 2 – Enabling access for specific Windows Cluster Servers

```
HSG80>Set D0 Enable_Access_Path = NTSERVER1, NTSERVER2
```

StorageWorks recommends enabling access to all connections if the only hosts on the loop are your Windows NT/Windows 2000 Cluster servers. To enable access to all hosts on the loop, issue the CLI command shown in Example 3. You will need to perform this command for every LUN that will be shared among the two cluster servers.

Example 3 – Enabling access for all FC loop connections

```
HSG80>Set D0 Enable_Access_Path = ALL
```

Preparing Both Host Servers for a FC Cluster

Perform all of the steps in this section on Host A, while Host B is powered down. When finished, power up Host B and repeat all of the steps on Host B.

NOTE: Follow normal procedures to **POWER DOWN Host B** before preparing Host A for a cluster.

Installing the Fibre Channel Host Bus Adapter Device Driver

The Fibre Channel Host Adapter device driver is provided with your fibre channel host adapter. Install the fibre channel host bus adapter device driver for your server platform as described in Chapter 1 of the *HSG80 ACS Solution Software Version 8.7 for Windows NT or Windows 2000 Installation and Configuration Guide.*

Assigning/Removing Drive Letters for Windows 2000

This section discusses assigning and de-assigning drive letters on your Windows system.

Temporarily Removing Drive Letters on Windows 2000 System

NOTE: This section is required only when you have created NTFS partitions on your Enterprise Storage RAID Array system before the installation of the HsxDisk driver.

Temporarily remove NTFS drive letter assignments for all partitions on the Enterprise/Modular Storage RAID Array. Do not remove drive letters for any drives that are not configured on your Enterprise/Modular Storage RAID Array Fibre Channel system. To temporarily remove drive letter assignments, perform the following procedure:

1. Start the Disk Management program.

Figure C–9 shows the Disk Management window displaying current partitions.
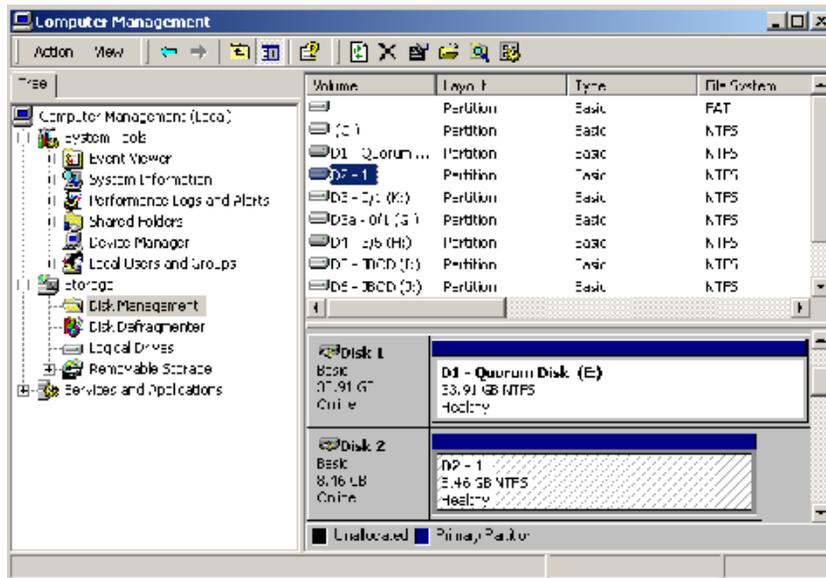
Figure C–9: Disk Management window showing the current partitions

2. Label your partitions if they are not already labeled, in order to distinguish each one.

3. Record the drive letters currently associated with each of the partition labels.

4. Click on an NTFS partition that exists on your Enterprise/Modular Storage RAID Array system.

5. Click on the desired partition, choose Change Drive Letter and Path…

   The Change Drive Letter dialog box appears, similar to Figure C–10.
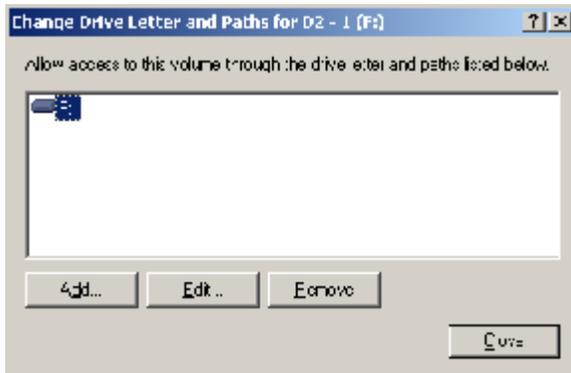
Figure C–10: Change Drive Letter and Paths dialog box

6. Click the **Remove** button (as shown in Figure C–10).

⚠ **CAUTION:** Do not remove the drive letters for any drive that is not connected to your Enterprise/Modular Storage RAID Array.

A confirmation dialog box appears as shown in Figure C–11.
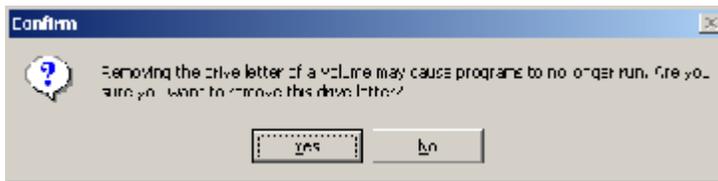
Figure C–11: Change Letter confirmation box

Running the Fibre Channel Software Setup Utility

The Fibre Channel Software Setup Utility serves various purposes, including:

- Installing the HsxDisk filter driver for Windows 2000.

- Setting Fibre Channel Host Bus adapter registry settings.

- Querying for Arbitrated Loop addresses.

- Establishing Extended Configuration settings.

- Checking the event log for specific error conditions.

- Reviewing driver revision levels.

NOTE: For additional information on running the Fibre Channel Software Setup, refer to *HSG80 ACS Solution Software Version 8.7 for Windows NT or Windows 2000 Installation Guide*.

Locate the CD-ROM disk labeled *RA/MA8000 ESA/EMA12000 Solution Software for Windows NT/Windows 2000* and select the solution for your specific configuration by performing the following steps: (This example shows the steps for the Arbitrated Loop Configuration.)

1. Insert the CD-ROM into your CD-ROM drive.

2. Select the solution software for your specific configuration.

3. Run the Fibre Channel Software Setup program.

4. Follow the migration wizard to complete the installation.

   If you chose the Solution Software for FC Hub selection, the FC Software Setup Utility will install the required 2000 driver registry parameters and prompt you to select an Arbitrated Loop Physical Address (ALPA) for each of your FC Host Adapters. StorageWorks recommends using ALPA 1 for Host A and ALPA 2 for Host B for the FC Host Adapters. Refer to Appendix B for the preferred list of ALPA addresses.

5. Restart the system.

Verifying Successful HsxDisk filter Driver Installation

After the host server is restarted, verify that the HsxDisk class driver installed successfully by performing the following procedure:

1. Open the *Event Viewer* from *Computer Management*.

2. Locate an information icon in the *Event Viewer* window with HsxDisk for the *Source.*

3. Double click on the HsxDisk entry and an entry detail screen displays.

4. The message in the detail screen indicates whether the HsxDisk driver was successfully installed. Upon successful HsxDisk driver installation, proceed to *NTFS Partition Drive Letter Reassignment or Creation,* if no drive letters have been created.

Reassigning or Creating the NTFS Partition Drive Letter

Preparing Host A

If you have not yet created any NTFS partitions on the Enterprise/Modular Storage RAID Array system, create them now by running the Disk Management utility on Host A. This action prepares Host A for a cluster. Then, return to "Preparing Both Host Servers for a FC Cluster" on page C–16, to repeat the preceding software setups on Host B.

Preparing Host B

The shared drive letters must be identical on both host servers in a cluster environment. Reassign the same drive letters to Host B that you assigned to Host A.

Installing and Configuring Cluster Software on Both Host Servers

The Enterprise/Modular Storage RAID Array, Host A and Host B must be prepared for a Fibre Channel cluster before installing Windows 2000 Cluster software. You are now ready to install and configure Windows 2000 Cluster software on both of your host servers, as described in the manual provided with your cluster software. Additional support can be found at http://www.microsoft.com.

Assigning/Removing Drive Letters for Windows NT

This chapter discusses assigning and de-assigning drive letters on your Windows NT system.

Temporarily Removing Drive Letters

This section is required only when you have created NTFS partitions on your Enterprise/Modular Storage RAID Array system before the installation of the HszDisk class driver. If you have not created NTFS partitions, proceed to "Software Setup Summary for a Fibre Channel Cluster" on page C–11.

The inclusion of the HszDisk class driver when NTFS partitions exist on your Enterprise/Modular Storage RAID Array system causes Windows NT to reassign the drive letters. HszDisk inserts all NTFS partitions on your Enterprise/Modular Storage RAID Array ahead of any local (non-shared bus) partitions. Windows NT would, for example, reassign drive letter C from your system disk to the first NTFS formatted storageset partition, Disk 0).

Since drive letter reassignments by the HszDisk class driver could invalidate your drive mappings, **you must temporarily remove NTFS drive letter assignments** for all partitions on the Enterprise/Modular Storage RAID Array prior to installing the HszDisk driver. Do not remove drive letters for any drives that are not configured on your Enterprise/Modular Storage RAID Array Fibre Channel system.

Temporarily Removing Drive Letter Assignments

1. Start the Disk Administrator. shows the Disk Administrator window displaying current partitions.
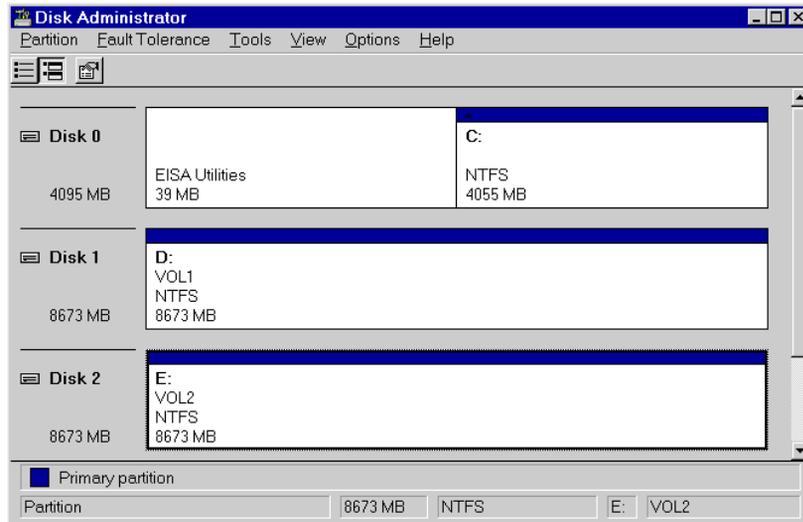
Figure C–12: Current Partitions

2. Label your partitions if they are not already labeled, so that you can distinguish each one.

3. Record the drive letters currently associated with each of the partition labels.

4. Click on an NTFS partition that exists on your Enterprise/Modular Storage RAID Array system.

5. Select *Tools > Assign Drive Letter*.

   The Assign Drive Letter dialog box appears, similar to Figure C–13.

Figure C–13: Assign Drive Letter

6. Click the *Do not assign a drive letter* radio button (as shown in Figure C–13) and then click **OK**.

⚠ **CAUTION:** Do not remove the drive letters for any drive that is not connected to your Enterprise/Modular Storage RAID Array.

A confirmation dialog box appears as shown in Figure C–14.
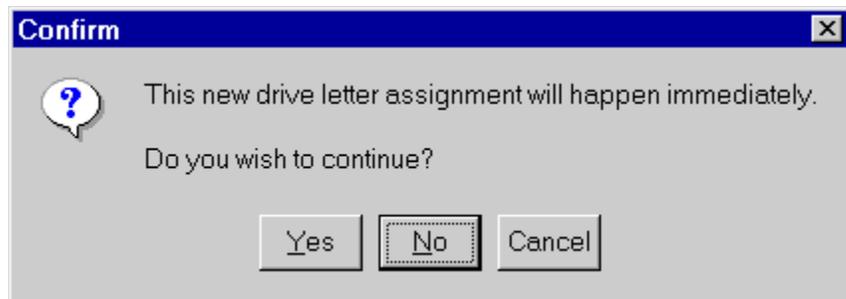
Figure C–14: Drive Letter Confirmation

7. Click **Yes**. The partition now appears without a drive letter designator similar to the screen shown in Figure C–15.
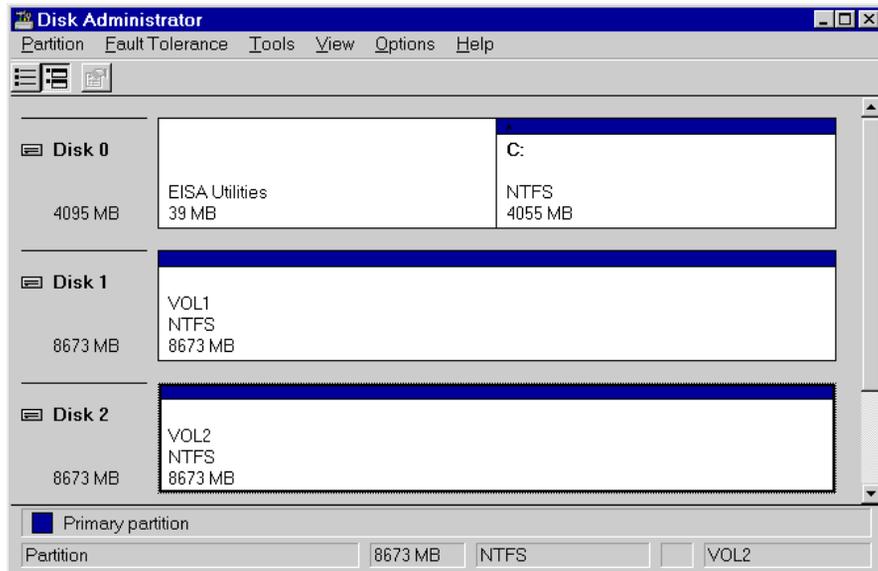
Figure C–15: No Drive Letter Assignments

8. Repeat Steps 4 through 7 for each of your partitions except the local and start partitions.

Running the Fibre Channel Software Setup Utility

The Fibre Channel Software Setup Utility serves various purposes, including:

- Installing the HszDisk Class driver for Windows NT.

- Setting Fibre Channel Host Bus adapter registry settings.

- Querying for Arbitrated Loop addresses.

- Establishing Extended Configuration settings.

- Checking the event log for specific error conditions.

- Reviewing driver revision levels.

Locate the CD-ROM disk labeled *Enterprise Storage RAID Array Solution Software for Windows NT* and select the solution for your specific configuration.

Perform the following steps: (This example shows the steps for the Arbitrated Loop Configuration.)

1. Insert the CD-ROM into your CD-ROM drive.

2. Select the solution software (FC-AL or FC-SW) for your specific configuration.

3. Run the Fibre Channel Software Setup program.

4. Follow the migration wizard to complete the installation.

NOTE: The FCA host bus adapter and device driver must be installed on your server as described in your adapter guide before setting the ALPA.

If you chose the Solution Software for FC Hub selection, the FC Software Setup Utility will install the required Windows NT driver registry parameters and prompt you to select an Arbitrated Loop Physical Address (ALPA) for each of your FC Host Adapters. StorageWorks recommends using ALPA 1 for Host A and ALPA 2 for Host B for the FC Host Adapters. Refer to Figure C–16 for an example of selecting an ALPA address. Refer to Table3-1 for the preferred list of ALPA addresses.
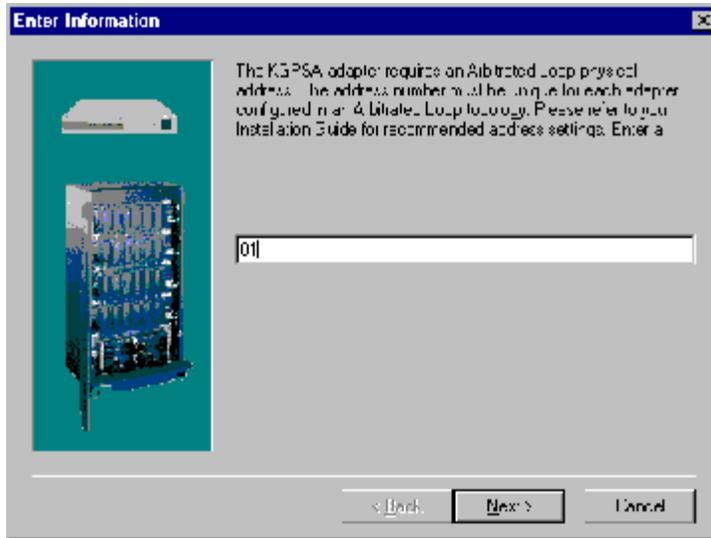
Figure C–16: Selecting an FC Arbitrated Loop Physical Address

5. Restart the system.

Verifying Successful HszDisk Class Driver Installation

After the host server is restarted, verify that the HszDisk class driver installed successfully by performing the following procedure:

1. Open the *Event Viewer* from the *Administrative Tools* group.

2. Locate an information icon in the *Event Viewer* window with HszDisk for the *Source.*

3. Double click on the HszDisk entry and an entry detail screen appears.

   The message in the detail screen indicates whether the HszDisk class driver was successfully installed.

   Upon successful HszDisk class driver installation, proceed to *NTFS Partition Drive Letter Reassignment or Creation,* next, if no drive letters have been created yet.

Reassigning or Creating the NTFS Partition Drive Letter

NOTE: (IF PREPARING HOST A) If you have not yet created any NTFS partitions on the Enterprise/Modular Storage RAID Array system, create them now by running the Disk Administrator utility on Host A. After so doing, you will have successfully prepared Host A for a cluster, and must return to"Preparing Both Host Servers for a FC Cluster" on page C–16, to repeat the preceding software setups on Host B.

NOTE: (IF PREPARING HOST B) THE SHARED DRIVE LETTERS MUST BE *identical* on both host servers IN A cluster ENVIRONMENT. Reassign the same drive letters to Host B that you assigned to Host A, using the following the procedures.

Reassign Drive Letters

This section describes how to reassign drive letters to NTFS partitions on a host if they were temporarily de-assigned.

1. Start the Disk Administrator which displays all the existing partitions, similar to the window shown in Figure C–17. (The only partitions with drive letters are the boot partition and any non-disk devices, such as a CD-ROM drive).
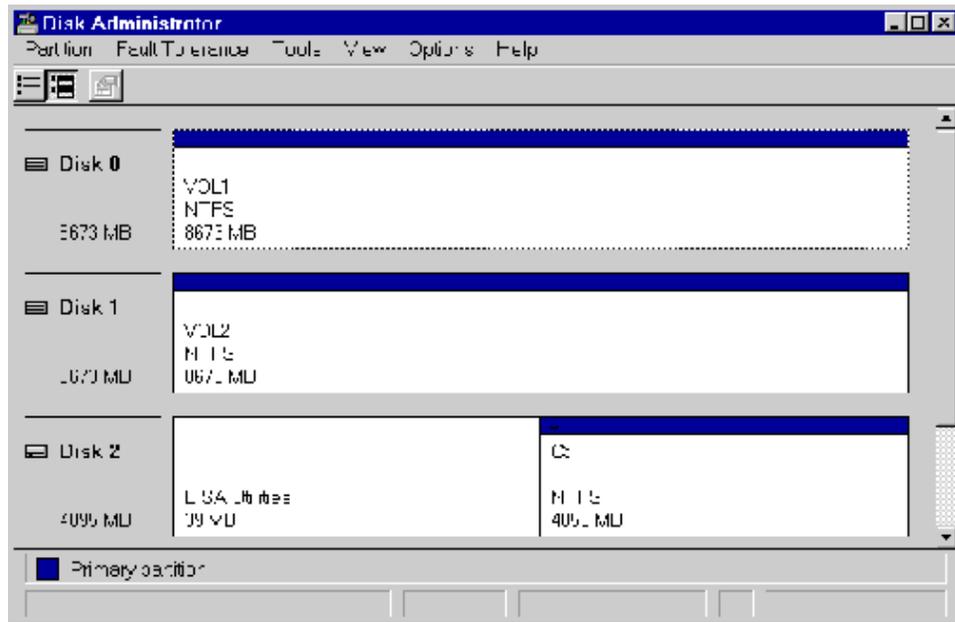
Figure C–17: Partition Appearance - (post HszDisk driver installation)

2. Highlight a (RAID Array storageset) partition.

3. Select *Tools* > *Assign Drive Letter*. The Assign Drive Letter window (Figure C–18) appears displaying the next available drive letter.
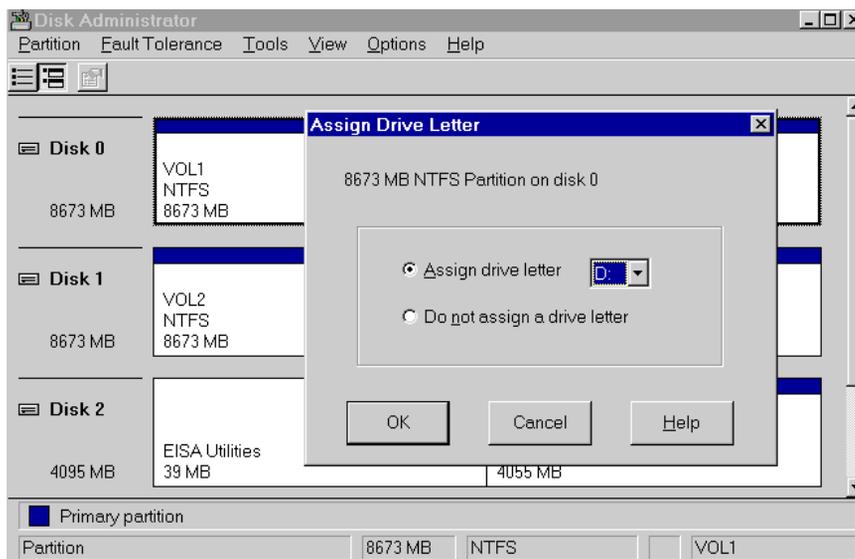
Figure C–18: Driver Letter Availability

4. Perform one of the following actions:

   - Click **OK** if you want to assign the selected drive letter and go to step 7.

   - Click the *Assign drive letter* radio button and go to the next step.

5. In the Assign Drive Letter window, select another drive letter from the drop down list and click **OK**.

   If the letter you want to assign does not appear in the list, Windows may have already assigned that letter to the CD-ROM drive. You can de-assign that letter from the CD-ROM to free it for use.

6. At the confirmation dialog box, click **Yes**. The partition now appears with the specified drive letter designator.

7. Repeat Steps 2 through 6 until you have assigned drive letters to all of the partitions that need one, similar to the window shown in Figure C–19.
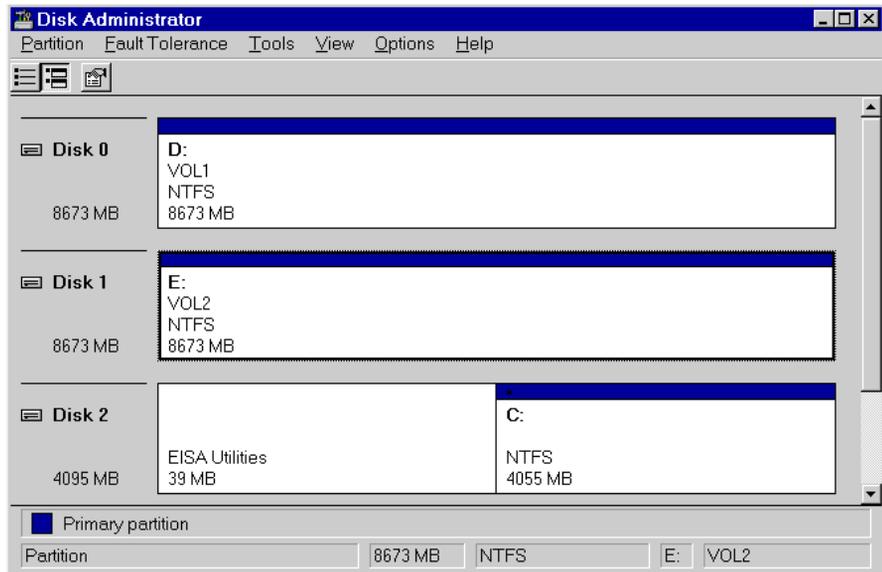
Figure C–19: All the Drive Letters Reassigned

Preparing Host A

With the NTFS partition drive letters successfully reassigned, or newly created, as applicable, Host A is prepared for a cluster. To prepare Host B, return to "Preparing Both Host Servers for a FC Cluster" on page C–16 and repeat all of the preceding steps on Host B.

Preparing Host B

With the NTFS partition drive letters successfully reassigned, Host B is prepared for a cluster. Proceed to "Installing and Configuring Cluster Software on Both Host Servers," page C–30.

Installing and Configuring Cluster Software on Both Host Servers

NOTE: The Enterprise/Modular Storage RAID Array, Host A and Host B must be prepared for a Fibre Channel cluster before installing Windows NT Cluster software.

You are now ready to install and configure Windows NT Cluster software on both of your host servers, as described in the manual provided with your cluster software.

Troubleshooting

This section describes how to troubleshoot a Fibre Channel Windows NT/Windows 2000 cluster. Troubleshooting the Enterprise/Modular Storage RAID Array Subsystem Fibre Channel Cluster involves verifying the following characteristics:

- Device Driver Initialization for the FC Host Adapters
- Windows NT/Windows 2000 Registry Device Driver Parameter Settings
- Connectivity of Cluster Components to the FC Arbitrated Loop

Verifying Device Driver Initialization

A problem with Windows NT/Windows 2000's HAL (Hardware Abstraction Layer) may prevent the FCA device driver (LP6NDS35.SYS) from initializing during system boot. The consequence of this problem is that none of your devices connected to your FCA adapter will be available and the event log entry, depicted in Figure A-1, will be entered in the system event log.

The Windows NT/Windows 2000 HAL reconfigure the PCI adapter with conflicting resources which causes a problem. A workaround is available that causes the HAL to use the BIOS assigned defaults, and not to reassign PCI resources. The workaround (from Microsoft) involves editing the *Boot.ini* file. In this case, you may need to perform the following actions.

1. Remove the read-only file attribute, (e.g., attrib -r -h -s c:\boot.ini).

2. Add the /PCILOCK option to the system boot entry,

3. Restart your machine.

```
Example boot.ini

[boot loader]

timeout=30

default=multi(0)disk(0)rdisk(0)partition(2)\WINNT

[operating systems]

multi(0)disk(0)rdisk(0)partition(2)\WINNT="Windows NT Server,
Enterprise Edition Version 4.00" /pcilock
```
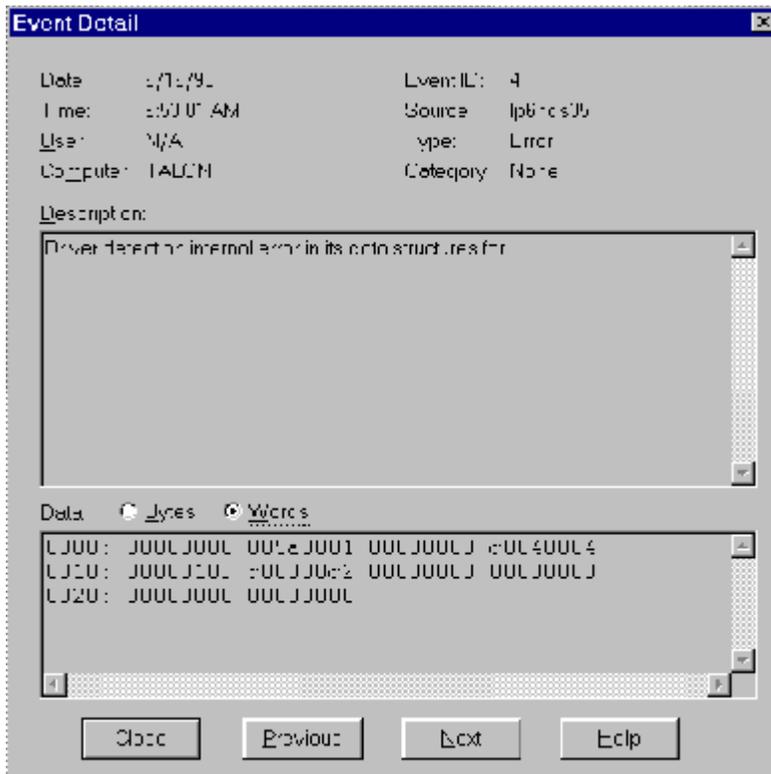

Figure C–20: Device Driver Initialization Event Log Entry

Verify the Windows Registry Device Driver Parameters

The FCA device driver parameters in the Windows NT/Windows 2000 registry must be set correctly for proper operation of your Enterprise/Modular Storage RAID Array storage subsystem configured in a Windows NT/Windows 2000 cluster. Locate the registry key in your system as depicted in Figure A-2 and review the registry setting values and compare them with the correct values that are listed in Table C–2 (Note, all values are decimal unless noted). If discrepancies are found, run the Fibre Channel Software Setup Utility and select the *Custom* button. Click on the *FCA Adapter Driver Setup* option. This will automatically correct the registry settings configured in your system. Reboot your system after completing the Setup.

> ⚠ **WARNING: StorageWorks does not recommend using the Registry Editor to adjust registry settings. Fatal system errors may result. Use the HSZInstall FC Utility. This utility will properly set the registry settings for the FCA adapter.**

Table C–2: LP6NDS35 Device Driver Parameters

Driver Parameter	Correct Value
RetryIoTimeOut	1
RetryInterval	52
EnableDPC	1
QueueTarget	1
QueueDepth	25 (15 for Extended Configurations)
ResetFF	0
ResetTPRLO	1
Topology	0 for FC-AL 1 for FC-SW
Simulate Device	0
ELS RetryCount	6
ScanDown	1
HardAlPa*	Refer to the following note

NOTE: *StorageWorks recommends using ALPA values 1 and 2 for the host bus adapters in a Fibre Channel Windows NT/Windows 2000 Cluster. The HardAlpa is not applicable for the Fibre Channel Switch Topology. Additional parameters are included when the host is configured with Secure Path Software.

Windows NT	**Windows 2000**
LP6NDS35	**CPQFCA**
HKEY_LOCAL_MACHINE –	HKEY_LOCAL_MACHINE –
- SYSTEM	- SYSTEM
-CurrentControlSet	-CurrentControlSet
- Services	- Services
- Lp6nds35	- CPQFCA
- Parameters	- Parameters
Number of Requests=50	
Maximum SGList=33	

Verifying Connectivity to the Fibre Channel Arbitrated Loop

This section outlines the procedure to troubleshoot a Fibre Channel Windows NT/Windows 2000 Cluster when one or both servers can not access the Fibre Channel Storage Array. The recommended troubleshooting steps are as follows:

NOTE: Before proceeding, verify that your configuration meets minimum requirement revisions as described in your documentation set. These procedures are only relevant for the Fibre Channel Arbitrated Loop.

1. Verifying HSG80 settings and connectivity to the Loop

    Issue the CLI command show this_controller to ensure that your HSG80 host ports are connected to the loop. The port 1 topology and port 2 topology, if used, should be LOOP_HARD and indicate a status of *Loop Up* or *Standby*. If one HSG80 controller indicates a Loop Up state, then the other controller will be in a Standby state. If your port topology and state is correct then proceed to Step 2.

    a. If the HSG80 host ports that you have configured are in an *Offline* state, then perform the following steps:

    b. Shutdown and power off both Windows NT/Windows 2000 Servers

    c. Verify that the fiber optic cable is properly seated in the GBIC module in your hub and in the GLM module in your HSG80 controller. Ensure that your Fibre Channel Hub is powered on and the LEDs are illuminated.

    d. Restart both HSG80 controllers.

If your HSG80 controllers continue to indicate an offline state, then refer to the troubleshooting section in your *StorageWorks HSG80 Array Controller ACS Version 8.7 Maintenance and Service Guide* for troubleshooting suggestions.

2. Verify that your Windows NT/Windows 2000 Servers (hosts) are connected to the Fibre Channel Loop

To verify that your Windows NT/Windows 2000 servers are connected to the loop, issue the CLI command show connection. As shown in Figure A-3, the output of this command shows information about present and previous host connections to the loop.

- The unit address column refers to the Arbitrated Loop Physical Address that you assigned when running the fibre channel software setup.

- The Status Column indicates the host connection (Windows NT/Windows 2000 server) is *On-Line* to either the HSG80 controller that you are connected to (OL this) or the other HSG80 controller (OL other).

It is recommend to rename the connection-name field to the computer name of your server. This will facilitate your ability to discern loop connections. The recommended method of discerning loop connection names is to boot one server at a time and issue the show connection command. The new On-line connection that is displayed will be the server that you just started.

```
HSG80> show connection

Connection                                      Unit

   Name     Operating system Controller Port Address Status   Offset

SERVER_A        WINNT          THIS       1   000001 OL other    0

    HOST_ID=1000-0000-C920-3C2B
ADAPTER_ID=1000-0000-C920-3C2B


SERVER_B        WINNT          THIS       1   000002 OL other    0

    HOST_ID=1000-0000-C920-3C20
ADAPTER_ID=1000-0000-C920-3C20
```

If your Windows NT/Windows 2000 servers are not connect to the Fibre Channel loop, verify the FCA driver has started by invoking the Device applet in the Control Panel.

a. Check the event log for errors by the FCA device driver.

b. Check the Fibre Channel cable from your host bus adapter to the Fibre Channel hub.

c. Verify the LEDs are illuminated where the Fibre Channel cable is connected to the hub and on the back of the Fibre Channel host bus adapter. If your Host servers are connected to the loop, proceed to Step 3.

3. Verifying the Storage Units have access to all host connections

Using the StorageWorks Command Console utility to create your storage partitions will, by default, restrict host access to the storage devices. To check host access, issue the CLI command as shown in Example 1.

Example 1 – Viewing Device Unit Information

```
HSG80> Show Units Full
```

If your device units have a host access of **none** or restrict access to a specific host connection name, then modify each device units to allow for **all** host access capabilities. Example 2 shows how to modify device unit D0 to allow unlimited hosts access. You will need to issue this command for each device storage unit.

Example 2 – Modifying access to your device units

```
HSG80>Set D0 Enable_Access = ALL
HSG80> show this_controller
```

Figure C–21: Verifying FC-AL Connectivity RAID Array Subsystem

Glossary

This glossary defines terms pertaining to the ACS solution software. It is not a comprehensive glossary of computer terms.

8B/10B	A type of byte definition encoding and decoding to reduce errors in data transmission patented by the IBM Corporation. This process of encoding and decoding data for transmission has been adopted by ANSI.
adapter	A device that converts the protocol and hardware interface of one bus type into another without changing the function of the bus.
ACS	*See* array controller software.
AL_PA	*See* arbitrated loop physical address.
alias address	An AL_PA value recognized by an arbitrated loop port in addition to the assigned AL_PA.
ANSI	Pronounced "ann-see." Acronym for the American National Standards Institute. An organization who develops standards used voluntarily by many manufacturers within the USA. ANSI is not a government agency.
arbitrate	A process of selecting one L_Port from a collection of several ports that request use of the arbitrated loop concurrently.
arbitrated loop	A loop type of topology where two or more ports can be interconnected, but only two ports at a time can communicate.
arbitrated loop physical address	Abbreviated AL_PA. A one-byte value used to identify a port in an Arbitrated Loop topology.

array controller   *See* controller.

array controller software   Abbreviated ACS. Software contained on a removable ROM program card that provides the operating system for the array controller.

association set   A group of remote copy sets that share selectable attributes for logging and failover. Members of an association set transition to the same state simultaneously. For example, if one association set member assumes the failsafe locked condition, then other members of the association set also assume the failsafe locked condition.

An association set can also be used to share a log between a group of remote copy set members that require efficient use of the log space.

asynchronous   Pertaining to events that are scheduled as the result of a signal asking for the event; pertaining to that which is without any specified time relation. *See also* synchronous.

autospare   A controller feature that automatically replaces a failed disk drive. To aid the controller in automatically replacing failed disk drives, you can enable the AUTOSPARE switch for the failedset causing physically replaced disk drives to be automatically placed into the spareset. Also called "AUTONEWSPARE."

bad block   A data block that contains a physical defect.

bad block replacement   Abbreviated BBR. A replacement routine that substitutes defect-free disk blocks for those found to have defects. This process takes place in the controller, transparent to the host.

backplane   The electronic printed circuit board into which you plug subsystem devices—for example, the SBB or power supply.

battery hysteresis   The ability of the software to allow write-block caching during the time a battery is charging, but only when a previous down time has not drained more than 50 percent of rated battery capacity.

BBR   *See* bad block replacement.

BIST   *See* built-in self-test.

bit   A single binary digit having a value of either 0 or 1. A bit is the smallest unit of data a computer can process.

block	Also called a sector. The smallest collection of consecutive bytes addressable on a disk drive. In integrated storage elements, a block contains 512 bytes of data, error codes, flags, and the block address header.
bootstrapping	A method used to bring a system or device into a defined state by means of its own action. For example, a machine routine whose first few instructions are enough to bring the rest of the routine into the computer from an input device.
built-in self-test	A diagnostic test performed by the array controller software on the controller policy processor.
byte	A binary character string made up of 8 bits operated on as a unit.
cache memory	A portion of memory used to accelerate read and write operations.
cache module	A fast storage buffer
CCL	CCL-Command Console LUN, a "SCSI Logical Unit Number" virtual-device used for communicating with Command Console Graphical User Interface (GUI) software.
channel	An interface that allows high speed transfer of large amounts of data. Another term for a SCSI bus. *See also* SCSI.
chunk	A block of data written by the host.
chunk size	The number of data blocks, assigned by a system administrator, written to the primary RAIDset or stripeset member before the remaining data blocks are written to the next RAIDset or stripeset member.
CLCP	An abbreviation for code-load code-patch utility. This utility is used to upgrade the controller and EMU software. It can also be used to patch the controller software.
CLI	See Command Line Interface.
coax	A two-conductor wire in which one conductor completely wraps the other with the two separated by insulation.
cold swap	A method of device replacement that requires the entire subsystem to be turned off before the device can be replaced. *See also* hot swap and warm swap.

command line interface
CLI. A command line entry utility used to interface with the HS-series controllers. CLI enables the configuration and monitoring of a storage subsystem through textual commands.

concat commands
Concat commands implement storageset expansion features.

configuration file
A file that contains a representation of a storage subsystem configuration.

container
1) Any entity that is capable of storing data, whether it is a physical device or a group of physical devices. (2) A virtual, internal controller structure representing either a single disk or a group of disk drives linked as a storageset. Stripesets and mirrorsets are examples of storageset containers the controller uses to create units.

controller
A hardware device that, with proprietary software, facilitates communications between a host and one or more devices organized in an array. The HSG80 family controllers are examples of array controllers.

copying
A state in which data to be copied to the mirrorset is inconsistent with other members of the mirrorset. *See also* normalizing.

copying member
Any member that joins the mirrorset after the mirrorset is created is regarded as a copying member. Once all the data from the normal member (or members) is copied to a normalizing or copying member, the copying member then becomes a normal member. *See also* normalizing member.

CSR
An acronym for control and status register.

DAEMON
Pronounced "demon." A program usually associated with a UNIX systems that performs a utility (housekeeping or maintenance) function without being requested or even known of by the user. A daemon is a diagnostic and execution monitor.

data center cabinet
A generic reference to large subsystem cabinets, such as the cabinets in which *StorageWorks* components can be mounted.

data striping	The process of segmenting logically sequential data, such as a single file, so that segments can be written to multiple physical devices (usually disk drives) in a round-robin fashion. This technique is useful if the processor is capable of reading or writing data faster than a single disk can supply or accept the data. While data is being transferred from the first disk, the second disk can locate the next segment.
DDL	Dual data link. The ability to operate on the CI bus using both paths simultaneously to the same remote node.
device	*See* node and peripheral device.
differential I/O module	A 16-bit I/O module with SCSI bus converter circuitry for extending a differential SCSI bus. *See also* I/O module.
differential SCSI bus	A bus in which a signal level is determined by the potential difference between two wires. A differential bus is more robust and less subject to electrical noise than is a single-ended bus.
DIMM	Dual inline Memory Module.
dirty data	The write-back cached data that has not been written to storage media, even though the host operation processing the data has completed.
DMA	Direct Memory Access.
DOC	DWZZA-On-a-Chip. ASCSI bus extender chip used to connect a SCSI bus in an expansion cabinet to the corresponding SCSI bus in another cabinet (See DWZZA).
driver	A hardware device or a program that controls or regulates another device. For example, a device driver is a driver developed for a specific device that allows a computer to operate with the device, such as a printer or a disk drive.
dual-redundant configuration	A controller configuration consisting of two active controllers operating as a single controller. If one controller fails, the other controller assumes control of the failing controller devices.
dual-simplex	A communications protocol that allows simultaneous transmission in both directions in a link, usually with no flow control.
DUART	Dual universal asynchronous receiver and transmitter. An integrated circuit containing two serial, asynchronous transceiver circuits.

DWZZA	A StorageWorks SCSI bus signal converter used to connect 8-bit single-ended devices to hosts with 16-bit differential SCSI adapters. This converter extends the range of a single-ended SCSI cable to the limit of a differential SCSI cable.
DWZZB	A StorageWorks SCSI bus signal converter used to connect a variety of 16-bit single-ended devices to hosts with 16-bit differential SCSI adapters.
ECB	External cache battery. The unit that supplies backup power to the cache module in the event the primary power source fails or is interrupted.
ECC	Error checking and correction.
EDC	Error detection code.
EIA	The abbreviation for Electronic Industries Association. EIA is a standards organization specializing in the electrical and functional characteristics of interface equipment.
EMU	Environmental monitoring unit. A unit that provides increased protection against catastrophic failures. Some subsystem enclosures include an EMU which works with the controller to detect conditions such as failed power supplies, failed blowers, elevated temperatures, and external air sense faults. The EMU also controls certain cabinet hardware including DOC chips, alarms, and fan speeds.
ESD	Electrostatic discharge. The discharge of potentially harmful static electrical voltage as a result of improper grounding.
extended subsystem	A subsystem in which two cabinets are connected to the primary cabinet.
external cache battery	*See* ECB.
F_Port	A port in a fabric where an N_Port or NL_Port may attach.
fabric	A group of interconnections between ports that includes a fabric element.
failback	The process of restoring data access to the newly-restored controller in a dual-redundant controller configuration. See also failover.

failedset	A group of failed mirrorset or RAIDset devices automatically created by the controller.
failover	The process that takes place when one controller in a dual-redundant configuration assumes the workload of a failed companion controller. Failover continues until the failed controller is repaired or replaced.
	The ability for HSG80 controllers to transfer control from one controller to another in the event of a controller failure. This ensures uninterrupted operation. Use Transparent Failover mode for single HBA configurations. Use multiple-bus failover mode for Secure Path based configurations.
FCA	Fibre Channel Adapter
FC–AL	The Fibre Channel Arbitrated Loop standard. See *Fibre Channel.*
FC–ATM	ATM AAL5 over Fibre Channel
FC–FG	Fibre Channel Fabric Generic Requirements
FG–FP	Fibre Channel Framing Protocol (HIPPI on FC)
FC-GS-1	Fibre Channel Generic Services-1
FC–GS-2	Fibre Channel Generic Services-2
FC–IG	Fibre Channel Implementation Guide
FC–LE	Fibre Channel Link Encapsulation (ISO 8802.2)
FC–PH	The Fibre Channel Physical and Signaling standard.
FC–SB	Fibre Channel Single Byte Command Code Set
FC–SW	Fibre Channel Switched Topology and Switch Controls
FCC	Federal Communications Commission. The federal agency responsible for establishing standards and approving electronic devices within the United States.
FCC Class A	This certification label appears on electronic devices that can only be used in a commercial environment within the United States.

FCC Class B   This certification label appears on electronic devices that can be used in either a home or a commercial environment within the United States.

FCP   The mapping of SCSI-3 operations to Fibre Channel.

FDDI   Fiber Distributed Data Interface. An ANSI standard for 100 megabaud transmission over fiber optic cable.

FD SCSI   The fast, narrow, differential SCSI bus with an 8-bit data transfer rate of 10 MB/s. *See also* FWD SCSI and SCSI.

fiber   A fiber or optical strand. Spelled *fibre* in Fibre Channel.

fiber optic cable   A transmission medium designed to transmit digital signals in the form of pulses of light. Fiber optic cable is noted for its properties of electrical isolation and resistance to electrostatic contamination.

Fibre Channel   A high speed, high-bandwidth serial protocol for channels and networks that interconnect over twisted pair wires, coaxial cable or fiber optic cable. The Fibre Channel Switched (FC-SW) (fabric) offers up to 16 million ports with cable lengths of up to 10 kilometers. The Fibre Channel Arbitrated Loop (FC-AL) topology offers speeds of up to 100 Mbytes/seconds and up to 127 nodes, all connected in serial. In contrast to SCSI technology, Fibre Channel does not require ID switches or terminators. The FC-AL loop may be connected to a Fibre Channel fabric for connection to other nodes.

fibre channel topology   An interconnection scheme that allows multiple Fibre Channel ports to communicate with each other. For example, point-to-point, Arbitrated Loop, and switched fabric are all Fibre Channel topologies.

FL_Port   A port in a fabric where N_Port or an NL_Port may be connected.

flush   The act of writing dirty data from cache to a storage media.

FMU   Fault management utility.

forced errors   A data bit indicating a corresponding logical data block contains unrecoverable data.

frame   An invisible unit used to transfer information in Fibre Channel.

FRU	Field replaceable unit. A hardware component that can be replaced at the customer location by service personnel or qualified customer service personnel.
FRUTIL	Field Replacement utility.
full duplex (n)	A communications system in which there is a capability for 2-way transmission and acceptance between two sites at the same time.
full duplex (adj)	Pertaining to a communications method in which data can be transmitted and received at the same time.
FWD SCSI	A fast, wide, differential SCSI bus with a maximum 16-bit data transfer rate of 20 MB/s. *See also* SCSI and FD SCSI.
GBIC	Gigabit Interface Converter. GBICs convert electrical signals to optical signals (and vice-versa.) They are inserted into the ports of the Fibre Channel switch and hold the Fibre Channel cables.
GLM	Gigabit link module
giga	A prefix indicating a billion (10^9) units, as in gigabaud or gigabyte.
gigabaud	An encoded bit transmission rate of one billion (10^9) bits per second.
gigabyte	A value normally associated with a disk drives storage capacity, meaning a billion (10^9) bytes. The decimal value 1024 is usually used for one thousand.
half-duplex (adj)	Pertaining to a communications system in which data can be either transmitted or received but only in one direction at one time.
hard address	The AL_PA which an NL_Port attempts to acquire during loop initialization.
heterogeneous host support	Also called *noncooperating host support*.
HIPPI–FC	Fibre Channel over HIPPI
host	The primary or controlling computer to which a storage subsystem is attached.

host adapter	A device that connects a host system to a SCSI bus. The host adapter usually performs the lowest layers of the SCSI protocol. This function may be logically and physically integrated into the host system.
HBA	Host bus adapter
host compatibility mode	A setting used by the controller to provide optimal controller performance with specific operating systems. This improves the controller performance and compatibility with the specified operating system.
hot disks	A disk containing multiple hot spots. Hot disks occur when the workload is poorly distributed across storage devices which prevents optimum subsystem performance. *See also* hot spots.
hot spots	A portion of a disk drive frequently accessed by the host. Because the data being accessed is concentrated in one area, rather than spread across an array of disks providing parallel access, I/O performance is significantly reduced. *See als*o hot disks.
hot swap or hot-pluggable	A method of device replacement that allows normal I/O activity on a device bus to remain active during device removal and insertion. The device being removed or inserted is the only device that cannot perform operations during this process. *See also* cold swap and warm swap.
hub	A device (concentrator) which performs some or all of the following functions: • Automatic insertion of operational loop devices without disrupting the existing configuration. • Automatic removal of failed loop devices without impacting the existing configuration. • Provides a centralized (star) wiring configuration and maintenance point. • Provides central monitoring and management.
IBR	Initial Boot Record.
ILF	Illegal function.
INIT	Initialize input and output.

initiator	A SCSI device that requests an I/O process to be performed by another SCSI device, namely, the SCSI target. The controller is the initiator on the device bus. The host is the initiator on the host bus.
instance code	A four-byte value displayed in most text error messages and issued by the controller when a subsystem error occurs. The instance code indicates when during software processing the error was detected.
interface	A set of protocols used between components, such as cables, connectors, and signal levels.
I/O	Refers to input and output functions.
I/O driver	The set of code in the kernel that handles the physical I/O to a device. This is implemented as a fork process. Same as driver.
I/O interface	*See* interface.
I/O module	A 16-bit SBB shelf device that integrates the SBB shelf with either an 8-bit single ended, 16-bit single-ended, or 16-bit differential SCSI bus (see SBB).
I/O operation	The process of requesting a transfer of data from a peripheral device to memory (or visa versa), the actual transfer of the data, and the processing and overlaying activity to make both of those happen.
IPI	Intelligent Peripheral Interface. An ANSI standard for controlling peripheral devices by a host computer.
IPI-3 Disk	Intelligent Peripheral Interface Level 3 for Disk
IPI-3 Tape	Intelligent Peripheral Interface Level 3 for Tape
JBOD	Just a bunch of disks. A term used to describe a group of single-device logical units.
kernel	The most privileged processor access mode.
LBN	Logical Block Number.
L_port	A node or fabric port capable of performing arbitrated loop functions and protocols. NL_Ports and FL_Ports are loop-capable ports.
LED	Light Emitting Diode.

link	A connection between two Fibre Channel ports consisting of a transmit fibre and a receive fibre.
local connection	A connection to the subsystem using either its serial maintenance port or the host SCSI bus. A local connection enables you to connect to one subsystem controller within the physical range of the serial or host SCSI cable.
local terminal	A terminal plugged into the EIA-423 maintenance port located on the front bezel of the controller. *See also* maintenance terminal.
logical bus	A single-ended bus connected to a differential bus by a SCSI bus signal converter.
logical unit	A physical or virtual device addressable through a target ID number. LUNs use their target bus connection to communicate on the SCSI bus.
logical unit number	LUN. A value that identifies a specific logical unit belonging to a SCSI target ID number. A number associated with a physical device unit during a task I/O operations. Each task in the system must establish its own correspondence between logical unit numbers and physical devices.
logon	Also called login. A procedure whereby a participant, either a person or network connection, is identified as being an authorized network participant.
loop	*See* arbitrated loop.
loop_ID	A seven-bit value numbered contiguously from zero to 126-decimal and represent the 127 legal AL_PA values on a loop (not all of the 256 hex values are allowed as AL_PA values per FC-AL.)
loop tenancy	The period of time between the following events: when a port wins loop arbitration and when the port returns to a monitoring state.
L_Port	A node or fabric port capable of performing Arbitrated Loop functions and protocols. NL_Ports and FL_Ports are loop-capable ports.
LUN	See logical unit number.
LRU	Least recently used. A cache term used to describe the block replacement policy for read cache.

Mbps	Approximately one million (10^6) bits per second—that is, megabits per second.
maintenance terminal	An EIA-423-compatible terminal used with the controller. This terminal is used to identify the controller, enable host paths, enter configuration information, and check the controller status. The maintenance terminal is not required for normal operations. *See also* local terminal.
member	A container that is a storage element in a RAID array.
metadata	The data written to a disk for the purposes of controller administration. Metadata improves error detection and media defect management for the disk drive. It is also used to support storageset configuration and partitioning. Nontransportable disks also contain metadata to indicate they are uniquely configured for *StorageWorks* environments. Metadata can be thought of as "data about data."
mirroring	The act of creating an exact copy or image of data.
mirrored write-back caching	A method of caching data that maintains two copies of the cached data. The copy is available if either cache module fails.
mirrorset	*See* RAID level 1.
MIST	Module Integrity Self-Test.
multibus failover	Allows the host to control the failover process by moving the units from one controller to another.
N_port	A port attached to a node for use with point-to-point topology or fabric topology.
NL_port	A port attached to a node for use in all topologies.
network	In data communication, a configuration in which two or more terminals or devices are connected to enable information transfer.
node	In data communications, the point at which one or more functional units connect transmission lines.
Non-L_Port	A Node of Fabric port that is not capable of performing the Arbitrated Loop functions and protocols. N_Ports and F_Ports loop-capable ports.

non-participating mode	A mode within an L_Port that inhibits the port from participating in loop activities. L_Ports in this mode continue to retransmit received transmission words but are not permitted to arbitrate or originate frames. An L_Port in non-participating mode may or may not have an AL_PA. *See also* participating mode.
nominal membership	The desired number of mirrorset members when the mirrorset is fully populated with active devices. If a member is removed from a mirrorset, the actual number of members may fall below the "nominal" membership.
node	In data communications, the point at which one or more functional units connect transmission lines. In Fibre Channel, a device that has at least one N_Port or NL_Port.
nonredundant controller configuration	(1) A single controller configuration. (2) A controller configuration that does not include a second controller.
normal member	A mirrorset member that, block-for-block, contains the same data as other normal members within the mirrorset. Read requests from the host are always satisfied by normal members.
normalizing	Normalizing is a state in which, block-for-block, data written by the host to a mirrorset member is consistent with the data on other normal and normalizing members. The normalizing state exists only after a mirrorset is initialized. Therefore, no customer data is on the mirrorset.
normalizing member	A mirrorset member whose contents are the same as all other normal and normalizing members for data that has been written since the mirrorset was created or lost cache data was cleared. A normalizing member is created by a normal member when either all of the normal members fail or all of the normal members are removed from the mirrorset. *See also* copying member.
NVM	Non-Volatile Memory. A type of memory where the contents survive power loss. Also sometimes referred to as NVMEM.
OCP	Operator control panel. The control or indicator panel associated with a device. The OCP is usually mounted on the device and is accessible to the operator.

offset	A relative address referenced from the base element address. Event Sense Data Response Templates use offsets to identify various information contained within one byte of memory (bits 0 through 7).
other controller	The controller in a dual-redundant pair that is connected to the controller serving the current CLI session. *See also* this controller.
outbound fiber	One fiber in a link that carries information away from a port.
parallel data transmission	A data communication technique in which more than one code element (for example, bit) of each byte is sent or received simultaneously.
parity	A method of checking if binary numbers or characters are correct by counting the ONE bits. In odd parity, the total number of ONE bits must be odd; in even parity, the total number of ONE bits must be even.
parity bit	A binary digit added to a group of bits that checks to see if errors exist in the transmission.
parity check	A method of detecting errors when data is sent over a communications line. With even parity, the number of ones in a set of binary data should be even. With odd parity, the number of ones should be odd.
parity RAID	*See* RAIDset.
participating mode	A mode within an L_Port that allows the port to participate in loop activities. A port must have a valid AL_PA to be in participating mode.
partition	A logical division of a container, represented to the host as a logical unit.
PCMCIA	Personal Computer Memory Card Industry Association. An international association formed to promote a common standard for PC card-based peripherals to be plugged into notebook computers. The card commonly known as a PCMCIA card is about the size of a credit card.
PDU	Power distribution unit. The power entry device for *StorageWorks* cabinets. The CDU provides the connections necessary to distribute power to the cabinet shelves and fans.
peripheral device	Any unit, distinct from the CPU and physical memory, that can provide the system with input or accept any output from it. Terminals, printers, tape drives, and disks are peripheral devices.

pluggable A replacement method that allows the complete system to remain online during device removal or insertion. The system bus must be halted, or quiesced, for a brief period of time during the replacement procedure. See also hot-pluggable.

point-to-point connection A network configuration in which a connection is established between two, and only two, terminal installations. The connection may include switching facilities.

port (1) In general terms, a logical channel in a communications system. (2) The hardware and software used to connect a host controller to a communications bus, such as a SCSI bus or serial bus.

Regarding the controller, the port is (1) the logical route for data in and out of a controller that can contain one or more channels, all of which contain the same type of data. (2) The hardware and software that connects a controller to a SCSI device.

port_name A 64-bit unique identifier assigned to each Fibre Channel port. The Port_Name is communicated during the login and port discovery process.

preferred address The AL_PA which an NL_Port attempts to acquire first during initialization.

primary cabinet The primary cabinet is the subsystem enclosure that contains the controllers, cache modules, external cache batteries, and the PVA module.

private NL_Port An NL_Port which does not attempt login with the fabric and only communicates with NL_Ports on the same loop.

program card The PCMCIA card containing the controller operating software.

protocol The conventions or rules for the format and timing of messages sent and received.

PTL Port-Target-LUN. The controller method of locating a device on the controller device bus.

PVA module Power Verification and Addressing module.

quiesce The act of rendering bus activity inactive or dormant. For example, "quiesce the SCSI bus operations during a device warm-swap."

RAID　　　　　Redundant Array of Independent Disks. Represents multiple levels of storage access developed to improve performance or availability or both.

RAID level 0　　A RAID storageset that stripes data across an array of disk drives. A single logical disk spans multiple physical disks, enabling parallel data processing for increased I/O performance. While the performance characteristics of RAID level 0 is excellent, this RAID level is the only one that does not provide redundancy. Raid level 0 storagesets are sometimes referred to as stripesets.

RAID level 0+1　A RAID storageset that stripes data across an array of disks (RAID level 0) and mirrors the striped data (RAID level 1) to provide high I/O performance and high availability. This RAID level is alternatively called a striped mirrorset.

RAID level 1　　A RAID storageset of two or more physical disks that maintain a complete and independent copy of the entire virtual disk's data. This type of storageset has the advantage of being highly reliable and extremely tolerant of device failure. Raid level 1 storagesets are sometimes referred to as mirrorsets.

RAID level 3　　A RAID storageset that transfers data parallel across the array disk drives a byte at a time, causing individual blocks of data to be spread over several disks serving as one enormous virtual disk. A separate redundant check disk for the entire array stores parity on a dedicated disk drive within the storageset. *See also* RAID level 5.

RAID level 5　　A RAID storageset that, unlike RAID level 3, stores the parity information across all of the disk drives within the storageset. *See also* RAID level 3.

RAID level 3/5　A RAID storageset that stripes data and parity across three or more members in a disk array. A RAIDset combines the best characteristics of RAID level 3 and RAID level 5. A RAIDset is the best choice for most applications with small to medium I/O requests, unless the application is write intensive. A RAIDset is sometimes called parity RAID.

RAIDset　　　　*See* RAID level 3/5.

RAM　　　　　Random access memory.

---

read ahead caching	A caching technique for improving performance of synchronous sequential reads by prefetching data from disk.
read caching	A cache management method used to decrease the subsystem response time to a read request by allowing the controller to satisfy the request from the cache memory rather than from the disk drives.
reconstruction	The process of regenerating the contents of a failed member data. The reconstruct process writes the data to a spareset disk and incorporates the spareset disk into the mirrorset, striped mirrorset, or RAIDset from which the failed member came. *See also* regeneration.
reduced	Indicates that a mirrorset or RAIDset is missing one member because the member has failed or has been physically removed.
redundancy	The provision of multiple interchangeable components to perform a single function in order to cope with failures and errors. A RAIDset is considered to be redundant when user data is recorded directly to one member and all of the other members include associated parity information.
regeneration	(1) The process of calculating missing data from redundant data. (2) The process of recreating a portion of the data from a failing or failed drive using the data and parity information from the other members within the storageset. The regeneration of an entire RAIDset member is called reconstruction. *See also* reconstruction.
remote copy	A feature intended for disaster tolerance and replication of data from one storage subsystem or physical site to another subsystem or site. Remote copy also provides methods of performing a backup at either the local or remote site. With remote copy, user applications continue to run while data movement goes on in the background. Data warehousing, continuous computing, and enterprise applications all require remote copy capabilities.
remote copy set	A bound set of two units, one located locally and one located remotely, for long-distance mirroring. The units can be a single disk, or a storageset, mirrorset, or RAIDset. A unit on the local controller is designated as the "initiator" and a corresponding unit on the remote controller is designated as the "target".
request rate	The rate at which requests are arriving at a servicing entity.

RFI	Radio frequency interference. The disturbance of a signal by an unwanted radio signal or frequency.
replacement policy	The policy specified by a switch with the SET FAILEDSET command indicating whether a failed disk from a mirrorset or RAIDset is to be automatically replaced with a disk from the spareset. The two switch choices are AUTOSPARE and NOAUTOSPARE.
SBB	*StorageWorks* building block. (1) A modular carrier plus the interface required to mount the carrier into a standard *StorageWorks* shelf. (2) any device conforming to shelf mechanical and electrical standards installed in a 3.5-inch or 5.25-inch carrier, whether it is a storage device or power supply.
SCSI	Small computer system interface. (1) An ANSI interface standard defining the physical and electrical parameters of a parallel I/O bus used to connect initiators to devices. (2) a processor-independent standard protocol for system-level interfacing between a computer and intelligent devices including hard drives, floppy disks, CD-ROMs, printers, scanners, and others.
SCSI-A cable	A 50-conductor (25 twisted-pair) cable generally used for single-ended, SCSI-bus connections.
SCSI bus signal converter	Sometimes referred to as an adapter. (1) A device used to interface between the subsystem and a peripheral device unable to be mounted directly into the SBB shelf of the subsystem. (2) a device used to connect a differential SCSI bus to a single-ended SCSI bus. (3) A device used to extend the length of a differential or single-ended SCSI bus. *See also* DOC (DWZZA-On-a-chip) and I/O module.
SCSI device	(1) A host computer adapter, a peripheral controller, or an intelligent peripheral that can be attached to the SCSI bus. (2) Any physical unit that can communicate on a SCSI bus.
SCSI device ID number	A bit-significant representation of the SCSI address referring to one of the signal lines, numbered 0 through 7 for an 8-bit bus, or 0 through 15 for a 16-bit bus. *See also* target ID number.
SCSI ID number	The representation of the SCSI address that refers to one of the signal lines numbered 0 through 15.

SCSI-P cable   A 68-conductor (34 twisted-pair) cable generally used for differential bus connections.

SCSI port   (1) Software: The channel controlling communications to and from a specific SCSI bus in the system. (2) Hardware: The name of the logical socket at the back of the system unit to which a SCSI device is connected.

serial transmission   A method transmission in which each bit of information is sent sequentially on a single channel rather than simultaneously as in parallel transmission.

signal converter   *See* SCSI bus signal converter.

single ended I/O module   A 16-bit I/O module. *See also* I/O module.

single-ended SCSI bus   An electrical connection where one wire carries the signal and another wire or shield is connected to electrical ground. Each signal logic level is determined by the voltage of a single wire in relation to ground. This is in contrast to a differential connection where the second wire carries an inverted signal.

spareset   A collection of disk drives made ready by the controller to replace failed members of a storageset.

storage array   An integrated set of storage devices.

storage array subsystem   *See* storage subsystem.

storageset   (1) A group of devices configured with RAID techniques to operate as a single container. (2) Any collection of containers, such as stripesets, mirrorsets, striped mirrorsets, and RAIDsets.

storageset expansion   The dynamic expansion of the storage capacity (size) of a unit. A storage container is created in the form of a concatenation set which is added to the existing storage set defined as a unit.

storage subsystem   The controllers, storage devices, shelves, cables, and power supplies used to form a mass storage subsystem.

storage unit	The general term that refers to storagesets, single-disk units, and all other storage devices that are installed in your subsystem and accessed by the host. A storage unit can be any entity that is capable of storing data, whether it is a physical device or a group of physical devices.
StorageWorks	A family of modular data storage products that allow customers to design and configure their own storage subsystems. Components include power, packaging, cabling, devices, controllers, and software. Customers can integrate devices and array controllers in *StorageWorks* enclosures to form storage subsystems.
	StorageWorks systems include integrated SBBs and array controllers to form storage subsystems. System-level enclosures to house the shelves and standard mounting devices for SBBs are also included.
stripe	The data divided into blocks and written across two or more member disks in an array.
striped mirrorset	*See* RAID level 0+1.
stripeset	*See* RAID level 0.
stripe size	The stripe capacity as determined by *n*–1 times the chunksize, where *n* is the number of RAIDset members.
striping	The technique used to divide data into segments, also called chunks. The segments are striped, or distributed, across members of the stripeset. This technique helps to distribute hot spots across the array of physical devices to prevent hot spots and hot disks.
	Each stripeset member receives an equal share of the I/O request load, improving performance.
surviving controller	The controller in a dual-redundant configuration pair that serves its companion devices when the companion controller fails.
switch	A method that controls the flow of functions and operations in software.
synchronous	Pertaining to a method of data transmission which allows each event to operate in relation to a timing signal. *See also* asynchronous.

tape	A storage device supporting sequential access to variable sized data records.
target	(1) A SCSI device that performs an operation requested by an initiator. (2) Designates the target identification (ID) number of the device.
target ID number	The address a bus initiator uses to connect with a bus target. Each bus target is assigned a unique target address.
this controller	The controller that is serving your current CLI session through a local or remote terminal. *See also* other controller.
tape inline exerciser	(TILX) The controller diagnostic software to test the data transfer capabilities of tape drives in a way that simulates a high level of user activity.
topology	An interconnection scheme that allows multiple Fibre Channel ports to communicate with each other. For example, point-to-point, Arbitrated Loop, and switched fabric are all Fibre Channel topologies.
transfer data rate	The speed at which data may be exchanged with the central processor, expressed in thousands of bytes per second (kbytes).
transparent failover	Keeps the storage array available to the hosts by allowing the surviving controller of a dual redundant pair to take over total control of the subsystem and is transparent (invisible) to the hosts.
ULP	Upper Layer Protocol.
ULP process	A function executing within a Fibre Channel node which conforms to the Upper Layer Protocol (ULP) requirements when interacting with other ULP processes.
Ultra SCSI	A Fast-20 SCSI bus. *See also* Wide Ultra SCSI.
unit	A container made accessible to a host. A unit may be created from a single disk drive or tape drive. A unit may also be created from a more complex container such as a RAIDset. The controller supports a maximum of eight units on each target. *See also* target and target ID number.
unwritten cached data	Sometimes called unflushed data. *See* dirty data.

UPS	Uninterruptible power supply. A battery-powered power supply guaranteed to provide power to an electrical device in the event of an unexpected interruption to the primary power supply. Uninterruptible power supplies are usually rated by the amount of voltage supplied and the length of time the voltage is supplied.
VHDCI	Very high-density-cable interface. A 68-pin interface. Required for Ultra-SCSI connections.
virtual terminal	A software path from an operator terminal on the host to the controller's CLI interface, sometimes called a host console. The path can be established via the host port on the controller or via the maintenance port through an intermediary host.
VTDPY	An abbreviation for Virtual Terminal Display Utility.
warm swap	A device replacement method that allows the complete system to remain online during device removal or insertion. The system bus may be halted, or quiesced, for a brief period of time during the warm-swap procedure.
Wide Ultra SCSI	Fast/20 on a Wide SCSI bus.
Worldwide name	A unique 64-bit number assigned to a subsystem by the Institute of Electrical and Electronics Engineers (IEEE) and set by manufacturing prior to shipping. This name is referred to as the node ID within the CLI.
write-back caching	A cache management method used to decrease the subsystem response time to write requests by allowing the controller to declare the write operation "complete" as soon as the data reaches its cache memory. The controller performs the slower operation of writing the data to the disk drives at a later time.
write-through caching	Write-through caching always writes directly to disk, ensuring that the application is never tricked into believing that the data is on the disk when it may not be. This results in hightest data integrity, through with slighly reduced performance.

write hole   The period of time in a RAID level 1 or RAID level 5 write operation when an opportunity emerges for undetectable RAIDset data corruption. Write holes occur under conditions such as power outages, where the writing of multiple members can be abruptly interrupted. A battery backed-up cache design eliminates the write hole because data is preserved in cache and unsuccessful write operations can be retried.

write-through cache   A cache management technique for retaining host write requests in read cache. When the host requests a write operation, the controller writes data directly to the storage device. This technique allows the controller to complete some read requests from the cache, greatly improving the response time to retrieve data. The operation is complete only after the data to be written is received by the target storage device.

This cache management method may update, invalidate, or delete data from the cache memory accordingly, to ensure that the cache contains the most current data.

Index