Compaq SANworks ™

SANworks Secure Path Version 2.1a for Sun Solaris

Installation and Reference Guide

Second Edition (November 2000)
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About This Guide

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

Text Conventions

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

user input	User input appears in a bold typeface and in lowercase.
paths/filenames	Directory paths and file names appear in lowercase letters (they are bold when part of a user command).
Menu Options	Menu options appear italicized and in initial capital letters.
Enter	When you are instructed to enter information, type the information and then press the Enter key.

Symbols in Text

The 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.

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.
- The stabilizing feet are attached to the rack if it is a single rack installation.
- The racks are coupled together in multiple rack installations.
- A rack may become unstable if more than one component is extended for any reason. Extend only one component at a time.

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 as 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[1]. This service is available 24 hours a day, 7 days a week.

Outside North America, call the nearest Compaq Technical Support Phone center. Telephone numbers for worldwide 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 number(s)
- Product model name(s) and number(s)
- 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 information on this product as well as the latest drivers and Flash ROM images. You can access the Compaq website by logging on to the Internet at http://www.compaq.com.

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

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.

Sun Solaris Version Numbers

Several conventions have been used to describe versions of the Sun Solaris operating system. To clarify version numbers refer to the following table:

.

Table 1 Sun Solaris Versions
Version 2.7 or 7
Version 2.8 or 8

Command Line Interface

Throughout the documentation in this book, we have used the Command Line Interface (CLI) to explain examples of how to set up your storage system. Because we are supporting more than one controller, the prompt has changed from the controller type to CLI>.

For example, where you would normally see

HSG80>

or

HSG60>

or

HSZ80>

you will now see

CLI>

Chapter 1

Theory of Operation

Overview

IMPORTANT: Before attempting to install Secure Path Version 2.1a, please read the Release Notes.

SANworks Secure Path is a high availability software product providing continuous data access to the StorageWorks RAID array systems listed in Table 1–1.

Table 1–1 StorageWorks RAID Array Systems

StorageWorks Fibre Channel RAID Array Systems	StorageWorks SCSI RAID Array Systems
RA8000	RA8000 Ultra SCSI
ESA12000	ESA12000 Ultra SCSI
MA8000	
EMA12000	
MA6000	

These RAID storage systems are configured on Sun Sparc platforms running Solaris 2.6, Solaris 7 or Solaris 8 operating systems in either a 32- or 64-bit kernel mode.

Redundant hardware, advanced RAID technology and automatic failover capability are used to enhance fault tolerance and availability. Secure Path, in conjunction with the StorageWorks RAID system, eliminates single points of failure such as RAID controllers, disk drives, hubs, cables, host bus adapters and Fibre Channel (FC) switches.

Figure 1–1 (Fibre Channel) and Figure 1–2 (Ultra SCSI) illustrate basic Secure Path hardware configurations. The physical connections define two separate paths. Each path originates at a unique host bus adapter on a Solaris server and ends at a port on a separate RAID controller on the storage system.

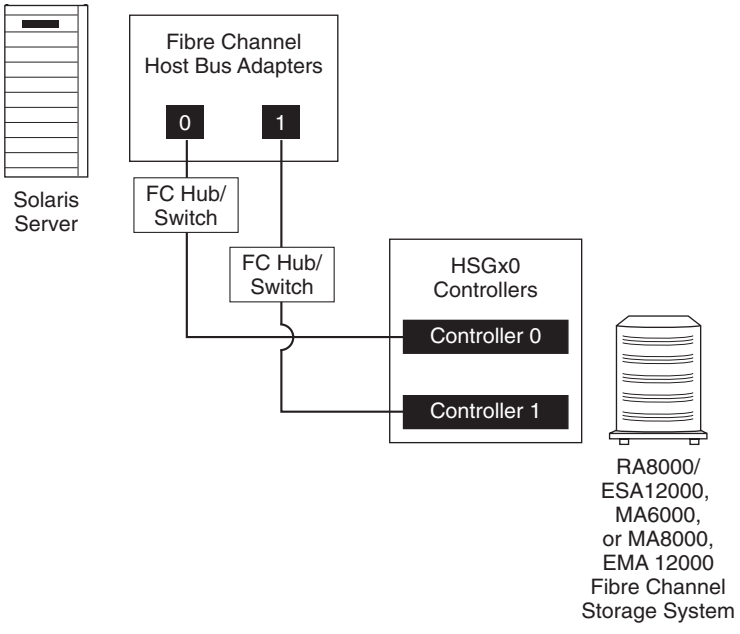

Figure 1–1. Basic Secure Path configuration for Fibre Channel

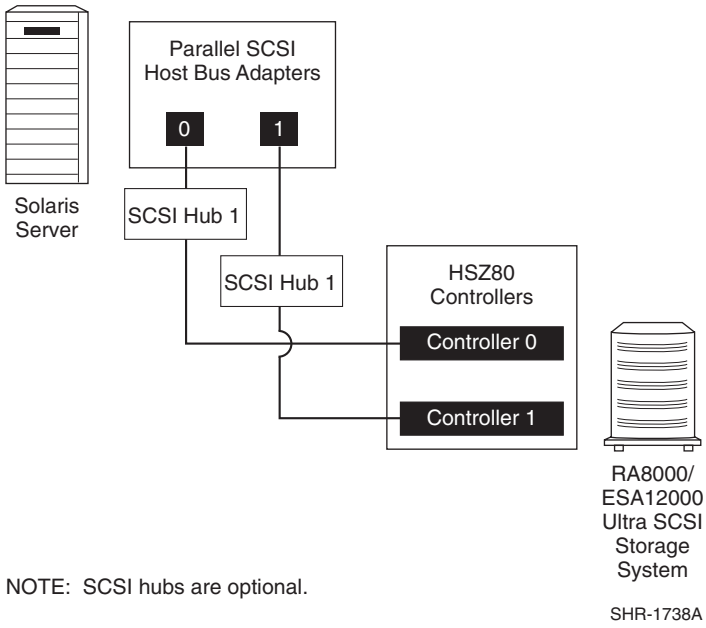

Figure 1–2. Basic Secure Path configuration for Ultra SCSI

Secure Path Version 2.1a has the following features:

- Allows a StorageWorks dual-controller RAID system to be cabled on two independent paths using two host bus adapters (HBAs) in each server. Secure Path supports Fibre Channel with the HSG60 and HSG80 controllers. Secure Path also supports Ultra SCSI with the HSZ80 controller.
- Monitors each path and automatically re-routes I/O to the functioning alternate path should an adapter, cable, hub, Fibre Channel 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 management tool to monitor and manage Secure Path devices and paths.

Secure Path Technology

The key to Secure Path's functionality is the capability of dual StorageWorks RAID controllers to operate in an active/active implementation, referred to as dual-redundant, multiple-bus mode.

Multiple-bus mode allows each controller to process I/O independently of the other controller under normal operation. A path consists of a unique connection from adapter to controller. I/O is active on one path at a time and storage units (LUNs) may be moved between paths using the Secure Path Management Tool, *spmt.*

The Secure Path software detects the failure of a path and automatically re-routes traffic to the other path. Path failover is completed seamlessly, without process disruption or data loss.

Following the replacement of an adapter or cable component, failed controller, hub or Fibre Channel switch, the storage units can be moved back to their original path using the Secure Path management tool.

To protect against drive failure in a Secure Path environment, storage units can be configured using RAID Levels 0+1, 1, or 3/5.

Chapter 2

Technical Description

Overview

SANworks Secure Path is server software that enhances the StorageWorks RAID storage system by providing automatic recovery from server-to-storage system connection failures. Secure Path supports two independent I/O paths between a Solaris server and a RAID storage system, improving overall data availability. If any component in the path between the server and storage system fails, Secure Path redirects all pending and subsequent I/O requests from the failed path to the alternate path, thereby preventing an adapter, cable, hub, Fibre Channel switch or controller failure from disrupting data flow.

Software Components

The Secure Path software includes the following:

- drivers (ldLite, mda, and path)
- two daemons - one for event notification and one for failover
- management tools (spmt and spinit)
- configuration tool (spconfig)

Secure Path uses these components to create, configure, and manage redundant paths to a storage device.

Figure 2–1 (Fibre Channel) and Figure 2–2 (Ultra SCSI) show each component in the path along which data moves from an application to storage.

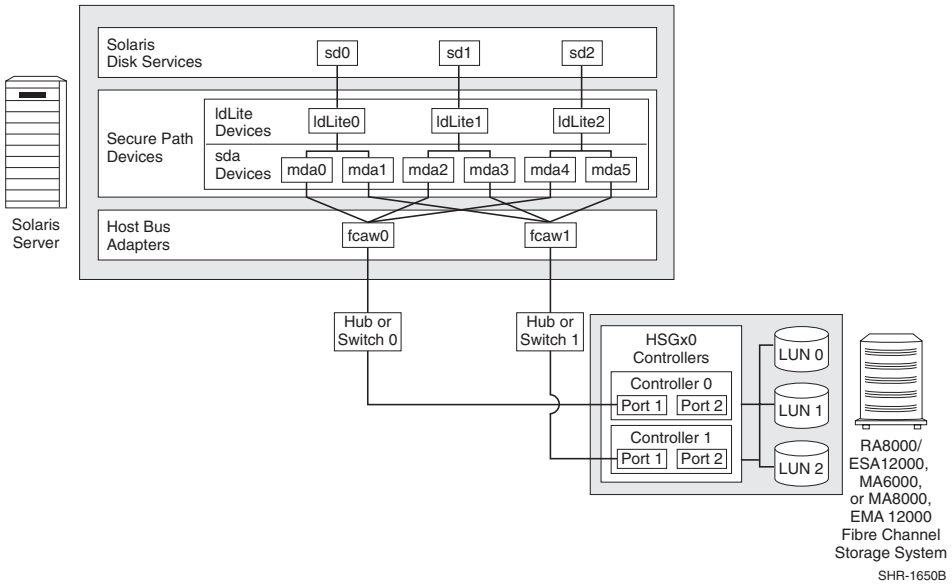

Figure 2–1. Components comprising the paths to storage for Fibre Channel technology

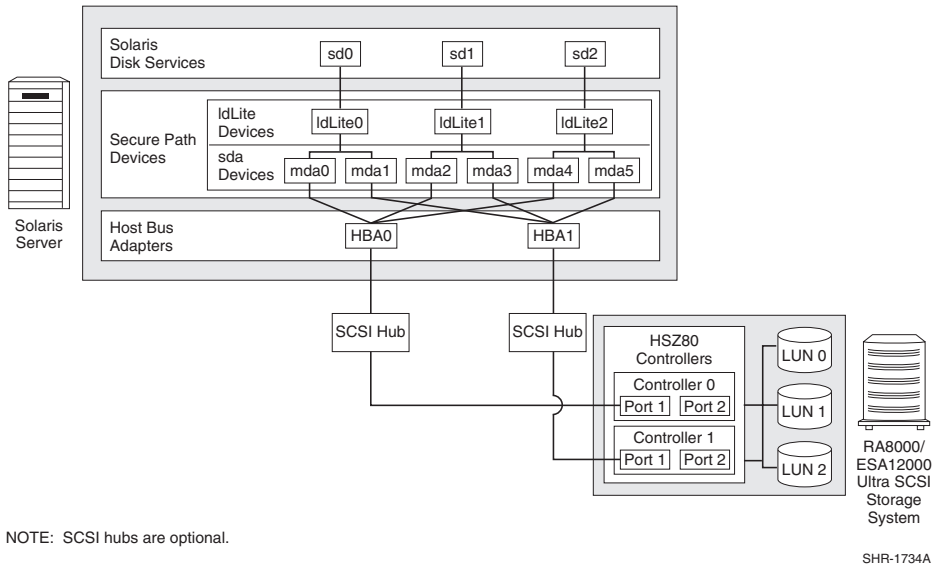

Figure 2–2. Components comprising the paths to storage for Ultra SCSI technology

Secure Path Drivers and daemon

Three Secure Path drivers (mda, ldLite, and path) reside between the Solaris sd class driver and the host bus adapter (HBA) driver. These drivers, along with the failover daemon, provide Secure Path's path failover functionality. When a path from the server to the storage system is active, the drivers act as a pass-through agent. All I/O from the Solaris sd class driver is sent directly to the host bus adapter (HBA) driver.

When an active path fails (due to a cabling problem, for example), the mda driver stops sending I/O to the HBA driver and signals the Secure Path failover daemon that a failure event has been detected. The mda driver then activates the standby path and issues all pending I/O as well as subsequent I/O to the activated path. Once the standby path has successfully been activated, the driver signals the failover daemon that the failover has completed successfully. The event daemon logs the event messages to the console and the system log file, and sends email notification to users if specified. The Secure Path drivers and the daemons are transparent to applications.

Secure Path Drivers

The Secure Path drivers manage paths to a storage device while providing a single device target to applications. Figure 2–3 illustrates the driver model structure.

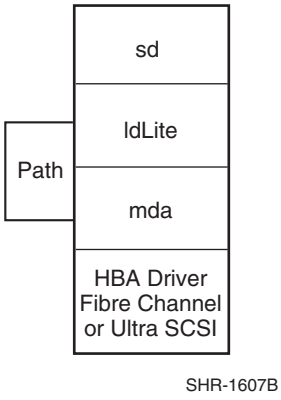

Figure 2–3. SANworks Secure Path V2.1a driver model

The following list describes each Secure Path driver.

- mda

  The mda driver, a SCSI-disk target driver, is specific to the Compaq HSG80, HSG60, and HSZ80 RAID storage system controllers. It is a path failover driver that provides I/O paths to the storage devices. It monitors the paths and when path failure is detected, automatically initiates path failover.

- ldLite

  The ldLite driver is a pseudo-HBA driver that presents separate mda path instances as a single device to the Solaris sd class driver.

- path

  The path driver provides facilities for the ldLite and mda drivers to communicate in the kernel. It also provides a character device interface that is used by the Secure Path management utility to manage the state of the paths to each storage device. The path driver is not used for any device I/O.

Failover

Path failover occurs when Secure Path redirects I/O from a failed physical path to the standby path. If a problem with an HBA, RAID controller, hub or Fibre Channel switch, or any connection hardware causes a path to fail, Secure Path stops sending I/O to the HBA driver, marks the path as failed, and assigns the standby path as the on-line path.

After this reconfiguration, I/O is sent along the online path. This failure-recovery process is transparent to applications.

Figure 2–4 (Fibre Channel) and Figure 2–5 (Ultra SCSI) show Secure Path environments on which a Solaris server has redundant connections to a RAID storage system.

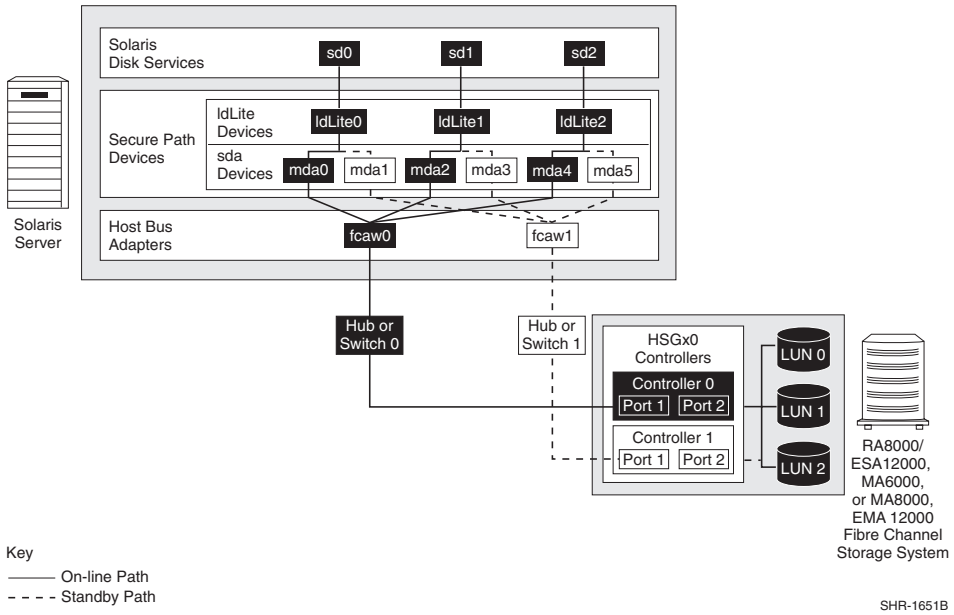

Figure 2–4. Before path failover for a Fibre Channel configuration

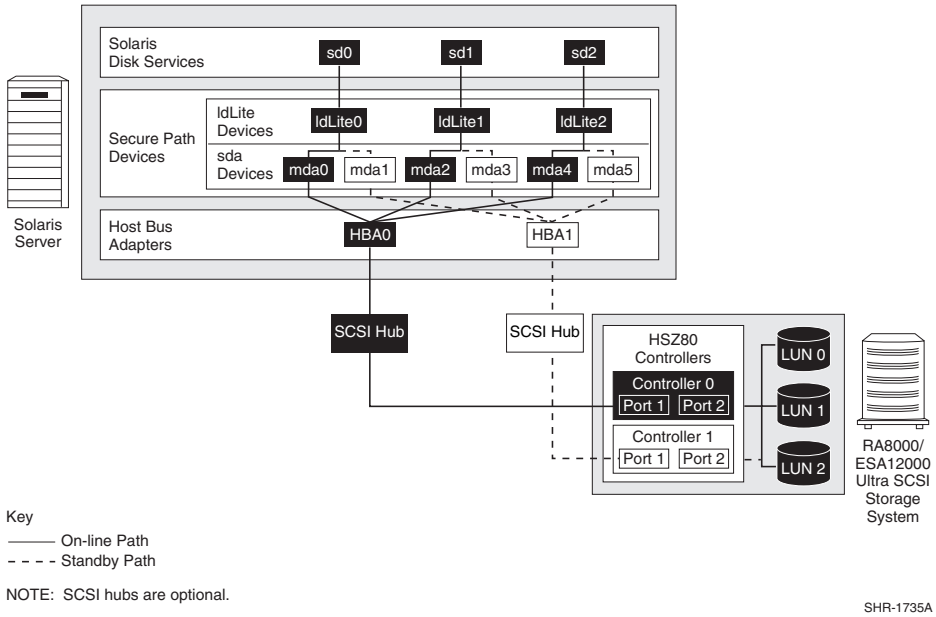

Figure 2–5. Before path failover for a Ultra SCSI configuration

The RAID storage system has three units and the Solaris server has three sd class devices associated with the units. Each device may be accessed by one of two possible paths.

In Figure 2–4 (Fibre Channel) and Figure 2–5 (Ultra SCSI) the active path is shown as a solid line and the standby path with a dotted line. Each Secure Path device is accessing the unit through the same HBA, hub/Fibre Channel switch-RAID controller. The *spmt* utility allows balancing of I/O loads over both paths.

As long as the online path is accessible, the Secure Path devices use this path for I/O. If the active path fails (due to a problem with the HBA, for example) Secure Path detects the error and stops sending I/O along this path.

Secure Path takes the path offline (marking it failed), and brings the standby path online and redirects I/O to the active path as shown in Figure 2–6 (Fibre Channel) and Figure 2–7 (Ultra SCSI). The dotted lines denote the failed path.

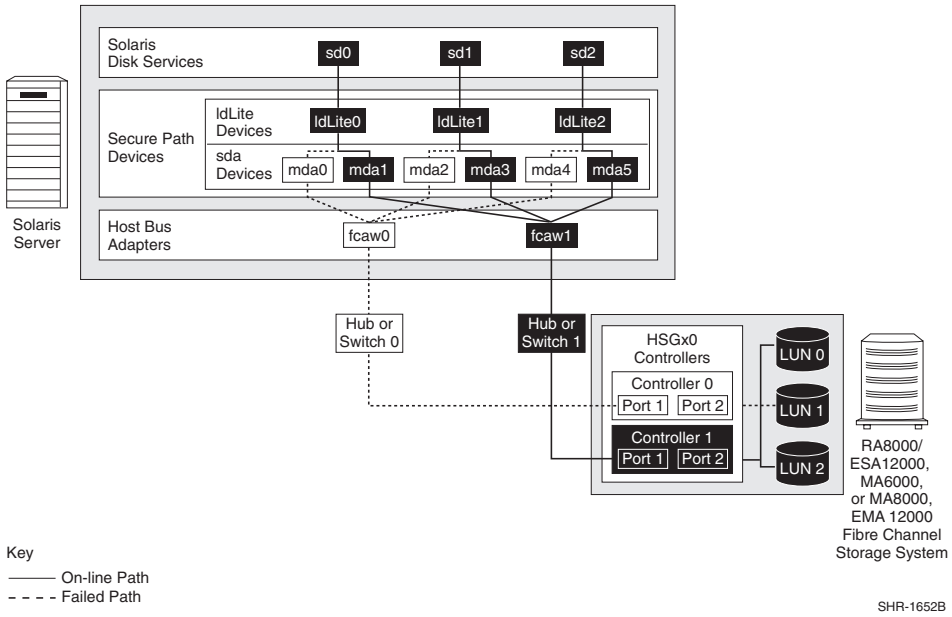

Figure 2–6. After path failover for a Fibre Channel configuration

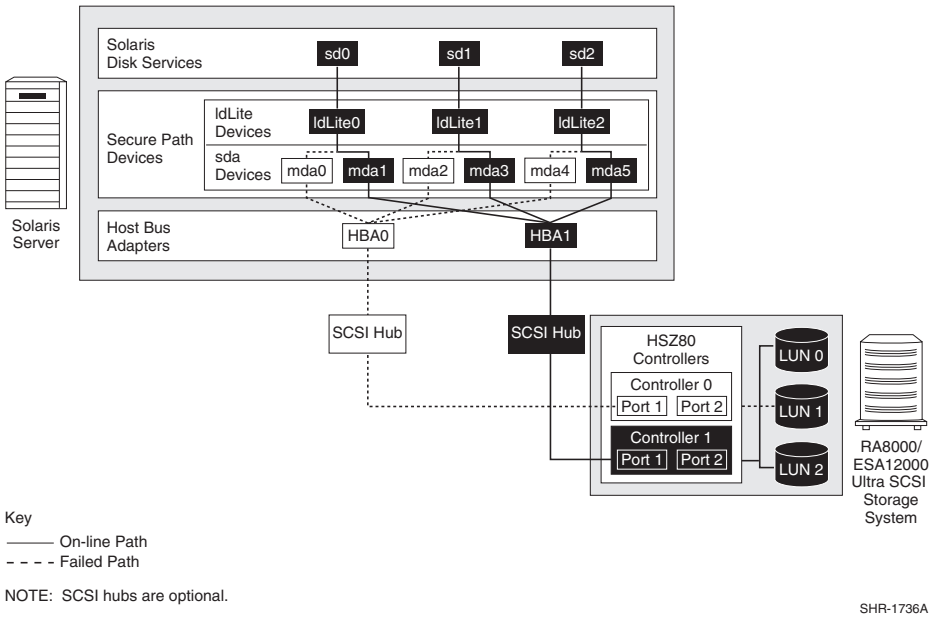

Figure 2–7. After path failover for a Ultra SCSI configuration

Application Access

Applications access Secure Path devices by accessing the sd class devices as they would normally. Each Secure Path device has an sd class device instance associated with it and a corresponding cXtYdZ device in /dev/dsk and /dev/rdsk directories.

Device States

Each Secure Path device has a status that describes its current condition. The state of a Secure Path device is determined by the condition of its paths. The states for a Secure Path device are as follows:

- operational

  The device has at least one physical I/O path open to a unit on the storage system.

- dead

  The device has no open physical I/O paths to the unit. This device is out of service.

Path States

The device path is the physical I/O path through which I/O is moved between the server and the unit on the storage system. A Secure Path device path consists of adapters, cables, hubs and/or switches from the server to the RAID controller port.

A Secure Path device path has the following states:

- online

  Indicates that this path is the active I/O path.

- standby

  Indicates that the path is being held in reserve. If the online path fails, Secure Path switches the standby path to the online state.

- quiesced

  Indicates that the path has been taken out of service.

- failed

  Indicates that the path is no longer available for I/O.

Chapter 3

Hardware Setup

Overview

IMPORTANT: Before attempting to install Secure Path Version 2.1a, please read the Release Notes.

This chapter provides the following Secure Path installation information:

- Reference material for high availability connection options
- Installation prerequisites
- Installation procedures for hub-based FC Arbitrated Loop (FC-AL) mode
- Installation procedures for switch-based FC Fabric (FC-SW) mode
- Installation procedures for Ultra SCSI HSZ80 RAID Storage

High Availability Connection Options Reference Material

Before installing Secure Path on a new or existing Fibre Channel configuration, review the RA8000/ESA12000 High Availability (HA) Application Notes for Sun Solaris found on the Compaq website. They will help familiarize you with the high availability connection layout (FC devices and cabling) of the configurations desired.

The application notes present a topological layout of several HA options. They provide part numbers, list related product documents, and discuss restrictions that apply when Secure Path co-exists with other software packages and FC hardware devices. The High Availability Application Notes documents supporting Sun Solaris are:

- RA8000/ESA12000 FC-AL High Availability Configurations for Sun Solaris, part number EK-FCALH-AA
- RA8000/ESA12000 Storage Area Network High Availability Configurations for Sun Solaris*, part number AA-RLMGB-TE

  * contains FC Fabric configuration options

Secure Path V2.1a introduces support for the Ultra SCSI HSZ80 RAID Storage and does not have existing applications notes for High Availability at this writing.

Access the Compaq website at:

www.compaq.com/products/storageworks

Components Required for Fibre Channel Secure Path Installation

Verify receipt of the Secure Path software kit and the FC hardware ordered for the installation. If any components are missing, please contact the account representative or call the Compaq Customer Services Hotline at (800) 354-9000. The basic requirements for Secure Path operation are listed in Table 3–1.

Table 3–1 Secure Path Fibre Channel Prerequisites

Host Feature	Requirement			
Platform	Sun Sparc			
Operating System	Solaris 8, Solaris 7, Solaris 2.6			
Kernel Mode	32-bit; 64-bit			
Sun Hardware	Sun4d servers Sun4u Servers			
Secure Path Software Kit	SANworks Secure Path V2.1a for Sun Solaris			
RAID Storage System(s)	StorageWorks RA8000/ESA12000, MA8000/EMA12000 or MA6000 (FC) with either HSG60 or HSG80 dual controllers			
Solution Software Kit	StorageWorks Solution Software for Sun Solaris. See Table 4–1 in Chapter 4 for supported solution kits.			
Host bus Adapter(s)	FC PCI 32-bit Adapter 380576-001 (SWSA4-PC) FC Sbus 64-bit Adapter 123503-001 (DS-SWSA4-SC)			
FC Hubs	7-port hub 242795-B21 (DS-SWXHX-07) 12-port hub 245573-B22 (DS-DHGGB-AB)			
FC Cables	FC Cables 234457-* (BNGBX-nn)			
Fibre Channel (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)

Table 3–1 Secure Path Fibre Channel Prerequisites (Continued)

Host Feature	Requirement			
	Compaq	16-Port	158225-B21	(DS-DSGGB-BB)
	Compaq	16-Port	212776-B21	(DS-DSGGC-AB)
GBICs	FC Optical GBIC 380561-B21 (Short Wave)			

Fibre Channel Installation

NOTE: These steps apply to systems using the HSG60 or HSG80 controllers. However, the HSG80 has been used consistently throughout the examples.

FC Arbitrated Loop Mode Installation

This section provides the steps for installing and configuring RAID systems and Sun servers for Secure Path operation in FC Arbitrated Loop (hub) mode.

IMPORTANT: If this is an installation of Secure Path on an existing RAID storage system, **all** I/O to the RAID system must be stopped and steps 1 and 2 below, skipped.

1. Unpack the RAID system and install the PCMCIA cards in the controllers.
2. Power On the RAID system. Allow the cache batteries to charge, if necessary, before proceeding.

CAUTION: For each RAID system in a production environment being converted to Secure Path operation, make sure that all users have logged off the Sun Solaris server(s) and that all I/O to the RAID system(s) has ceased. Follow normal procedures to back up the storage systems before proceeding.

3. Establish a serial connection to the RAID storage system and use the CLI utility to configure the RAID system and create storagesets, as required.

CAUTION: Before proceeding, allow initialization of the storagesets to complete.

NOTE: Secure Path installation requires that at least one unit be configured on the RAID storage system, but a complete disk device configuration is strongly recommended. Additionally, the unit(s) must be visible on two paths from the Solaris server using the *format* command.

4. Using the CLI, determine the configuration of the RAID system with the following command:

   CLI> **show this_controller**

or

   CLI> **show other_controller**

An example of the controller output (with line numbers appended for reference) follows.

```
Controller:                                                    1.
     HSG80 ZG90305234 Software V85F-0, Hardware E05            2.
     NODE_ID         = 5000-1FE1-0000- 8920                    3.
     ALLOCATION_CLASS = 0                                      4.
     SCSI_VERSION    = SCSI-2                                  5.
     Configured for dual-redundancy with ZG90811309            6.
        In dual-redundant configuration                        7.
     Device Port SCSI address 6                                8.
     Time: 01-AUG-2000   09:39:19                              9.
     Command Console LUN is disabled                          10.
Host PORT_1:                                                  11.
     Reported PORT_ID = 5000-1FE1-0000- 8921                  12.
     PORT_1_TOPOLOGY = LOOP_HARD (standby)                    13.
     PORT_1_AL_PA    = 72 (72 negotiated)                     14.
Host PORT_2:                                                  15.
```

```
    Reported PORT_ID = 5000-1FE1-0000- 8922                    16.
    PORT_2_TOPOLOGY = LOOP_HARD (loop up)                      17.
    PORT_2_AL_PA    = 71 (71 negotiated)                       18.
    NOREMOTE_COPY                                              19.
Cache:                                                         20.
    64 megabyte write cache, version 0012                      21.
    Cache is GOOD                                              22.
    No unflushed data in cache                                 23.
    CACHE_FLUSH_TIMER = DEFAULT (10 seconds)                   24.
Mirrored Cache:                                                25.
    64 megabyte write cache, version 0012                      26.
    Cache is GOOD                                              27.
    No unflushed data in cache                                 28.
Battery:                                                       29.
    NOUPS                                                      30.
    FULLY CHARGED                                              31.
    Expires:              16-DEC-2001                          32.
```

a. If the RAID storage system controllers are in Transparent Failover Mode (see line 6 of example controller output), then they must be reconfigured for Multiple-bus Failover Mode as documented in Appendix E.

   When converting to Multiple-bus Failover Mode, it is recommended that a left-side or right-side pair of ports be cabled for the loop configuration. A configuration in this manner will have the first loop configuration utilizing the top (left or right port) controller and the second loop configuration utilizing the bottom (left or right port) controller for the second loop configuration for Secure Path. For Secure Path configurations, the identical Arbitrated Loop Physical Address (ALPAs) will not cause a problem as they are on different loops. In a large installation, it is recommended that the ALPAs be set to unique values to make explicit the path from an adapter to a port. (Refer to Appendix D for ALPA values.)

b. Set the Preferred Path for each storage unit to specify the controller that the unit

will use upon the RAID system boot time as follows:

First, enter the following command to obtain a list of all units defined in the RAID system:

CLI> **show units full**

An example of the "show units" output follows:

```
D11                              DVGRPR0    (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)
```

As shown in this example, the state of the path is on-line to this_controller, and no preferred path has been assigned.

Next, enter the following commands to specify the preferred path for each of the units:

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

- or -

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

Example:

CLI > **set d11 preferred_path = other_controller**

To transition the units to the preferred path, enter the following CLI commands:

CLI> **shutdown other_controller**

CLI> **shutdown this_controller**

Depress and release the reset button on each controller at the same time.

5. Power down the server. Install the Fibre Channel adapters as necessary per the adapter installation instructions. Cable the Fibre Channel adapter and the RAID storage system controllers to the hubs, as shown in Figure 3–1.

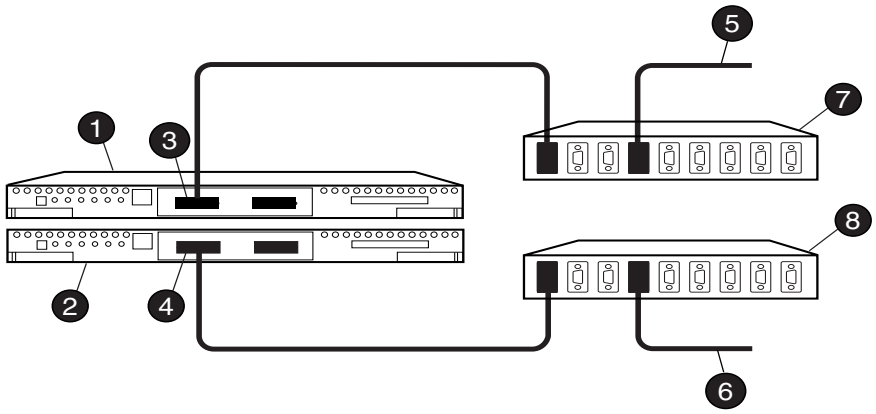

Figure 3–1. Cabling Two RAID Controllers and Two FC Hubs

❶ Top HSGx0 Controller

❷ Bottom HSGx0 Controller

❸ Top Controller, port 1 (to host via top hub)

❹ Bottom Controller, port 1 (to host via bottom hub)

❺ FC cable to host bus adapter A

❻ FC cable to host bus adapter B

❼ FC-AL hub (top)

❽ FC-AL hub (bottom)

6. Power On the server.
7. Boot the system using the reconfiguration switch as follows:

   # **touch /reconfigure**

   # **reboot**
   Secure Path installation requires that at least one LUN be configured on the RAID storage system, but a complete disk/device configuration is strongly recommended. Additionally, the units) must be visible on two paths from the Solaris Server using the *format* command.

8. Install or reinstall the Solution Software for Solaris kit as required and configure the Fibre Channel drivers for loop mode.

   NOTE: Refer to the *Solution Software for Sun Solaris – Installation and Reference Guide* for detailed Solution Software configuration information, including SWCC Agent and arbitrated loop.

9. After installing the Solaris Solution software, invoke the config.sh in the /opt/steam/bin area (or the default installation directory selected), and perform the following two steps:

   a. Add the new adapter(s) to the host system and configure the new adapters for the intended targets on the RAID storage system. When adding the new FC adapter to the system, it is important to also add support for the *target* that is associated with the *ALPA* that is set for the host port. For example, if host port 1 is configured for ALPA 71, the target value assigned to this adapter will be 65. This change is made via the */opt/steam/config.sh* utility, under option 20, then option 4 *Modify/ Add Adapters*. The target to ALPA mapping is included in Appendix D.

   NOTE: If you had selected the default installation path for the CPQhsg80 package, invoke: **/opt/steam/bin/config.sh Option 20**. If you chose an alternate location during the installation of the CPQhsg80 package, invoke: **your area/steam/bin/config.sh Option 20**.

   b. Reboot the server(s) and verify that the targets on the RAID storage system are visible on both adapters. This critical step ensures that Secure Path will be able to configure the server. If the two paths are not visible, refer to the *Solution Software for Sun Solaris – Installation and Reference Guide* to resolve the problem.

10. After the server has been rebooted, check to ensure that each connection has an offset of 0 and that its operating system is set to SUN, using the following commands:

    a. Inspect the connection settings. Enter:

       CLI > **show connections**

       Example of the show connections output:

```
Connection                                                          Unit
Name          Operating system      Controller  Port  Address   Status   Offset
!NEWCON32          SUN                 THIS      1     000001   OL this    0
     HOST_ID=1000-00E0-6940-123C                ADAPTER_ID=2000-00E0-6940-123C
!NEWCON34          SUN                 OTHER     1     000001   OL other   0
     HOST_ID=1000-00E0-6940-11A8                ADAPTER_ID=2000-00E0-6940-11A8
```

    b. To set the operating system:

    CLI > **set (connection name) operating_system = sun**

c. For shared storage (accessed by more than one server) it is recommended that both offset and enable_access_path be applied to each connection and unit on the RAID system as necessary.

To set the offset, if necessary:

CLI > **set (connection name) unit_offset = offset_value**

For installations that will not have shared storage, an offset of 0 is recommended.

CLI > **set (connection name) unit_offset = 0**

To set the enable_access_paths,

CLI > **set D*n* disable_access_path = all**

CLI > **set D*n* enable_access_path = connection_name, connection_name**

Restart both controllers using:

CLI> **restart other**

CLI> **restart this**

The RAID System is now ready for the installation of the Secure Path Software, as described in Chapter 4.

FC Fabric Mode Installation

This section provides the steps for installing and configuring RAID system(s) and Sun server(s) for Secure Path operation in FC Fabric (Switch) mode.

IMPORTANT: If this is an installation of Secure Path on an existing RAID storage system, **all** I/O to the RAID system must be stopped and steps 1 and 2 below, skipped.

1. Unpack the RAID system and install the PCMCIA cards in the controllers.
2. Power On the RAID system. Allow the cache batteries to charge, if necessary, before proceeding.

CAUTION: For each RAID system in a production environment being converted to Secure Path operation, make sure that all users have logged off the Sun Solaris server(s) and that all I/O to the RAID system(s) has ceased. Follow normal procedures to backup the storage systems before proceeding.

3. Establish a serial connection to the RAID storage system and use the CLI utility to configure the RAID system and create storagesets, as required.

CAUTION: Before proceeding, allow initialization of the storagesets to complete.

NOTE: Secure Path installation requires that at least one LUN be configured on the RAID storage system, but a complete disk/device configuration is strongly recommended. Additionally, the units must be visible on two paths from the Solaris Server using *format*.

4. Using the CLI, determine the configuration of the RAID system with the following command:

   CLI > **show this_controller**

   or

   CLI> **show other_controller**

   An example of the controller output (with reference line numbers appended) follows.

```
Controller:                                                    1.
    HSG80 ZG90305234 Software V85F-0, Hardware E05             2.
    NODE_ID         = 5000-1FE1-0000- 8920                     3.
    ALLOCATION_CLASS = 0                                       4.
    SCSI_VERSION    = SCSI-2                                   5.
    Configured for dual-redundancy with ZG90811309             6.
       In dual-redundant configuration                         7.
    Device Port SCSI address 6                                 8.
    Time: 01-AUG-2000  09:39:19                                9.
    Command Console LUN is disabled                           10.
Host PORT_1:                                                  11.
    Reported PORT_ID = 5000-1FE1-0000-8923`                   12.
    PORT_1_TOPOLOGY = FABRIC (fabric up)                      13.
Address         = 021000                                      17.
```

Host PORT_2:		14.
Reported PORT_ID = 5000-1FE1-0000-8924		15.
PORT_2_TOPOLOGY = FABRIC (connection down)		16.
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.
Expires:	16-DEC-2001	31.

a. If the controllers are in Transparent Failover Mode (see line 6 of example controller output) they must be reconfigured for Multiple-bus Failover Mode. Configure the RAID system controllers for Multiple-bus Failover Mode as documented in Appendix E.

In Transparent Failover Mode, under fabric configuration, both left-hand ports share the same WWPN. Similarly, both right-hand ports share the same WWPN.

When changing the HSGx0 controller pair from Transparent Failover Mode to Multiple-bus Failover Mode in fabric, however, the WWPN for the different host ports are all unique. This information is necessary when using the */opt/steam/config.sh* utility to assign the WWPN to target mapping for configuring the new adapter(s).

For example, in Transparent Failover Mode, host port 1 has a WWPN of 5000-1FE1-0000-8921. This is the same for the top and bottom controllers. When the controllers are configured for Multiple-bus Failover Mode, the WWPN for port 1 of the top controller will change to 5000-1FE1-0000-8923, while host port 1 of the lower controller will have a WWPN of 5000-1FE1-0000-8921. The target to WWPN map must reflect these different values.

b. Set the preferred path for each storage unit to specify the controller that the unit will use upon the RAID system boot time as follows:
First, enter the following command to obtain a list of all units defined in the RAID storage system:

```
CLI> show units full
```

An example of the show units output follows:

```
D11                          DVGRPR0    (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)
```

As shown in this example, the state of the path is on-line to this_controller and no preferred path has been assigned.

Next, enter the following commands to specify the preferred path for each of the units:

```
CLI> set (unit #) preferred_path = this_controller
 - or -
CLI> set (unit #) preferred_path = other_controller
```

Example:

CLI> **set d11 preferred_path = other_controller**

To transition the units to the preferred path, enter the following CLI commands:

CLI> **shutdown other_controller**

CLI> **shutdown this_controller**

To restart the controllers, depress and release the reset button on each controller at the same time.

5. Power down the server. Install the Fibre Channel adapters as necessary per the adapter installation instructions.
6. Cable the Fibre Channel adapter and the RAID storage system controllers to the SAN Switches, as shown in Figure 3–2.

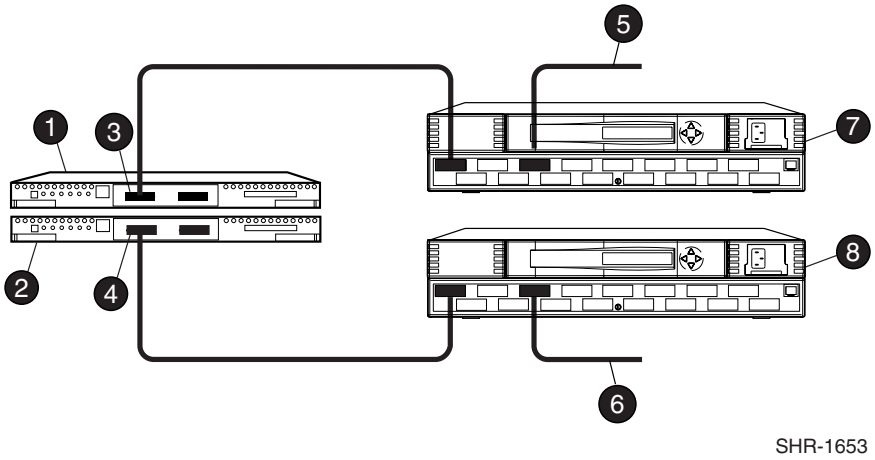

Figure 3–2. Cabling Two RAID Controllers and Two SAN Switches

❶ Top HSGx0 Controller

❷ Bottom HSGx0 Controller

❸ Top Controller, port 1 (to host via top switch)

❹ Bottom Controller, port 1 (to host via bottom switch)

❺ FC cable to host bus adapter A

❻ FC cable to host bus adapter B

❼ SAN Switch (top)

❽ SAN Switch (bottom)

7. Power On the server.
8. Boot the system using the reconfiguration switch as follows:

   # touch /reconfigure

   # reboot

9. Install or reinstall the Solution Software for Solaris kit as required and configure the Fibre Channel drivers for fabric mode. This is done with the /opt/steam/bin/config.sh utility using *Option 20*, and then *Option 4*.

   NOTE: If you had selected the default installation path for the Solution Software, invoke**: /opt/steam/bin/config.sh Option 20**. If you chose an alternate location invoke **your_area/steam/bin/config.sh Option 20**.

   NOTE: Refer to the *Solution Software for Sun Solaris – Installation Reference Guide* for detailed Solution Software configuration information, including SWCC Agent and fabric instances of the WWPNs.

   Verify that the correct WWPNs have been mapped to targets. This information is found in the output displayed using the following commands:

   CLI> **show this**

   CLI> **show other**

10. After the server has booted, check the RAID storage system to ensure that each connection has an offset of 0 and that its operating system is set to SUN, using the following commands:

    a. To inspect the connection settings, enter:

       CLI> **show connections**

    Example show connections output:

Connection Name	Operating system	Controller	Port	Address	Status	Unit Offset
!NEWCON32	SUN	THIS	1	000001	OL this	0
HOST_ID=1000-00E0-6940-123C		ADAPTER_ID=2000-00E0-6940-123C				
!NEWCON34	SUN	OTHER	1	000001	OL other	0
HOST_ID=1000-00E0-6940-11A8		ADAPTER_ID=2000-00E0-6940-11A8				

    b. To set the operating system:

       CLI> **set (connection name) operating_system = sun**

    c. For shared storage (accessed by more than one server) it is recommended that both

offset and enable_path_access be applied to each connection and unit on the RAID system as necessary.

To set the offset, if necessary:

CLI > **set (connection name) unit_offset = offset_value**

For installations that will not have shared storage, an offset of 0 is recommended.

CLI > **set (connection name) unit_offset = 0**

To set the enable_access_paths,

CLI > **set D*n* disable_access_path = all**

CLI > **set D*n* enable_access_path = connection_name, connection_name**

CLI > **restart other**

CLI > **restart this**

The RAID System is now ready for the installation of the Secure Path Software, as described in Chapter 4.

Components Required for RA8000/ESA12000 Ultra SCSI Secure Path Installation

Table 3–2 details the prerequisites for an installation of Secure Path and also provides a list of the possible key components depending on the existing configuration.

Table 3–2 Secure Path Ultra SCSI Prerequisites

Host Feature	Requirement
Platform	Sun Sparc
Operating System	Solaris 8, Solaris 7, Solaris 2.6
Mode	32-bit; 64-bit
Sun Hardware	Sun4d servers Sun4u Servers
Secure Path Software Kit	SANworks Secure Path V2.1a for Sun Solaris

Table 3–2 Secure Path Ultra SCSI Prerequisites

Host Feature	Requirement		
RAID Storage System(s)	StorageWorks RA8000/ESA12000 Ultra SCSI with HSZ80 dual controllers		
Solution Software Kit	StorageWorks Solution Software for Sun Solaris. See Table 4–1 in Chapter 4 for supported solution kits		
Host Bus Adapters	Sun X1065A (Sbus) Sun X6541A (PCI)		
Ultra SCSI Key Components	SCSI Hub, 3-Port	400561-B21	DS-DWZZH-03
	SCSI Hub, 5 port	400562-B21	DS-DWZZH-05
	Trilink connector	401948-001	H8861-AA
	Host bus cable, 0.5 meter	400984-001	BN37A-0E
	Host bus cable, 2 meters	400982-002	BN37A-02
	Host bus cable, 5 meters	400983-005	BN37A-05
	Host bus cable, 10 meters	400985-010	BN37A-10
	Host bus cable, 15 meters	400986-015	BN37A-15
	Host bus cable 20 meters	400987-020	BN37A-20
	Terminator	401947-001	H8863-AA

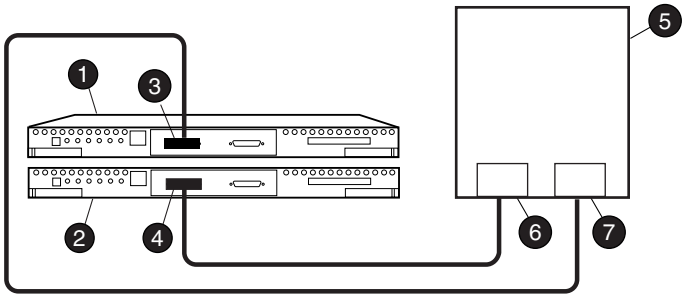

Figure 3–3. Cabling two RAID Controllers and HBAs for a Ultra SCSI Configuration

❶ Top HSZ80 Controller

❷ Bottom HSZ80 Controller

❸ Top Controller, port 1

❹ Bottom Controller, port 1

❺ Solaris Server

❻ HBA 0

❼ HBA 1

Ultra SCSI Installation

This section provides the steps for installing and configuring Ultra SCSI (HSZ80) RAID system(s) and Sun server(s) for Secure path.

IMPORTANT: If this is an installation of Secure Path on an existing RAID storage system, **all** I/O on the RAID system must be stopped and steps 1 and 2 below, skipped.

1. Unpack the RAID system and install the PCMCIA cards in the controllers
2. Power On the RAID system. Allow the cache batteries to charge, if necessary, before proceeding.

CAUTION: For each RAID system in a production environment being converted to Secure Path operation, make sure that all users have logged off the Sun Solaris server(s) and that all I/O to the RAID system(s) has ceased. Follow normal procedures to backup the storage systems before proceeding.

3. Establish a serial connection to the RAID storage system and use the CLI utility to configure the RAID system and create storagesets.

CAUTION: Before proceeding, allow initialization of the storagesets to complete.

NOTE: Secure Path installation requires that at least one unit be configured on the RA8000/ESA12000 Ultra SCSI system, but a complete disk/device configuration is strongly recommended. Additionally, the units(s) must be visible on two paths from the Solaris Server using the *format* command.

4. Using the CLI, determine the configuration of the RAID system with the following command

   CLI> **show this_controller**

   or

   CLI> **show other_controller**

   An example of the controller output (with line numbers appended for reference) follows. The controller in this display is already set to multiple bus failover.

```
Controller:
    HSZ80 ZG81400218 Software V8.3Z-0, Hardware  E02                    1.
    NODE_ID         = 5000-1FE1-0000-13D0                              2.
    ALLOCATION_CLASS = 0                                               3.
   SCSI_VERSION     = SCSI-2                                           4.
    Configured for MULTIBUS_FAILOVER with ZG82500433                   5.
   In dual-redundant configuration                                     6.
    Device Port SCSI address 7                                         7.
    Time: 01-AUG-2000  09:39:19                                        8.
Host PORT_1:                                                           9.
    SCSI target(s) (0, 1, 2, 3, 4)                                     10.
    TRANSFER_RATE_REQUESTED = 20MHZ                                    11.
```

```
    Host Functionality Mode = F                                    12.
Host PORT_2:                                                       13.
    SCSI target(s) (0, 1, 2, 3, 4)                                 14.
     TRANSFER_RATE_REQUESTED = 20MHZ                               15.
    Host Functionality Mode = F                                    16.
     Command Console LUN is disabled                               17.
Cache:                                                             18.
    64 megabyte write cache, version 0012                          19.
    Cache is GOOD                                                  20.
     No unflushed data in cache                                    21.
     CACHE_FLUSH_TIMER = DEFAULT (10 seconds)                      22.
Mirrored Cache:                                                    23.
     64 megabyte write cache, version 0012                         24.
    Cache is GOOD                                                  25.
    No unflushed data in cache                                     26.
Battery:                                                           27.
    NO UPS                                                         28.
    FULLY CHARGED                                                  29.
```

5. If the controllers are in Transparent Failover Mode (see lines 5 and 6 of example controller output) they must be reconfigured for Multiple-bus Failover Mode as documented in the Appendix E.
6. After the server has booted, check the RAID storage system to ensure that the RAID array has the correct Host Mode setting for SUN, mode F. (See lines 12 and 16 in the example controller above.) If this mode is not set or incorrectly set, use

   CLI> **set this host_function = f**
7. Create the storage sets on the RAID storage system.

   On the HSZ80 RAID array units are assigned a unit number of D**n**. The value **n** of D**n** carries target and LUN values, either implicitly or explicitly.

The general format is D-TT-LL where the first two digits (TT) represent the target value and the second two (LL), the LUN. However, leading zeros are not required in the string and this includes the target and or LUN values.

Determining the target and LUN values of a unit requires that the D**n** be read from **right to left to identify the LUN and the target**.

Examples:	D1207	=>>	target=12,	lun=07
	D401	=>>	target= 4,	lun=01
	D5	=>>	target= 0	lun=5
	D0	=>>	target= 0	lun=0

In general, for Solaris assuming the default scsi-initiator value of 7, we have the following Targets and LUNS.

D**n** Value	Target Value	Target Range	LUN Value	LUN Range
Dz	**0**	**0**	**z**	**0-9**
Dyz	**0**	**0**	**yz**	**00-15**
Dxyz	**x**	**00-6, 8, 9**	**yz**	**00-15**
Dwxyz	**wx**	**00-06, 08-15**	**yz**	**00-15**

NOTE: When a device file and link are created on the server, the target and LUN are used in the construction of cXtYdZ. Example:

D123 on Controller 1 is C1t12d3

8. Set the preferred path for each storage unit to specify the controller that the unit will use upon the RAID system boot time as follows:

   Enter the following command to obtain a list of all units defined in the RAID storage system:

   CLI> **show units full**

   An example of the show units output follows:

```
D02                                DISK50300                                1.
    LUN ID:    6000-1FE1-0000-13D0-0009-8140-0218-01A2                      2.
    Switches:                                                               3.
    RUN              NOWRITE_PROTECT    READ_CACHE                          4.
    READAHEAD_CACHE     WRITEBACK_CACHE                                     5.
    MAXIMUM_CACHED_TRANSFER_SIZE = 32                                       6.
    Access:                                                                 7.
    THIS_PORT_1  = (0, 1, 5, 6, 15)                                         8.
    THIS_PORT_2  = (0, 1, 5, 6, 15)                                         9.
    OTHER_PORT_1 = ALL                                                      10.
    OTHER_PORT_2 = ALL                                                      11.
    State:                                                                  12.
    ONLINE to this controller                                               13.
    Not reserved                                                            14.
    NOPREFERRED_PATH                                                        15.
    Size: 8378028 blocks                                                    16.
    Geometry (C/H/S): ( 3708 / 20 / 113 )                                   17.
```

As shown in lines 13 and 15 of this example, the state of the path is on-line to this_controller and no preferred path has been assigned.

Next, enter the following commands to specify the preferred path for each of the units:

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

- or -

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

Example:

CLI> **set d2 preferred_path = other_controller**

To transition the units to the preferred path, enter the following CLI commands:

CLI> **shutdown other_controller**

CLI> **shutdown this_controller**

To restart the controllers, depress and release the reset button on each controller at the same time.

9. Power down the server. Install the Ultra SCSI adapters as necessary per the adapter installation instructions.

10. Cable the adapters and the RAID storage system controllers.

11. Power on the server.

12. Boot the system with reconfiguration as follows:

    # touch /reconfigure

    # reboot

13. Install or reinstall the Solution Software for Solaris kit as required and configure the adapters under the solution kit configuration utility in */opt/steam/bin/config.sh* using Option 20*, Add/Modify Adapters* and then Option 4.

    NOTE: If you had selected the default installation path for the Solution Software, invoke**: /opt/steam/bin/config.sh** Option 20. If you chose an alternate location during the installation of the Solution Software, invoke: ***your_area*/steam/bin/config.sh** Option 20 and then Option 4.

    NOTE: Refer to the applicable Solution Software for Sun Solaris – Installation Reference Guide for detailed configuration information.

14. Shared Storage

    For shared storage it is possible to set modes for units using

    CLI> **set this host_function = (id,host_function_mode)**

    Additionally, for shared storage, it is recommended that access control be applied to each unit (Dn) on the RAID system as required. Storage is shared on the HSZ80 controller by SCSI ID - either the default server scsi-initiator-id or the specific adapter scsi-id.

    For the Ultra SCSI RAID storage system, the CLI command set for access control is:

    THIS_PORT_1_DISABLE_ACCESS_PATH = XX

    THIS_PORT_2_DISABLE_ACCESS_PATH = XX

```
THIS_PORT_1_ENABLE_ACCESS_PATH =  XX
THIS_PORT_2_ENABLE_ACCESS_PATH = XX
OTHER_PORT_1_DISABLE_ACCESS_PATH = XX
OTHER_PORT_2_DISABLE_ACCESS_PATH = XX
OTHER_PORT_1_ENABLE_ACCESS_PATH = XX
OTHER_PORT_2_ENABLE_ACCESS_PATH = XX
```

where the value of XX may be "ALL" or a SET of SCSI IDs for exclusive access.

Example: Clear any existing access.

```
CLI> set  d15  this_port_1_disable_access_path = all
CLI> set d15  this_port_2_disable_access_path = all
```

Set desired access for servers with SCSI ID of 2 and 7

```
CLI> set d15 this_port_1_enable_access_path =  (2,7)
CLI> set d15 this_port_2_enable_access_path =  (2,7)
```

The system is now ready for the installation of the Secure Path Software as described in Chapter 4.

Chapter 4

Installing Secure Path Software

Overview

IMPORTANT: Before attempting to install Secure Path Version 2.1a, please read the Release Notes.

This chapter provides the procedures to install a *new* Secure Path software configuration. For information on upgrading *existing* Secure Path configurations to Secure Path V2.1a, and/or from a FC loop to SAN switch (FC fabric), or for adding an Ultra SCSI Storage system with HSZ80 controllers, see Appendix B.

Prerequisites

Verify that the following requirements and the requirements in Table 4–1are met:

- One of the following StorageWorks Solaris Solution Software kits as appropriate for the RAID Array(s) and Sun server are installed.

Table 4–1 Solaris Solution Kits by RAID System

Solaris OS	HSZ80	HSG80	HSG60
2.6, 2.7, **2.8**	CPQfcraid V2.3c [1] [2] CPQ/JNI driver = 2.5.9	CPQfcraid V2.3c [1] [2] CPQ/JNI driver = 2.5.9	CPQfcraid V2.3c [1] [2] CPQ/JNI driver=2.5.9
2.6, 2.7, **2.8**	CPQraidsw V2.2 agent=2.2		
	ACS Version 8.3Z	**ACS Version 8.5F, 8.5G, 8.5P, 8.5S**	**ACS Version 8.5L**

[1] **Default install is Fibre channel; if configuring for SCSI, a manual installation is required.**

[2] Supports both the JNI PCI and Sbus Fibre Channel adapters.

- The procedures in Chapter 3, *Hardware Setup* are successfully completed.
- Only one physical connection (path) exists between each RAID controller and each host bus adapter.

  NOTE: Using a pair of adapters and a pair of controllers at the RAID system means there are two paths.

- At least one unit is configured on the RAID storage system and is visible to the server from both paths. Ideally, and strongly recommended, the RAID storage systems are configured with all the desired storagesets/units.

Installing Secure Path Software

Install Secure Path software as follows:

> **CAUTION:** For each RAID system in a production environment that is being converted to Secure Path operation, make sure that all users have logged off the Sun Solaris server(s) and that all I/O to the RAID system(s) has ceased. Follow normal procedures to backup the storage systems before proceeding.

1. Back up the entire system according to normal procedures.
2. Mount the CD-ROM.

   Check to make sure that *vold,* the volume management daemon, is running.

   Enter:

   # ps –ea | grep vold

If *vold* **i**s currently running:

a. Insert the CD-ROM into the CD-ROM Drive.

b. Check that the volume manager has automatically mounted the CD-ROM, by entering:

   # mount

   NOTE: The system command may take a few seconds to mount the CD-ROM. If the *mount* command does not indicate that the CD_ROM has been mounted, wait a short interval and then repeat the command. The *volcheck* command may be used to force *vold* to check for mounted media.

c. Change to the Solaris directory. Enter:

   # cd /cdrom/sp_v21a_sun/solaris

d. Continue with step 3.

If *vold* **is not** currently running:

a. Insert the CD-ROM into the CD-ROM drive.

b. Mount the CD-ROM. For example, enter:

   # mount –f hsfs –r /dev/dsk/c0t6d0s2 /cdrom

c. Change to the Solaris directory, enter:

   # cd /cdrom/sp_v21a_sun/solaris

3. Install Secure Path software, *CPQswsp,* on the Sun Solaris servers. The Secure Path software is installed using the Solaris *pkgadd* utility.

   Enter:

   # pkgadd –d pkgs

   Below is a sample successful installation script.

IMPORTANT: As shown in the sample installation, the post-install script displays a warning that the driver (mda) failed to attach. This is an expected warning because the Secure Path has not been completely configured. (After the configuration files are generated and the server rebooted, the driver will successfully attach).

Sample successful installation script:

 # pkgadd -d pkgs

The following packages are available:

1 CPQswsp SANworks Secure Path

(sparc) 21a

Select package(s) you wish to process (or 'all' to process all packages). (default: all) [?,??,q]:

Processing package instance <CPQswsp> from </tmp>

SANworks Secure Path

(sparc) 21a

Copyright Compaq Computer Corporation 2000, All rights reserved.

[complete Copyright text]

Using </opt> as the package base directory.

Processing package information.

Processing system information.

3 package pathnames are already properly installed.

Verifying package dependencies.

Verifying disk space requirements.

Checking for conflicts with packages already installed.

Checking for setuid/setgid programs.

This package contains scripts which will be executed with super-user permission during the process of installing this package.

Do you want to continue with the installation of <CPQswsp> [y,n,?] **y**

Installing SANworks Secure Path as <CPQswsp>

Installing part 1 of 1.

/etc/init.d/spinit

/kernel/drv/ldLite

/kernel/drv/ldLite.conf

/kernel/drv/ldLite.conf.proto

... [files are moved to respective path areas]

[verifying class <none>]

/etc/rcS.d/S65spinit <linked pathname>

Executing postinstall script.

drvconfig: Driver (mda) failed to attach

Warning: Driver (mda) successfully added to system but failed to attach

NOTE: This message may be ignored as the mda devices are not yet configured. When the server is rebooted, after configuration (see Chapter 5), the mda driver will load successfully

Installation of <CPQswsp> was successful.

NOTE: A message is posted informing the user that the configuration tool, ***spconfig***, must be invoked prior to rebooting the server to complete the installation. The command is:

#/opt/CPQswsp/bin/spconfig -o -p /kernel/drv

<END of sample installation>

The system is now ready to be configured. Enter:

reboot

Proceed to Chapter 5.

Chapter 5

Using *spconfig* to Configure the System for Secure Path

Invoking *spconfig*

During the installation of the Secure Path software, the installation specifically requests that the configuration tool, *spconfig,* be invoked to configure Secure Path.

The *spconfig* tool is designed as a first-time, non-reentrant configuration tool for the files *mda.conf*, *ldLite.conf*, *fca-pci.conf*, *fcaw.conf*, *sd.conf* which are located in /kernel/drv.

The s*pconfig* tool requires at least one LUN with two visible paths on the server. This LUN allows *spconfig* to communicate with the RAID storage system to gather information required for the configuration files named above.

> **NOTE:** Before running *spconfig*, it is recommended that you record the controller's serial numbers for each RAID system.

Some configurations may present too many combinations for *spconfig* to determine the desired HBA and RAID storage system combinations.

The *spconfig* utility must be run interactively, requiring user input to define the configuration. Interactive configuration is accomplished by invoking *spconfig* with a switch to indicate operator intervention (-o) as follows:

```
# /opt/CPQswsp/bin/spconfig -o -p /kernel/drv
```

Sample *spconfig* session:

Provided below is a sample *spconfig* session (partial) with comments regarding the required prompt input.The session is from a system that has a pair of Sbus and a pair of PCI adapters to two separate RAID systems. Only pairs of the same adapter are supported.

```
root# /opt/CPQswsp/bin/spconfig -o -p /kernel/drv
```

Spconfig identifies the device, HBA, and RAID storage system and queries if this represents a Secure Path device/target. Answer yes or no in response to each query. With a yes response, *spconfig* will gather information about that RAID storage system.

```
---------------------------------------
Found the following target:
  Device:      /dev/rdsk/c3t65d0s2
  HBA:         /pci@b,2000/fibre-channel@2
  RAID Array:      this -> ZG81701026
                   other -> ZG81700977
---------------------------------------
Is this a valid SecurePath Device/Target? [y or n]:y
Talking to Controllers on /dev/rdsk/c3t65d0s2.
Found 13 Luns.
```

As *spconfig* displays other devices, HBAs, and RAID storage system entries, respond with a yes or no to indicate if this entry is part of the Secure Path configuration.

```
---------------------------------------
Found the following target:
  Device:       /dev/rdsk/c2t64d0s2
  HBA:          /sbus@6,0/fcaw@2,0
  RAID Array: this -> ZG92810311
                other -> ZG92810388
---------------------------------------
Is this a valid SecurePath Device/Target? [y or n]:y
Talking to Controllers on /dev/rdsk/c2t64d0s2.
Found 19 Luns.
```

When the Secure Path HBAs and RAID storage systems have been identified, *spconfig* displays the complete list of Target/LUNs found.

```
        Found                                   LUN ID                  /dev/rdsk
-------------------------------------------------------------------------------------------------------
Getting: 6000-1FE1-0000-3250-0009-8170-1026-0076                    /dev/rdsk/c3t65d0s2
Getting: 6000-1FE1-0000-3250-0009-8170-1026-007A                    /dev/rdsk/c3t65d0s2
Getting: 6000-1FE1-0000-3250-0009-8170-1026-007E                    /dev/rdsk/c3t65d0s2
.
.
.
Getting: 6000-1FE1-0000-3250-0009-8170-0977-0010                    /dev/rdsk/c4t64d0s2
Getting: 6000-1FE1-0000-3250-0009-8170-0977-0011                    /dev/rdsk/c4t64d0s2
-------------------------------------------------------------------------------------------------------
```

spconfig generates the configuration files, *mda.conf* and *ldLite.conf*. It modifies and/or adds entries to *sd.conf*. If the configuration is for fabric, *spconfig* writes entries to the driver configuration files, fca-pci.conf for PCI and fcaw.conf for Sbus.

```
Completed modifications to sd.conf...
Completed modifications to ldLite.conf...
Completed modifications to mda.conf...
#
```

spconfig has completed the necessary file creation and modifications and the system is ready for a configuration reboot. The preferred method is

```
# touch /reconfigure
# reboot
```

IMPORTANT: If a configuration error was encountered during installation, refer to the next section “Responding to a Configuration Error.”

Verify the Secure Path configuration by running the Secure Path Maintenance Tool, *spmt*.

Example:

```
# /opt/CPQswsp/bin/spmt display
Device: c2t0d0   Status: Operational
Storage System: 5000-1fe1-0000-8920
LUN:6000-1fe1-0000-8920-0009-9030-5234-005a
Preferred Path: none
=======================================
Controller      Unit    State    HBA      Path
=======================================
ZG90811309   D110  online     fcaw0    /sbus@3,0/fcaw@0,0
ZG90305234   D110  standby   fcaw1    /sbus@b,0/fcaw@0,0
```

Responding to a Configuration Error

Table 5–1 contains the most probable errors that the Secure Path Configuration tool, *spconfig*, reports if it cannot access the current configuration and/or create configuration files for the Secure Path V2.1a installation.

Take the corrective action to clear the reported problem and verify that the system prerequisites are met. Invoke *spconfig* again and verify the configuration.

Table 5–1 spconfig Error Messages

Error Message	Description	Correction Action
Cannot have a Fabric target less than 16	*spconfig* has determined that the target to the WWPN map contains more than 50 adapter pairs of entries. This exceeds the capabilities of *spconfig.*	Contact Compaq Support.
No valid devices were found	*spconfig* is unable to find any devices connected to a RAID storage system in Multiple-bus mode with two paths and at least one LUN.	Verify that all prerequisites stated in Chapter 4 have been met.
Previous CPQswsp entries have been found in sd.conf	*spconfig* detects another version of Secure Path is installed.	If Secure path V2.0 or V2.1 is installed, install V2.1a using the upgrade switch for pkgadd, as noted in Appendix B.
The required package (CPQhsg80, CPQfcraid or CPQraidsw) has not been installed or has not been configured	*spconfig* is unable to locate the required package header in the /kernel/drv/sd.conf file. This message typically indicates that the StorageWorks Solution Software for Solaris has not been installed.	Verify that all prerequisites stated in Chapter 4 have been met.
-p (path) not found or command line switches not passed properly	An incorrect path or path command format was entered for the location of sd.conf.	Verify that the correct command format containing the path is provided, as follows: # **/opt/CPQswsp/bin/spconfig -o -p/kernel/drv**
Out of Memory in *function_name*	Insufficient system memory exists for *spconfig* to build its required information structures.	Close unnecessary applications and/or reduce the number of concurrent users using memory. Invoke the *spconfig* command with the -o switch.

Table 5–1 spconfig Error Messages

Error Message	Description	Correction Action
Could not write *file_name* or *file_name* appears to be corrupted	Typically, an indication that unexpected manual edits have been made to the file causing an inability to read or write. In rare cases, a corrupt file has been encountered.	Verify that the correct file entries have been made.
Invalid inquiry data was returned from /dev/disk link	*spconfig* found invalid data while building a data representation for the Secure Path Devices.	Verify that all prerequisities stated in Chapter 4 have been met.
NULL buffer passed to function_name	*spconfig* found an internal inconsistency with the data representation of this configuration.	Verify that all prerequisites stated in Chapter 4 have been met.

Chapter 6

Modifying Existing Configurations

Adding Units to and Deleting Units from the RAID Storage System

The initial installation for Secure Path V2.1a will configure the existing RAID systems, making all LUNs available to the host server.

In a production environment, however, the configuration may need to be changed with the addition or deletion of a LUN at the RAID storage system. The following sections provide the steps to add or delete a unit allowing the server to acquire the new Target/LUN combinations.

CAUTION: For each RAID system in a production environment, make sure that all users have logged off the Sun Solaris servers and that all I/O to the RAID systems has ceased. Follow normal procedures to backup the storage systems before proceeding.

Adding a Fibre Channel (HSG80, HSG60) Unit

To add a unit to a Secure Path installation, follow these steps:

1. Add the unit to the RAID storage system using the CLI or SWCC interface. All examples shown use the CLI interface.

   Example:

   CLI> **add unit D18 S1**

2. Display the unit's LUN ID. Enter:

   CLI> **show D18**

   The LUN ID is displayed in the hex format:

   nnnn-nnnn-nnnn-nnnn-nnnn-nnnn-nnnn. Record this value.

   Example:

   LUN ID: 6000-1FE1-0000-8920-0009-9030-5234-006E

   From the server point of view there are two modes to consider, FC Arbitrated Loop and FC Fabric.

For each mode, there are three (3) types of additions to consider, depending on whether the RAID storage system and/or adapter pair is new or existing. Use Table 6–1 to identify the configuration scenario into which a unit will be added. The procedures for each configuration are provided in the sections that follow.

The files that require additional data entries are documented in Chapter 8. Editing the files of the Secure Path system requires a clear understanding of those file entries.

NOTE:

Refer to Appendix D for a complete list of Arbitrated Loop Physical Addresses (ALPAs).

Table 6–1 Configuration Scenarios for Adding a Unit

Configuration Mode	RAID system	Adapter Pair
A. Arbitrated Loop	Existing	Existing
B. Arbitrated Loop	New	Existing
C. Arbitrated Loop	New	New (Second Pair)
D. FC Fabric	Existing	Existing
E. FC Fabric	New	Existing
F. FC Fabric	New	New (Second Pair)

A. Arbitrated Loop Mode — Adding a New Unit onto an *Existing* RAID System Currently Configured on an *Existing* Pair of Adapters.

1. On the server, in the */kernel/drv* directory, edit the three configuration files as described in steps a through c, below.

a. ***mda.conf*** — Add two new path entries for the Target/LUN.

Example: Assume that the target is 64 and the new unit added is D18.

```
name="mda" parent= "/sbus@3,0/fcaw@0,0" target=64 lun=18;
name="mda" parent= "/sbus@b,0/fcaw@0,0" target=64 lun=18;
```

b. **1dLite.conf** — Add the new LUN ID, recorded previously.

Example: Assume that the last used targ***N***-devName in *ldLite.conf* had the value '20'.

```
Targ21-devName ="6000-1FE1-0000-0D40-0090-8090-0656-0123"; #D18
```

c. **sd.conf** — Verify that an entry exists in *sd.conf* matching the "**N**" value in the **targN**-devName entry of the *ldLite.conf* file. In the example, targ21-devName was added. An entry must exist for target 21.

Example:

```
name="sd" parent="/pseudo/ldLite@0" target = 21, lun=0;
```

2. Reboot the server. Enter:

```
# touch /reconfigure
# reboot
```

3. Verify that the server has acquired the new UNIT. Enter:

```
# format
```

Inspect the device list and verify that the new target c*X*t*Y*d*Z* has been acquired and is now visible.

B. Arbitrated Loop Mode — Adding a New Unit onto a *New* RAID System Currently Configured on an *Existing* Pair of Adapters.

1. When adding a new RAID storage system into an existing loop, define a unique set of ALPAs for the ports that will be used. All ALPAs on a loop must be unique.

In the examples that follow, the existing RAID storage system has an ALPA pair of 71, 72 (Hex) that map to decimal 64, 65. The new system being added has unique ALPAs of 73, 74 (Hex) that map to decimal 63, 62. Refer to Appendix D for ALPA values. The decimal mapping is used in *mda.conf* which follows.

IMPORTANT: When the units are added to the RAID storage system, record the LUN IDs.

2. On the server, in the */kernel/drv* directory, edit the three configuration files as described in steps a through c, below.

   a. **mda.conf** - Add two new path entries for the Target/ LUN.

      Example: Assume the target is 73 (hex) (maps to decimal 63) and the unit added is D18.

      ```
      name="mda" parent= "/sbus@3,0/fcaw@0,0" target=63 lun=18;
      name="mda" parent= "/sbus@b,0/fcaw@0,0" target=63 lun=18;
      ```

   b. **1dLite.conf** – Add the new LUN IDs, recorded previously.

      Example: Assume that the last used targ***N***-devName was 24.

      ```
      targ25-devName =
      "6000-1FE1-0000-0D40-0780-2324-0609-00E0"; #D18
      ```

      The LUN ID will differ from that of another RAID system, as it will contain the new controller identification.

   c. **sd.conf** – Verify that an entry exists in *sd.conf* matching the "**N**" value in the targ**N**-devName entry of the *ldLite.conf* file. In the example, targ25-devName was added and an entry must exist for 25.
      Example:

      ```
      name="sd" parent="/pseudo/ldLite@0" target = 25, lun=0;
      ```

3. Reboot the server by entering:

   # touch /reconfigure

   # reboot

4. Verify that the server has acquired the new UNIT. Enter:

   # format

Inspect the device list and verify that the new target c*X*t*Y*d*Z* has been acquired and is now visible.

C. Arbitrated Loop Mode - Adding a New Unit onto a *New* RAID System Configured onto a *New* (Second Pair) of Adapters in the Server.

1. With a second pair of adapters, the configuration will now have a second pair of arbitrated loops to configure. This new pair of adapters will require another pair of FC-AL hubs. Since the RAID storage systems are on separate loops, the ALPAs chosen will not conflict with those from the existing configuration. However, on the same loop, the ALPAs must be unique.

2. Assume that new controllers will have the default ALPAs of 71,72 (hex), that maps to 64, 65 decimal. (Refer to Appendix D for ALPA mappings.)
3. When the RAID storage system is configured, use the CLI to display each of the LUN IDs and record these for use in the next steps.
4. On the server, in the */kernel/drv* directory, edit the three configuration files as described in steps a through c, below.

   a. **mda.conf** — Add two new path entries for the Target/LUN.
   Example: Assume that the target is 71 (decimal 65) and the new units added are D1, D2, D12. However, since the server now has a second pair of adapters, the *parent="hardware_path"* will change to reflect the new hardware path. The hardware path may be found by invoking

   # /opt/steam/bin/config.sh

   Using Option 20, *Adding /Changing Adapters*, select *Add Adapters* from the output displayed and the software will invoke a scan of the system. Record hardware paths for the two new adapters. Do not actually add these adapters to the server list. Choose "N" when prompted to configure the adapter. The example entries below show new Sbus adapters.

   Path 1. (Add 1 entry per Unit created.)

   ```
   name="mda" parent= "/sbus@4,0/fcaw@0,0" target=65 lun=1;
   name="mda" parent= "/sbus@4,0/fcaw@0,0" target=65 lun=2;
   name="mda" parent= "/sbus@4,0/fcaw@0,0" target=65 lun=12;
   ```

   Path 2.

   ```
   name="mda" parent= "/sbus@f,0/fcaw@0,0" target=65 lun=1;
   name="mda" parent= "/sbus@f,0/fcaw@0,0" target=65 lun=2;
   name="mda" parent= "/sbus@f,0/fcaw@0,0" target=65 lun=12;
   ```

   b. **1dLite.conf** — Add the new LUN IDs, recorded previously.
   Example: Assume that the last used targ***N***-devName was "24".

   ```
   targ25-devName = "6000-1FE1-0000-0D40-0780-2324-0609-00E0";
   targ26-devName = "6000-1FE1-0000-0D40-0780-2324-0609-00F4";
   targ27-devName = "6000-1FE1-0000-0D40-0780-2324-0609-00A0";
   ```

   The LUN ID will differ from that of another RAID system, as it will contain the new controller identification.

   c. **sd.conf —** Verify that an entry exists in *sd.conf* matching the above "**N**" value in the targ**N**-devName entry of the *ldLite.conf* file. In the example, three entries were created, targ25-devName, targ26-devName, targ27-devName. Therefore an entry

must be added for each.
Example:

```
name="sd" parent="/pseudo/ldLite@0" target = 25, lun=0;
name="sd" parent="/pseudo/ldLite@0" target = 26, lun=0;
name="sd" parent="/pseudo/ldLite@0" target = 27, lun=0;
```

5. Reboot the server. Enter:

   # touch /reconfigure

   # reboot

6. Verify that the server has acquired the new UNIT. Enter:

   # format

Inspect the device list and verify that the new target c*X*t*Y*d*Z* has been acquired and is now visible.

D. FC Fabric Mode — Adding a New Unit onto an *Existing* RAID System Currently Configured on an *Existing* Single Pair of Adapters.

1. On the server, in the /kernel/drv directory, edit the three configuration files as described in steps a through c, below.

   a. **mda.conf —** Add two new path entries for the host Target/LUN.
   Example: Assuming that the target is 124 and the new unit added is D18.

   ```
   name="mda" parent= "/sbus@3,0/fcaw@0,0" target=124 lun=18;
   name="mda" parent= "/sbus@b,0/fcaw@0,0" target=124 lun=18;
   ```

   b. **1dLite.conf** — Add the new LUN ID, recorded previously from the

   ```
   CLI> show D18
   ```

   at the RAID system level.

   Example: Assume that the last used targ**N**-devName was 20.

   ```
   targ21-devName = "6000-1FE1-0000-0D40-0090-8090-0656-0123"; #D18
   ```

   c. **sd.conf** — Verify that an entry exists in *sd.conf* matching the "**N**" value in the targ***N***-devName entry of the *ldLite.conf* file. In the example, targ21-devName was added and an entry must exist for 21.
   Example:

   ```
   name="sd" parent="/pseudo/ldLite@0" target = 21, lun=0;
   ```

2. Reboot the server. Enter:

   # touch /reconfigure

   # reboot

3. Verify that the server has acquired the new UNIT. Enter:

   # format

Inspect the device list and verify that the new target c*X*t*Y*d*Z* has been acquired and is now visible.

E. FC Fabric Mode — Adding a New Unit onto *New* RAID System Currently Configured on an *Existing* Single Pair of Adapters.

1. To add another RAID system into the FC fabric requires cabling from the switch to the controllers of the RAID storage system as described in Chapter 3, creation of the UNITS and recording of the LUN IDs. The LUN ID can also be obtained from

   CLI>**show Dn**

   for each unit **n**.

   Additionally, it is required that the World Wide Port Names (WWPN) for the controllers be known.

   Using the CLI, the WWPNs can quickly and easily be determined.

   CLI> **show this**

   The information displayed contains a section labeled Host PORT_1 and Host PORT_2. Below these labels are entries of the Reported Port_ID, which is the WWPN in the format:

   nnnn-nnnn-nnnn-nnnn

   Record the correct WWPN mapping to the ports cabled. If the ports on the left side of the controller are used, record the Host Port 1 values. If the ports are on the right side of the controller, record the Host Port 2 values.

   NOTE: Secure Path allows for only one host port connection per controller.

   The example below displays the top controller of a dual-redundant pair. The cabling is on the left port and the right port has been set off line.

Example:

(from CLI> **show this)**

Host PORT_1:

Reported PORT_ID = 5000-1FE1-0000-8483

PORT_1_TOPOLOGY = FABRIC (fabric up)

Address = 011500

Host PORT_2:

Reported PORT_ID = 5000-1FE1-0000-8484

PORT_2_TOPOLOGY = offline

NOREMOTE_COPY

(from CLI> **show other**)

Host PORT_1:

Reported PORT_ID = 5000-1FE1-0000-8481

PORT_1_TOPOLOGY = FABRIC (fabric up)

Address = 011500

Host PORT_2:

Reported PORT_ID = 5000-1FE1-0000-8482

PORT_2_TOPOLOGY = offline)

NOREMOTE_COPY

In the previous example, the value to record for the top-left port (host port 1) is "5000-1FE1-0000-8483." Upon displaying the other controller, the value to record for the bottom-left port is "5000-1FE1-0000-8481."

2. On the server, in the /kernel/drv directory, edit the four configuration files as described in steps a through d below.

   a. **fcaw.conf** (for Sbus adapters) or **fca-pci.conf** (for PCI adapters)
   Inspect the listing of the entries that denote the WWPN for the existing RAID storage system. The entries are of the form

   targetN_wwpn="nnnnnnnnnnnnnnnn";

   Example:

   target125_wwpn="50001fe100000d43."

The target values, **N**, start at 125 and are counted down. The first RAID storage system required entries of 125 and 124. Therefore, the next entry starts at the next lower value, 123.

For example: for the new RAID system, use the WWPNs obtained in Step 1:

5000-1FE1-0000-3241 and 5000-1FE1-000-3243.

Create an entry for each WWPN.

target123_wwpn="50001FE100003241";

target122_wwpn="50001FE100003243";

b. **mda.conf** — Add two new path entries for the Target/LUN.

Example:

Using the example above, targets 123 and 122 and units D0, D4, and D5 added, the following would be added:

```
# Path 1 - the first hardware path
name="mda" parent= "/sbus@3,0/fcaw@0,0" target=123 lun=0;
name="mda" parent= "/sbus@3,0/fcaw@0,0" target=123 lun=4;
name="mda" parent= "/sbus@3,0/fcaw@0,0" target=123 lun=5;
# Path 2 - the second hardware path
name="mda" parent= "/sbus@f,0/fcaw@0,0" target=122 lun=0;
name="mda" parent= "/sbus@f,0/fcaw@0,0" target=122 lun=4;
name="mda" parent= "/sbus@f,0/fcaw@0,0" target=122 lun=5;
```

c. **1dLite.conf** — Add the new LUN IDs, recorded earlier.

Example: Assume that the last used targ**N**-devName was '13'.

```
targ14-devName = "6000-1FE1-0000-0D40-0090-8090-0656-0123";
targ15-devName = "6000-1FE1-0000-0D40-0090-8090-0656-012E";
targ16-devName = "6000-1FE1-0000-0D40-0090-8090-0656-0130";
```

The LUN ID will differ from that of another RAID system, as it will contain the new controller identification.

d. **sd.conf** —Verify that an entry exists in *sd.conf* matching the "**N**" value in the targ**N**-devName entry of the *ldLite.conf* file.

Example:

```
name="sd" parent="/pseudo/ldLite@0" target = 16, lun=0;
```

3. Reboot the server. Enter:

```
# touch /reconfigure
# reboot
```

4. Verify that the server has acquired the new UNIT. Enter:

```
# format
```

Inspect the device list and verify that the new target c*X*t*Y*d*Z* has been acquired and is now visible.

F. FC Fabric Mode - Adding a New Unit onto a *New* RAID System Configured onto a *New* (Second) Pair of Adapters in the Server.

1. To add another RAID system into the fabric requires cabling from the server to the switch and from the switch to the controllers of the RAID system as described in Chapter 3. UNITS are created and their LUN IDs are recorded. Finally, the World Wide Port Names for the controllers are recorded.

   Using the CLI, the WWPNs can quickly and easily be determined.

   ```
   CLI> show this
   ```

   The information displayed contains a section labeled Host PORT_1 and Host PORT_2. Below these labels are entries of the Reported Port_ID, which is the WWPN in the format:

   nnnn-nnnn-nnnn-nnnn

   Record the correct WWPN mapping to the ports cabled. If the ports on the left side of the controller are used, record the Host Port 1 values. If the ports are on the right side of the controller, record the Host Port 2 values.

   NOTE: Secure Path allows for only one host port connection per controller.

   The example above displays the top controller of a dual-redundant pair. The cabling is on the left port and the right port has been set off line. In this example, the value to record for the top-left port is “5000-1FE1-0000-8483.” Upon displaying the other controller, the value to record for the bottom-left port is “5000-1FE1-0000-8481.”

Example:

(from CLI> **show this)**

```
Host PORT_1:
    Reported PORT_ID = 5000-1FE1-0000-8483
    PORT_1_TOPOLOGY = FABRIC (fabric up)
    Address        = 011500
Host PORT_2:
    Reported PORT_ID = 5000-1FE1-0000-8484
    PORT_2_TOPOLOGY = offline
    NOREMOTE_COPY
```

(from CLI> **show other**)

```
Host PORT_1:
    Reported PORT_ID = 5000-1FE1-0000-8481
    PORT_1_TOPOLOGY = FABRIC (fabric up)
    Address        = 011500
Host PORT_2:
    Reported PORT_ID = 5000-1FE1-0000-8482
    PORT_2_TOPOLOGY = offline
    NOREMOTE_COPY
```

The example above displays the top controller of a dual-redundant pair. The cabling is on the left port and the right port has been set off line. In this example, the value to record for the top-left port is "5000-1FE1-0000-8483." Upon displaying the other controller, the value to record for the bottom-left port is "5000-1FE1-0000-8481."

2. On the server, in the /kernel/drv directory, edit the four configuration files as described in steps a through d below.

   a. Edit **fcaw.conf** for the Sbus adapter; or **fca-pci.conf** for the PCI adapter. Inspect the listing of the entries that denote the WWPN for the existing RAID system(s). The entries are of the form:

      ```
      targetN_wwpn="nnnnnnnnnnnnnnnn";
      ```

      Example:

      ```
      target125_wwpn="50001fe100000d43";
      ```

The new RAID storage system requires that new entries be made to the configuration file for the Fibre Channel driver; for the Sbus driver, *fcaw.conf*; and for the PCI driver, *fca-pci.conf*.

The target values, **N**, start at 125 and are counted down. The first RAID storage system required entries of 125 and 124. Therefore, the next entry starts at the next lower value, 123.

From the example output, the new RAID storage system WWPNs are:

5000-1FE1-0000-8981 and 5000-1FE1-000-8983

Locate the section in the driver configuration file specific to the driver type (either *fcaw.conf* or *fca-pci.conf*) and add the entries for the new RAID storage system as shown in the example below.

```
target123_wwpn="50001FE100008981";
target122_wwpn="50001FE100008983";
```

b. **mda.conf** — Add two new path entries for the Target/LUN.

Example: Using the example above, targets 123 and 122 and units D0, D10, D11, D12, and D25 added, proceed as follows.

Since the server has a new pair of adapters; new entries in mda.conf must be added to reflect the new adapters, parents and paths. The hardware path may be found by invoking:

#/opt/steam/bin/config.sh

from the Solaris Solutions kit. Using this directory string assumes that you chose the default installation directory.

Using Option 20, *Adding/Changing Adapters*, choose *Add Adapters* from the menu displayed and the software will invoke a scan of the system. Record the new hardware paths for the two new adapters. **Do not actually add these adapters to the adapter listing. Enter 'N' (no) when prompted to configure the adapter**. The example entries shown below contain the new Sbus adapter parent, target and LUN values.

```
Path 1
name="mda" parent= "/sbus@3,0/fcaw@0,0" target=123 lun=0;
name="mda" parent= "/sbus@3,0/fcaw@0,0" target=123 lun=10;
name="mda" parent= "/sbus@3,0/fcaw@0,0" target=123 lun=11;
name="mda" parent= "/sbus@3,0/fcaw@0,0" target=123 lun=12;
name="mda" parent= "/sbus@3,0/fcaw@0,0" target=123 lun=25;
```

```
Path 2
name="mda" parent= "/sbus@f,0/fcaw@0,0" target=122 lun=0;
name="mda" parent= "/sbus@f,0/fcaw@0,0" target=122 lun=10;
name="mda" parent= "/sbus@f,0/fcaw@0,0" target=122 lun=11;
name="mda" parent= "/sbus@f,0/fcaw@0,0" target=122 lun=12;
name="mda" parent= "/sbus@f,0/fcaw@0,0" target=122 lun=25;
```

c. **1dLite.conf** — Add the new LUN IDs, recorded previously.
Example: Assume that the last used targ**N**-devName was '13'. The LUN IDs for D0, D10, D11, D12, and D25 are added.

```
targ14-devName = "6000-1FE1-0000-8980-0090-8090-0656-0123";
targ15-devName = "6000-1FE1-0000-8980-0090-8090-0656-012E";
targ16-devName = "6000-1FE1-0000-8980-0090-8090-0656-0130";
targ17-devName = "6000-1FE1-0000-8980-0090-8090-0656-0132";
targ18-devName = "6000-1FE1-0000-8980-0090-8090-0656-0140";
```

The LUN ID will differ from that of another RAID storage system, as it will contain the new controller identification.

d. **sd.conf** — Verify that an entry exists in *sd.conf* matching the "**N**" value in the targ**N**-devName entry of the *ldLite.conf* file. In the example, targets 14 through 18 were added, therefore an entry must exist in *sd.conf* for each.
.
Example:

```
name="sd" parent="/pseudo/ldLite@0" target=16 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=17 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=18 lun=0;
```

1) Reboot the server. Enter:

```
# touch /reconfigure
# reboot
```

2) Verify that the server has acquired the new UNIT. Enter:

```
# format
```

Inspect the device list and verify that the new target c*X*t*Y*d*Z* has been acquired and is now visible.

Adding an Ultra SCSI (HSZ80) Unit

To add a unit to a Secure Path installation for a RA8000/ESA12000 Ultra SCSI RAID Array using the HSZ80 controller, proceed as follows:

1. Add the unit to the RAID storage system using the CLI or SWCC interface.

   Example:

   CLI> **add unit D108 s1**

2. Display the unit's LUN ID.

   Enter: CLI> **show D108**

   The LUN ID is displayed in the hex format:

   nnnn-nnnn-nnnn-nnnn-nnnn-nnnn-nnnn-nnnn. **Record this value**

   Example: LUN ID: 6000-1FE1-0000-8920-0009-9030-5234-006E

3. The next step is to edit the Secure Path and Solaris system files on the server. The specific editing is described below. (Reference chapter 8 for file descriptions.)

4. On the server, in the /kernel/drv directory, edit the three Secure Path configuration files as described in steps a through c, below.

   a. ***mda.conf*** — Add two new path entries for the Target/LUN, D108.

      Example: From our inspection of the D**n** value**, we note that the target is 1 and the LUN is 08 or simply, 8.**

      By inspecting the existing entries in ***mda.conf***, the parents of the existing RAID array can be identified.

      name="mda"parent="/pci@1f,2000/scsi@1" target=1 lun=8 qdepth=32:

      name="mda"parent="/pci@4,2000/scsi@1" target=1 lun=8 qdepth=32:

   b. ***ldLite.conf*** — Add the new LUN ID, recorded previously. Assume that the last targ***N*** -devName value in *ldLite*.conf is 20. The new entry would be added.

      Example: target21-devName = "6000-1FE1-0000-8920-0009-9030-5234-0063";

   c. ***sd.conf*** — Add an entry in sd.conf at the top of the file to account for the new "***N***" value in the targ***N***-devName entry of *ldLite.conf*.

      In the example targ21-devName was added. The following entry would be added.

      Example: name="sd" parent="/pseudo/ldLite@0" target = 21, lun=0;

5. Reboot the server. Enter:

   # touch /reconfigure

   # reboot

6. Verify that the server has acquired the new UNIT. Enter:

   # format

   Inspect the device list and verify that the new target has been acquired and is now visible.

Deleting a Unit

1. On the RAID storage system, using the CLI or the SWCC display, identify the UNIT to be removed using the following command:

   CLI> **show units**

   CLI> **show Dn**

   The LUN ID assigned to that UNIT is displayed in the hex format:

   nnnn-nnnn-nnnn-nnnn-nnnn-nnnn-nnnn-nnnn. Record the LUN ID.

   Example:

   LUN ID: 6000-1FE1-0000-8920-0009-9030-5234-006E

2. Delete the UNIT using the CLI or SWCC interface.

   Example:

   CLI> **delete D18**

3. On the server, in the /kernel/drv directory, edit the following files as described:

   a. **mda.conf** – delete the two path entries to the Target/LUN.
   Example:

   ```
   name="mda" parent= "/sbus@3,0/fcaw@0,0" target=64 lun=18;
   name="mda" parent= "/sbus@b,0/fcaw@0,0" target=64 lun=18;
   ```

   b. **1dLite.conf** – delete the LUN ID, recorded previously.
   Example:

   ```
   Targ21-devName = "6000-1FE1-0000-0D40-0090-8090-0656-0123";
   ```

   c. **sd.conf** –Delete the target value entry matching the ldLite entry shown by the example below.
   Example:

   ```
   name="sd" parent="/pseudo/ldLite@0" target=21 lun=0;
   ```

d. For Fabric Only:
If the deleted UNIT was the last UNIT and the RAID system is to be taken out of a FABRIC configuration, then either the ***fcaw.conf*** (Sbus) or ***fca-pci.conf*** (PCI) file will contain entries that should be deleted.
Inspect the listing of the entries that denote the WWPN for the RAID storage system and delete them. For example, if the entries shown below identify the WWPNs for the RAID storage system, then they should be deleted.

```
target123_wwpn="50001FE100008981";
target122_wwpn="50001FE100008983";
```

4. Reboot the server by entering the following command:

```
# touch /reconfigure
# reboot
```

5. Verify that the server has deleted the UNIT.

   Enter:

```
# format
```

   Inspect the device list and verify that the deleted target, has been removed and is no longer visible.

Chapter 7

Managing SANworks Secure Path

Overview

This chapter explains how to manage Secure Path using management tools.

Secure Path Management Tools

Secure Path provides two management tools:

- **spmt** — manages paths, and permits CLI access to the controller.
- **spinit** — manages the two daemons that detect path events and send e-mail notification to specified mail addresses.

spmt Commands

Table 7–1 lists the command options of the *spmt* utility. Command format and usage information follows the table.

Table 7–1 spmt Command Options

Commands	Action
display	Displays status and information about Secure Path devices.
cli	Invokes a Command Line Interpreter (CLI) session to the RAID controller.
toggle	Switches the I/O to the standby path.
restart	Sends a CLI RESTART command to a specified controller.
shutdown	Sends a CLI SHUTDOWN command to a specified controller.
restore	Restores a Secure Path device to its user-defined (via CLI) PREFERRED_PATH.
remove	Quiesces paths for a specified host bus adapter (HBA).
reconfig	Activates paths for a specific HBA.
notify	Manages the notification list for Secure Path messages.

spmt Command Format and Usage

spmt display

The *spmt display* command displays information about Secure Path devices, including the controllers, paths, and host bus adapters that are used by that Secure Path device.

The *spmt display* command has the form:

 # spmt display [-t target_number]

where:

Default displays information and status for all Secure Path devices.

target_number is the Secure Path target assigned to the storage unit. This number is contained as the **Y** value in the Secure Path device path: c**X**t**Y**d***Z***. (i.e., Device: c3t**2**d0).

Each field displayed in the output is described in Table 7–2. A sample follows the table.

Table 7–2 Fields displayed by spmt display

Field	Value	Meaning
Device (File)	c*X*t*Y*d*Z*	The Secure Path device
Status (of device)	operational	The Secure Path device can be accessed on at least one path.
	dead	All device paths used by this Secure Path device have failed
Storage System	WWNN	Fibre Channel World Wide Node Name assigned to the RAID storage system
LUN	WWID	Fibre Channel World Wide LUN identifier
Preferred Path	None or 10 Character alphanumeric	None = no preferred path or serial number of the controller on the preferred path
Controller	10 character alphanumeric	Serial number of the RAID controller
Unit	D*n*	Unit number of the storage RAID system
State	online	Active path for the Secure Path device.

Table 7–2 Fields displayed by spmt display (Continued)

Field	Value	Meaning
State	standby	Alternate path for the Secure Path Device.
	failed	Path is unavailable for I/O.
	quiesced	Path disabled for I/O by the user.
HBA	Adapter instance number	Identifies the host bus adapter.
Path (hardware)	HBA hardware parent string	The string that represents the complete hardware path of bus and instance of the adapter.

Example:

```
# spmt display –t 9
```

Sbus target/LUN display

```
Device: c3t9d0    Status: Operational
Storage System: 5000-1fe1-0001-ed20
LUN: 6000-1fe1-0001-ed20-0009-9281-0158-0005
Preferred Path: none
======================================
Controller      Unit    State    HBA      Path
======================================
ZG92810158    D110  online    fcaw0    /sbus@49,0/fcaw@1,0
ZG92810434    D110  standby fcaw1    /sbus@50,0/fcaw@1,0
```

PCI target/LUN display

```
Device: c1t35d0     Status: Operational
Storage System: 5000-1fe1-0000-8920
LUN: 6000-1fe1-0000-8920-0009-9030-5234-00a9
Preferred Path: ZG90405234
================================================
Controller       Unit    State     HBA               Path
================================================
ZG90305234  D45    standby  pci1242,46430  /pci@b,2000/fibre-channel@2
ZG92810434  D45    online    pci1242,46431  /pci@f,2000/fibre-channel@2
```

Ultra SCSI target/LUN display

```
Device:c6tld0 Status:Operational
Storage System:5000-1fel-0000-13d0
LUN: 6000-1fel-0000-13d0-0009-8140-0218-019f
Preferred Path: None
================================================
Controller       Unit    State     HBA                  Path
================================================
ZG82500433 D0 standby  pci1000,f2/pci@1F,    2000/scsi@1
ZG81400218 D0 online     pci1000,f4 /pci@4,    2000/scsi@1
```

spmt cli

The *spmt cli* command invokes a CLI session with a RAID controller on the active path of the specified Secure Path device. The CLI session has all the capabilities except for the Run command for the controller utilities. Controller utilities are only available from the serial port direction on the controller.

The *spmt cli* command has the form:

```
# spmt cli -t  target_number
```

where:

target_number is the Secure Path target assigned to the storage unit, contained as the **Y** value is the Secure Path device path: c**X**t**Y**d*Z* (i.e., Device: c3t**2**d0).

Example:

```
# spmt cli -t 2
CLI>
```

NOTE: To end the CLI session, type q and return.

spmt toggle

The *spmt toggle* command changes the path that a Secure Path device uses to access a LUN. The online path becomes the standby path and the standby path becomes the online path. Use this command to manually distribute LUN access across different paths for better performance.

NOTE: In a multiple host environment, toggle will only move LUNs that are currently available on the local host.

The *spmt toggle* command has the form:

```
# spmt toggle -t target_number
```

where:

target_number is the Secure Path target assigned to the storage unit, contained as the **Y** value is the Secure Path device path: c**X**t**Y**d*Z* (i.e., Device: c3t**2**d0).

Example:

```
# spmt toggle –t 2
```

spmt restart/spmt shutdown

The *spmt restart* and *spmt shutdown* commands cause I/O to be redirected to the other controller. The *spmt restart* command will function if multiple hosts are actively accessing LUNs. Therefore, if Secure Path is active on those hosts, I/O will be properly transferred to alternate paths.

The difference between *restart* and *shutdown* is that restart will cause the controller to reboot, while shutdown will stop the controller.

The purpose of these two commands is to move all online LUNs from the specified controller to the other controller. This allows the user to perform maintenance operations on the specified controller.

These commands have the form:

 # spmt restart -c serial_number

 # spmt shutdown -c serial_number

where:

serial_number specifies the RAID controller to be taken offline.

Examples:

 # spmt restart –c ZG92810158

 # spmt shutdown –c ZG92810158

spmt restore

The *spmt restore* command moves all online LUNs to their user-defined PREFERRED_PATH (this_controller or other_controller) specified in Chapter 3. This command takes no arguments and will operate on all LUNs. (See the *spmt toggle* command described previously in this chapter.)

spmt remove

The *spmt remove* command quiesces the path for a specified host adapter. All I/O is redirected to the other path and the removed path is marked quiesced. This also disables the path for future I/O until a *spmt reconfig* is issued.

The *spmt remove* command has the form:

 # spmt remove -a hba

where:

hba refers to the instance of the Solaris host bus adapter.
(For example, fcaw0). Obtain this value from the HBA field in the table generated by ***spmt display***.

Example:

 # spmt remove -a fcaw1

spmt reconfig

The *spmt reconfig* command restores the host bus adapter path that was removed from the Secure Path configuration by the *spmt remove* command.

To restore the user-defined PREFERRED_PATH, use the *spmt restore* command.

The *spmt reconfig* command has the form:

 # spmt reconfig -a hba

where:

hba refers to the instance of the Solaris host bus adapter.

Example:

 # spmt reconfig –a fcaw1

spmt notify

The *spmt notify* command manages the notification listing for messages from the Secure Path system.

The *spmt notify* command has the form:

 # spmt notify { display | add | remove | toggle }

The *spmt notify display* displays the list of current e-mail users that will be notified by Secure Path for any events in the Secure Path system. The display will also indicate the current state of the e-mail notification.

The *spmt notify add* allows the user to input *e-mail_addresses* to add to the current list for e-mail notification.

where: *email_address* is a standard network address. The default *e-mail address* is the **root** account on the server.

The *spmt notify toggle* allows the user to enable or disable the mail notification function. When invoked, the current mail notification state is displayed and the user may toggle it to the other state.

The *spmt notify remove* allows the user to remove the *e-mail_address* from the current list for e-mail notification.

Secure Path daemon utility (spinit)

The *spinit* utility is used to start and stop the Secure Path event or failover *daemon*.

The *spinit* utility has the form:

```
# spinit start
# spinit stop
```

where:

start starts the **daemon**
stop stops the **daemon**

Using SPMT Commands for Solaris Dynamic Reconfiguration Management

In order to use Solaris Dynamic Reconfiguration (DR) correctly, *spmt* commands must be invoked to quiesce that data bus. This is done by issuing the following commands:

```
# spmt remove -a fcaw1
```

where: **fcawl** is the adapter on the system board you want to remove.

Refer to the Sun Solaris documentation for specific steps used for DR and your system architecture.

When the DR has completed, *spmt* may be used to restore the HBA as follows:

```
# spmt reconfig -a fcaw1
```

This will cause the fcaw1 adapter to be put back into the Secure Path Configuration. The path will no longer be quiesced. It will be marked as a standby path until further *spmt* commands are issued to change the path.

Optionally, to restore all LUNs to their preferred path, use **#spmt restore**.

Chapter 8

Secure Path System Files

Overview

This chapter lists the configuration files, file entries, and specific formats for entries required for proper Secure Path operation.

Configuration Files

Table 8–1 lists the files added or modified as part of the Secure Path V2.1a installation.

Table 8–1 Configuration Files Added/Modified by Secure Path V2.1a

Added Files	Description
/kernel/drv/mda.conf	Configuration file for the mda driver
/kernel/drv/ldLite.conf	Configuration file for the ldLite driver
Modified Files	**Description**
/etc/driver_classes	Registers the ldLite driver
/etc/devlink.tab	Defines devlinks entry for the ldLite driver
/kernel/drv/fcaw.conf (Sbus driver) /kernel/drv/fca-pci.conf (PCI driver)	Assigns a target number to a controller's World Wide Port Names (WWPN) - FC fabric mode only.
/kernel/drv/sd.conf	Adds pseudo/ldLite entries for Secure Path targets

File/Entry Format

/etc/driver_classes

For the *ldLite* driver to be properly associated with a driver class the following entry has been added to the driver_classes file:

```
ldLite scsi
```

/etc/devlink.tab

So that the Secure Path utilities can communicate with the drivers, the following entry has been added to the *devlink.tab* file:

```
type=ddi_pseudo;name=ldLite;minor=ctl   pathCtl
```

/kernel/drv/fcaw.conf (Sbus driver)
/kernel/drv/fca-pci.conf (PCI driver)

In a fabric configuration, a target must be assigned to a WWPN. Target values must be in the range of 125 down to 16, inclusive. For example, to assign target 125 to the port number 5000-1FE1-0000-0D43, *fcaw.conf* would have the following entry:

```
target125_wwpn="50001FE100000D43";
```

/kernel/drv/mda.conf

Secure Path device paths are configured by the mda driver utilizing the entries in the *mda.conf* file. The entries designate the hardware path, the target assigned to the controller port, and the LUN assignment.

Fibre Channel (Support for HSG80 and HSG60)

In a loop configuration, the target assigned is related to the Arbitrated Loop Physical Address (ALPA). Appendix D provides a list of valid ALPAs.

Example entry for the Sbus adapter:

```
name="mda" parent="/sbus@49,0/fcaw@1,0" target=65 LUN=20 qdepth=32;
name="mda" parent="/sbus@50,0/fcaw@1,0" target=64 LUN=20 qdepth=32;
```

In a fabric configuration, the target assigned to the controller port is the target number assigned to the port number in the *fcaw.conf* or *fca-pci.conf* file.

Example entry for the PCI adapter:

```
name="mda" parent="/pci@b,2000/fibre-channel@2" target=125 lun=0 qdepth=32;
name="mda" parent="/pci@f,2000/fibre-channel@2" target=124 lun=0 qdepth=32;
```

Ultra SCSI (HSZ80)

Example entries for the Sbus and PCI Ultra SCSI adapters:

```
name=”mda” parent=”/sbus@7,0/QLGC,isp@0,10000” target=1 lun=0 qdepth=32;
name=”mda” parent=”/pci@1f,2000/scsi@1” target=1 lun=3 qdepth=32;
```

/kernel/drv/ldLite.conf

NOTE: Entries shown below are identical for the Fibre Channel and Ultra SCSI HBAs.

Secure Path device files are configured by the ldLite driver utilizing the *ldLite.conf* file. Subsequently, the first entry assigns a driver (ldLite) with a pseudo hardware path for a SCSI class.

```
name="ldLite" parent="pseudo" class="scsi" instance=0;
```

The other entries designate the specific units identified by the World Wide LUN ID assigned by the RAID storage system. For every pair of LUN assignments in *mda.conf* there is matching targ**N**-devName in *ldLite.conf*. The target number, **N**, assigns a Secure Path device number to a unit on a RAID storage system. The *ldLite.conf* target number, **N**, must be unique. The value assigned must have a corresponding entry in the /kernel/drv/sd.conf file. Examples of entries in *ldLite.conf* are as follows:

```
targ0-devName="6000-1FE1-0001-ED10-0009-9281-0311-0001";
targ1-devName="6000-1FE1-0001-ED10-0009-9281-0311-0002";
```

/kernel/drv/sd.conf

All Secure Path devices must have a corresponding sd target entry. Secure Path creates its own sd.conf entries, one per targN of the ldLite.conf file entries. These entries are placed at the head of the sd.conf file and allow Secure Path devices to configure prior to other sd targets. By placing the pseudo/ldLite.conf entries at the head of the sd.file, conflicts between Secure Path entries and other SCSI bindings are prevented.

Secure Path entries have the format:

name=”sd” parent=”/pseudo/ldLite@0” target=N LUN=0; where N represents the value of targN-dev-Name in ldLite.con.

For example, Secure Path device target 20 would have the following entry:

name="sd" parent=”/pseudo/ldLite@0” target=20 LUN=0;

When Secure Path units and LUNs are added or removed, these entries must also be added or removed.

Secure Path and the Command Console LUN

The Command Console LUN (CCL) is a special pseudo disk device on the RAID storage system that allows the server to communicate with the RAID array.

When the Secure Path configurator finds CCLs that are enabled, it adds entries to each configuration file but comments them out so that they are not configured in the system as active entries. Installation sites that have their own applications that communicate with the controller may remove the comment character (‘#’) and reboot the system to create active device links to the CCL.

Entries for the CCL in the *mda.conf, ldLite.conf* and *sd.conf* are similar to other LUNs with the following differences:

- *mda.conf*

  If the CCL is enabled, the unit assigned to the CCL can be determined by issuing the following CLI command:

  CLI> **show this_controller**

  The LUN ID assigned to the CCL is displayed in the controller data. Similar to any storage LUN on the RAID storage system, there must be two entries for the CCL in *mda.conf* — one for each path.

- *1dLite.conf*

  The World Wide LUN ID that is needed in *ldLite.conf* is created by appending the Node ID of the RAID storage system with the hexidecimal equivalent of the SCSI ID of the CCL device (HSG80CCL, HSG60CCL, HSZ80CCL).

  The Node ID can be determined by issuing the CLI command:

  CLI> **show this_controller**

  The Node ID is a 16-character hexadecimal value displayed as the NODE_ID in the Controller data.

  The SCSI device ID of the CCL must also be converted to a hexadecimal value. The conversions for supported controllers are shown in Table 8–2.

Table 8–2 Controller CCL Hexadecimal Strings

Controller	Hexadecimal Value
HSG80CCL	4853-4738-3043-434C
HSG60CCL	4853-4736-3043-434C
HSZ80CCL	4853-5A38-3043-434C

  For example, to assign the CCL to target 20 of a StorageWorks HSG80 Storage System with a Node ID of 5000-1FE1-0001-ED10, *ldLite.conf* must have the following entry:

  targ20-devName = “5000-1FE1-0001-ED10-4853-4738-3043-434C”

Appendix A

Glossary

This glossary defines terms pertaining to the Secure Path Software, Fibre Channel Technology, Ultra SCSI Technology and the HSG60, HSG80, and HSZ80 array controllers. It is not a comprehensive glossary of computer terms.

ALPA

Arbitrated Loop Physical Address. A value used to identify a port in a Fibre Channel Arbitrated Loop topology. (See Appendix D for valid ALPA settings.)

Controller

The hardware device that facilitates communication between a host and one or more LUNs organized as an array. Secure Path supports the HSG80 and HSG60 array controllers for Fibre Channel and the HSZ80 for Ultra SCSI. Each controller in a RAID system is identified by a unique serial number.

Device Status

Attributes that describe the current operational condition of a device. A device may exist in the following states:

operational - the Secure Path device can be accessed on at least one path.

dead - all paths used by this Secure Path device have failed.

Fabric

A network comprised of high-speed fibre connections resulting from the interconnection of switches and devices. A fabric is an active and intelligent non-shared interconnect scheme for nodes.

HBA

The I/O device (Host Bus Adapter) which serves as the interface connecting a host system to the Storage Area Network (SAN) or storage system.

Host/Server

The computer system on which the Secure Path server software is running.

Hub

A device that connects nodes into a logical loop by using a physical star topology. Hubs will automatically recognize an active node and insert the node into the loop. A node that fails or is powered off is automatically removed from the loop.

LUN

The LUN is the server's logical unit number assigned to a RAID storage set.

Path

A communication route that enables data and commands to pass between a host server and a storage device.

Path State

Attributes that describe the current operational condition of a path. A path may exist in the following states:

online — indicates a path that is currently servicing I/O requests.

failed — a path that is nonfunctional and not actively servicing I/O requests.

standby — a path that is neither online nor failed. It is available to receive I/O if an alternate path fails.

quiesced — the path has been disabled by the user.

SAN

Storage Area Network. A configuration of networked devices for storage.

SCSI

Small Computer System Interface. A parallel interface standard. The following table lists SCSI varieties used in this book with each corresponding data transmission rates:

SCSI Name	Transmission Rate
SCSI	20 MB
Ultra SCSI	40 MB
Ultra SCSI II	80 MB

Server/Host

The computer system on which the Secure Path server software is running.

Switch

A Fibre Channel, 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.

Target

A target is the addressable device to logical I/O units (LUNs). The target value assigned to the paths to the storage device in the *mda.conf* file depends on the transfer technology.

For FC Arbitrated Loop, the target is based on the ALPA assigned to the port on the controller for that path. The ALPA number on the RAID controller translates to a target number on the host. The translation table is found in Appendix D.

For FC switched fabric, a target is assigned to a WWPN. This target can have values between 16 and 125.

For parallel SCSI, it is the ID of a SCSI target.

Topology

An interconnection scheme that allows multiple servers and storage devices to communicate. Arbitrated Loop and switched fabric are examples of Fibre Channel topologies.

Appendix B

Secure Path Installation/Upgrades

Overview

The Secure Path upgrade scenarios discussed in this appendix are as follows:

Section	Existing Configuration	Intended Configuration
A	V2.0, V2.1Hub/Arbitrated Loop	V2.1a, Hub/Arbitrated Loop
B	V2.0, V2.1 Hub/Arbitrated Loop	V2.1a, Switch Fabric
C	V2.1a, Fibre Channel	V2.1a, Adding an HSZ80 Ultra SCSI RAID Array into a Fibre Channel configuration

CAUTION: The installation instructions that follow require that no I/O is in progress to the target/LUNs on the RAID systems communicating with the Sun server that is to be upgraded. Also, follow normal procedures to perform a complete backup before making any changes to the Secure Path configuration.

A. Upgrading a V2.0 or V2.1 Hub/Arbitrated Loop to a V2.1a Hub/Arbitrated Loop

This section explains how to upgrade Secure Path V2.0 or 2.1 to Secure Path V2.1a in an existing hub-based FC Arbitrated Loop configuration.

When Secure Path is upgraded to V2.1a, it preserves the existing configuration files, *mda.conf* and *ldLite.conf,* and any entries added to the *sd.conf* files by the Secure Path V2.0 or V2.1 application. This includes the existing targets as seen by the *format* command.

After the software upgrade, new UNITS may be added on the RAID as documented in Chapter 6.

When Secure Path V2.1a is installed as an upgrade, it will:

- Overlay new versions of the Secure Path drivers.
- Update the utilities in the /opt/CPQswsp/bin area.
- Invoke a script that will adjust the sd.conf pseudo/ldLite entries to match the V2.1a standard

The V2.1a upgrade installation is automatic. It is invoked using the standard Sun Solaris application installation procedures as follows:

```
# pkgadd -a upgrade -d pkgs
```

B. Upgrading a V2.0 or V2.1 Hub/Arbitrated Loop to a V2.1a Switch Fabric

To upgrade Secure Path V2.0 or V2.1 in an existing FC Arbitrated Loop to Secure Path V2.1a in a switch-based FC Fabric configuration requires that:

- Existing configuration mapping of target/LUNs is maintained before and after the change of configuration modes to preserve existing targets as seen by the *format* command.
- The Secure Path configuration files are modified to accommodate the transition from the ALPAs of the loop environment to the WWPNs of the Switch/Fabric environment.
- Existing UNITS on the RAID remain constant during the configuration conversion. (New UNITS may be added after the conversion, as documented in the information on adding units in Chapter 6).

To upgrade the software and convert the configuration, follow these steps:

1. Copy */kernel/drv/ldLite.conf to /kernel/drv/ldLite.conf.ref*. To simplify a later step, print a copy for reference.
2. Remove Secure Path V2.0 or V2.1 using the following Solaris command:

   ```
   # pkgrm CPQswsp
   ```

3. Convert the RAID storage system from loop mode to fabric mode and record the WWPNs assigned to each port used in the Secure Path configuration.

   NOTE: Secure Path allows for only one host port connection per controller.

   Move the corresponding cables from the Fibre Channel hubs to Fibre Channel switches. Port 1 on each controller is recommended.

4. Perform the next actions to change the mode of the driver(s) and create entries in */kernel/drv/sd.conf* to the target/LUNs on the RAID array:

   a. At the server, invoke the Solaris configuration utility. Enter:

      # /opt/steam/bin/config.sh

   b. Select Option 20, *Add/Change Adapters*.

   c. Select Option 4, *Modify an Adapter* and select each adapter to be used in the Secure Path configuration.

   d. Update the mode from loop to fabric, and when the WWPN is requested, input the values as recorded in step 3. Associate the correct adapter to the specific controller port on the RAID system.

5. Reboot the server with a reconfiguration boot. The following is recommended:

   # touch /reconfigure

   # reboot

   Secure Path requires that at least one target/LUN is visible from the server and from both adapters. After rebooting the server, verify that at least one target/LUN is visible from the server and from both adapters. In other words, at least one unit has two paths. This condition must be met before proceeding to the next step.

6. Install Secure Path V2.1a. Refer to Chapter 4 and Chapter 5 for installation information.

   Secure Path V2.1a installation generates new configuration files in */kernel/drv*. Specifically, *mda.conf* and *ldLite.conf*. It also adds entries to the *fcaw.conf* or *fca-pci.conf* files of the WWPN bindings for the fibre channel driver(s). Additionally, the /kernel/drv/sd.conf file will be updated.

7. Compare the versions of the *ldLite.conf* and *ldLite.conf.ref* files from Step 1. Both lists of entries should have the same targ*T*-devName paired with the same LUN ID string.

Example:

```
targ12-devName="6000-1FE1-0000-3250-0009-8170-0977-0010";
```

In this example, the value of *T* is 12 and is paired to a specific LUN ID at the Raid storage system. At the same time, *T* is the Target value used in /kernel/drv/sd.conf and represents the '*Y*' value in c*X*t*Y*d*Z* device files.

Verify that all targ*T*-devNames and World Wide LUN ID are paired identically in the new and old versions of the *ldLite.conf* file. Adjust the mapping accordingly.

C. Adding a HSZ80 Ultra SCSI RAID into an existing Secure Path FC Configuration

1. Configure the HSZ80 in multiple-bus failover mode as documented in Appendix E.
2. Using the SWCC software or the CLI interface to a serial port on the HSZ80 array, configure the storage sets as desired. For each **n** value in D**n,** record the associated LUN ID as shown from the CLI> SHOW UNIT Dn display.
3. If the HSZ80 storage system is to be shared by other servers, it will be necessary to add access control to the units. This is implemented by using unique scsi-initiator-ids from each server. The default Solaris SCSI-ID is 7. This value may be modified in the OS at the shell prompt, by invoking eeprom.

   # eeprom scsi-initiator_id= *new_value*

   During reboot, Solaris will set the current scsi-initiator-id for all HBAs on the system. It is the scsi-initiator-id that is the argument (parameter) for the enable_access = SCSI ID. The use of the scsi-initiator is the key to Selective Storage Presentation in the SCSI environment.

   Another method is to keep the default scsi-initiator id but change the adapter(s) used in the shared storage configuration. The method for changing an adapter SCSI-initiator id is adapter specific and is documented with the adapter.
4. If the adapters are not installed, then power down the server and install the adapters.

   On reboot,

   # cd /opt/steam/bin and invoke config.sh

   Select Option 20, Add/Change Adapters and then Option 2, Add an Adapter. The server will be scanned for the new adapters and you will be prompted to add them to the configuration. Do not add the adapters when prompted by the utility. Record the parent string as noted in the adapter display. Record each adapter that will be used for the HSZ80 under Secure Path. (It is assumed that the adapter pair is either PCI based or Sbus based. They may not be a pair of mixed adapters.)
5. Edit the following files in /kernel/drv :

mda.conf

mda.conf — the entries to be added are similar to the following but the parent value recorded in step 4 must be used. Also, the target and LUN values must be entered as described below.

Sbus example of two paths to the same target/lun.

```
name="mda" parent="/sbus@7,0/QLGC,isp@0,10000" target=1 lun=0 qdepth=32;
name="mda" parent="/sbus@6,0/QLGC,isp@2,10000" target=1 lun=0 qdepth=32;
```

PCI example of two paths to the same target/lun.

```
name="mda" parent="/pci@1f,2000/scsi@1" target=1 lun=3 qdepth=32;
name="mda" parent="/pci@4,2000/scsi@1" target=1 lun=3 qdepth=32;
```

Determining Target and LUN values

On the HSZ80 RAID array, the value **n** of D**n** carries the target and LUN values, either implicitly or explicitly.

The general format is D-TT-LL where the first two digits (TT) represent the target value and the second two (LL), represent the LUN. However, leading zeros are not required in the string and this includes the target and or LUN values.

This requires that the D**n** is read from **right to left to identify the LUN and the target**.

Examples:	D1207	=>>	target=12,	lun=07
	D401	=>>	target= 4,	lun=01
	D5	=>>	target= 0	lun=5
	D0	=>>	target= 0	lun=0

In general, for Solaris assuming the default scsi-initiator value of 7, we have the following Targets and LUNs.

Dn Value	Target Value	Target Range	LUN Value	LUN Range
Dz	**0**	**0**	**z**	**0-9**
Dyz	**0**	**0**	**yz**	**00-15**
Dxyz	**x**	**00-6, 8, 9**	**yz**	**00-15**
Dwxyz	**wx**	**00-06, 08-15**	**yz**	**00-15**

In mda.conf, add two entries per LUN, one for each parent (adapter).

ldLite.conf

Edit ldLite.conf and add new entries in the form as shown in the following example:

targ**N**-devName = "6000-1FE1-0000-13D0-0009-8140-0218-01A8"; #D8

An entry must be created for each Dn seen by the server. Since these entries are added to existing ldLite.conf entries and the **N** value must be unique, select the next consecutive values for the new entries.

NOTE: The actual D8 value is added as a comment to help the maintainer/administrator identify the storage set on the RAID array.

sd.conf

Edit sd.conf and examine the entries at the top of the file. They are of the form:

name="sd" parent="/pseudo/ldLite@0" **target=4** lun=0;

The value of **target** maps to the same **N** entered in ldLite.conf for the newly added entries. Add one entry for each entry added to ldLite.conf.

At this stage the RAID array is configured and the configuration files are updated with the HSZ80 parent/paths. Reboot the server with the recommended steps of

1. # **touch /reconfigure**
2. # **reboot**

When the system has rebooted, enter **#cd /opt/CPQswsp/bin** and invoke */.spmt display* to verify that new entries have been added to the Secure Path set of entries.

Appendix C

Removing SANworks Secure Path Software

Overview

This appendix describes how to remove SANworks Secure Path software from your server. Removing the Secure Path software will restore the server to a single path, RAID storage environment.

Under a single path configuration, the HSG80, HSZ80, and HSG60 controllers must be set into (Transparent) Failover mode. The steps to accomplish the removal of the software and the transition of the HSGx0/HSZ80 controllers to (Transparent) Failover mode are described in Appendix E.

How to Remove SANworks Secure Path Software

Removing the Software

1. On the specific server(s), invoke the Sun Solaris package remove function and select CPQswsp as shown below:

   # pkgrm CPQswsp

2. After the Secure Path package has been removed, visit the area /opt/steam/bin (the default area), or the area selected during the installation of the Solaris Solutions kit, and invoke the following:

   # /config.sh

   During the installation of the Secure Path software, target entries are removed from the /kernel/drv/sd.conf file and moved to the *mda.conf* and *ldLite.conf* files.

For all controllers (HSG60, HSG80, HSZ80)

The following steps regenerate the *sd.conf* file for use with the fibre channel drivers as a single path application. During these steps, new target names and new LUN values may be chosen.

a. Using the Option 20, *Add/Change Adapters* and then Option 4, *Modify Adapters,* select each adapter and reselect the mode of operation, the desired targets, the desired number of LUNs and the specific WWPNs for the intended RAID storage system.

b. Press RETURN to complete each adapter update and the changes will be made to the /kernel/drv/sd.conf as well as the fibre channel driver configuration file(s), *fca-pci.conf* and/or *fcaw.conf*.

3. Reboot the server. The recommended procedure is:

```
# touch /reconfigure
# reboot
```

Reconfiguring the RAID Controllers

If the RAID storage system is to be used for single path access by one or more servers, then the HSG80, HSG60, or HSZ80 dual-redundant controllers must be restored to (Transparent) Failover Mode.

The steps to perform the transition to (Transparent) Failover mode are documented in Appendix E.

Appendix D

Valid ALPA Settings

About ALPA Settings

Table D–1 lists the Arbitrated Loop Physical Address (ALPA) settings and corresponding SCSI target numbers for hard-addressing the Fibre Channel Arbitrated Loop using the CPQfca-pci or CPQfcaw drivers. Use Table D–1 when setting the PORT_1_AL_PA and PORT_2_AL_PA addresses on the HSG80 and HSG60 controllers. The default setting for port 1 is AL_PA=71 and port 2 is AL_PA=72. If you are configuring multiple HSGx0 controllers on a loop, ensure that all ports on a loop have unique AL_PAs.

Table D–1 ALPA Settings

Host Server ALPAs (Lowest to Highest Priority)			Controller Port ALPAs (Lowest to Highest Priority)		
ALPA (hex)	Target (hex)	Target (dec)	ALPA (hex)	Target (hex)	Target (dec)
6E	42	66	EF	00	0
6D	43	67	E8	01	1
6C	44	68	E4	02	2
6B	45	69	E2	03	3
6A	46	70	E1	04	4
69	47	71	E0	05	5

Table D–1 ALPA Settings (Continued)

Host Server ALPAs (Lowest to Highest Priority)			Controller Port ALPAs (Lowest to Highest Priority)		
ALPA (hex)	Target (hex)	Target (dec)	ALPA (hex)	Target (hex)	Target (dec)
67	48	72	DC	06	6
66	49	73	DA	07	7
65	4A	74	D9	08	8
63	4B	75	D6	09	9
5C	4C	76	D5	0A	10
5A	4D	77	D4	0B	11
59	4E	78	D3	0C	12
56	4F	79	D2	0D	13
55	50	80	D1	0E	14
54	51	81	CE	0F	15
53	52	82	CD	10	16
52	53	83	CC	11	17
51	54	84	CB	12	18
4E	55	85	CA	13	19
4D	56	86	C9	14	20
4C	57	87	C7	15	21
4B	58	88	C6	16	22
4A	59	89	C5	17	23
49	5A	90	C3	18	24
47	5B	91	BC	19	25
46	5C	92	BA	1A	26

Table D–1 ALPA Settings (Continued)

Host Server ALPAs (Lowest to Highest Priority)			Controller Port ALPAs (Lowest to Highest Priority)		
ALPA (hex)	**Target (hex)**	**Target (dec)**	**ALPA (hex)**	**Target (hex)**	**Target (dec)**
45	5D	93	B9	1B	27
43	5E	94	B6	1C	28
3C	5F	95	B5	1D	29
3A	60	96	B4	1E	30
39	61	97	B3	1F	31
36	62	98	B2	20	32
35	63	99	B1	21	33
34	64	100	AE	22	34
33	65	101	AD	23	35
32	66	102	AC	24	36
31	67	103	AB	25	37
2E	68	104	AA	26	38
2D	69	105	A9	27	39
2C	6A	106	A7	28	40
2B	6B	107	A6	29	41
2A	6C	108	A5	2A	42
29	6D	109	A3	2B	43
27	6E	110	9F	2C	44
26	6F	111	9E	2D	45
25	70	112	9D	2E	46
23	71	113	9B	2F	47

Table D–1 ALPA Settings (Continued)

Host Server ALPAs (Lowest to Highest Priority)			Controller Port ALPAs (Lowest to Highest Priority)		
ALPA (hex)	**Target (hex)**	**Target (dec)**	**ALPA (hex)**	**Target (hex)**	**Target (dec)**
1F	72	114	98	30	48
1E	73	115	97	31	49
1D	74	116	90	32	50
1B	75	117	8F	33	51
18	76	118	88	34	52
17	77	119	84	35	53
10	78	120	82	36	54
0F	79	121	81	37	55
08	7A	122	80	38	56
04	7B	123	7C	39	57
02	7C	124	7A	3A	58
01	7D	125	79	3B	59
			76	3C	60
Reserved for Host Server FL_PORT			75	3D	61
00	7E	126	74	3E	62
			73	**3F**	**63**
			72	**40**	**64**
			71	**41**	**65**

NOTE: The gray area denotes addresses that are reserved for host bus adapters (not to be used by HSGx0 controllers). The most commonly used controller port ALPA addresses are in bold font.

Appendix E

HSG80, HSG60, and HSZ80 Controller Failover Transitions

Overview

The purpose of this appendix is to detail the process and steps of setting dual-redundant HSG80, HSG60, and HSZ80 controllers from one failover state to another.

NOTE: Connections and offsets only apply to HSG80 and HSG60 controllers.

Examples used in this appendix are based on the HSG80 controller but all actions are identical for the HSG60 and the HSZ80 controller.

The failover states are Transparent Failover (TF), Multiple-bus Failover (MBF) and Nofailover (NF).

The following three sections detail the steps to change:

1. From Transparent Failover to No Failover Mode
2. From Transparent Failover to Multiple-bus Failover Mode
3. From Multiple-bus Failover to No Failover and then to Transparent Failover Mode

First, establish a serial connection to the controller with the serial line connected to the top controller. This controller will be referred to as THIS_CONTROLLER. The second controller will be referenced as the OTHER_CONTROLLER. All HSG80, HSG60, and HSZ80 actions in the steps below are assumed to be through this serial connection.

Verify the current state of the controllers is achieved by entering

```
CLI> show this_controller
```

The display from the SHOW command has a number of sections. The information that is required is contained in the first section with the header of '**Controller:**' A sample display for Transparent Failover is shown below. The failover state is identified with an arrow (->)preceding the noted text.

```
Controller:
     HSG80 ZG83502145 Software V85F-0, Hardware  E03
     NODE_ID         = 5000-1FE1-0000-3350
     ALLOCATION_CLASS = 0
     SCSI_VERSION     = SCSI-2
   ->  Configured for dual-redundancy with ZG80200290
   ->   In dual-redundant configuration
```

As the controller state changes, the display will be shown to help verify that the change has completed successfully.

Changing from Transparent Failover to No Failover mode

1. At the CLI> prompt, enter

   CLI> **set nofailover**

This action will cause the OTHER_CONTROLLER to shut down.

2. At the CLI> prompt, enter

   CLI> **show this_controller** to verify the change to no failover.

```
Controller:
     HSG80 ZG83502145 Software V85F-0, Hardware  E03
     NODE_ID         = 5000-1FE1-0000-3350
     ALLOCATION_CLASS = 0
     SCSI_VERSION     = SCSI-2
   ->  Not Configured for dual-redundancy
```

3. Restart the OTHER_CONTROLLER by pressing the RESET button on the OTHER_CONTROLLER.

The OTHER_CONTROLLER will sound an alarm as it discovers the second controller but detects that it is not bound in a failover mode. The alarm (may be silenced) and the message about the controllers being misconfigured may be disregarded.

4. To verify the change in controller state, use

   CLI> **show this_controller**

```
Controller:
     HSG80 ZG83502145 Software V85F-0, Hardware  E03
     NODE_ID         = 5000-1FE1-0000-3350
     ALLOCATION_CLASS = 0
     SCSI_VERSION     = SCSI-2
  ->  Not Configured for dual-redundancy
  ->       Controller misconfigured -- other controller present
```

5. This state change is important only if a controller is to be replaced or the state is changing from transparent failover to multiple-bus failover or vice-versa. This is not an ending state in itself.

Changing from Transparent Failover to Multiple-bus Failover mode

Whether there are defined UNITs or not for the RAID system, the following steps will implement Transparent Failover to Multiple-bus Failover.

1. At the CLI prompt, enter

   CLI> **set nofailover**

   This action will cause the OTHER_CONTROLLER to shut down.

2. At the CLI> prompt, enter

   CLI> **show this_controller** to verify the change to no failover.

```
Controller:
     HSG80 ZG83502145 Software V85F-0, Hardware  E03
     NODE_ID         = 5000-1FE1-0000-3350
     ALLOCATION_CLASS = 0
     SCSI_VERSION     = SCSI-2
  ->   Not Configured for dual-redundancy
```

Restart the OTHER_CONTROLLER by pressing the RESET button on the OTHER_CONTROLLER.

The OTHER_CONTROLLER will sound an alarm as it discovers the second controller but knows that it is not bound in failover mode. The alarm (may be silenced) and the message about the controllers being misconfigured may be disregarded.

```
Controller:
HSG80 ZG83502145 Software V85F-0, Hardware  E03
NODE_ID         = 5000-1FE1-0000-3350
ALLOCATION_CLASS = 0
SCSI_VERSION     = SCSI-2
-> Not Configured for dual-redundancy
-> Controller misconfigured -- other controller present
```

3. When the OTHER_CONTROLLER is online enter the following command to put the controllers into Multiple-bus Failover mode,

   CLI> **set multibus_failover copy=this**

This action will copy all unit and connection information to the OTHER_CONTROLLER and restart both controllers.

After both controllers have restarted, the controller pair will be bound in Multiple-bus failover mode with consistent views of all the RAID Array information.

4. Verify that the controllers are now in Multiple-bus failover.

   CLI> **show this_controller**

```
Controller:
        HSG80 ZG83502145 Software V85F-0, Hardware  E03
        NODE_ID         = 5000-1FE1-0000-3350
        ALLOCATION_CLASS = 0
        SCSI_VERSION     = SCSI-2
      ->  Configured for MULTIBUS_FAILOVER with ZG80200290
      ->      In dual-redundant configuration
```

5. If the RAID Array had connections prior to making this transition, you will have to examine the connections

   CLI> **show connections**

and inspect the last column, “offset value”.

> **NOTE:** In Transparent Failover mode, the controller, by default, assigns an offset value of 0 to the left-hand port and an offset value of 100 to the right-hand port. In Multiple-bus Failover mode, the controller assigns an offset value of 0 to all ports, unless existing connections have non-zero offset values.

CLI> **set connection *connection_name* unit_offset=0**

Changing from Multiple-bus Failover Mode to No Failover and then to Transparent Failover Mode

1. If there are connections on the storage system, for HSGx0 controllers use CLI> **show connections** then all connections must be deleted. To delete all connections use CLI> **delete *connection_name*** for each connection.

   > **NOTE:** The connections will be regenerated later.

2. If there are units (Dn) on the storage system, they must be deleted. This is due to the inconsistencies incorporated in the volumes' WWID in different failover modes.

CLI> **show units,**

CLI>**delete dn** (for each Dn)

NOTE: The UNITs will be restored after the controller state is changed. It is advised that the Dn values and associated information as well as the storage set information be recorded for later use. The controller state change will not affect the data on the storage sets.

3. If the controllers are currently in a failover mode, then

   CLI> **set nofailover**

This action will cause the OTHER_CONTROLLER to shutdown.

Verify the current state of the controller by entering

CLI> **show this_controller**

```
Controller:
    HSG80 ZG83502145 Software V85F-0, Hardware  E03
    NODE_ID         = 5000-1FE1-0000-3350
    ALLOCATION_CLASS = 0
    SCSI_VERSION     = SCSI-2
  ->  Not Configured for dual-redundancy
```

Restart the OTHER_CONTROLLER by pressing the RESET button on the OTHER_CONTROLLER.

The OTHER_CONTROLLER will sound an alarm as it discovers the second controller but knows that it is not bound in a failover mode. The alarm (may be silenced) and the message about the controllers being misconfigured may be disregarded.

Verify the current state of the controller by entering

CLI> **show this_controller**

```
Controller:
        HSG80 ZG83502145 Software V85F-0, Hardware  E03
        NODE_ID         = 5000-1FE1-0000-3350
        ALLOCATION_CLASS = 0
        SCSI_VERSION    = SCSI-2
    ->  Not Configured for dual-redundancy
-> Controller misconfigured -- other controller present
```

4. When the OTHER_CONTROLLER is available,

   CLI> **set failover copy=this**

This action will copy all unit and configuration information to the OTHER_CONTROLLER and restart it. When restarted, the controller pair will be bound in Transparent Failover mode.

CLI> **show this_controller** and verify the controller state.

```
Controller:
        HSG80 ZG83502145 Software V85F-0, Hardware  E03
        NODE_ID          = 5000-1FE1-0000-3350
        ALLOCATION_CLASS = 0
        SCSI_VERSION     = SCSI-2
    ->  Configured for dual-redundancy with ZG80200290
    ->      In dual-redundant configuration
```

5. Restore the UNIT to storage set mapping that was recorded earlier. Use

   CLI> **add unit dn *storage_set_name***

   NOTE: Do not initialize the storagesets. This action will destroy data on the storageset(s).

6. Restart both controllers,

   CLI> **restart other_controller**

   CLI> **restart this_controller**

   so that connections may be reacquired. An alternative method to reestablish the connections is to reboot the server(s).

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