

# *Compaq SANworks* <sup>TM</sup>

## **Secure Path Version 2.0 for IBM AIX**

Installation and Reference Guide

First Edition (December 2000)  
Part Number: AA-RLTOA-TE/221294-001  
**Compaq Computer Corporation**

© 2000 Compaq Computer Corporation.

COMPAQ, the Compaq logo, and StorageWorks Registered in U. S. Patent and Trademark Office. SANworks is a trademark of Compaq Information Technologies Group, L.P.

All other product names mentioned herein may be trademarks or registered trademarks of their respective companies.

Confidential computer software. Valid license from Compaq required for possession, use or copying. Consistent with FAR 12.211 and 12.212, Commercial Computer Software, Computer Software Documentation, and Technical Data for Commercial Items are licensed to the U.S. Government under vendor's standard commercial license.

Compaq shall not be liable for technical or editorial errors or omissions contained herein. The information in this document is subject to change without notice.

THE INFORMATION IN THIS PUBLICATION IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND. THE ENTIRE RISK ARISING OUT OF THE USE OF THIS INFORMATION REMAINS WITH RECIPIENT. IN NO EVENT SHALL COMPAQ BE LIABLE FOR ANY DIRECT, CONSEQUENTIAL, INCIDENTAL, SPECIAL, PUNITIVE OR OTHER DAMAGES WHATSOEVER (INCLUDING WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION OR LOSS OF BUSINESS INFORMATION), EVEN IF COMPAQ HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE FOREGOING SHALL APPLY REGARDLESS OF THE NEGLIGENCE OR OTHER FAULT OF EITHER PARTY AND REGARDLESS OF WHETHER SUCH LIABILITY SOUNDS IN CONTRACT, NEGLIGENCE, TORT, OR ANY OTHER THEORY OF LEGAL LIABILITY, AND NOTWITHSTANDING ANY FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY.

**The limited warranties for Compaq products are exclusively set forth in the documentation accompanying such products. Nothing herein should be construed as constituting a further or additional warranty.**

Printed in the U.S.A.

SANworks Secure Path Version 2.0 for IBM AIX Installation and Reference Guide  
First Edition (December 2000)  
Part Number AA-RLTOA-TE/221294-001

# Contents

## About This Guide

Text Conventions .....	ix
Symbols in Text .....	x
Getting Help .....	x
Compaq Technical Support .....	x
Compaq Website .....	xi
Compaq Authorized Reseller .....	xi
Terms Specific to this Manual .....	xii
HSGx0 .....	xii
Command Line Interpreter .....	xii

## Chapter 1

### Secure Path 2.0 for IBM AIX Overview

Overview .....	1-1
Theory of Operation .....	1-1
Features .....	1-2
Software Components .....	1-3
Secure Path Driver .....	1-5
Driver Components .....	1-6
Summary of the Secure Path Status and Management Utility (cbxfesm) .....	1-6

Failover . . . . .	1-6
Application Access . . . . .	1-9
Secure Path States . . . . .	1-10

## Chapter 2

### Setting Up Secure Path on Fibre Channel

Required Components . . . . .	2-1
Supported Configurations . . . . .	2-3
Installing and Configuring the RAID System and IBM Server for Secure Path Software . . . . .	2-7

## Chapter 3

### Installing Secure Path 2.0 Software

Installation Requirements . . . . .	3-1
Installing Secure Path 2.0 for IBM AIX . . . . .	3-2
Managing a Secure Path Environment . . . . .	3-5
Secure Path Status and Management Utility (cbxfscm) . . . . .	3-5

## Chapter 4

### Installation, Verification, and Troubleshooting

Prerequisites . . . . .	4-1
Troubleshooting Utilities . . . . .	4-2
The sctest Utility . . . . .	4-2
The mbtest Utility . . . . .	4-3
The fcinfo Utility . . . . .	4-4

## Appendix A

### Removing SANworks Secure Path Software

Removing Secure Path Software . . . . .	A-1
Reconfiguring the RAID Storage System Controllers . . . . .	A-3

## Appendix B

### Converting to a Multiple Path Configuration

Converting to Multiple-Bus Failover Mode . . . . .	B-1
--	-----

## Glossary

## Index

## Figures

Figure 1–1. Software Components for the Paths to Storage . . . . .	1–4
Figure 1–2. SANworks Secure Path Version 2.0 Driver Model . . . . .	1–5
Figure 1–3. Before Path Failover. . . . .	1–8
Figure 1–4. After Path Failover. . . . .	1–9
Figure 2–1. Supported FC SAN Switch Configurations Using 1 Adapter Pair. . . . .	2–4
Figure 2–2. Supported FC Switch Configurations Using 2 Adapter Pairs . . . . .	2–5
Figure 2–3. Supported FC SAN Switch Configurations Using 2 Adapter Pairs and 4 FC SAN Switches 2–6	
Figure 3–1. Cabling Two Controllers and Two FC SAN Switches. . . . .	3–3



## Tables

Table 2-1 Secure Path (FC SAN Switch Installation) Prerequisites . . . . .	2-2
Table 3-1 The cbxfesm Command Options . . . . .	3-5
Table 3-2 Fields Displayed by “# cbxfesm display listpath hdisk9” . . . . .	3-7
Table 4-1 Configuration Items . . . . .	4-1





# About This Guide

This guide is designed to be used as step-by-step instructions for installation and as a reference for operation, troubleshooting, and future upgrades.

## Text Conventions

This document uses the following conventions to distinguish elements of text:

<b>Keys</b>	Keys appear in boldface. A plus sign (+) between two keys indicates that they should be pressed simultaneously.
USER INPUT	User input appears in a different typeface and in uppercase
<i>Filenames</i>	File names appear in lowercase italics.
Menu Options, Command Names, and Dialog Box Names	These elements appear in initial capital letters.  [NOTE: UNIX commands are case sensitive.]

COMMANDS, DIRECTORY NAMES, DRIVE NAMES and UTILITIES	These elements appear in upper case. [NOTE: UNIX commands are case sensitive and may or may not appear in uppercase]
Type	When you are instructed to <i>type</i> information, type the information <b>without</b> pressing the <b>Enter</b> key.
Enter	When you are instructed to enter information, type the information and then press the <b>Enter</b> key.

## 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 loss of information.

---

**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.

## Getting Help

If you have a problem and have exhausted the information in this guide, you can get further information and other help in the following locations:

### Compaq Technical Support

You are entitled to free hardware technical telephone support for your product for as long you own the product. A technical support specialist will help you diagnose the problem or guide you to the next step in the warranty process.

In North America, call the Compaq Technical Phone Support Center at 1-800-OK-COMPAQ. This service is available 24 hours a day, 7 days a week.

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

Outside North America, call the nearest Compaq Technical Support Phone Center. Telephone numbers for world wide Technical Support Centers are listed on the Compaq website. Access the Compaq website by logging on to the Internet at <http://www.compaq.com>.

Be sure to have the following information available before you call Compaq:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Add-on boards or hardware
- Third-party hardware or software
- Operating system type and revision level
- Detailed, specific questions

## **Compaq Website**

The Compaq website has latest information on this product as well as the latest drivers. You can access the Compaq website by logging on to the Internet at <http://www.compaq.com/storage>.

## **Compaq Authorized Reseller**

For the name of your nearest Compaq Authorized Reseller:

- In the United States, call 1-800-345-1518.
- In Canada, call 1-800-263-5868.
- Elsewhere, see the Compaq website for locations and telephone numbers.

## **Terms Specific to this Manual**

### **HSGx0**

*SANworks Secure Path 2.0 for IBM AIX* supports both the HSG80 and the HSG60 controllers. Because more than one controller is supported, HSGx0 is used to indicate information applicable to both controllers.

### **Command Line Interpreter**

The prompt CLI> is also used to indicate a command to the Command Line Interpreter (CLI).

For example, where the prompt may be:

HSG80>

or

HSG60>

you will now see

CLI>

# *Chapter 1*

## **Secure Path 2.0 for IBM AIX Overview**

### **Overview**

Secure Path 2.0 for IBM AIX is a high availability software product providing support for two paths and continuous data access for StorageWorks Fibre Channel (FC) RAID storage systems that are configured on IBM platforms running AIX 4.3.2 or AIX 4.3.3.

Redundant hardware, advanced RAID technology, and automatic failover capability are used to maximize fault tolerance and availability. In conjunction with the StorageWorks RAID system, Secure Path eliminates the following as single points of failure: RAID controllers, disk drives, FC Storage Area Network (SAN) switches, cables, and FC host bus adapters (HBAs).

### **Theory of Operation**

Secure Path 2.0 for IBM AIX functionality supports two I/O paths between an AIX host and a StorageWorks FC RAID storage system, thereby improving overall data availability. If any component on the host-to-storage system path fails, Secure Path redirects all pending and subsequent I/O requests from the failed path to the standby path, preventing an adapter, cable, controller, or FC Storage Area Network (SAN) switch failure from disrupting data access.

In a Secure Path hardware configuration, redundant physical connections define two separate paths. Each path originates at a separate host bus adapter on an AIX server and ends at a separate port on a RAID controller on the storage system. The key to Secure Path functionality is the capability of dual-redundant StorageWorks RAID controllers to operate in an active/passive implementation.

Two modes exist for active/passive failover capability related to the RAID dual-redundant controllers. The first mode is associated with the ports of the dual controllers. The RAID controller assigns unit numbers of 0-99 to the left hand ports (typically port 1) and 100-199 to the right hand ports (typically port 2). Failover is by port only and affects only the units within the range of values for the pair of ports. This mode is called “Transparent Failover mode.”

The second is associated with the entire top controller in relation to the bottom controller. All units 0-199 are visible to both controllers. This mode is called “Multiple-bus Failover mode”.

When constructing configurations with No Single Points of Failure (NSPOF), the multiple-bus failover mode is preferred because both controllers have visibility to all units.

Multiple-bus failover mode allows each controller to process I/O independently of the other controller. During runtime, storage units may be moved between paths at any time through the use of the Secure Path Status and Management Utility (cbxfesm).

The Secure Path driver software detects the failure of I/O operations on a failed path and automatically reroutes traffic to the other path. Path failover is completed without disruption to the process or data loss.

Following a swap of a cable component, failed controller, GBIC or FC SAN switch, the Secure Path Status and Management Utility (cbxfesm) is used to move storage units back to their original path.

## Features

Secure Path 2.0 for IBM AIX has the following feature:

- Allows a StorageWorks dual-controller RAID system to be cabled on two independent FC SAN switch paths using two host bus adapters (HBAs) in each server.
- Monitors each path and automatically re-routes I/O to the functioning alternate path should an adapter, cable, FC SAN switch or controller failure occur. Failure detection is reliable and designed to prevent false or unnecessary failovers. Failovers are transparent and non-disruptive to applications.
- Provides a Status and Management Utility (cbxfesm) to monitor and to manage Secure Path devices and paths.
- Supports two paths to the target/lun on the StorageWorks RAID system.

## **Software Components**

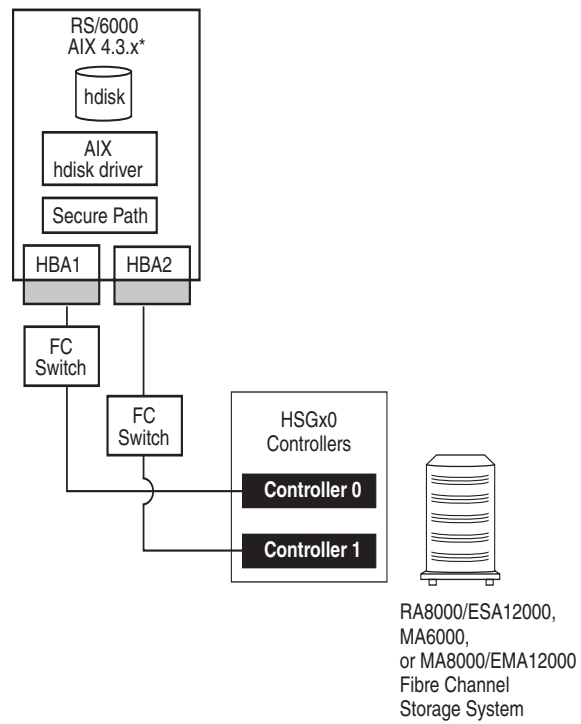
Secure Path 2.0 for IBM AIX software consists of:

1. The Secure Path Status and Management Utility (cbxfesm) with associated Man Pages.
2. The Secure Path FC HBA device driver
3. AIX Man Pages
4. Three troubleshooting utilities with related Man Pages:
  - a. sctest
  - b. mbtest
  - c. fcinfo

Refer to Chapter 4 for more information on the troubleshooting utilities.

Together, these software components are used to configure and manage redundant paths to storage devices.

Figure 1-1 shows each component of the path. Data moves through the components along the path from the application to the storage subsystem.



SHR-1745A

Figure 1-1. Software Components for the Paths to Storage

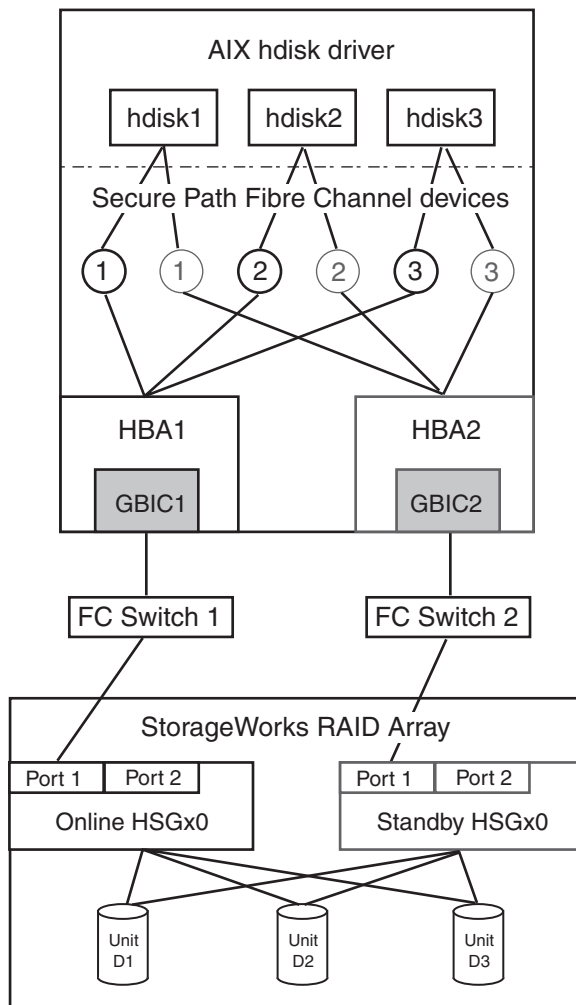
\* Indicates both AIX 4.3.2 and 4.3.3



## Secure Path Driver

The Secure Path driver presents itself as a single device target to applications while cooperating with the AIX hdisk driver to manage multiple paths to a storage device.

Figure 1-2 illustrates the driver model structure..



① ② ③ Lighter numbered paths indicate the alternate or standby path

SHR-1744A

Figure 1-2. SANworks Secure Path Version 2.0 Driver Model

## Driver Components

- AIX hdisk Driver

The hdisk driver is the SCSI and FC disk driver that AIX installs at boot or during `cfgmgr` operation.

- PC1000 HBA Driver

PC1000 is the Compaq HBA driver that manages multiple adapters in a Secure Path environment. PC1000 enables the AIX system to perform failover by presenting multiple instances of a single LUN used as a single device to the hdisk driver. This driver can be used with the Secure Path Status and Management utility (`cbxfesm`).

## Summary of the Secure Path Status and Management Utility (`cbxfesm`)

The primary utility used with Secure Path 2.0 for IBM AIX is `cbxfesm`. The Secure Path Status and Management Utility (`cbxfesm`) is located in the directory `/usr/lpp/cbxfc`. This utility is designed for the purpose of communicating with the PC1000 HBA driver. The features that are implemented with the `cbxfesm` utility include:

- Displaying information
- Moving a LUN from one path to another (for load balancing for example)
- Unfailing an LUN

## Failover

Secure Path 2.0 for IBM AIX operation is characterized by the unassisted redirection of I/O from a failed physical path to a functioning physical path. This process is called path failover. If a problem with a host bus adapter, RAID controller, FC SAN switch, or a hardware connection causes a path to fail, Secure Path performs all of the following functions:

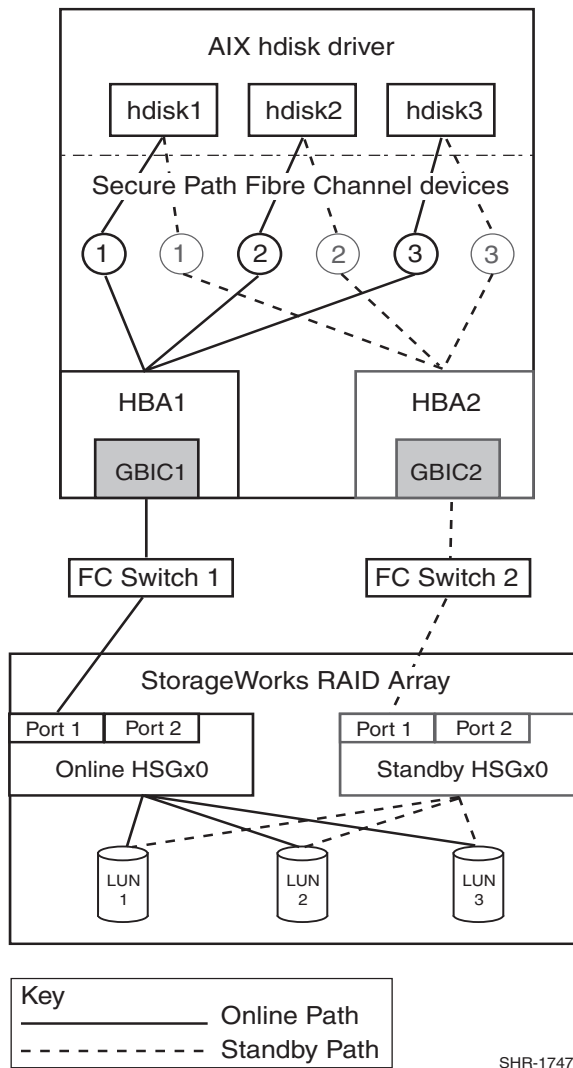
- Stops sending I/O to the HBA driver
- Marks the path as failed
- Assigns the standby path to be the online path
- Restarts I/O and signals the alternate HBA to continue data transfer

After reconfiguration, I/O moves along the new online path (previously the standby path). This failure-recovery process does not affect the applications.

In Figure 1-3, the RAID system has three units, and the AIX server has three hdisk devices. Each hdisk device has two paths—online and standby. In the figures in this chapter, the labels for the online path appear in boldface, and the labels for the standby path appear in the normal typeface. In Figure 1-3, the active (online) path is shown as a solid line, and the path on standby is shown as a dotted line. To clarify this example, each Secure Path device is accessing the units through the same HBA/FC SAN switch/RAID controller.

As long as the online path is accessible, the Secure Path devices use it for I/O. If the active path fails (for example, due to a problem with the HBA1), Secure Path detects the error and stops sending I/O along this path. It then takes the path offline (marks it failed), brings the standby path online, and redirects I/O to the newly active path as shown in Figure 1-4. In Figure 1-4, the dotted lines indicate the failed path.

Figure 1-3 is shown as follows:



SHR-1747A

Figure 1-3. Before Path Failover

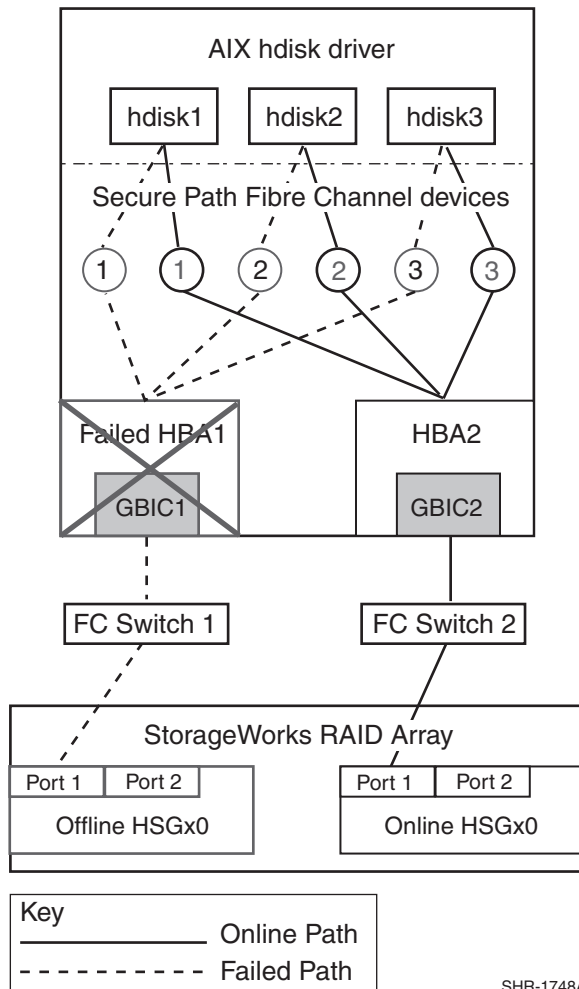


Figure 1-4. After Path Failover

## Application Access

Secure Path devices are not handled any differently than `hdisk` devices by AIX applications. A `hdisk` device instance and a corresponding unit in the RAID Storage Array configuration is associated with a unique Secure Path device.

## Secure Path States

The device path is the physical I/O path through which the current I/O moves between the host system and the storage system unit. A Secure Path device path consists of a single FC host bus adapter, an FC SAN switch, and a single port on a RAID controller. Other considerations include the associated cabling from the HBA to the FC SAN switch, and from the FC SAN switch to the controller port.

A Secure Path device path is in one of the following three states:

- Online

The online state indicates that I/O is currently using this path.

- Standby

The standby state indicates that the path is held in readiness for service. If the online path fails, Secure Path brings the standby path into service; that is, it becomes the active path.

- Failed

The failed state indicates that Secure Path has marked this device path unavailable because of an error. I/O will not be directed to this path.

## ***Chapter 2***

# **Setting Up Secure Path on Fibre Channel**

### **Required Components**

Verify that you have received the Secure Path software kit and the FC hardware ordered for your installation. If a component is missing, please contact your account representative or call the Compaq Customer Services Hotline at (800) 354-9000. The basic requirements for Secure Path operation are listed in Table 2-1.

**Table 2-1 Secure Path (FC SAN Switch Installation) Prerequisites**

Host Feature	Requirement
Platform	IBM RS/ 6000 (PCI bus only)
Operating Systems	AIX 4.3.2; AIX 4.3.3
Secure Path Software Kit	SANworks Secure Path 2.0 for IBM AIX
RAID Storage Systems	
HSG80	StorageWorks RA8000/MA8000/ESA12000/EMA12000 (FC) with dual controllers running ACS version 8.5F
HSG60	StorageWorks MA6000 with dual controllers running ACS version 8.5L
Solution Software Kit (with adapter driver)	StorageWorks Solution Software for IBM AIX for the HSG80 or the HSG60
Host Bus Adapters	FC PCI Adapter, part number DS-SWIA1-PD
FC Cables	FC Cables 234457-* (BNGBX-nn)
FC SAN Switches	Compaq 8-Port 380591-B21 (DS-DSGGA-AA)
	Compaq 8-Port 380591-B22 (DS-DSGGA-AC)
	Compaq 8-Port 158222-B21 (DS-DSGGB-AA)
	Compaq 8-Port 158223-B21 (DS-DSGGB-AB)
	Compaq 8-Port 176219-B21 (DS-DSGGC-AA)
	Compaq 16-Port 380578-B21 (DS-DSGGA-AB)
	Compaq 16-Port 380578-B22 (DS-DSGGA-AD)
	Compaq 16-Port 158224-B21 (DS-DSGGB-BA)
	Compaq 16-Port 158225-B21 (DS-DSGGB-BB)
	Compaq 16-Port 212776-B21 (DS-DSGGC-AB)
FC Switch Firmware	The SAN switches required the following minimum firmware versions:
	DS-DSGGA-XX - V1.6d <sup>1</sup>
	DS-DSGGB-XX -V2.0.3a
	DS-DSGGC-XX -V2.1.7

<sup>1</sup>If the DS-DSGGA-XX switch does not have the supported firmware, follow the directions contained on the CD-ROM for the IBM AIX Secure Path Version 2.0 release located in <mount directory>/firmware/README.

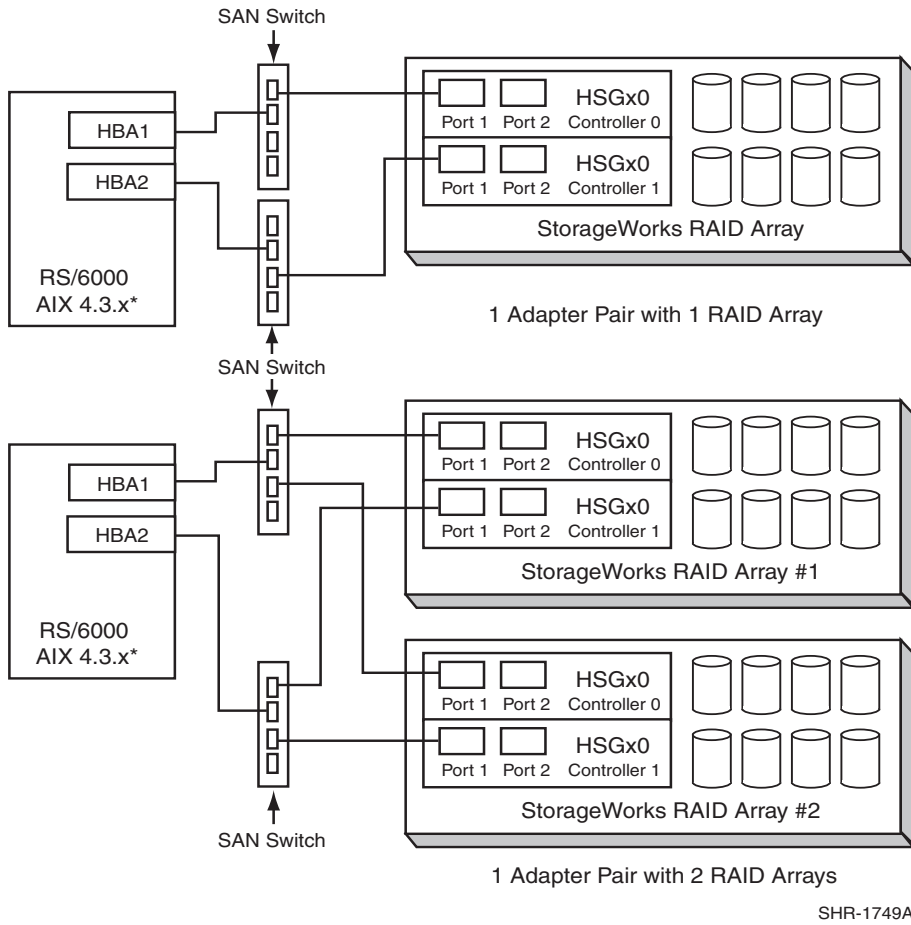


## **Supported Configurations**

The following rules apply to configuring a single RS/6000 host:

- Maximum of eight pairs of adapters installed in the host.
- Maximum of four RAID systems per adapter pair.
- Two adapter pairs must not share the same unit on the RAID system.

Note that Figures 2-1 through 2-3 illustrate a subset of the supported configurations.



SHR-1749A

Figure 2-1. Supported FC SAN Switch Configurations Using 1 Adapter Pair

\* Indicates both AIX 4.3.2 and 4.3.3

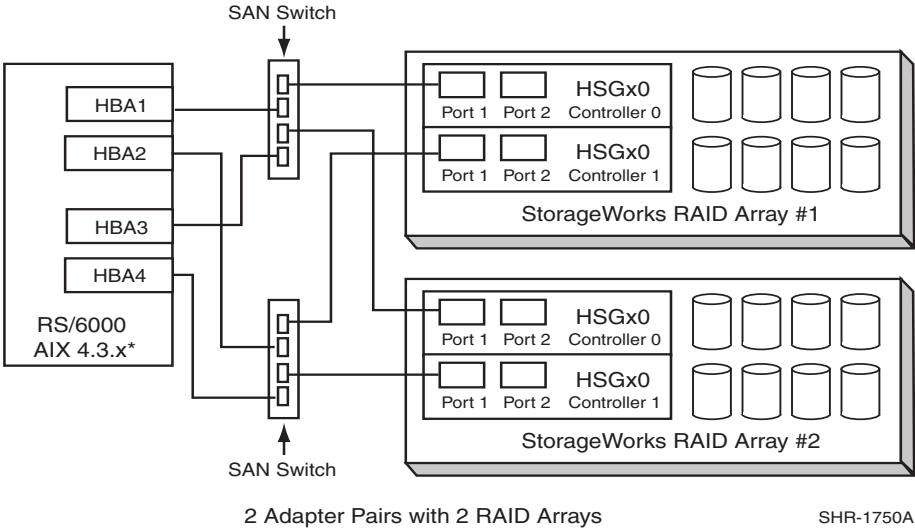
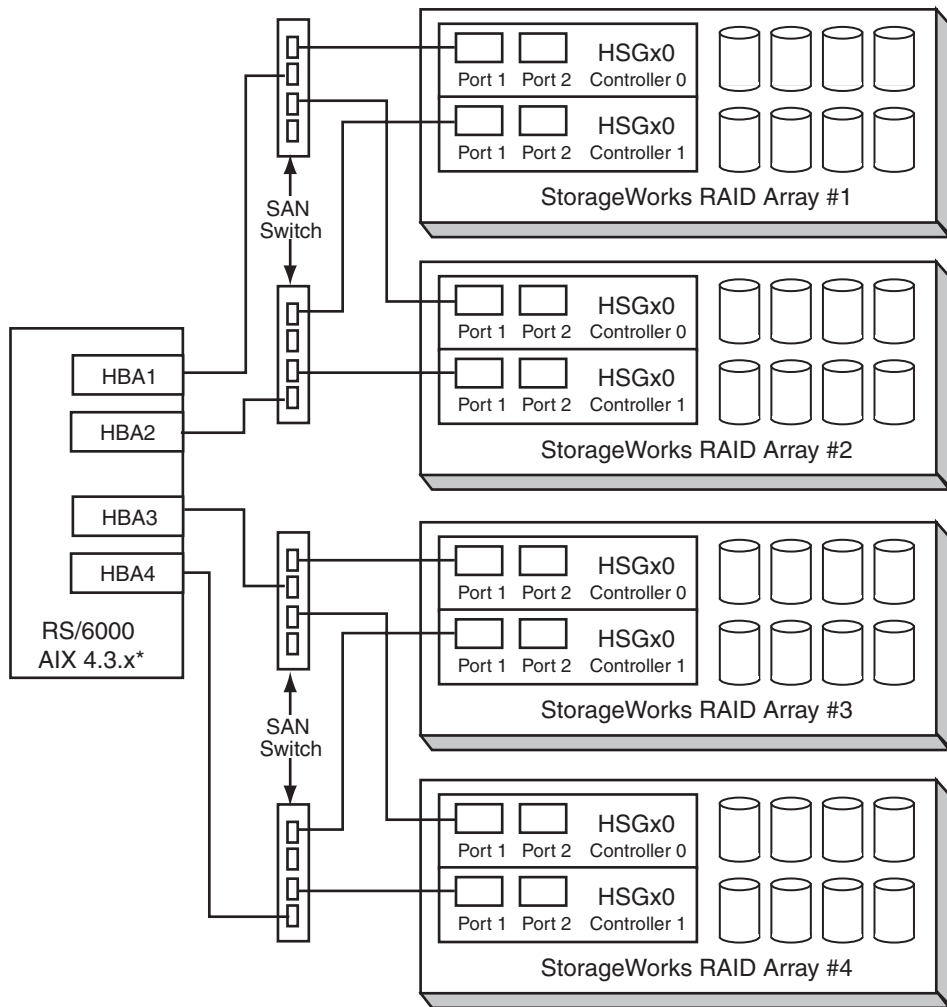


Figure 2-2. Supported FC Switch Configurations Using 2 Adapter Pairs

\* Indicates both AIX 4.3.2 and 4.3.3



SHR-1751A

Figure 2-3. Supported FC SAN Switch Configurations Using 2 Adapter Pairs and 4 FC SAN Switches

\* Indicates both AIX 4.3.2 and 4.3.3

## Installing and Configuring the RAID System and IBM Server for Secure Path Software

This section provides the steps for installing and configuring a new RAID system(s) and IBM server(s) for Secure Path operation.

---

**IMPORTANT:** Refer to Appendix B, *Converting to a Multiple Path Configuration* for information on existing HSGx0 Raid Storage Systems being converted to Secure Path.

---

1. Unpack your RAID system, and install the PCMCIA cards in the controllers.  
**NOTE:** Secure Path for IBM AIX requires StorageWorks ACS version 8.5F software for the HSG80 or V 8.5L for the HSG60 on the RAID storage system.
2. Power on your RAID system. Allow the cache batteries to charge (if necessary) before you proceed.
3. Establish a serial connection to the RAID storage system and use the Command Line Interpreter (CLI) utility to configure the RAID system and create storagesets, as described in the *Compaq StorageWorks HSG60/HSG80 Array Controller ACS Version 8.5c Solutions Software for IBM AIX 4.3.x Installation and Configuration Guide*.

**NOTE:** The ACS Version number 8.5c shown in the installation and configuration guide above represents the Solution Software version, not the controller ACS version. Please refer to Table 2-1, "Secure Path (FC SAN Switch Installation) Prerequisites, for the correct HSG60 and HSG80 ACS versions.

**NOTE:** Secure Path installation requires that at least one unit be configured on the RAID system, but a complete disk device configuration is recommended.

4. From the Command Line Interface (CLI), determine the configuration of the RAID system. Use the following command:

```
CLI > show this_controller
```

or

```
CLI> show other_controller
```

An example with the resulting command output using the HSG80 and V8.5F ACS (including line numbers appended) follows:

Output Text	Line No
Controller:	1.
HSG80 ZG90305073 Software V85F-0, Hardware E05	2.
NODE_ID = 5000-1FE1-0000- 89D0	3.
ALLOCATION_CLASS = 0	4.
SCSI_VERSION = SCSI-2	5.
Configured for dual-redundancy with ZG90305163	6.
In dual-redundant configuration	7.
Device Port SCSI address 7	8.
Time: 11-DEC-2000 11:23:48	9.
Command Console LUN is lun 0 (NOIDENTIFIER)	10.
Host PORT_1:	11.
Reported PORT_ID = 5000-1FE1-0001- 7321	12.
PORT_1_TOPOLOGY = FABRIC (fabric up)	13.
Address = 011521	14.
Host PORT_2:	15.
Reported PORT_ID = 5000-1FE1-0001- 7322	16.
PORT_2_TOPOLOGY = OFFLINE (offline)	17.
NOREMOTE_COPY	18.
Cache:	19.
64 megabyte write cache, version 0012	20.
Cache is GOOD	21.
No unflushed data in cache	22.
CACHE_FLUSH_TIMER = DEFAULT (10 seconds)	23.
Mirrored Cache:	24.
64 megabyte write cache, version 0012	25.
Cache is GOOD	26.
No unflushed data in cache	27.
Battery:	28.
NOUPS	29.
FULLY CHARGED	30.

(Continued)

Output Text	Line No
Expires: 09-OCT-2002	31.

- a. If the controllers are in Transparent Failover Mode (line 6), you must reconfigure them for multiple-bus failover mode. Use the following commands.

HSG80 > **set nofailover**

---

**IMPORTANT:** The “other” controller will shut down and you must restart it manually. Momentarily depress the reset button on the front panel of the controller. Wait for two minutes for the controller to reboot before proceeding. All controllers will notify you that they are not bound in a failover mode. However, on the RA8000/ESA12000 Storage System, the OTHER\_CONTROLLER sounds an alarm when it detects the second controller, which is not bound in any failover mode. You can silence the alarm and disregard the message about misconfigured controllers.

---

CLI > **set multibus\_failover copy = this\_controller**

Both controllers will restart in multiple-bus failover mode.

After the other controller restarts, verify that both controllers are configured for multiple-bus mode. Use the following commands:

CLI > **show this\_controller**

or

CLI> **show other\_controller**

Line 6 of your output should look similar to the following line (ignoring the value of the serial number):

Configured for MULTIBUS\_FAILOVER with ZG90305163

- b. Specify the controller for the unit to use at RAID system boot time. Set the RAID Preferred Path for each storage unit, as follows:
- 1) Use the following command to get a list of all units defined in the RAID system:

**2-10** SANworks Secure Path Version 2.0 for IBM AIX Installation and Reference Guide

```
CLI > show units full
D11                DISK10000 (partition)
LUN ID: 6000-1FE1-0000-8920-0009-9030-5234-006E
NOIDENTIFIER
Switches:
  RUN              NOWRITE_PROTECT  READ_CACHE
  READAHEAD_CACHE  WRITEBACK_CACHE
  MAXIMUM_CACHED_TRANSFER_SIZE = 32
Access:
  ALL
State:
  ONLINE to this controller ←
  Not reserved
  NOPREFERRED_PATH ←
Size: 8533749 blocks
Geometry (C/H/S): (1680 / 20 / 254)
```

2) Looking at the unit state indicated by the ← symbol, use the following commands to specify the preferred\_path for each unit.

```
CLI > set (unit #) preferred_path = this_controller
```

- or -

```
CLI > set (unit #) preferred_path = other_controller
```

Example:

```
CLI > set d11 preferred_path = other_controller
```

3) Restart both controllers on the RAID cabinet by depressing the reset button on each controller concurrently.



# Chapter 3

## Installing Secure Path 2.0 Software

This chapter describes how to install and configure Secure Path software.

### Installation Requirements

Installing Secure Path software on your AIX server requires that the RAID Storage System(s) are installed with your ACS V8.5c Solution Software. When installing the RAID system(s), be sure that only one path exists between each controller and each host adapter.

**NOTE:** The ACS Version number 8.5c shown above represents the Solution Software version, not the controller ACS version. Please refer to Table 2–1, Secure Path (FC SAN Switch Installation) Prerequisites for the correct HSG60 and HSG80 ACS versions.



**CAUTION:** For each RAID system in a production environment that you are converting to a Secure Path operation, have all users log off the IBM AIX server(s). It is imperative to follow the instructions in Appendix B, *Converting to a Multiple Path Configuration*.

## Installing Secure Path 2.0 for IBM AIX

To install the Secure Path software:

1. Mount the Compaq SANworks Secure Path 2.0 Software for AIX CD into the CD-ROM drive on /mnt as follows:
  - a. Place the CD in the CD-ROM drive of your AIX server
  - b. Create the /mnt directory if it doesn't exist. Enter:  
**# mkdir /mnt**
  - c. Mount the CD volume by entering:  
**# mount -v cdrfs -r /dev/cd0 /mnt**
  - d. Change directory to the location of the driver. Enter:  
**# cd /mnt/driver**
2. Create a temporary directory on the AIX server and copy the driver image to it. An example follows:  
**# mkdir /tmp/driver**  
**# cp PC1000.image /tmp/driver**
3. Change to the temporary directory you created. For example:  
**# cd /tmp/driver**
4. Install the driver and management utility. At the command prompt, enter:  
**# installp -acd . all**
5. Verify that the Secure Path driver is installed by entering:  
**# lspp -l PC1000.driver.obj**  
The following example verification message appears:  
PC1000.driver.obj 1.5.10.1 COMMITTED StorageWorks AIX Dual-Rail
6. Shut down the AIX operating system and power down the AIX server. Install the FC host bus adapters as necessary per the adapter installation instructions. Cable the FC Host Bus Adapter and the RAID storage system to the FC SAN switches, as shown in Figure 3-1.

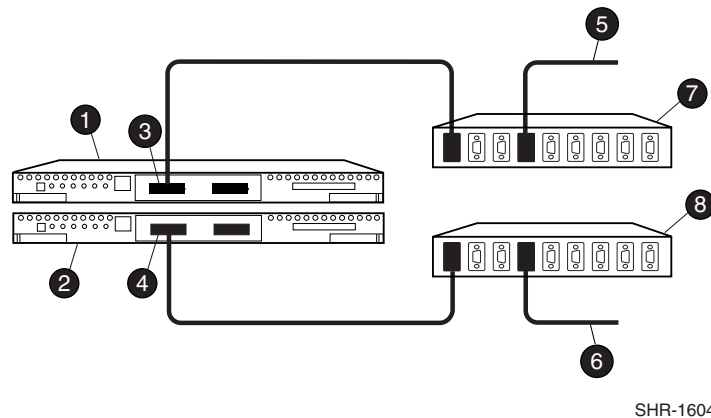


Figure 3-1. Cabling Two Controllers and Two FC SAN Switches

Figure Key	
❶ HSGx0 Controller A	❺ FC cable to host bus adapter A
❷ HSGx0 Controller B	❻ FC cable to host bus adapter B
❸ Controller 1, port 1 (to host via top switch)	❼ FC Switch (top)
❹ Controller 2, port 1 (to host via bottom switch)	❽ FC Switch (bottom)

7. Power up the server and boot AIX.
8. Install the Solution Software V8.5c for AIX 4.3.x and configure the Fibre Channel drivers for switch mode. If you are using SWCC agent and client, configure the SWCC agent at this time. Refer to the *Compaq StorageWorks HSG60/HSG80 Array Controller ACS Version 8.5c Solutions Software for IBM AIX Installation and Configuration Guide* for detailed information on SWCC Agent and Fibre Channel configuration.

**NOTE:** The ACS Version number 8.5c shown in the installation and configuration guide above represents the Solution Software version, not the controller ACS version. Please refer to Table 2-1, Secure Path (FC SAN Switch Installation) Prerequisites for the correct HSG60 and HSG80 ACS versions.

9. Ensure that each connection has an offset of 0 and an operating system set to WINNT.

**NOTE:** Although an IBM operating system entry is present in the CLI and SWCC for the Fibre Channel connection, use default setting "WINNT" for operation with your IBM host. The IBM setting may cause problems when the LUNs are not available to AIX or during a controller failover.

Use the following commands:

3-4 SANworks Secure Path Version 2.0 for IBM AIX Installation and Reference Guide

❑ To inspect the connections enter:

CLI > **show connections**

Connection		Unit				
Name	Operating system	Controller	Port	Address	Status	Offset
!NEWCON03	WINNT	OTHER	1	031200	OL other	0
	HOST_ID=5005-02E0-1000-0000			ADAPTER_ID=5005-02E0-1000-0000		
!NEWCON04	WINNT	THIS	1	011200	OL this	0
	HOST_ID=5005-02E0-1000-0071			ADAPTER_ID=5005-02E0-1000-0071		

❑ To set the operating system:

CLI> **set (connection name) operating\_system = WINNT**

Where: [connection name] is the name of the connection with the status listed as OL this (Online This) or OL other (Online Other) when the SHOW CONNECTION command is entered.

Once the connections have been made to WINNT, the SHOW CONNECTION command should display WINNT in the Operating System column for the connection name set with the command above.

❑ To set the offset (if necessary):

CLI> **set (connection name) unit\_offset = 0**

10. Verify that the Secure Path Status and Management Utility is installed by running the following Secure Path Maintenance Tool command:

**# /usr/lpp/cbxfc/cbxfesm listdev**

**Example:**

**# /usr/lpp/cbxfc/cbxfesm listdev**

Device	Failed	Online	Standby
Disk 6	0	1	1
Disk 7	0	1	1
Disk 8	0	1	1
Disk 9	0	1	1

## Managing a Secure Path Environment

The Secure Path software package includes the following utility for managing the Secure Path environment:

- The Secure Path Status and Management Utility (cbxfesm)

The cbxfesm utility is used to manage paths, display status, and enable CLI access to the controller over the Fibre Channel link.

### Secure Path Status and Management Utility (cbxfesm)

Table 3-1 lists the command options that are available for the cbxfesm utility. Required arguments appear in angle brackets (< >). A detailed description of each option and selective examples follows the table.

<b>Table 3-1 The cbxfesm Command Options</b>	
<b>Command</b>	<b>Action</b>
listdev	Displays the device status list.
listpath <dev>	Prints unfailed path list.
unfail <dev> <adap>	Performs unfailed path command.
listadapt	Prints path status list.
config <adap>	Performs configure path command.

#### Flag options

- d Generate debugging output. (For more information refer to Chapter 4, *Installation, Verification and Troubleshooting.* )
- h Do not generate header lines in output. Use to generate input to other programs.

### Command Argument Options

#### **listdev**

Prints a list of all devices connected to Fibre Channel adapters, along with the status of paths to the device.

#### **listpath <dev>**

Prints information about the paths to the specified device.

#### **unfail <dev> <adap>**

Changes the state parameter of a device path from Failed or from Standby to Online.

#### **listadapt**

Lists the Fibre Channel adapters in the system.

#### **config <adap>**

This command configures paths to all devices that are connected to a specific adapter.

### Examples

- To configure paths on adapter scsi1 that were not discovered at startup due to unplugged cables, enter:

```
# cbxfesm config scsi1
```

- To display the status of device hdisk9, enter:

```
# cbxfesm listpath hdisk9
```

```
# Device: hdisk9
```

```
# Device ID: 6000-1FE1-0005-B570-0009-9500-5329-001B
```

```
Path: scsi3 0,11 Standby
```

```
Path: scsi4 0,11 Online
```

The output shows two paths. The device is currently online through its preferred path over adapter scsi4 at ID = 0, LUN = 11. The path through scsi3 is available as an alternate path. The fields in the output are described in Table 3-2.

**Table 3-2 Fields Displayed by “# cbxfesm display listpath hdisk9”**

<b>Field</b>	<b>Example</b>	<b>Meaning</b>
Device ID	6000-1FE1-0005-B570 -0009-9500-5329-001B	World Wide Port ID of the LUN
Path	scsi4, 0,11 Online	Represents the Adapter ID, Represents the LUN ID Represents the Path state.





# Chapter 4

## Installation, Verification, and Troubleshooting

This chapter details specific configuration parameters for troubleshooting problems with Secure Path 2.0 for IBM AIX Secure Path. Below is a listing of prerequisite configuration items and troubleshooting utilities.

### Prerequisites

This section lists the prerequisite configuration items.

**Table 4–1 Configuration Items**

Parameter	Description
oslevel	AIX 4.3.2 or 4.3.3
/usr/stgwks2/steam/bin/config.sh	Platform Kit
<b>NOTE:</b> Refer to the Software Solution kit for your controller for installation details	
lspp -l PC1000.driver.obj	FC Secure Path fabric driver
<b>NOTE:</b> The above lspp -l PC1000.driver.obj command should return the name of the fabric driver which is PC1000.driver.obj followed by the version number. Please see the Secure Path 2.0 for IBM AIX Release notes for up-to-date information on the driver version number.	
/usr/lpp/cbxfc/cbxfesm	Utilities

## Troubleshooting Utilities.

There are three troubleshooting utilities associated with the Secure Path driver.

### The sctest Utility

The sctest utility allows the user to issue SCSI commands to the RAID system. To access information on sctest, enter:

```
#sctest
```

An example output screen follows.

```
Error in arguments
```

```
sctest version v1.7.
```

```
Issues SCSI device commands via adapter pass-through.
```

```
Usage:
```

```
sctest <device> <cmd> <args>
```

```
Device is name of adapter.
```

```
Command and args are:
```

?			- show command summary
I	<id>	<lun>	- show inquiry data
V	<id>	<lun>	- show VPD
T	<id>	<lun>	- test unit ready
F			- adapter information
S	<id>	<lun>	- start unit
P	<id>	<lun>	- stop unit
R	<id>	<lun>	- reset unit
H	<id>	<lun>	- halt unit

## The mbtest Utility

The mbtest utility allows the user to issue FC-SW commands and locate FC-SW information.

An example help screen follows.

```
mbtest version v1.12
```

Usage:

```
mbtest <device> <cmd>
```

where <device> is Fibre Channel device, such as scsi1

<cmd> is one of:

HELP		- print this message
NOP		- null mailbox command
ID		- get card loop id
MAP		- get position map
NODE	<l_id>	- get node name for id
PORT	<l_id>	- get port name for id
PDB	<l_id>	- get port database for id
LIP		- send LIP
STATE		- Show firmware state
LSTAT	<l_id> <p>	- Show link state for id and port no.
FWREV		- Show firmware revision level
QSTAT	<l_id> <lun>	- Show device queue status
RESET	<l_id>	- Reset target: all tasks, all initiators
LRESET	<l_id> <s>	- Send LIP Reset to target, then delay seconds
PLOGI	<l_id>	- Issue PLOGI loop login to a port
LPB	<l_id>	- Issue LPByx to a port
LPE	<l_id>	- Issue LPEyx to a port
DEV	<c> <l_id> <lun>	- Execute mailbox cmd c for a device.
ABORT	<hdl> <l_id> <lun>	- Abort hex handle for a device.

c is one of 22 abort device, 23 abort target, 25 stop queue,

26 start queue, 27 sgl step queue, 28 abort queue,

#### 4-4 SANworks Secure Path 2.0 for IBM AIX Installation and Reference Guide

29 get queue status, 101 clear ACA, 103 clear task set,

104 abort task set.

FABRIC		- Get driver's fabric database
DISCOVER		- Initiate fabric device discovery
PLOGI	<l_id>	- Issue PLOGI login to a loop port
FLOGI	<l_id> <p_id>	- Issue FLOGI login to a fabric port
FLOGO	<l_id>	- Issue FLOGO logout to a fabric port
GETPORT		- Get list of port and loop IDs for all logged in fabric ports
GETNODE		- Get list of node and loop IDs for all logged in fabric ports
GETINIT		- Display the initialization control block



**CAUTION:** The mbtest utility should only be used to troubleshoot an existing problem. It is not recommended for the novice user.

---

### The fcinfo Utility

The fcinfo command is a debugging tool used to display information about the system. This utility displays information gathered from the AIX commands lscfg, lsattr, lsdev, and from the ODM database. The purpose of this utility is to assist support personnel in tracking problems.

# *Appendix* **A**

## **Removing SANworks Secure Path Software**

This appendix describes how to remove StorageWorks Secure Path software from your server. Removing the Secure Path software restores the server to a single path RAID storage environment.

Under a single path configuration, the controllers must be set to Transparent Failover mode. The steps for how to remove the software and transition the HSGx0 controllers to Transparent Failover mode follow.

### **Removing Secure Path Software**

To remove the Secure Path software:

1. Use the following steps to stop all activity to the units on the RAID system.
  - a. Stop all I/O

- b. Show the mounted devices by entering

```
#mount
```

node	mounted	mounted over	vfs	date	options
	/dev/hd4	/	jfs	Nov 13 14:57	rw,log=/dev/hd8
	/dev/hd2	/usr	jfs	Nov 13 14:57	rw,log=/dev/hd8
	/dev/hd9var	/var	jfs	Nov 13 14:57	rw,log=/dev/hd8
	/dev/hd3	/tmp	jfs	Nov 13 14:57	rw,log=/dev/hd8
	/dev/hd1	/home	jfs	Nov 13 14:58	rw,log=/dev/hd8
	/dev/r11v1	/mnt/r1	jfs	Nov 15 09:08	rw,log=/dev/r1log
	/dev/r21v	/mnt/r2	jfs	Nov 15 09:08	rw,log=/dev/r2log
	/dev/r31v	/mnt/r3	jfs	Nov 15 09:08	rw,log=/dev/r3log
	/dev/r41v	/mnt/r4	jfs	Nov 15 09:09	rw,log=/dev/r4log

- c. Unmount the devices. Enter:

```
# umount /dev/r1lv
```

- d. List the available volume groups by entering:

```
# lsvg
```

```
rootvg
```

```
R1
```

```
R2
```

```
R3
```

```
R4
```

- e. Deactivate the volume groups by entering:

```
# varyoffvg R1
```

- f. Export the volume groups by entering:

```
# exportvg R1
```

2. Remove all the hdisk units based on the HSG80 using the following command:

```
#rmdev - dl hdisk4
```

3. Remove the adapter instance by entering:

```
# rmdev - dl scsi1
```

A completion message appears.

```
scsi1 removed
```

4. Remove the adapter driver by entering the following:

```
# installp -u PC1000
```

An example of the successful completion message is shown as follows:

Installation Summary

```
-----
Name                Level    Part    Event    Result
-----
PC1000.driver.obj   1.5.9808.0  USR    DEINSTALL SUCCESS
```

**NOTE:** If the same server and the same RAID storage system are to be reconnected in Transparent Failover mode, use the steps in *Reconfiguring the RAID Storage System Controllers* section which follows to reconfigure the RAID system. It will be necessary to install the Transparent Failover driver for your Fibre Channel adapter which is supplied in the StorageWorks Solution Software for IBM AIX 8.5c.

**NOTE:** The ACS Version number 8.5c shown above represents the Solution Software version, not the controller ACS version. Please refer to Table 2-1, "Secure Path (FC SAN Switch Installation) Prerequisites," on page 2 for the correct HSG60 and HSG80 ACS versions.

## Reconfiguring the RAID Storage System Controllers

If one or more servers are using the RAID Array for single path access, the HSG80 dual-redundant controllers must be placed into the failover mode known as Transparent Failover Mode.

To change the state of the controller to Transparent Failover Mode:

1. Establish a serial connection to the storage subsystem.
2. All connections on the storage system must be deleted. To show available connections, enter:  

```
CLI> show connections
```
3. Delete all connections with the command that follows. Repeat this step for each connection.

CLI> **delete** (*connection\_name*)

**NOTE:** The connections will be generated later.

4. If there are units (Dn) on the storage system, you must delete them using the following command. Be sure to record the Dn values and their associated information as well as the storageset information for later use. The controller state change does not affect the data on the storagesets. Repeat this step for each Dn on the storage system.

CLI> **show units**

CLI> **delete Dn**

**NOTE:** This is due to differences incorporated in the volume's WWID in different failover modes.

The UNITS are restored after the controller state is changed. Be sure to record the Dn values and their associated information, as well as the storageset information for later use. The controller state change does not affect the data on the storagesets.

5. If the controllers are currently in a failover mode, they must be removed from this mode. Enter:

CLI> **set nofailover**

---

**IMPORTANT:** The "other" controller will shut down and you must restart it manually. Momentarily depress the reset button on the front panel of the controller. Wait for two minutes for the controller to reboot before proceeding with an RA8000/ESA12000 Storage System. The OTHER\_CONTROLLER sounds an alarm when it detects the second controller, which is not bound in any failover mode. All controllers will notify you that they are not bound in a failover mode. You can silence the alarm and disregard the message about misconfigured controllers.

---

6. When the OTHER\_CONTROLLER becomes available copy all unit and configuration information to it. Enter:

CLI> **set failover copy=this**

This will cause the OTHER\_CONTROLLER to reboot. When restarted, the controller pair is bound in Transparent Failover mode. Use the commands

CLI> **show this\_controller** and

CLI> **show other\_controller**

to verify that the controller pair is in Transparent Failover mode:

Example

CLI> **show this\_controller**

The partial output should read:

...



Controller:

HSG80 ZG91205506 Software V85F-0, Hardware E06

NODE\_ID = 5000-1FE1-0001-7320

ALLOCATION\_CLASS = 0

SCSI\_VERSION = SCSI-2

Configured for dual-redundancy with ZG91205623 ←

In dual-redundant configuration ←

Device Port SCSI address 7

Time: 27-OCT-2000 09:10:21

Command Console LUN is lun 0 (NOIDENTIFIER)

**NOTE:** The partial output contains the line: “Configured for dual-redundancy with ZG91205623 in dual-redundant configuration.” The words “Configured for dual-redundancy” and “dual-redundant configuration” indicated by the ←, verify that the controller pair is bound in Transparent Failover mode.

7. Restore the units to the storage set mapping that was recorded earlier. Refer to the *Compaq StorageWorks HSG60/HSG80 Array Controller ACS Version 8.5c Solutions Software for IBM AIX Installation and Configuration Guide* for HBA driver installation instructions and Transparent Failover cabling information.

**NOTE:** The ACS Version number 8.5c shown in the installation and configuration guide above represents the Solution Software version, not the controller ACS version. Please refer to Table 2-1, “Secure Path (FC SAN Switch Installation) Prerequisites,” on page 2 for the correct HSG60 and HSG80 ACS versions.



# Appendix *B*

## Converting to a Multiple Path Configuration

This appendix provides the procedures necessary to convert existing storage systems from a single path to a multiple path configuration. The steps below explain what commands to use to deactivate and export volume groups, remove hdisks and adapters, and set the RAID array to Multiple-Bus Failover mode.

### Converting to Multiple-Bus Failover Mode

Covert to Multiple-Bus Failover mode with the following procedure.

1. List the available devices by entering:

```
#mount
```

node	mounted	mounted over	vfs	date	options
	/dev/hd4	/	jfs	Nov 13 14:57	rw,log=/dev/hd8
	/dev/hd2	/usr	jfs	Nov 13 14:57	rw,log=/dev/hd8
	/dev/hd9var	/var	jfs	Nov 13 14:57	rw,log=/dev/hd8
	/dev/hd3	/tmp	jfs	Nov 13 14:57	rw,log=/dev/hd8
	/dev/hd1	/home	jfs	Nov 13 14:58	rw,log=/dev/hd8
	/dev/r11v	/mnt/r1	jfs	Nov 15 09:08	rw,log=/dev/r1log
	/dev/r21v	/mnt/r2	jfs	Nov 15 09:08	rw,log=/dev/r2log
	/dev/r31v	/mnt/r3	jfs	Nov 15 09:08	rw,log=/dev/r3log
	/dev/r41v	/mnt/r4	jfs	Nov 15 09:09	rw,log=/dev/r4log

2. Unmount the devices. Enter:

```
# umount /dev/r1lv
```

3. List the available volume groups by entering:

```
# lsvg
```

An example output appears as follows:

```
rootvg  
R1  
R2  
R3  
R4
```

4. Deactivate the volume groups by entering:

```
# varyoffvg R1
```

5. Export the volume groups by entering:

```
# exportvg R1
```

6. Remove the hdisks and adapters by entering the following commands.

```
#rmdev -dl hdiskx where x is the number of the hdisk
```

```
#rmdev -dl scsix (where x is the number of each scsi device)
```

**NOTE:** Note: To remove both hdisks and the scsi devices, enter  
#rmdev -Rdl scsix, where x is the number of the scsi device.

7. Set the RAID Array to Multiple-Bus failover mode.

- a. Disable Transparent failover mode. Enter

```
CLI>set nofailover
```

- b. OTHER\_CONTROLLER will shutdown. Manually restart it by pressing the reset button. (Controller will have a solid green indicator.)

- c. Wait about 1 minute for the controller to restart. Then set the RAID system in Multiple-Bus failover mode. When this command is executed, both controllers will automatically restart. Upon completion the CLI prompt will reappear. Enter the following:

```
CLI> set multibus_failover copy=this_controller
```

8. Multiple-Bus failover mode recognizes units in the range of D0 - D199. However, Multiple-Bus failover mode on AIX only recognizes units from D0-D15. Any units which have unit numbers greater than D100 must be transferred to unit numbers below D16.
  - a. First, display the units from the RAID Array and determine which units need to be transferred. Make a note of which storage set is used by each unit. In the following example, D100 and D101 must be transferred and they are using S2 and S3, respectively.

CLI> **show units**

LUN	Uses	Used by
D1	M1	
D2	S1	
D100	S2	
D101	S3	

- b. Delete the units which need to be transferred. An example command follows:

CLI> **delete d100**

- c. Add new units below D16, containing the storagesets in the chart. For example:

CLI> **add unit d3 s2**

- d. When all of the units have been added, execute the show command to be sure all units have been added between D0-D15.

CLI> **show units**

LUN	Uses	Used by
D1	M1	
D2	S1	
D3	S2	
D4	S3	

9. Remove the existing FC HBA Driver

To remove the FC HBA driver, enter:

**#installp -u PC1000**

The following is a sample completion screen output:

Installation Summary

```
-----  
Name           Level      Part      Event      Result  
-----  
PC1000.driver.obj  1.5.10.0  USR      DEINSTALL  SUCCESS
```

10. Install the multiple path driver

To install the multiple path driver, enter:

```
# installp -acd . all
```

Installation Summary

```
-----  
Name           Level      Part      Event      Result  
-----  
PC1000.driver.obj  1.5.10.1  USR      APPLY      SUCCESS
```

**NOTE:** Please see Chapter 3, *Installing Secure Path 2.0 Software*, page 3-2 for more information on installing the multiple path driver.

11. Shutdown the AIX server

12. Install the additional HBA(s) as per the installation instructions and reconfigure the FC fabric for Multiple-Bus Failover mode. Refer to the section “Installing and Configuring the Raid System” in Chapter 2 of this book for more information.

13. Transfer the RAID box to Multiple-Bus Failover mode. Refer to the section “Installing and Configuring the Raid System” in Chapter 2 of this book for more information.

14. Power on the AIX system. The manager (cfgmgr) will run automatically.

15. Import the volume groups. Enter:

```
# importvg -y R1 /dev/hdisk4
```

where x is the hdisk number for the physical volume containing the original volume group.

16. Mount the volumes. An example follows:

```
# mount /dev/r1lv /mnt/r1
```

# Glossary

This glossary defines terms used in this guide or related to this product. It is not a comprehensive glossary of computer terms.

<b>Glossary Term</b>	<b>Glossary Definition</b>
<b>CLI</b>	The Command Line Interpreter accessed by an RJ11 serial connector on the front panel of the HSG80. The CLI command set is available in the HSG80 documentation.
<b>Controller</b>	The hardware device that facilitates communication between a host channel link and one or more LUNs organized as an array. Secure Path 2.0 for IBM AIX supports the HSG60/HSG80 array controllers. Each controller in an HSG60/HSG80 RAID system is identified by a unique World Wide ID.
<b>Driver</b>	A host based program that processes I/O requests for a particular device type.
<b>Fabric</b>	A network comprised of high-speed fiber connections resulting from the interconnection of switches and devices. A fabric is an active and intelligent non-shared interconnect scheme for nodes.
<b>Failback</b>	The ability of Secure Path to use a recovered repaired failed path pending a subsequent failure of an active path.
<b>Failover</b>	The process that takes place when one storage system controller in a dual-redundant configuration fails and the other controller takes over control of the data access on the storage system. The controller assuming control continues to manage the storage system even after the failed controller is operational or replaced.

**Glossary–2** *SANworks Secure Path Version 2.0 for IBM AIX Installation and Reference Guide*

<b>FC-SW</b>	Fibre Channel Switch - A multiple-port device that provides virtual I/O paths between Fibre Channel devices such as servers, storage systems and other Storage Area Network (SAN) switches. A switch is an intelligent, programmable connection component of a storage area network.
<b>GBIC</b>	Gigabit Interface Converter. GBICs plug into ports of all Fibre Channel system components (host controllers, hubs, switches) and convert electrical signals to optical signals (and vice-versa).
<b>HBA</b>	The I/O device (Host Bus Adapter) that serves as the interface connecting a host system bus backplane to the Storage Area Network.
<b>High Availability</b>	Having data available to the end user a high percentage of time.
<b>Host</b>	The computer system on which the Secure Path server software resides.
<b>LUN</b>	The logical unit number assigned to a device at the Server system.
<b>Path</b>	A communication route that enables data and commands to pass between a host server and a storage device
<b>Secure Path</b>	Secure Path is a high availability software product providing continuous data access StorageWorks RAID array systems.
<b>Path State</b>	Attribute that describes the current operational condition of a path. The state attribute can have one of the following three values: <ul style="list-style-type: none"><li><input type="checkbox"/> <b>Online</b> indicates a path that is currently servicing I/O requests.</li><li><input type="checkbox"/> <b>Failed</b> indicates a path that is disabled and not actively servicing I/O requests.</li><li><input type="checkbox"/> <b>Standby</b> indicates a path that is neither Active nor Failed.</li></ul>
<b>Switch</b>	See FC-SW
<b>Unit</b>	The logical number assigned to a storageset at the RAID System Controller.



# Index

## A

- access
  - application 1-2, 1-9
  - device 1-9
  - hdisk 1-9
- active 1-1
- active/passive 1-1
- adapter driver
  - removing A-3
- adapter pairs
  - sharing the same unit on the RAID system 2-3
- adapters
  - maximum configuration 2-3
- After Path Failover
  - illustrated 1-9
- AIX
  - host (see AIX server) 1-1
  - server 1-1, 1-7
- application
  - access 1-5

## B

- Before Path Failover
  - illustrated 1-8

## C

- cabling
  - Transparent Failover A-5
- cbxfesm 1-2, 1-3
  - features 1-6
- CLI commands 2-9, A-4
  - delete connection\_name A-4
  - set (unit#) preferred\_path 2-10
  - set failover copy=this A-4
  - set multibus copy=this B-2

- set no failover,set multibus\_failover,show this\_controller, show other\_controller 2-9
- show units full 2-10
- Command Line Interpreter
  - definition 1-1
  - command options 3-5, 3-6
- components
  - required to set up Secure Path 2-1
- configuration
  - commands for (see also command options) 2-7, 3-6
  - controller A-4
  - device path 3-6
  - path 1-3, 3-5
  - RAID storage array (see also RAID Storage Array) 1-9
  - verify cbxfesm install 3-4
- configuration files
  - troubleshooting 4-1
- configuration rules 2-3
- configurations
  - supported 2-3
- configuring the RAID system for Secure Path steps 2-7
- controller
  - definition 1-1
  - failure, configuring 2-9
  - OTHER\_CONTROLLER 2-9, A-4
  - port 1-10
- controller output
  - example 2-8

## D

- data availability 1-1
- data path 1-1

**Index-2** SANworks Secure Path 2.0 for IBM AIX Installation and Reference Guide

- Deactive B-2
- detection
  - failover 1-2
- device
  - accessing 1-9
  - listing B-1
  - storage 1-3
  - target 1-5
  - unmount B-2
- device ID
  - example,meaning 3-7
- device path 3-6
- device path state
  - failed 1-10
  - online 1-10
  - standby 1-10
- directory on the AIX server
  - create 3-2
- driver
  - definition 1-1
  - model structure, components 1-5
- driver components
  - AIX hdisk driver 1-6
  - PC1000 HBA driver 1-6
- driver utility
  - installing 3-2
- E**
- environment
  - RAID storage A-1
- error message 1-7, 2-9, A-4
- F**
- fabric
  - definition 1-1
- failback
  - definition 1-1
- failover
  - definition 1-6, 1-1
  - functions 1-6
  - of controller 1-2
  - transparent A-4
- transparent mode A-1
- failure
  - alarm 2-9, A-4
  - detection 1-2, 1-6
  - marking 1-7
  - monitoring 1-2
  - of controller 2-9
  - of path 1-6
  - physical path 1-6
  - recovery 1-6
  - transparent 2-9
- FC 1-1
- FC cables 2-2
- FC SAN Switch Configurations / 2 Adapter Pairs / 4 FC SAN Switches
  - illustrated 2-6
- FC SAN switch configurations 1 adapter pair
  - illustrated 2-4
- FC SAN switch installation prerequisites
  - platform 2-2
- FC SAN switches 2-2
- FC Switch Configurations/ 2 Adapter pairs
  - illustrated 2-5
- FC switch firmware 2-2
- fdaffdsa B-2
- features 1-2
- Fibre Channel SAN Switch 1-2
- Fibre Channel Switch
  - definition 1-2
- G**
- Gigabit Interface Converter
  - See GBIC definition 1-2
- H**
- hardware configuration
  - AIX 1-1
  - host bus adapter 1-1
- HBA 1-7
- HBA driver 1-6
- HBAs 2-2
- hdisk device 1-9

high availability  
    definition 1-2  
host  
    definition 1-2  
Host Bus Adapter  
    See HBA definition 1-2  
host bus adapter (HBA) 1-1, 1-2

**I**

I/O 1-2  
installation  
    on fibre channel 2-7  
    Secure Path software 3-2  
    solution software 3-3  
    Solutions Software HBA driver A-5  
Installation Requirements 3-1  
Installing and configuring the IBM server  
    steps 2-7  
installing and configuring the RAID system  
    steps 2-7  
installing Secure Path  
    steps 3-2  
installing the IBM server for Secure Path 2-7  
installing the RAID system for Secure Path  
    steps 2-7

**L**

listadapt  
    action 3-5  
listdev  
    action 3-5  
listpath  
    action 3-5  
logical unit number  
    See LUN 1-2  
LUN  
    RAID system 1-9

**M**

mbtest 1-3  
    troubleshooting utility 4-3  
multiple-bus failover mode 1-2, 2-9  
multiple-bus mode 1-1

**N**

No Single Points of Failure  
    See NSPOF 1-2

**O**

operating systems 2-2

**P**

path  
    active (online) 1-6  
    configuring 1-3, 3-5  
    device 3-6  
    example, meaning 3-7  
    failed 1-1, 1-2, 1-10  
    preferred 3-6  
    standby 1-1, 1-2, 1-7  
    state 1-10  
    status 1-10

path state  
    definition 1-2  
path support 1-2  
preferred 3-6  
preferred path 3-6  
Prerequisites  
    FC SAN switch installation 2-2

**R**

R/S 6000 2-3  
RAID array  
    set to multiple-bus failover mode B-2  
RAID controllers  
    reconfiguring A-3  
RAID storage array 1-9  
RAID storage system 1-1, 2-2  
RAID system  
    StorageWorks 1-1  
RAID systems  
    maximum configurations 2-3  
reconfiguration 1-6  
removing  
    transparent failover driver B-3  
removing adapters B-2  
removing hdisks B-2

**Index-4** SANworks Secure Path 2.0 for IBM AIX Installation and Reference Guide

- removing Secure Path
  - deactivating volume groups A-2
  - exporting volume groups A-2
  - removing adapter driver A-3
  - removing adapter instance A-2
  - removing hdisks A-2
  - steps A-1
  - stopping I/O A-1
  - unmounting devices A-2

**S**

- SAN 1-1
- SANworks Secure Path Version 2.0 Driver Model
  - illustrated 1-5
- sctest 1-3
  - command arguments 4-2
  - example output screen 4-2, 4-3
  - troubleshooting utility 4-2
- Secure 1-1
- Secure Path
  - definition 1-2
  - removing the software A-1
- Secure Path 2.0
  - overview 1-1
- Secure Path status and management utility
  - See cbxfesm 1-2
- Secure Path status and management utility (cbxfesm)
  - summary 1-6
- software components 1-3, 1-6
  - AIX man pages 1-3
  - device driver 1-3
  - See cbxfesm 1-3
  - troubleshooting utilities 1-3
- Software Components for the Paths to Storage
  - illustrated 1-4
- solution kit 2-2
- state
  - device path 1-10
- Storage Area Network
  - See SAN 1-1
- StorageWorks 1-1, 2-7

- supported configurations
  - illustrated 2-3

**T**

- topology 2-1
- transparent failover mode 1-2
  - steps to convert to multiple-bus failover mode 2-9
- troubleshooting
  - mbtest utility 4-3
  - sctest utility 4-2

**U**

- unfail
  - action 3-5
- units
  - adding B-3
  - deleting B-3
- units (Dn) A-4
- Unmount B-2
- utilities
  - troubleshooting 4-2
- utility
  - cbxfesm 1-2, 3-5
  - mbtest 4-3
  - sctest 4-2

**V**

- volume groups
  - deactivating B-2
  - exporting B-2
- volumes
  - mounting B-4