

Compaq SANworks

Secure Path Version 3.0 for Sun Solaris

Installation and Reference Guide

Part Number: AA-RKYDE-TE

First Edition (October 2001)

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This guide describes the SANworks Secure Path software for Sun Solaris. It includes information about Secure Path technology, installation, and management.

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About this Guide

The following sections are covered:

- Text Conventions
- Symbols in Text
- Symbols on Equipment
- Rack Stability
- Getting Help
- Compaq Authorized Reseller

Text Conventions

The conventions included in Table 1 apply in most cases.

Table 1: Text Conventions

Element	Convention	Examples
<i>file names</i>	<i>Italics</i> , unless the file name is included in a directory name/path.	<ul style="list-style-type: none">• To configure storage, edit <i>storageaset.ini</i>.• (Directory name/path): Errors are logged to <code>\syslog\errors\config_errors.txt</code>.
<ul style="list-style-type: none">• User Input• Command Names	User input appears in helvetica. command names appear in helvetica, unless they are case sensitive. Entered <code><variables></code> are displayed in angle brackets (<code>< ></code>) and all lowercase.	<ul style="list-style-type: none">• To exit from the program, type <code>exit</code>.• At the prompt, type this command: <code>show this_controller</code>• Use <code>set this_controller</code> to change parameters. (no variable)• To see your settings, give the command: <code>SHOW <storageaset> FULL</code> (with variable)

Table 1: Text Conventions (Continued)

Element	Convention	Examples
<ul style="list-style-type: none"> System Responses (Output and Messages) Drive Names 	Monospace font	<ul style="list-style-type: none"> Insert Disk into Drive A. You will see the Disk Full message. Navigate to your CD-ROM drive (usually D: or E:).
URLs	Sans serif font.	For update notices, visit: http://www.compaq.com

Symbols in Text

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



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



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

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

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

Symbols on Equipment



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

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



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

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



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

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



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

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



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

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

Rack Stability



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

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

Getting Help

If you still have a question after reading this guide, contact your service representative or visit our website.

Compaq Technical Support

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

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

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

Be sure to have the following information available before calling:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions.

Compaq Website

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

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.

Secure Path Technology

Compaq *SANworks*TM Secure Path is a server-based software product that enhances *StorageWorks*TM RAID Array storage systems by providing automatic recovery of data from server-to-storage system connection failures. Secure Path supports multiple I/O paths between host and storage, which improves overall data availability. If any component in a path between host and storage fails, Secure Path redirects pending and subsequent I/O requests to an alternate path.

This chapter provides the following Secure Path information:

- Features
- Software Components
- Controller Ownership
- Path Definition details
- Secure Path Operation
- Path Management Behavior Summary.

Overview

Compaq *SANworks* Secure Path for Sun Solaris is a high-availability software product that manages and maintains continuous data access to the following Compaq StorageWorks storage systems:

- RA8000
- ESA12000
- MA8000
- EMA12000
- MA6000
- EMA16000.

Secure Path eliminates the RAID controller, host bus adapter (HBA), and interconnect hardware (cables, switches, and connectivity devices) as single points of failure in the I/O path.

Through the deployment of redundant hardware and advanced RAID technology, Secure Path enhances fault tolerance and storage system availability by providing automated failover capability.

Redundant physical connections define separate physical “paths” in a Secure Path hardware configuration. Each path originates at an HBA port on a server, and ends at a unique RAID controller port in the storage system.

Figure 1–1 illustrates basic Secure Path hardware configurations. The physical connections define two separate paths. Each path originates at a unique Storage Area Network (SAN) host bus adapter on a Solaris server and ends at a port on a separate RAID controller on the storage system.

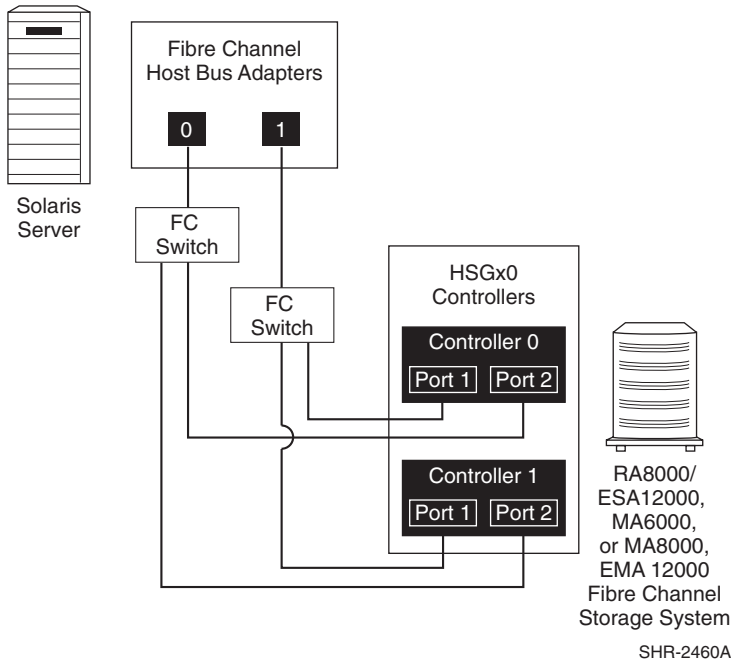


Figure 1–1: Basic Secure Path Fibre Channel Configuration

Secure Path enables dual StorageWorks RAID controllers to operate in an active/active LUN ownership 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 device. 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 *spmgr*.

Secure Path takes advantage of the HSG80 preferred path unit attribute. Available storage units may be preferred to one or the other of the two controllers by setting a preferred path unit attribute. This attribute determines which controller is used for access at storage system boot time. During runtime, storage units may be moved between paths at any time through the use of the Secure Path Management utility. On HSG80 RAID devices, storage units may also be accessed on each controller through either of two available ports.

The Secure Path software detects the failure of I/O operations on a failed path and automatically re-routes traffic to other available paths. Secure Path software will seek alternate paths through available SAN switches, controllers, controller ports, and/or host bus adapters. Path failover is completed seamlessly, without process disruption or data loss.

Following a replacement of a failed adapter, cable, controller or other component, storage units can be restored or failed-back to their original path using the Secure Path Management utility.

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

Features

Secure Path provides the following features:

- Allows StorageWorks dual-controller RAID systems and host servers equipped with multiple HBAs redundant physical connectivity along independent Fibre Channel fabric paths.
- Monitors each path and automatically re-routes I/O to a functioning alternate path if a component failure occurs.
- Determines the availability of storage units and physical paths through the implementation of path verification diagnostics.
- Monitors and identifies failed paths and failed-over storage units.

- Facilitates static load balancing, which allows manual movement of devices between paths.
- Automatically restores failed-over storage units to repaired paths with auto-failback capability enabled.
- Implements anti-thrash filters to prevent failover/failback effects caused by marginal or intermittent conditions.
- Exploits the potential for improved data throughput and increased bandwidth using dual RAID controllers configured in multiple-bus mode operation with load balancing capability enabled.
- Detects failures reliably without inducing false or unnecessary failovers.
- Implements failover/failback actions transparently without disrupting applications.

Software Components

The Secure Path Software Kit for Solaris includes the following software components.

Drivers

The Secure Path drivers manage paths to a storage device while providing a single device target to applications.

- **swsp driver**—a failover driver that is presented as a pseudo-HBA driver to system SCSI disk drivers. This driver presents multiple paths as a single device to the host SCSI disk driver. It also initiates path failover when necessary and manages all kernel threads related to failover.
- **hsx driver**—an array-specific driver that provides paths from an HBA driver for specific arrays up to the swsp driver. This driver manages the separate paths to a LUN and encapsulates array-specific knowledge such as specific commands to migrate a LUN from one controller to the other. The hsx driver supports Compaq StorageWorks HSG controllers.
- **path driver**—required by the Solaris operating system to allow the hsx and swsp drivers to communicate in the kernel.

Figure 1–2 illustrates the driver model structure.

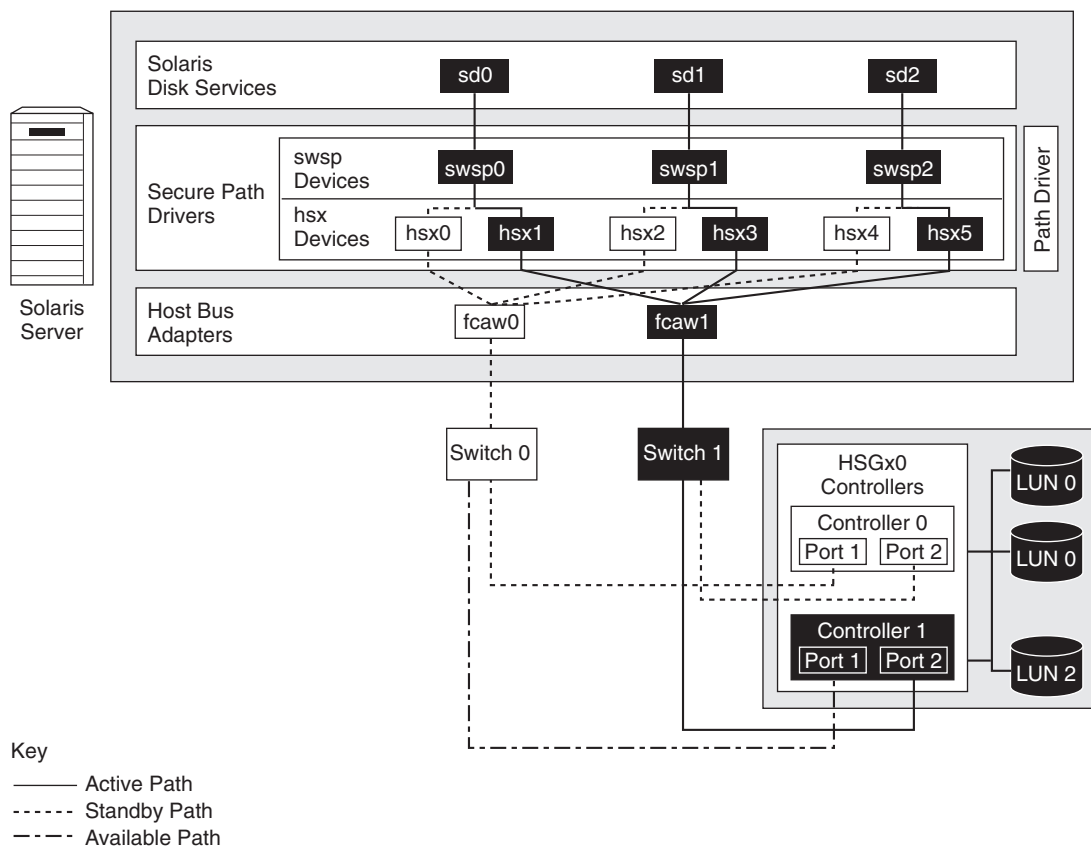


Figure 1–2: Driver Model Structure

Agent

The Secure Path agent (*spagent*) is a daemon process that provides an interface for Secure Path applications and utilities to communicate to the multipath drivers. The *spagent* also provides notification of path change events through e-mail. The *spagent* is not required to be running for Secure Path drivers to configure and provide full failover functionality; however, it must be running if e-mail event notification is desired.

The only supported method to start and stop the Secure Path agent is the *spinit* script.

Management Tools

The Secure Path Manager (*spmgr*) is a command line application that allows users to monitor and manage Secure Path devices and to change the configuration settings of the drivers. See Chapter 4 for a complete description of *spmgr* commands.

NOTE: You must have network services running in order for *spmgr* to communicate with *spagent*.

Configuration Tool

The Secure Path configuration utility, *spconfig*, is run after the Secure Path installation. It performs the following functions:

- Queries storage systems
- Enables the user to modify the Secure Path storage configuration
- Modifies driver configuration files for Secure Path

Controller Ownership

Storage systems that are multiple-bus capable generally contain a pair of redundant controllers and support one of the following basic operational models:

- **Active/passive**—In the active/passive model, all storage sets are assigned ownership to one controller of the pair for I/O processing. The other controller is inactive, but available as a substitute in case of failure on the original.
- **Active/active**—In the active/active model, I/O processing may be routed through both controllers simultaneously, providing better performance in addition to high availability. The RAID Arrays supported by Secure Path implement a modified version of the active/active model. While I/O can be processed simultaneously by both controllers, any given storage set is “owned” or online to a host through only one controller. Ownership of a storage set may be transferred to the other controller at any time through a host-initiated command sequence.

However, since the ownership transfer results in controller cache flushing and I/O wind down, the storage set may become inaccessible for a period of several seconds to complete this sequence. Arbitrary ownership transfers are never automatically initiated by Secure Path and should be avoided by the user.

NOTE: Secure Path automatically retries I/O requests that terminated in error due to ownership transfers. It also queues new I/O requests until the ownership transfer has completed to ensure data integrity.

Path Definition

Within Secure Path, a path is defined as the collection (configuration) of physical interconnect components including HBAs, switches, cables, RAID controllers, and the ports on the controllers. Since the Secure Path driver component is positioned between the HBA driver and the system SCSI disk driver, the Secure Path driver can only distinguish physical paths when elements of the SCSI equivalent address are different.

Some configurations include multiple switches within a fabric with the switches connected by one or more inter-switch links. These paths are neither directly visible to nor manageable by Secure Path. While these inter-switch paths provide an additional level of redundancy within the fabric, their management is handled directly within the switch. Refer to the documentation received with your switch hardware for more information about inter-switch link routing and failover policies.

The Path State is set automatically by Secure Path and reflects the status of the current actual path, which may deviate from user expectations because of path failures. See Table 4-4 on page 4-5 for a list and description of Path states and attributes.

Secure Path Operation

Failover occurs automatically when a selected set of error conditions is detected. Secure Path normally performs path failover only when user I/O is active or if path verification is enabled. However, it is possible for Secure Path Manager to show some units with a common failed path in the fail-over state, while other units appear to remain accessible through that path. Units remain in the failed path if there is no I/O or until polled.

Failover follows a certain hierarchy, conditioned by the state of Load Balancing as described below. Secure Path does not change the mode of “Preferred” paths in failover situations, so you can restore original path assignments after making repairs.

- Load Balancing *disabled*:

Secure Path marks the path failed and switches to the next “Available” path connected to the same controller, if such exists.

If there is no “Available” path on the same controller, Secure Path attempts to move the device to a “Standby” path on the other controller.

- Load Balancing *enabled*:

Initially, failover consists of marking a bad path “failed,” which effectively removes it from the list of usable paths for the storage set.

- If no “Active” paths remain for the device, Secure Path activates an “Available” path on the same controller, if one exists.
- If no “Available” paths remain on the same controller Secure Path attempts to move the device to a “Standby” path on the other controller.

Failback Options

Secure Path enables the user to set the path failback option to manual or automatic.

- In manual mode, devices are restored to their preferred path through a management utility command. The operation is performed even if system I/O is in process to the selected device.
- In auto-restore mode, Secure Path tests a failed path at fixed intervals if I/O is in process for the affected device. If the path appears to be viable, and the path is set as preferred, the Path State is set to “Active” and I/O will again be routed through this path.

Load Balancing

When enabled, Load Balancing allows multiple paths between a host and a specific storageset to be utilized in parallel. Fibre Channel interconnection schemes result in multiple paths between a host and each controller. I/O intended for storagesets connected to a given controller alternately dispatches through the set of appropriate paths, spreading the load across all components in the RAID storage system and maximizing performance potential. Load Balancing may not be used in other environments that utilize device reservations as a lock mechanism since the RAID array controllers enforce reservations on a per-port basis.

Load Balancing requires a Fibre Channel configuration that results in at least four unique paths from the host node to the storage system. While this can be accomplished with several different physical configurations, maximum performance potential is achieved when all four ports of the RAID storage system are used.

When Load Balancing is enabled, the Secure Path driver causes all paths to the owning controller to be marked “Active” by default. This is true when the following conditions occur:

- A host boots up
- Secure Path fails over a storageset from one controller to the other
- A user manually moves a selected storageset between controllers using the Secure Path management utility, *spmgr*

Path Verification

When enabled with *spmgr*, Path Verification causes Secure Path to periodically test the viability of all paths to all storage sets for paths marked “Available,” “Failed,” “Active, or “Standby.” Path Verification does not test paths that are in a “Quiesced” state.

Path Verification is useful for detecting failures that affect overall path redundancy before they affect failover capability. If an “Active” path fails path verification, failover occurs. If an “Available” path fails path verification, its state will change from “Available” to “Failed.”

If a path marked “Failed” passes path verification, the Path State is set to “Available” if it is on the “Active” controller, and “Standby” if it is on the “Standby” controller. If auto-failback is enabled, the path becomes “Active” only if the path is on the “Active” controller and it is marked preferred.

Path Management Behavior Summary

Table 1–1 provides a summary of path management behavior conditioned by the optional features of Secure Path.

Table 1–1: Path Management Behavior Summary

Feature	Behavior/Action
Startup	<ul style="list-style-type: none"> • Choose the “Preferred” path to the controller on which the LUN is online. • Mark it “Active.” If no path is marked “Preferred” select one and make it the “Active” Path.
Active Path Failure	<ul style="list-style-type: none"> • Secure Path marks the “Active” path as failed and fails to the “Available” path. • Secure Path moves I/O through available paths. • If there are no “Available” paths, failover occurs to a “Standby” path on the other controller.
Available or Standby Path Failure	<ul style="list-style-type: none"> • Failed path is marked failed. • Behavior is result of background path verification.

Table 1–1: Path Management Behavior Summary (Continued)

Feature	Behavior/Action
Path Repaired	<ul style="list-style-type: none">• Path is marked “Available” or “Standby” depending to which controller the device is currently online.• If auto-failback is enabled, and the path is preferred, then that path is marked “Active.”

Hardware Setup

This chapter provides the following Secure Path hardware setup information:

- Hardware Setup Overview
- Required Components
- Hardware Installation Procedure

Hardware Setup Overview

The following procedure presents an overview of the hardware setup.

1. Prior to setting up your hardware, be sure all users have logged off the server and that all array file systems have been backed up and unmounted.
2. Verify that all the following hardware and software prerequisites have been met:
 - Supported Host Bus Adapters (HBAs) must be installed, and working properly.
 - You are running a supported version of Solaris, with all required patches loaded.
 - A supported version of the Solution Software Kit is installed.

NOTE: Refer to Table 2–1 for all hardware and software prerequisites.

3. Cable your HBAs, switches and storage, making sure that the configuration is valid.
4. Configure your StorageWorks RAID array.

Only one simple Secure Path configuration is described in this guide. Many more valid configurations are possible; however they are not documented here. Therefore, before installing Secure Path on a new or existing Fibre Channel (FC) configuration, first review the RA8000, MA6000/MA8000, ESA12000, and EMA12000 High Availability Application Notes found on the Compaq website. They will familiarize you with various high availability connection layouts for FC devices and cabling.

The application notes present a topological layout of several high-availability options. They also list part numbers and related reference documentation, and discuss restrictions that apply when Secure Path co-exists with cluster software and FC hardware devices.

The following table shows the name and part number of the high availability application notes for FC installations:

<i>Enterprise Modular Storage RAID Array FC-SW Configurations for Sun Application Notes</i>	AA-RQ5WA-TE
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NOTE: For the most current Application Notes, visit the Compaq website at www.compaq.com/products/storageworks.

Required Components

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

Table 2-1: Secure Path Installation Prerequisites

Host Feature	Requirement
Platform	Sun Sparc
Operating System	Solaris 8, Solaris 7, Solaris 2.6
Kernel Mode	32-bit; 64-bit
Sun Hardware	Sun4u Architecture only
Secure Path Software Kit	SANworks Secure Path V3.0 for Sun Solaris
RAID Storage Systems	StorageWorks RA8000/ESA12000, MA8000/EMA12000 or MA6000 (FC) with either HSG60 or HSG80 dual controllers using ACS V8.5 or V8.6 (See note after this table.)
Solution Software Kit	StorageWorks Solution Software for Sun Solaris, V8.5c or V8.6

Table 2–1: Secure Path Installation Prerequisites (Continued)

Host Feature	Requirement			
Host bus Adapters	FC PCI 32-bit Adapter 380576-001 (SWSA4-PC) FC Sbus 64-bit Adapter 123503-001 (DS-SWSA4-SC)			
Required Patches	Solaris 2.6: 105375-18, 105357-04, 105356-10, 106226-01, 105181-29, 106429-02, 106125-08, 105210-38 Solaris 2.7: 106541-16, 107544-03, 106980-16 Solaris 2.8: 108528-09, 109793-07, 111049-02, 110912-01, 111293-03, 110383-01, 110794-02, 108827-10			
Fibre Channel (SAN) Switches	Compaq	8-Port	380591-B21	(DS-DSGGA-AB)
	Compaq	8-Port	176219-B21	(DS-DSGGC-AA)
	Compaq	16-Port	158224-B21	(DS-DSGGB-BA)
	Compaq	16-Port	158225-B21	(DS-DSGGB-BB)
	Compaq	16-Port	212776-B21	(DS-DSGGC-AB)
GBICs	FC Optical GBIC 380561-B21 (short wave)			

NOTE: Running ACS V8.6, the system must have:

- Hardware revision E08 or higher HSG80 controller modules.
- A minimum of 128 MB of cache; if mirrored cache is enabled, an additional 128 MB of cache per controller is required.

Refer to the *ACS Solution Software for HSG80 Release Notes* for details.

Hardware Installation Procedure

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



CAUTION: If you are installing Secure Path on an existing RAID storage system, stop all I/O to the RAID system and skip steps 1 and 2 below.

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 servers and that all I/O to the RAID systems 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 LUN be configured on the RAID storage system, but a complete disk/device configuration is strongly recommended. Additionally, the units must be visible to at least two paths from the Solaris Server using *format*.

4. Verify the configuration of the RAID system by entering 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 E08 2.
    NODE_ID          = 5000-1FE1-0000- 8920 3.
    ALLOCATION_CLASS = 0 4.
    SCSI_VERSION     = SCSI-2 5.
    Configured for MULTIBUS_FAILOVER 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 14.
Host PORT_2: 15.
    Reported PORT_ID = 5000-1FE1-0000-8924 16.
    PORT_2_TOPOLOGY = FABRIC (connection down) 17.
NOREMOTE_COPY 18.
Cache: 19.
    64 megabyte write cache, version 0012 20.
    Cache is GOOD 21.
    No unflushed data in cache 22.
    CACHE_FLUSH_TIMER = DEFAULT (10 seconds) 23.
Mirrored Cache: 24.
    64 megabyte write cache, version 0012 25.
    Cache is GOOD 26.
```

No unflushed data in cache	27.
Battery:	28.
NOUPS	29.
FULLY CHARGED	30.
Expires:	16-DEC-2001 31.

- a. Configure the RAID system controllers for Multiple-bus Failover Mode, if the controllers are in Transparent Failover Mode (see line 6 of the example controller output). This procedure is documented in Appendix A.

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

NOTE: When you change the HSGx0 controller pair from Transparent Failover Mode to Multiple-bus Failover Mode in fabric, 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 adapters.

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, if desired, 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
```

Enter the following CLI commands to transition the units to the preferred path:

```
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. If required, install the Fibre Channel adapters per the adapter installation instructions.

- Cable the Fibre Channel adapter and the RAID storage system controllers to the SAN Switches, as shown in Figure 2–1.

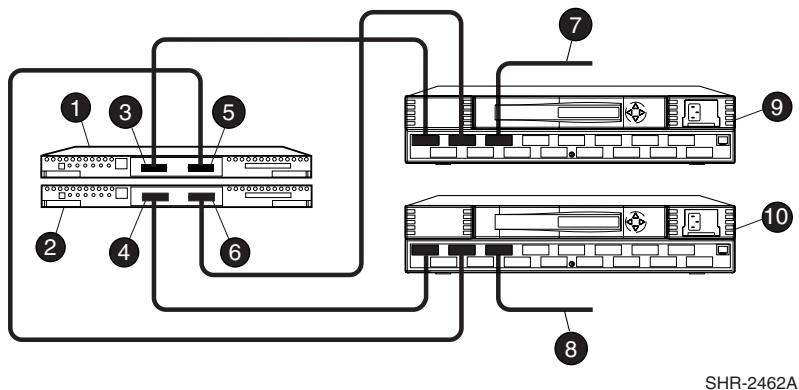


Figure 2–1: Cabling Two RAID Controllers and Two SAN Switches

- | | |
|---|--|
| ❶ Top HSGx0 Controller | ❸ Bottom Controller, port 2 (to host via top switch) |
| ❷ Bottom HSGx0 Controller | ❹ FC cable to host bus adapter A |
| ❺ Top Controller, port 1 (to host via top switch) | ❻ FC cable to host bus adapter B |
| ❻ Bottom Controller, port 1 (to host via bottom switch) | ❹ SAN Switch (top) |
| ❽ Top Controller, port 2 (to host via bottom switch) | ❷❸ SAN Switch (bottom) |

- Power on the server.
- Boot the system using the reconfiguration switch at the open boot prompt (ok) as follows:
ok boot -r

9. If you do not have a supported version of the SANworks Solution Software (refer to Table 2–1), you will need to install it now. Refer to the instructions provided in the Solutions Software kit.
10. During the Solution Software installation, you will be prompted to
11. Use the `/opt/steam/bin/config.sh` utility; choosing *Option 20*, and then *Option 4* during solution software installation to:
 - Configure the Fibre Channel drivers for fabric mode
 - Install or reinstall the Solution Software for Solaris kit
 - Configure the Fibre Channel drivers for fabric mode.

NOTE: If you 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.

12. Verify that the correct WWPNS have been mapped to targets. This information is found in the output displayed using the following command (Line 2).

NOTE: This example only shows partial output from the command.

CLI> show this

```

Host PORT_1:                                     1.
    Reported PORT_ID = 5000-1FE1-0000-8923       2.
    PORT_1_TOPOLOGY = FABRIC (fabric up)         3.
Address          = 021000                        4.
Host PORT_2:                                     5.
    Reported PORT_ID = 5000-1FE1-0000-8924       6.
    PORT_2_TOPOLOGY = FABRIC (connection down)   7.

```

13. After you install the Solution Software, and the WWPNS have been mapped to targets, you will be prompted to reboot your system with the reconfigure flag. Use the following commands:

```

# touch /reconfigure
# reboot

```

14. After the server has booted, check the RAID storage system to ensure that the connection operating system setting is SUN, using the following commands:

- a. To inspect the connection settings, enter:

```
CLI> show connection
```

Example show connections output:

Connection						Unit
Name	Operating system	Controller	Port	Address	Status	Offset
!NEWCON021000	SUN	THIS	1	000001	OL this	0
	HOST_ID=1000-00E0-6940-123C			ADAPTER_ID=2000-00E0-6940-123C		
!NEWCON031000	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. Perform one of the following actions:

- If a RAID storage system is shared (accessed by more than one server), Compaq recommends that both `offset` and `enable_path_access` be applied to each connection and unit on the RAID system by entering the following command:

```
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
```

- d. Set the `enable_access_paths`:

```
CLI > set Dn disable_access_path = all
```

```
CLI > set Dn enable_access_path = connection_name, connection_name
```

```
CLI > restart other_controller
```

```
CLI > restart this_controller
```

The RAID System is now ready for the installation of the Secure Path Software, as described in Chapter 3.

Installing Secure Path Software

This chapter provides the procedures to install a *new* Secure Path software configuration. If you are upgrading an existing Secure Path installation, refer to Chapter 5.

This chapter contains the following information that is required for proper Secure Path installation and operation.

- Installation Prerequisites
- Software Installation Procedure
- Using spconfig to Configure the System for Secure Path
- Spconfig Error Messages
- Configuration Files Added/Modified by Secure Path V3.0
- Secure Path and the CCL

Installation Prerequisites

IMPORTANT: Before attempting to install Secure Path software, please read the Release Notes.

Before installing Secure Path V3.0, verify the following requirements:

- The prerequisites listed in Table 2–1 on page 2–2 have been met.
- The procedures in Chapter 2, “Hardware Setup” have been performed.
- At least one unit is configured on the RAID storage system and is visible to the server from at least 2 paths. Ideally, and strongly recommended, the RAID storage systems should be configured with all the desired storagesets/units.

Software Installation Procedure

Install Secure Path software by performing the following procedures:



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 servers and that **all** I/O to the RAID systems has ceased. Follow normal procedures to back up the storage systems before proceeding.

1. Back up the entire system, according to normal procedures.
2. Check to make sure that *vold*, the volume management daemon, is running by entering the following command:

```
# ps -ea | grep vold
```

- If *vold* is currently running:
 - a. Insert the Secure Path V3.0 CD-ROM into the CD-ROM Drive.
 - b. Check that the volume manager has automatically mounted the CD-ROM, by entering the following command:

```
# 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 by entering the following command:

```
# cd /cdrom/sp_v30_sun/solaris
```

- d. Continue with step 3.

- If *vold* is not currently running:
 - a. Insert the Secure Path V3.0 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/solaris
```

3. Install Secure Path software, *CPQswsp*, on the Sun server by running the Solaris *pkgadd* utility using the following command:

```
# pkgadd -d pkgs
```

Below is a sample successful installation script, including the user's responses to the prompts.

```
# pkgadd -d pkgs
The following packages are available:
1  CPQswsp      SANworks Secure Path
      (sparc) 3.0
Select package(s) you wish to process (or 'all' to process
all packages). (default: all) [?,??,q]: 1
Processing package instance <CPQswsp> from </tmp>
SANworks Secure Path
(sparc) 3.0
# Copyright Compaq Computer Corporation 2001, All rights reserved.
#
# Restricted Rights: Use, duplication by the U.S. Government is subject
# to restriction as set forth in subparagraph (c) (1) (ii) of DFARS
# 252.227-7013, or in FAR 52.227-19, or in FAR 52.227-14 Alt. III, as
# applicable
#
# Portions of this software are proprietary to and embody the confidential
# technology of Compaq Computer Corporation. Possession, use, or copying of
# this software and media is authorized only pursuant to a valid written
# license from Compaq or an authorized sublicensor.
```

```
#
Installing Secure Path Version 3.0
Logging to /var/adm/CPQswsp.FriSep14-15:12:04.log
## Executing checkinstall script.
Found prerequisite kit(s): CPQfcraid
Using </opt> as the package base directory.
## Processing package information.
## Processing system information.
4 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>
## Executing preinstall script.
## Installing part 1 of 1.
[ verifying class <none> ]
/etc/rc0.d/K36spinit <linked pathname>
/etc/rc1.d/K36spinit <linked pathname>
/etc/rc2.d/S89spinit <linked pathname>
/etc/rcS.d/K36spinit <linked pathname>
/etc/rcS.d/S89spinit <linked pathname>
## Executing postinstall script.

*****
*****
**
** Please run /opt/CPQswsp/bin/spconfig                               **
** before rebooting your system to complete the installation of Secure Path**
**
*****
*****
Installation of <CPQswsp> was successful.
The following packages are available:
1 CPQswsp      SANworks Secure Path
(sparc) 3.0
Select package(s) you wish to process (or 'all' to process
all packages). (default: all) [?,??,q]: q
#
```

Using spconfig to Configure the System for Secure Path

While installing Secure Path, the software specifically requests that the configuration tool, *spconfig*, be invoked to configure Secure Path.

The *spconfig* tool is a configuration tool for the files *hsx.conf*, *swsp.conf*, *fca-pci.conf*, *fcaw.conf*, and *sd.conf* which are located in */kernel/drv*.

The *spconfig* tool requires at least one LUN with at least 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: The *spconfig* utility is normally run without any options, as follows:

```
#/opt/CPQswsp/bin/spconfig
```

Some configurations may present too many combinations for *spconfig* to determine the desired HBA and RAID storage system combinations. If this is the case, run the *spconfig* utility interactively which requires user input to define the configuration. Invoke interactive configuration by entering *spconfig* with a switch to indicate operator intervention (-o) as shown in the following sample command:

```
# /opt/CPQswsp/bin/spconfig -o
```



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.

Sample *spconfig* Sessions

This section provides two sample sessions: one that is relatively simple, containing no options, and another that is more complex, using the `-o` option.

spconfig Session Without Options

The following is an example of running *spconfig* without any options:

```
# /opt/CPQswsp/bin/spconfig
Indicator Key:
.      Inquiry
+      Show This CLI command
-      Show Other CLI command
~      Show Connections CLI command
,      Show Units CLI command
.+~/,.....
Writing conf files.
* * * * *
Done.
#
```

spconfig Session With Options

The following procedure is an example of an *spconfig* session (partial) with operator intervention. The session is from a system that has a pair of Sbus and a pair of PCI adapters to two separate RAID systems.

```
# /opt/CPQswsp/bin/spconfig -o
```

1. *Spconfig* identifies the device, HBA, and RAID storage system and queries if this should be a Secure Path device/target. Answer **yes** or **no** in response to each query. With a yes response, *spconfig* will configure the RAID storage system.

```
-----
Found the following target:
  Device:      /dev/rdisk/c3t65d0s2
  HBA:        /fca-pci0
  RAID Array: 5000-1FE1-0000-4920
-----
Is this a valid SecurePath Device/Target? [y or n]:y
```


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

```
-----
Found the following target:
  Device:          /dev/rdsk/c2t64d0s2
  HBA:            fcaw0
  RAID Array:     5000-1FE1-0000-5920
-----
```

Is this a valid SecurePath Device/Target? [y or n]:y

3. After the Secure Path HBAs and storage systems have been configured, *spconfig* generates the configuration files, *hsx.conf* and *swsp.conf*. It also modifies and/or adds entries to *sd.conf*.

```
Writing conf files.
* * * * *
Done.
#
```

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

4. At this point, *spconfig* has completed the necessary file creation and modifications and the system is ready for a configuration. Reboot by entering the following commands:

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

5. After the system has been rebooted, verify the Secure Path configuration by running the Secure Path Maintenance Tool, *spmgr*.

Example:

```
# /opt/CPQswsp/bin/spmgr display
Server: pluto          Report Created: Tue, Oct 02 15:37:36 2001
Command: ./spmgr display
=====
Storage: 5000-1FE1-0010-5D90
Load Balance: Off    Auto-restore: Off
Path Verify: On     Verify Interval: 30
HBAs: fcaw-0 fcaw-1
Controller: ZG10505157, Operational
           ZG10505033, Operational
Devices:  c4t0d0 c4t0d1 c4t0d2 c4t0d3 c4t0d4 c4t0d5
```

TGT/LUN	Device	WWLUN_ID	Parent	#_Paths	
0/ 0	c4t0d0	6000-1FE1-0010-5D90-0009-1050-5157-0019	/swsp@0,1	4	
	Controller	Path_Instance	HBA	Preferred?	Path_Status
	ZG10505157	hsx-214-33-0	fcaw-0	no	Standby
		hsx-624-33-0	fcaw-1	no	Standby
	Controller	Path_Instance	HBA	Preferred?	Path_Status
	ZG10505033	hsx-419-32-0	fcaw-0	no	Active
		hsx-829-32-0	fcaw-1	no	Available

Responding to a Configuration Error

Table 3-1 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 V3.0 installation.

If an error occurs:

1. Take the recommended corrective action to clear the reported problem.
2. Invoke *spconfig* again and verify the problem no longer exists.
3. You may also need to re-run *spconfig* with different options (most likely -o).

Refer to "spconfig Command Syntax and Options" on page 3-10 for a description of *spconfig* syntax and options.

Spconfig Error Messages

Table 3–1: Spconfig Errors

Error Message	Description	Corrective Action
Invalid argument: <i>arg</i>	See usage	See Table 3–2 on page 3–11.
<i>directoryArg</i> is not a directory	Argument supplied with -p is not a directory	Make sure the directory supplied with the -p option is a directory.
<i>directoryArg</i> : No such file or directory	No such file or directory for argument supplied with -p	Make sure the directory supplied with the -p option is a directory.
stat(<i>directoryArg</i>): <i>systemError</i>	Stat error for argument supplied with -p	See stat(2) man page.
alloc(<i>#bytes</i>) <i>systemError</i>	Out of system memory	Make sure the system has adequate free memory and that it is tuned to allow a single process to access an adequate amount of the free memory.
calloc(): <i>systemError</i>	Out of system memory	Make sure the system has adequate free memory and that it is tuned to allow a single process to access an adequate amount of the free memory.
Can't find WWPN for adapter parent " <i>parent</i> " type <i>type</i>	Could not find the WWPN to match the HBA	Make sure the HBA driver version is supported or that /var/adm/messages contains the WWPN for this adapter.
NULL start of list <i>arrayPtr</i> <i>HBAPtr</i>	No valid devices to configure	Make sure you are in Multibus mode and that your Selective Storage Presentation is correct.

Table 3–1: Spconfig Errors (Continued)

Error Message	Description	Corrective Action
NULL start of list on conn <i>ConnHBAPtr ConnPortPtr</i>	No valid connections in HSG connection table	Make sure that the connection table contains valid connection data for this host.
Missing D# token	Bad CLI data, could not find D#	Stop all I/O to the storage and rerun <i>spconfig</i> .
Corrupt D#	Bad CLI data, the D# is not a number	Stop all I/O to the storage and rerun <i>spconfig</i> .
Missing LUN ID: token	Bad CLI data, could not find "LUN ID:" token	Stop all I/O to the storage and rerun <i>spconfig</i> .
Missing LUN ID	Bad CLI data, could not find LUN ID	Stop all I/O to the storage and rerun <i>spconfig</i> .
Missing Access: token	Bad CLI data, could not find "Access:" token	Stop all I/O to the storage and rerun <i>spconfig</i> .
ScsiRecvDiag:Sense key: <i>key</i> , ASC: <i>asc</i> , ASCQ: <i>ascq</i>	CLI error on receive diagnostics	Call support.
ScsiRecvDiag(): devfd= <i>fileDesc</i> SendStat= <i>status</i> Sense key: <i>key</i> , ASC: <i>asc</i> , ASCQ: <i>ascq</i>	CLI error on receive diagnostics	Call support.

spconfig Command Syntax and Options

spconfig is a configuration utility used for Secure Path installation. This utility generates entries for all HSG devices that are configured for multiple-bus mode. This utility may be run more than once, however it is typically used only for initial system configuration.

Syntax:

```
spconfig
    [-h]
    [-i]
    [-s]
    [-o]
    [-p path]
    [-d number]
```

Table 3–2: Spconfig Options

Option	Description
-h	Displays usage statement.
-i	Disables progress indicators.
-s	Silences all screen output, except errors.
-o	Operator intervention; prompts for each storage system found and asks if you want to add it to the configuration.
-p	Writes configuration files to directory specified by <path>, however prototype and existing files are still read from /kernel/drv.
-d	Modifies dynamic LUN options, where <number> is the number of extra entries to add. The number of entries can be between 0 and 255. The default number of entries (if the -d option is not specified) is 199.

Configuration Files Added/Modified by Secure Path V3.0

Table 3–3 lists the files added or modified as part of the Secure Path V3.0 installation.

Table 3–3: Configuration Files Added/Modified by Secure Path V3.0

Added Files	Description
/kernel/drv/hsx.conf	Configuration file for the hsx driver.
/kernel/drv/swsp.conf	Configuration file for the swsp driver.
Modified Files	Description
/etc/driver_classes	Registers the swsp driver.
/etc/devlink.tab	Defines devlinks entry for the swsp 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).

Table 3–3: Configuration Files Added/Modified by Secure Path V3.0

Added Files	Description
/kernel/drv/sd.conf	Adds pseudo/swsp entries for Secure Path targets.

File/Entry Format

/etc/driver_classes

For the *swsp* driver to be properly associated with a driver class, the installation process adds to the *driver_classes* file:

```
swsp scsi
```

/etc/devlink.tab

So that the Secure Path utilities can communicate with the drivers, the installation process adds to the *devlink.tab* file:

```
type=ddi_pseudo;name=swsp;minor=ctl swsppCtl
```

/kernel/drv/fcaw.conf (Sbus driver)

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

In a fabric configuration, a target must be assigned to a WWP. Target values must be in the range of 32 up to 125, inclusive. For example, to assign target 32 to the port number 5000-1FE1-0000-0D43, *fcaw.conf* would have the following entry:

```
target32_wwpn="50001FE100000D43";
```

/kernel/drv/hsx.conf

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

Example entries in the *hsx.conf* file for the Sbus adapter:

```
name="hsx" parent="/sbus@49,0/fcaw@1,0" target=32 LUN=20 qdepth=32;
```

```
name="hsx" parent="/sbus@50,0/fcaw@1,0" target=33 LUN=20 qdepth=32;
```

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 entries in the *hsx.conf* file for the PCI adapter:

```
name="hsx" parent="/pci@b,2000/fibre-channel@2" target=32 lun=0 qdepth=32;
name="hsx" parent="/pci@f,2000/fibre-channel@2" target=33 lun=0 qdepth=32;
```

/kernel/drv/swsp.conf

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

```
name="swsp" class="root" portid=0 reg=0x0,0x1,0x1 instance=0
array-name="5000-1FE1-0000-8920";
```

The other entries in the *swsp.conf* file designate the specific units identified by the World Wide LUN ID assigned by the RAID storage system. For every pair of LUN assignments in *hsx.conf* there is a matching `wwlid_IITTL=in swsp.conf`.

- The instance number **I** assigns the LUN to a particular RAID system.
- The target and LUN number **T** and **L** assigns the target and LUN number presented to the SCSI disk driver.

The value assigned must have a corresponding entry in the */kernel/drv/sd.conf* file. Examples of entries in *swsp.conf* file are as follows:

```
wwlid_I0T0L0="6000-1FE1-0001-ED10-0009-9281-0311-0001";
wwlid_I0T0L1="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 unique target LUN nexus. These entries are placed at the head of the *sd.conf* file and allow Secure Path devices to configure prior to other sd targets. When Secure Path places the *pseudo/swsp.conf* entries at the head of the *sd.conf* file, conflicts between Secure Path entries and other SCSI bindings are prevented.

Secure Path entries have the format:

```
name="sd" parent="swsp" target=T LUN=L; where T represents the target and L the LUN number.
```

For example, Secure Path device target 0 and LUN 0 would have the following entry:

```
name="sd" parent="swsp" target=0 LUN=0;
```

Secure Path and the CCL

Secure Path provides support for both SCSI-2 and SCSI-3 CCL modes. During the installation of Secure Path, a special driver (cpqccl) is loaded that allows Solaris to recognize the SCSI-3 CCL. Due to the simplicity, this is the preferred mode. You may also configure the CCL in SCSI-2 mode. In this case, the CCL is seen by the system as a standard disk.

Managing Secure Path

This chapter describes the user interface for the Secure Path V3.0 Management tool: *spmgr*. It includes the following topics:

- Secure Path Manager Overview
- Spmgr Commands
- Spmgr Common Terms
- Displaying Configuration Information
- The alias and unalias Commands
- Setting Storage System Parameters
- Path Management
- The add and delete WWLUNID Commands

NOTE: Examples are based on the HSG80 controller, but all actions are identical for the HSG60 controller.

Secure Path Manager Overview

The Secure Path Manager (*spmgr*) utility enables the user to monitor and manage devices, storage systems, and paths to units that are in the Secure Path configuration. It also allows modifications to the configuration for the purpose of repair, replacement, or reconfiguration; *spmgr* relies on the *spagent* to handle calls to the driver (*swsp*).

Spmgr Commands

This section describes the *spmgr* commands. Table 4–1 lists the command options; their format and usage are presented in detail after the table.

Table 4–1: *Spmgr* Commands

Command	Options / Argument	Description
spmgr add	WWLUNID [target LUN]	Add a new device to the Secure Path configuration.
spmgr alias	alias_name old_name no argument	Assign an alias to an object.
spmgr delete	WWLUNID device	Removes a device from the Secure Path configuration.
spmgr display	-a[v] [adapter] -c[v] [controller_ser_num] -d[v] [device] -p path-Instance -r[v] [WWNN] -u -l no argument	Displays information about configured Secure Path devices.
spmgr log	-c 0, 1...3 -l 0, 1...3 -n 0, 3 no argument	Sets logging to the console, system log file, and e-mail notification.
spmgr notify	add severity_level email_address delete email_address no argument	Manage e-mail address and event logging severity to each e-mail recipient.
spmgr prefer	path_instance	Assign a preferred attribute to a path.
spmgr quiesce	-a adapter -c controller_ser_num -p path_instance	Move I/O to an alternative object and temporarily remove selected object from use.
spmgr restart	-a adapter -c controller_ser_num -p path_instance all	Return a previously quiesced object to an active or available state.

Table 4–1: Spmgr Commands (Continued)

Command	Options / Argument	Description
spmgr restore	-d device -r WWNN all	Restore one or more devices to their preferred I/O path.
spmgr select	-a adapter [-d device] -c controller_ser_num [-d device] -p path_instance	Select a path for I/O.
spmgr set	-a on off [WWNN] -b on off [WWNN] -f interval -p on off [WWNN]	Enable or disable special driver functionality.
spmgr unalias	alias_name old_name	Delete an alias.
spmgr unprefer	path_instance	Remove a preferred path attribute.

NOTE: Commands typed without an argument respond with “usage” if the command is a configuration altering command. The commands: *alias*, *display*, *log*, and *notify* respond with current command or configuration information.

Spmgr Common Terms

The following table describes the common terms used with *spmgr*. For a more complete list of Secure Path terms, refer to the Glossary provided at the end of this guide.

Table 4–2: Spmgr Common Terms

Term	Definition
Device	The standard representation for a device or device link on a server. For example: <code>cxtYdz</code> .
Logical Unit	The logical unit or LUN is a device that is managed by Secure Path and identified by its 32-digit World Wide LUN Identifier (WWLUNID).
Adapter	The operating system ID of the HBA.
Storage System (Array)	The storage system as identified by its 16-digit World Wide Node Name (WWNN).
Controller	The controller is identified by a unique serial number. The serial number of the HSG80/60 is a 10-character alphanumeric string.

Displaying Configuration Information

Controller States

The following table lists the possible controller states and their descriptions.

Table 4–3: Controller States

Controller State	Description
Failed	This state may mean a failed or offline condition, since the server cannot communicate with the other controller at this time.
Operational	The controller is available with a good status.
Unknown	The server cannot communicate with this controller.

Path States and Attribute

The following table lists and describes the path states reported by the Secure Path driver.

Table 4–4: Path States and Attribute

Path States/ Attribute	Description
Active	This state indicates that the path is currently used for the I/O stream.
Available	This state indicates that the path is available on the active controller for the I/O stream.
Failed	This state indicates that the path is currently unusable for the I/O stream.
Quiesced	This state indicates that the path may be valid, but has been made unavailable for I/O.
Standby	This state indicates that the path is valid on the standby controller.
Preferred	This attribute indicates that the path is preferred for the I/O stream, across reboots. It may not be assigned to either a failed or a quiesced path.

Device States

The following table lists and describes device states.

Table 4–5: Device States and Description

Device States	Description
Critical	Only one path remains available to the storage unit.
Degraded	At least one or more paths are failed to the storage unit.
Operational	All paths are available to the storage unit.
Unknown	Unable to communicate with the unit. This may indicate no available path or a failed device.
Failed	Paths are available but an inquiry to the device returns a not-ready state even after retries.

Display Header Information

Due to the possible complexity of the Secure Path configuration and the possibility of shared storage or clustered software across multiple servers, the display information will always have two standard lines of information at the start of the display:

Line 1: Server: Server Name Report Created: Date and Time

Line 2: Command: Command string

The display Command

This section describes the # spmgr display commands and associated switches. Each switch results in a different type of display.

Each command line must begin with the following standard path information:

```
# /opt/CPQswsp/bin/spmgr
```

NOTE: The verbose flag may only be used with some, but not all, cases of the command.

Syntax:

```
# spmgr display -a[v] [adapter]
                 -c[v] [controller_ser_num]
                 -d[v] [device]
                 -p path_instance
                 -r[v] [WWNN]
                 -l
                 -u
                 (no argument)
```

For each of these command switches, this section presents:

- Description
- Syntax
- All forms of the command
- Examples of all forms of the command
- Example displays of all forms of the command.

spmgr display

When you enter # spmgr display, all information for the entire configuration is displayed. The amount of information displayed depends on the number of HBAs, storage systems, and paths to a unit on each storage system.

The full display derives from the component portions described in this section. You can limit the amount of data displayed by combining the # spmgr display command with one of the described switches.

Example:

```
# /opt/CPQswsp/bin/spmgr display

Server: pluto          Report Created: Tue, Oct 02 15:37:36 2001
Command: ./spmgr display
=====
Storage: 5000-1FE1-0010-5D90
Load Balance: Off   Auto-restore: Off
Path Verify: On    Verify Interval: 30
HBAs: fcaw-0 fcaw-1
Controller: ZG10505157, Operational
              ZG10505033, Operational
Devices: c4t0d0 c4t0d1 c4t0d2 c4t0d3 c4t0d4 c4t0d5

TGT/LUN  Device          WWLUN_ID          Parent          #_Paths
0/ 0     c4t0d0          6000-1FE1-0010-5D90-0009-1050-5157-0019  4
                                                /swsp@0,1
          Controller Path_Instance     HBA              Preferred?      Path_Status
          ZG10505157
          hsx-214-33-0   fcaw-0           no               Standby
          hsx-624-33-0   fcaw-1           no               Standby
          Controller Path_Instance     HBA              Preferred?      Path_Status
          ZG10505033
          hsx-419-32-0   fcaw-0           no               Active
          hsx-829-32-0   fcaw-1           no               Available

TGT/LUN  Device          WWLUN_ID          Parent          #_Paths
0/ 1     c4t0d1          6000-1FE1-0010-5D90-0009-1050-5157-001A  4
                                                /swsp@0,1
          Controller Path_Instance     HBA              Preferred?      Path_Status
          ZG10505157
          hsx-215-33-1   fcaw-0           no               Standby
          hsx-625-33-1   fcaw-1           no               Standby
          Controller Path_Instance     HBA              Preferred?      Path_Status
          ZG10505033
          hsx-420-32-1   fcaw-0           no               Active
```

		hsx-830-32-1	fcaw-1	no	Available
TGT/LUN	Device	WWLUN_ID	Parent		#_Paths
0/ 2	c4t0d2	6000-1FE1-0010-5D90-0009-1050-5157-001B	/swsp@0,1		4
	Controller	Path_Instance	HBA	Preferred?	Path_Status
	ZG10505157			no	
		hsx-216-33-2	fcaw-0	no	Standby
		hsx-626-33-2	fcaw-1	no	Standby
	Controller	Path_Instance	HBA	Preferred?	Path_Status
	ZG10505033			no	
		hsx-421-32-2	fcaw-0	no	Active
		hsx-831-32-2	fcaw-1	no	Available

spmgr display -a[v] [HBA]

The -a switch lists HBA (host bus adapter) related information. If a parameter is supplied, it must be the *adapter instance number*.

Syntax:

```
# spmgr display -a
      -av
      -a HBA
      -av HBA
```

When the -a switch is used without a parameter, the display contains a complete list of all HBAs in the Secure Path configuration from the server where the command is entered.

Example:

```
# /opt/CPQswsp/bin/spmgr display -a

Server: pluto          Report Created: Tue, Oct 02 14:50:53 2001
Command: ./spmgr display -a
Adapters in the Secure Path Configuration
=====
fcaw-0, fcaw-1
```

When the -a switch is paired with the v switch, the display contains a list of all adapters in the Secure Path configuration. In this case, the “v” acts like a wildcard for the device switch, -a.

Example:

```
# /opt/CPQswsp/bin/spmgr display -av

Server:   pluto           Report Created: Tue, Oct 02 14:51:03 2001
Command:  ./spmgr display -av
Adapter   Parent                Driver Version
=====
fcaw-0    /sbus@2,0/fcaw@1,0      2.5.9
fcaw-1    /sbus@6,0/fcaw@1,0      2.5.9
```

When invoked with the -a switch and HBA, the display shows the Solaris path attached to the HBA, as shown in the following example:

Example:

```
# /opt/CPQswsp/bin/spmgr display -a fcaw-0

Server:   pluto           Report Created: Tue, Oct 02 14:53:16 2001
Command:  ./spmgr display -a fcaw-0
Adapter   Parent                Driver Version
=====
fcaw-0    /sbus@2,0/fcaw@1,0      2.5.9
```

When invoked with the -a switch, v switch, and HBA, the display shows all paths attached to the HBA, as shown in the following example:

Example:

```
# /opt/CPQswsp/bin/spmgr display -av fcaw-0

Server:   pluto           Report Created: Tue, Oct 02 14:53:36 2001
Command:  ./spmgr display -av fcaw-0
=====
Adapter:  fcaw-0         Version: 2.5.9
Parent:   /sbus@2,0/fcaw@1,0
Storage:  5000-1FE1-0010-5D90
```

Item	Device	Controller	HBA	Parent	Instance
0	c4t0d0	ZG10505157	fcaw-0	/swsp@0,1	hsx-214-33-0
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
1	c4t0d0	ZG10505033	fcaw-0	/swsp@0,1	hsx-419-32-0
	WWNN: 5000-1FE1-0010-5D90			Path State: Active	
2	c4t0d1	ZG10505157	fcaw-0	/swsp@0,1	hsx-215-33-1
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
3	c4t0d1	ZG10505033	fcaw-0	/swsp@0,1	hsx-420-32-1
	WWNN: 5000-1FE1-0010-5D90			Path State: Active	

```

4      c4t0d2  ZG10505157  fcaw-0  /swsp@0,1      hsx-216-33-2
      WWNN: 5000-1FE1-0010-5D90      Path State: Standby
5      c4t0d2  ZG10505033  fcaw-0  /swsp@0,1      hsx-421-32-2
      WWNN: 5000-1FE1-0010-5D90      Path State: Active
6      c4t0d3  ZG10505157  fcaw-0  /swsp@0,1      hsx-217-33-3
      WWNN: 5000-1FE1-0010-5D90      Path State: Standby
7      c4t0d3  ZG10505033  fcaw-0  /swsp@0,1      hsx-422-32-3
      WWNN: 5000-1FE1-0010-5D90      Path State: Active
8      c4t0d4  ZG10505157  fcaw-0  /swsp@0,1      hsx-218-33-4
      WWNN: 5000-1FE1-0010-5D90      Path State: Standby
9      c4t0d4  ZG10505033  fcaw-0  /swsp@0,1      hsx-423-32-4
      WWNN: 5000-1FE1-0010-5D90      Path State: Active
10     c4t0d5  ZG10505157  fcaw-0  /swsp@0,1      hsx-219-33-5
      WWNN: 5000-1FE1-0010-5D90      Path State: Standby
11     c4t0d5  ZG10505033  fcaw-0  /swsp@0,1      hsx-424-32-5
      WWNN: 5000-1FE1-0010-5D90      Path State: Active

```

spmgr display -c[v] [controller_serial_number]

The -c switch displays controller related information. If a parameter is supplied, it must be a *controller_serial_number*. The command has the following possible forms:

Syntax:

```

# spmgr display -c
                -cv
                -c controller_serial_number
                -cv controller_serial_number

```

Example:

```

# /opt/CPQswsp/bin/spmgr display -c

Server:  pluto          Report Created: Tue, Oct 02 14:51:50 2001
Command: ./spmgr display -c
Current Controller List
=====
ZG10505157, ZG10505033

```

Example:

```
# /opt/CPQswsp/bin/spmgr display -cv
Server: pluto          Report Created: Tue, Oct 02 14:51:55 2001
Command: ./spmgr display -cv
Controller: ZG10505157 Status: Operational
Vendor: Compaq
WWNN: 5000-1FE1-0010-5D90
WWPN1: 5000-1FE1-0010-5D93
HBAs: fcaw-0, fcaw-1

Controller: ZG10505033 Status: Operational
Vendor: Compaq
WWNN: 5000-1FE1-0010-5D90
WWPN1: 5000-1FE1-0010-5D91
HBAs: fcaw-0, fcaw-1
```

Example:

```
# /opt/CPQswsp/bin/spmgr display -c ZG10505167
Server: pluto          Report Created: Tue, Oct 02 14:52:35 2001
Command: ./spmgr display -c ZG10505157
Controller: ZG10505157 Status: Operational
Vendor: Compaq
WWNN: 5000-1FE1-0010-5D90
WWPN1: 5000-1FE1-0010-5D93
HBAs: fcaw-0, fcaw-1
```

Example:

```
# /opt/CPQswsp/bin/spmgr display -cv ZG10505167
```

```
Server: pluto          Report Created: Tue, Oct 02 14:52:53 2001
Command: ./spmgr display -cv ZG10505157
Controller: ZG10505157  Status: Operational
Vendor: Compaq
WWNN: 5000-1FE1-0010-5D90
WWPN1: 5000-1FE1-0010-5D93
HBAs: fcaw-0, fcaw-1
```

Item	Device	Controller	HBA	Parent	Instance
0	c4t0d0	ZG10505157	fcaw-0	/swsp@0,1	hsx-214-33-0
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
1	c4t0d0	ZG10505157	fcaw-1	/swsp@0,1	hsx-624-33-0
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
2	c4t0d1	ZG10505157	fcaw-0	/swsp@0,1	hsx-215-33-1
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
3	c4t0d1	ZG10505157	fcaw-1	/swsp@0,1	hsx-625-33-1
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
4	c4t0d2	ZG10505157	fcaw-0	/swsp@0,1	hsx-216-33-2
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
5	c4t0d2	ZG10505157	fcaw-1	/swsp@0,1	hsx-626-33-2
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
6	c4t0d3	ZG10505157	fcaw-0	/swsp@0,1	hsx-217-33-3
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
7	c4t0d3	ZG10505157	fcaw-1	/swsp@0,1	hsx-627-33-3
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
8	c4t0d4	ZG10505157	fcaw-0	/swsp@0,1	hsx-218-33-4
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
9	c4t0d4	ZG10505157	fcaw-1	/swsp@0,1	hsx-628-33-4
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
10	c4t0d5	ZG10505157	fcaw-0	/swsp@0,1	hsx-219-33-5
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
11	c4t0d5	ZG10505157	fcaw-1	/swsp@0,1	hsx-629-33-5
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	

spmgr display -d[v] [device]

The `-d` switch displays device related information. If a parameter is supplied, it must be a *device*.

Syntax:

```
# spmgr display -d
          -dv
          -d [device]
          -dv [device]
```

Example:

```
# /opt/CPQswsp/bin/spmgr display -d
Server:   pluto           Report Created: Tue, Oct 02 14:54:05 2001
Command:  ./spmgr display -d
Devices by Storage System
=====
Storage:  5000-1FE1-0010-5D90
Devices:  c4t0d0  c4t0d1  c4t0d2  c4t0d3  c4t0d4  c4t0d5
```

Example:

```
# /opt/CPQswsp/bin/spmgr display -dv
Server:   pluto           Report Created: Tue, Oct 02 14:54:13 2001
Command:  ./spmgr display -dv
Device:   c4t0d0
Status:   Operational [4 paths (2/0/2)]
Storage:  5000-1FE1-0010-5D90
LUN ID:   6000-1FE1-0010-5D90-0009-1050-5157-0019
Preferred Controller: None
HBAs:    fcaw-0 fcaw-1

Device:   c4t0d1
Status:   Operational [4 paths (2/0/2)]
Storage:  5000-1FE1-0010-5D90
LUN ID:   6000-1FE1-0010-5D90-0009-1050-5157-001A
Preferred Controller: None
HBAs:    fcaw-0 fcaw-1

Device:   c4t0d2
Status:   Operational [4 paths (2/0/2)]
Storage:  5000-1FE1-0010-5D90
LUN ID:   6000-1FE1-0010-5D90-0009-1050-5157-001B
Preferred Controller: None
```

HBAs: fcaw-0 fcaw-1

Device: c4t0d3
Status: Operational [4 paths (2/0/2)]
Storage: 5000-1FE1-0010-5D90
LUN ID: 6000-1FE1-0010-5D90-0009-1050-5157-001C
Preferred Controller: None
HBAs: fcaw-0 fcaw-1

Device: c4t0d4
Status: Operational [4 paths (2/0/2)]
Storage: 5000-1FE1-0010-5D90
LUN ID: 6000-1FE1-0010-5D90-0009-1050-5157-001D
Preferred Controller: None
HBAs: fcaw-0 fcaw-1

Device: c4t0d5
Status: Operational [4 paths (2/0/2)]
Storage: 5000-1FE1-0010-5D90
LUN ID: 6000-1FE1-0010-5D90-0009-1050-5157-001E
Preferred Controller: None
HBAs: fcaw-0 fcaw-1

NOTE: Secure Path displays path states using the following rules:

- The following convention is used:
[total number of paths (active/failed/standby)]
Where: Actual numerical equivalents replace the text.
- For example, the following attributes:
Total paths = 10, Active = 8, Failed = 0, Standby = 2
Are displayed as:
[10 paths (8/0/2)]

Example:

```
# /opt/CPQswsp/bin/spmgr display -d c4t0d5
```

```
Server: pluto Report Created: Tue, Oct 02 14:54:57 2001  
Command: ./spmgr display -d c4t0d5  
Device: c4t0d5  
Status: Operational [4 paths (2/0/2)]  
Storage: 5000-1FE1-0010-5D90  
LUN ID: 6000-1FE1-0010-5D90-0009-1050-5157-001E  
Preferred Controller: None  
HBAs: fcaw-0 fcaw-1
```

Example:

```
# /opt/CPQswsp/bin/spmgr display -dv c4t0d5
```

```
Server: pluto          Report Created: Tue, Oct 02 14:55:10 2001
Command: ./spmgr display -dv c4t0d5
Device:      c4t0d5
Status:      Operational [4 paths (2/0/2)]
Storage:     5000-1FE1-0010-5D90
LUN ID:      6000-1FE1-0010-5D90-0009-1050-5157-001E
Preferred Controller: None
HBAs: fcaw-0 fcaw-1
```

Item	Device	Controller	HBA	Parent	Instance
0	c4t0d5	ZG10505157	fcaw-0	/swsp@0,1	hsx-219-33-5
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
1	c4t0d5	ZG10505033	fcaw-0	/swsp@0,1	hsx-424-32-5
	WWNN: 5000-1FE1-0010-5D90			Path State: Active	
2	c4t0d5	ZG10505157	fcaw-1	/swsp@0,1	hsx-629-33-5
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
3	c4t0d5	ZG10505033	fcaw-1	/swsp@0,1	hsx-834-32-5
	WWNN: 5000-1FE1-0010-5D90			Path State: Available	

spmgr display -p path_instance

The -p switch displays storage path information. A parameter is required and it must be a *path_instance*.

Syntax:

```
#spmgr display -p path_instance
```

Example:

```
# /opt/CPQswsp/bin/spmgr display -p hsx-219-33-5
```

```
Server: pluto          Report Created: Tue, Oct 02 14:58:32 2001
Command: ./spmgr display -p hsx-219-33-5
Path:      hsx-219-33-5          Adapter: fcaw-0
Controller: ZG10505157          Status: Operational
Device:    c4t0d5              Status: Operational
```

spmgr display -r[v] [WWNN]

The -r switch displays storage system information. If a parameter is supplied, it must be a *WWNN*. The command has the following possible forms:

Syntax:

```
# spmgr display -r
      -rv
      -r WWNN
      -rv WWNN
```

Example:

```
# /opt/CPQswsp/bin/spmgr display -r

Server:  pluto          Report Created: Tue, Oct 02 14:59:39 2001
Command: ./spmgr display -r
=====
Storage:  5000-1FE1-0010-5D90
```

Example:

```
# /opt/CPQswsp/bin/spmgr display -rv

Server:  pluto          Report Created: Tue, Oct 02 14:59:49 2001
Command: ./spmgr display -rv
=====
Storage:  5000-1FE1-0010-5D90
Load Balance: Off  Auto-restore: Off
Path Verify: On   Verify Interval: 30
HBAs: fcaw-0 fcaw-1
Controller: ZG10505157, Operational
           ZG10505033, Operational
Devices:  c4t0d0 c4t0d1 c4t0d2 c4t0d3 c4t0d4 c4t0d5
```


Example:

```
# /opt/CPQswsp/bin/spmgr display -r 5000-1FE1-0010-5D90

Server: pluto          Report Created: Tue, Oct 02 15:02:34 2001
Command: ./spmgr display -r 5000-1FE1-0010-5D90
=====
Storage: 5000-1FE1-0010-5D90
Load Balance: Off    Auto-restore: Off
Path Verify: On     Verify Interval: 30
HBAs: fcaw-0 fcaw-1
Controller: ZG10505157, Operational
           ZG10505033, Operational
Devices: c4t0d0 c4t0d1 c4t0d2 c4t0d3 c4t0d4 c4t0d5
```

Example:

```
# /opt/CPQswsp/bin/spmgr display -rv 5000-1FE1-0010-5D90

Server: pluto          Report Created: Tue, Oct 02 15:02:51 2001
Command: ./spmgr display -rv 5000-1FE1-0010-5D90
=====
Storage: 5000-1FE1-0010-5D90
Load Balance: Off    Auto-restore: Off
Path Verify: On     Verify Interval: 30
HBAs: fcaw-0 fcaw-1
Controller: ZG10505157, Operational
           ZG10505033, Operational
Devices: c4t0d0 c4t0d1 c4t0d2 c4t0d3 c4t0d4 c4t0d5
Path Information: [P] = Preferred
```

Item	Device	Controller	HBA	Parent	Instance
0	c4t0d0	ZG10505157	fcaw-0	/swsp@0,1	hsx-214-33-0
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
1	c4t0d0	ZG10505033	fcaw-0	/swsp@0,1	hsx-419-32-0
	WWNN: 5000-1FE1-0010-5D90			Path State: Active	
2	c4t0d0	ZG10505157	fcaw-1	/swsp@0,1	hsx-624-33-0
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
3	c4t0d0	ZG10505033	fcaw-1	/swsp@0,1	hsx-829-32-0
	WWNN: 5000-1FE1-0010-5D90			Path State: Available	
4	c4t0d1	ZG10505157	fcaw-0	/swsp@0,1	hsx-215-33-1
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
5	c4t0d1	ZG10505033	fcaw-0	/swsp@0,1	hsx-420-32-1
	WWNN: 5000-1FE1-0010-5D90			Path State: Active	
6	c4t0d1	ZG10505157	fcaw-1	/swsp@0,1	hsx-625-33-1
	WWNN: 5000-1FE1-0010-5D90			Path State: Standby	
7	c4t0d1	ZG10505033	fcaw-1	/swsp@0,1	hsx-830-32-1

```
WWNN: 5000-1FE1-0010-5D90      Path State: Available
8  c4t0d2 ZG10505157 fcaw-0 /swsp@0,1      hsx-216-33-2
WWNN: 5000-1FE1-0010-5D90      Path State: Standby
9  c4t0d2 ZG10505033 fcaw-0 /swsp@0,1      hsx-421-32-2
WWNN: 5000-1FE1-0010-5D90      Path State: Active
10 c4t0d2 ZG10505157 fcaw-1 /swsp@0,1      hsx-626-33-2
WWNN: 5000-1FE1-0010-5D90      Path State: Standby
11 c4t0d2 ZG10505033 fcaw-1 /swsp@0,1      hsx-831-32-2
WWNN: 5000-1FE1-0010-5D90      Path State: Available
12 c4t0d3 ZG10505157 fcaw-0 /swsp@0,1      hsx-217-33-3
WWNN: 5000-1FE1-0010-5D90      Path State: Standby
13 c4t0d3 ZG10505033 fcaw-0 /swsp@0,1      hsx-422-32-3
WWNN: 5000-1FE1-0010-5D90      Path State: Active
14 c4t0d3 ZG10505157 fcaw-1 /swsp@0,1      hsx-627-33-3
WWNN: 5000-1FE1-0010-5D90      Path State: Standby
15 c4t0d3 ZG10505033 fcaw-1 /swsp@0,1      hsx-832-32-3
WWNN: 5000-1FE1-0010-5D90      Path State: Available
16 c4t0d4 ZG10505157 fcaw-0 /swsp@0,1      hsx-218-33-4
WWNN: 5000-1FE1-0010-5D90      Path State: Standby
17 c4t0d4 ZG10505033 fcaw-0 /swsp@0,1      hsx-423-32-4
WWNN: 5000-1FE1-0010-5D90      Path State: Active
18 c4t0d4 ZG10505157 fcaw-1 /swsp@0,1      hsx-628-33-4
WWNN: 5000-1FE1-0010-5D90      Path State: Standby
19 c4t0d4 ZG10505033 fcaw-1 /swsp@0,1      hsx-833-32-4
WWNN: 5000-1FE1-0010-5D90      Path State: Available
20 c4t0d5 ZG10505157 fcaw-0 /swsp@0,1      hsx-219-33-5
WWNN: 5000-1FE1-0010-5D90      Path State: Standby
21 c4t0d5 ZG10505033 fcaw-0 /swsp@0,1      hsx-424-32-5
WWNN: 5000-1FE1-0010-5D90      Path State: Active
22 c4t0d5 ZG10505157 fcaw-1 /swsp@0,1      hsx-629-33-5
WWNN: 5000-1FE1-0010-5D90      Path State: Standby
23 c4t0d5 ZG10505033 fcaw-1 /swsp@0,1      hsx-834-32-5
WWNN: 5000-1FE1-0010-5D90      Path State: Available
```

spmgr display -u

This command requires no parameter and returns a display of all unattached units for each storage system. This switch provides the list of units by storage system and reports the WWLUN ID for each. The information gathered by this display may then be used to add a unit to the Secure Path configuration.

Example:

```
# /opt/CPQswsp/bin/spmgr display -u

Server: pluto          Report Created: Tue, Oct 02 15:52:56 2001
Command: ./spmgr display -u
Storage: 5000-1FE1-0010-5D90
LUN ID:  6000-1FE1-0010-5D90-0009-1050-5157-0020
         6000-1FE1-0010-5D90-0009-1050-5157-0021
```

spmgr display -l

This command requires no parameter and returns a display of all unused target/LUNs for each storage system. This switch provides a list of units by storage system, and displays the device file for each. The information gathered from this display may be used to add a unit to the Secure Path configuration at a particular target/LUN.

Example:

```
# /opt/CPQswsp/bin/spmgr display -l

Server: pluto          Report Created: Thu, Oct 11 09:30:13 2001
Command: ./spmgr display -l
Available Target/Luns per Storage System
= = = = =
Storage: 5000-1FE1-0005-B5F0
c4t0d5, c4t0d6, c4t0d7, c4t0d8, c4t0d9, c4t0d10, c4t0d11, c4t0d12, c4t0d13,
c4t0d14, c4t0d15, c4t0d16, c4t0d17, c4t0d18, c4t0d19, c4t0d20, c4t0d21,
c4t0d22, c4t0d23, c4t0d24, c4t0d25, c4t0d26, c4t0d27, c4t0d28, c4t0d29,
c4t0d30, c4t0d31, c4t0d32, c4t0d33, c4t0d34, c4t0d35, c4t0d36, c4t0d37,
c4t0d38, c4t0d39, c4t0d40, c4t0d41, c4t0d42, c4t0d43, c4t0d44, c4t0d45,
c4t0d46, c4t0d47, c4t0d48, c4t0d49, c4t0d50, c4t0d51, c4t0d52, c4t0d53,
c4t0d54, c4t0d55, c4t0d56, c4t0d57, c4t0d58, c4t0d59, c4t0d60, c4t0d61,
c4t0d62, c4t0d63, c4t0d64, c4t0d65, c4t0d66, c4t0d67, c4t0d68, c4t0d69,
c4t0d70, c4t0d71, c4t0d72, c4t0d73, c4t0d74, c4t0d75, c4t0d76, c4t0d77,
c4t0d78, c4t0d79, c4t0d80, c4t0d81, c4t0d82, c4t0d83, c4t0d84, c4t0d85,
c4t0d86, c4t0d87, c4t0d88, c4t0d89, c4t0d90, c4t0d91, c4t0d92, c4t0d93,
c4t0d94, c4t0d95, c4t0d96, c4t0d97, c4t0d98, c4t0d99, c4t0d100, c4t0d101,
c4t0d102, c4t0d103, c4t0d104, c4t0d105, c4t0d106, c4t0d107, c4t0d108,
c4t0d109, c4t0d110, c4t0d111, c4t0d112, c4t0d113, c4t0d114, c4t0d115,
c4t0d116, c4t0d117, c4t0d118, c4t0d119, c4t0d120, c4t0d121, c4t0d122,
c4t0d123, c4t0d124, c4t0d125, c4t0d126, c4t0d127, c4t0d128, c4t0d129,
c4t0d130, c4t0d131, c4t0d132, c4t0d133, c4t0d134, c4t0d135, c4t0d136,
```

c4t0d137, c4t0d138, c4t0d139, c4t0d140, c4t0d141, c4t0d142, c4t0d143,
c4t0d144, c4t0d145, c4t0d146, c4t0d147, c4t0d148, c4t0d149, c4t0d150,
c4t0d151, c4t0d152, c4t0d153, c4t0d154, c4t0d155, c4t0d156, c4t0d157,
c4t0d158, c4t0d159, c4t0d160, c4t0d161, c4t0d162, c4t0d163, c4t0d164,
c4t0d165, c4t0d166, c4t0d167, c4t0d168, c4t0d169, c4t0d170, c4t0d171,
c4t0d172, c4t0d173, c4t0d174, c4t0d175, c4t0d176, c4t0d177, c4t0d178,
c4t0d179, c4t0d180, c4t0d181, c4t0d182, c4t0d183, c4t0d184, c4t0d185,
c4t0d186, c4t0d187, c4t0d188, c4t0d189, c4t0d190, c4t0d191, c4t0d192,
c4t0d193, c4t0d194, c4t0d195, c4t0d196, c4t0d197, c4t0d198, c4t0d199,
c4t0d200, c4t0d201, c4t0d202, c4t1d0, c4t2d0, c4t3d0, c4t4d0, c4t5d0,
c4t6d0, c4t8d0, c4t9d0, c4t10d0, c4t11d0, c4t12d0, c4t13d0, c4t14d0,
c4t15d0

The alias and unalias Commands

The Secure Path application supports the use of aliases. Aliases replace or substitute longer strings for shorter strings.

Example:

The World Wide Node Name (WWNN) of a storage system is *5000-1FE1-0005-3480*. You can assign the alias *Bird* to replace the longer, less easy-to-remember WWNN *5000-1FE1-0005-3480*.

When an alias is used in an *spmgr* display, it is shown in parenthesis after the term that it substitutes for.

Example:

Storage: 5000-1FE1- 0001-3420 (fire)

Where: fire is the alias.

Alias commands:

- Define an alias and store it for future use.
- Remove an alias from the alias table.
- Display the alias table.

spmgr alias alias_name old_name

To add an alias to the alias table use the following alias command.

Syntax:

```
# spmgr alias alias_name old_name
```

In the following example, the alias of *Birdtop* is created for the controller serial number: *ZG66654211*.

```
# /opt/CPQswsp/bin/spmgr alias Birdtop ZG66654211
```

spmgr unalias

To remove an alias from the alias table invoke the *spmgr unalias* command and enter either the *alias_name* or the *old_name*.

Syntax:

```
# spmgr unalias old_name
alias_name
```

In the following example, the alias, *Birdtop*, is removed from the alias table.

```
# /opt/CPQswsp/bin/spmgr unalias Birdtop
```

spmgr alias

Use the alias display command to display the alias table.

Syntax:

```
# spmgr alias
```

Example:

```
# /opt/CPQswsp/bin/spmgr alias

Server: Pluto Report Created: Wed, Aug 15 15:42:37 2001
Alias:old_string
=====
bob:5000-1fe1-0000-1231
jim:5000-1fe1-0000-1233
fredt:ZG111298235442
fredb:ZG238817633215
=====
```

NOTE:

- When the `spmgr display` command is invoked, the screen output will use both the alias, if any, and the standard Storage system WWNN, controller serial number, etc. The alias will be enclosed in parentheses (`alias_name`).
- For the command set that requires a parameter, it is assumed that the parameter or its alias may be input. Commands may not be aliased.

Setting Storage System Parameters

The Secure Path 3.0 driver has options a user can enable or disable on a storage system or global basis. These options may be turned off and on dynamically. Under normal conditions, these changes occur within 45 seconds.

- The `spmgr set` command allows the user to enable storage system specific settings for the Secure Path driver.
 - **Load Balancing**—Version 3.0 of Secure Path implements a round-robin usage of all available paths to a unit for its I/O. The default for Load Balancing is disabled.
 - **Path Verification**—The driver checks the state of all possible paths to all units at a settable period or frequency. The default for Path Verification is enabled with a period of 30 seconds.
 - **Auto-restore**—The auto-restore command enables the driver to automatically restore paths to their preferred path after a failure and subsequent reinstatement of that path. The default for Auto-restore is disabled.
- The `spmgr log` command allows the user to enable logging from Secure Path driver to the syslog, console and e-mail notification.
- The `spmgr notify` command enables the user to manage the distribution of the three classes of event reports (critical, warning and informational) via an e-mail address list.

The set Command

Syntax:

```
# spmgr set -a (on | off) [WWNN]
             -b (on | off) [WWNN]
             -p (on | off ) [WWNN]
             -f verify_period
```

spmgr set -a on | off [WWNN]

This command enables or disables the Auto-Restore feature of driver. When Auto-Restore is enabled it directs the driver to monitor the state of the paths. If the preferred path should fail and then later return to service, the driver will automatically reroute all I/O to the restored path. When Auto-Restore is disabled, there is no Auto-Restore by the Secure Path driver. The I/O will continue along the current path(s) until another event changes the active path. The default is disabled.

spmgr set -b on | off [WWNN]

This command enables or disables the Load Balancing option of the driver. When Load Balancing is enabled, it allows I/O to be sent to the unit along all available paths. When load balancing is disabled, the I/O will be sent along the Preferred Path (if one is selected) or will use the first available path for I/O. The default is disabled.

spmgr set -p on | off [WWNN]

This command enables or disables the path verification of the driver. When enabled, this command verifies the state of all possible paths to all units. On large configurations with active I/O to many units this command may reduce performance. The default is enabled.

spmgr set -f (1...65535 seconds)

This command sets the path verification interval. This interval can be set between 1 to 65535 seconds. The use of the -f switch does not change the current state of the path verification, it will only change the value for the interval. Therefore, if path verification is disabled, it remains disabled with the new interval. The default is 30 seconds.

The log Command

Syntax:

```
# spmgr log -l (level 0, 1..3)
          -c (level 0, 1..3)
          -n (level 0, 3 )
```

The numerical level indicates the message severity. The levels of severity are:

1: Critical, 2: Warning, 3: Informational

When you select a numerical level, messages of that severity and higher are delivered to the appropriate output.

- If 3 is selected, then 3,2,1 are logged
- If 2 is selected, then 2,1 are logged
- If 1 is selected, then 1 is logged
- If 0 is selected then logging is disabled for that item.

spmgr log -l [0, 1..3]

This command sets the level of logging to the syslog of the server. When you select level 1...3, the messages of that severity and higher are written to the syslog file. The default is 2.

spmgr log -c [0,1..3]

This command sets the level of logging to the console. When you select level 1..3, the messages of that severity and higher are displayed on the console. The default is 1.

spmgr log -n [0, 3]

This command enables or disables logging to the notify function. This option has two values 0, and 3. The default is 3. Level 0 is provided for disabling all notification messages.

spmgr log

The #spmgr log command displays the current logging settings.

Example:

```
# /opt/CPQswsp/bin/spmgr log

Server: Pluto Report Created: Wed, Aug 15 15:42:37 2001
Current Log Options
= = = = =
Syslog,enabled,level 2
Console,disabled,level 0
Notify,enabled,level 3
= = = = =
```

The notify Command

The notification function enables the user to manage the distribution of the three classes of event reports: critical, warning and informational. In Secure Path V3.0, notification is through e-mail.

Syntax:

```
#spmgr notify add
                delete
                (no argument)
```

Severity Levels

Messages from the Secure Path drivers are one of three severity levels:

- Critical messages are severity level 1.
- Warning messages are severity level 2.
- Informational messages are severity level 3.

The implementation for notify is to send event notices to the user from the highest to the lowest level of the severity marking as follows:

- A user with severity level 3, receives level 3, 2 and 1 severity messages.
- A user with severity level 2, receives level 2 and 1 severity messages.
- A user with severity level 1, receives severity level 1 messages only.

spmgr notify add

This command adds an e-mail address to the notification list.

Syntax:

```
# spmgr notify add severity_level email_address
```

Example:

```
# /opt/CPQswsp/bin/spmgr notify add 3 john.doe@oscar.edu.it
```

Where: severity_level is 3 and email_address is john.doe@oscar.edu.it

NOTE: A user is defined by a unique email_address. A user with more than one email_address may have multiple records, one for each unique address.

spmgr notify delete

This command deletes an e-mail address from the notification list.

Syntax:

```
# spmgr notify delete email_address
```

Example:

```
# /opt/CPQswsp/bin/spmgr delete julie.smith@hollywood.edu
```

Where: julie.smith@hollywood.edu is the email_address.

spmgr notify

This command displays the list of users to be notified that have been saved in configuration files.

Example:

```
# /opt/CPQswsp/bin/spmgr notify

Server: Pluto          Report Created: Wed, Aug 15 15:42:37 2001
Command: spmgr notify
      Current Log Options
Severity      Mode      email_address
=====
1             M        bob.proliant@compaq.com
2             M        evil.knevil@jump.into.the.net
3             M        harry.houdini@magic.org
=====
```

Path Management

Secure Path Version 3.0 supports up to 32 paths to a unit on a storage system. Given the very large number of paths that can be configured for a single system, *spmgr* provides the user the ability to monitor and manage paths.

The path management actions include:

- Selecting paths
- Preferring and unpreferring paths
- Restoring preferred paths
- Quiescing and restarting objects and paths.

The select Command

A path is a combination of all the components from server to the unit on the storage system. When you describe the entire path you must identify the HBA and the controller port.

Selecting paths means to identify a path to be used for I/O. Path information, including *selected* paths, can be viewed with one or more options of the *spmgr* display command.

- When paths are selected for I/O and are intended to remain selected during a server reboot or power cycle, they are referred to as *preferred paths*.
- If the path is selected for the duration of the server's current processing time, they are referred to as *selected paths* and are not preserved during a reboot or power cycle of the server.

Syntax:

```
spmgr select -a HBA [-d device]
             -c controller_ser_num [-d device]
             -p path_instance
```

spmgr select -a HBA

This command selects the path with the indicated HBA conditions and makes that path Active.

Example:

```
# /opt/CPQswsp/bin/spmgr select -a fcaw-0
```

Result: The Secure Path driver locates all paths from td0 to all Units on all storage systems and marks them *selected*.

spmgr select -a HBA -d device

This command selects the path with the indicated HBA and device and makes that path Active.

Example:

```
# /opt/CPQswsp/bin/spmgr select -a fcaw-0 -d c21t0d2
```

Result: The Secure Path driver locates one path from td0 to unit c21t0d2 and marks it *selected*.

spmgr select -c controller_serial_number

This command selects the path with the indicated controller serial number and makes that path Active. For example, if there are three HBAs with paths through one controller, the Secure Path driver marks one path for each device from one HBA, not necessarily the same HBA. The result is to have identified selected paths for multiple units with this command.

Example:

```
# /opt/CPQswsp/bin/spmgr select -c ZG10505167
```

Result: The Secure Path driver marks each path through the controller, ZG10505167, to each unit as the selected path for I/O.

spmgr select -c controller_serial_number -d device

This command selects the path with the indicated controller and device and makes that path Active. This command selects one controller. Therefore, the driver is able to mark one path for each device on that controller as *selected*. This command indicates which controller to begin selecting and which unit to end marking. Thus if there are three HBAs with paths through that controller, the Secure Path driver will mark one path for the device from one HBA. The overall result is to have identified selected paths for a single unit with this command.

Example:

```
# /opt/CPQswsp/bin/spmgr select -c ZG10505167 -d c21t0d2
```

Result: The Secure Path driver marks each path through the controller, ZG10505167 to unit c21t0d2 as the selected path for I/O.

spmgr select -p path_instance

This command selects the indicated path and makes that path Active. This parameter, *path_instance*, satisfies the path equation because it contains the necessary components of HBA, controller-port and device. Thus, no other switches or parameters are required to identify the path.

Example:

```
# /opt/CPQswsp/bin/spmgr select -p hsx-219-33-5
```

Result: The Secure Path driver marks path hsx-219-33-5 as the selected path for I/O.

The prefer and unprefer Commands

On an array, each LUN may be assigned to a particular controller and be available for selection at startup. This feature is enabled by using the HSGx0 ADD or SET commands and the Preferred_path attribute for a unit. For example, a unit can be assigned to be preferred to "this" controller by entering the following command:

```
HSG80> SET D6 PREFERRED_PATH = THIS_CONTROLLER
```

Since Secure Path can have more than one path to each controller, a user can further specify a "preferred path." To differentiate between the controller unit attribute of *Preferred_path* and the Secure Path "preferred path" this document refers to the controller-based Preferred_path attribute as the *preferred controller*.

The preferred path assignment allows the user fine control in setting static load balancing because the path chosen determines which adapter and controller port are designated as the default path at system startup. One preferred path can be assigned to each controller for each LUN.

At any time the user can select a different path to be used for I/O. The selected path is not preserved for a server power cycle or operating system restart. To preserve an active path through power cycles as well as restarts, the user should identify it as a *preferred path*. Preferred path identifications are marked by the Secure Path driver in the running system and the identifications are stored in the configuration files for that driver. Thus, the path may be maintained permanently until removed or another preferred path is selected.

To support the preferring and removal of preferred paths, *spmgr* provides two commands, `# spmgr prefer` and `#spmgr unprefer`. These two commands each require a single parameter: the `path_instance`.

spmgr prefer path_instance

This command instructs the Secure Path driver to mark a selected path as *preferred*. If load balance is disabled, this path becomes the active I/O path. Additionally, *spmgr* adds this `path_instance` to the Secure Path driver's configuration file and upon reboot of the server, the preferred path(s) will be restored.

Syntax:

```
# spmgr prefer path_instance
```

This command requires that the *path_instance* be supplied on the command line. The *path_instance* is provided in the *spmgr* display listings.

Example:

```
# /opt/CPQswsp/bin/spmgr prefer hsx-219-33-5
```

spmgr unprefer path_instance

This command instructs the Secure Path driver to unmark the path as a preferred path. Additionally, the configuration file for the Secure Path driver is modified by removing the preferred path markings.

Syntax:

```
# spmgr unprefer path_instance
```

Example:

```
# /opt/CPQswsp/bin/spmgr unprefer hsx-219-33-5
```

Impact of Load Balancing and Active Paths (Preferred or Selected)

Preferred path and *Selected path* are meaningless designations when the user has enabled load balancing. Load balancing treats all paths equally and directs I/O to all available paths. In other words, load balancing is a higher priority than *preferred* or *selected* paths.

When load balancing is enabled, the Secure Path driver will attempt to use all the available paths to a LUN in a round-robin fashion.

If load balancing is enabled and the user *prefers* a path, the system will perform the following actions:

- The driver will mark the path as preferred but the path will not be used as preferred until the load balancing is turned off.
- The configuration file for paths will have this path marked as preferred and upon reboot, this path will be marked as preferred and deployed as preferred if and when load balancing is disabled.

If load balancing is enabled and the user selects a path, the system will perform the following actions:

- If the path is on the Standby controller, I/O will be moved to the Standby controller and the selected path will be one of the Active paths.
- If the path is on the Active controller the path will continue to be used as one of the set of active paths.

This selection and marking is not preserved across reboots or power cycling.

The restore Command

Once a path has failed or has been taken off line by one or more events, the *spmgr restore* command enables the user to restore one or more LUNS to their preferred I/O path. This command enables the user to manually restore all or part of a configuration when the auto-restore feature has been disabled.

A path to a device consists of an adapter (HBA) and a port on a controller (WWNN). A unit on a storage system may be seen through several paths, for example, more than one HBA and controller. The default for *spmgr restore* is to return all LUNs to their preferred path. It will transition all LUNs to their preferred controller and their adapter if one has been specified and if load balancing is disabled.

By using one or more of the switches for this command, the user will have full control of restoring preferred paths to the Secure Path configuration.

The use of this command assumes two important conditions:

- Paths were preferred previously. If paths to some LUNs have not been preferred, no action will be performed on those units.
- Load Balancing is currently disabled. If Load Balancing is currently enabled, no action will be performed on any path.

Syntax:

```
spmgr restore all
        -d device
        -r WWNN
```

spmgr restore all

Restores all LUNs to their preferred paths and/or preferred controller. If there is no preferred controller, the default will be the current controller. If there is no preferred path, the default will be the current path.

Syntax:

```
# spmgr restore all
```

Example:

```
# /opt/CPQswsp/bin/spmgr restore all
```


spmgr restore -d *device*

Restores a preferred path to the indicated device.

Syntax:

```
# spmgr restore -d device
```

Example:

```
# /opt/CPQswsp/bin/spmgr restore -d c21t0d2
```

spmgr restore -r *WWNN*

Restores a preferred path to the indicated storage system.

Syntax:

```
#spmgr restore -r WWNN
```

Example:

```
# /opt/CPQswsp/bin/spmgr restore -r 5000-1FE1-0010-5B00
```

The quiesce Command

Quiescing an object means to

- Move all active I/O from an object to an alternate path.
- Mark all paths to the object as 'quiesced' to temporarily remove the object from use.

The objects that are supported for V3.0 of Secure Path are adapters and controllers. Also, quiescing individual paths is supported to allow other fabric infrastructure such as switches to be removed and replaced.

NOTE: Path verification is not done on a quiesced path.

Syntax:

```
# spmgr quiesce -a HBA  
                -c controller_serial_number  
                -p path_instance
```

spmgr quiesce -a HBA

When this command is invoked, *spmgr* will move all active I/O using this HBA to paths available on other HBAs. The paths of the specified HBA will then be marked as *quiesced* and no further I/O will be sent along that path until the HBA is returned to service with the corresponding restart command.

These actions may be verified by issuing the # spmgr display -a HBA to view the current path state.

This feature may be used to move I/O to another adapter as the first step to replacing an HBA.

Example:

```
# /opt/CPQswsp/bin/spmgr quiesce -a fcaw-0
```

spmgr quiesce -c controller_serial_number

When this command is invoked, *spmgr* will move all active I/O using this controller to paths on the other controller of the storage system. The paths of the specified controller will then be marked as *quiesced* and no further I/O will be sent along that path until the controller is returned to service with the restart command.

These actions may be verified by issuing the # spmgr display -c controller command to view the current path states.

This feature may be used to move I/O to the other controller as the first step to upgrading or replacing a controller.

Example:

```
# /opt/CPQswsp/bin/spmgr quiesce -c ZG11233409
```

spmgr quiesce -p path_instance

When this command is invoked, *spmgr* will move all active I/O using this path to another path on the same controller if possible or to a path on the *other* controller. The specified path will then be marked as *quiesced* and no further I/O will be sent along that path until the path is returned to service with the restart command.

These actions may be verified by issuing the # spmgr display command to view the current path states.

Example:

```
# /opt/CPQswsp/bin/spmgr quiesce -p hsx-219-33-5
```

The restart Command

Object restarting is the means of changing a quiesced adapter or controller to an Available or Standby state. When restarted, the HBA or controller is available as an I/O entity for a path.

Syntax:

```
# spmgr restart all
-a HBA
-c controller
-p path_instance
```

spmgr restart all

When this command is invoked, *spmgr* will verify the existence of all components on quiesced paths and change those paths to Available or Standby as appropriate. If the Auto-restore feature is enabled and one or more of those paths are Preferred paths, those paths will be made the Active path.

spmgr restart -a HBA

When this command is invoked, *spmgr* will verify the existence of the HBA and then change the state of the paths using the HBA to Available or Standby. If the Auto-restore feature is enabled and a path using that HBA is the preferred path, the path will be made the Active path.

Example:

```
# /opt/CPQswsp/bin/spmgr restart -a fcaw-0
```

spmgr restart -c controller

When invoked, *spmgr* will verify the existence of the controller and then change the state of the paths using the controller to Standby. If the Auto-restore feature is enabled and a path using that controller is the preferred path, then the path will be made the Active path.

Example:

```
# /opt/CPQswsp/bin/spmgr restart -c fire-top
```

`spmgr restart -p path_instance`

When invoked, `spmgr` will verify the existence of the path and then change the state of the path to Available or Standby. If the Auto-restore feature is enabled and the path is the preferred path, the path will be made Active.

Example:

```
# /opt/CPQswsp/bin/spmgr restart -p c12t0d5
```

The add and delete WWLUNID Commands

Version 3.0 of Secure Path supports the dynamic addition and removal of LUNS on a storage system. There are several steps required to add and delete LUNs:

1. Create the unit on the storage system.
2. Run `drvconfig` so that the system sees the new unit(s).
3. Enter either the `spmgr display -u` or `spmgr display -dv` command to obtain the WWLUNID of the unit(s).
4. Enter the `spmgr add` or `spmgr delete` command to add or delete the unit(s).
5. Enter the `drvconfig;devlinks;disks` command to attach the new units(s), and create the device files.

NOTE: If you are deleting units, these steps will not remove the orphaned device files. Choose one of the options below to deal with these "phantom disks," depending on your specific requirements:

- Enter the `devfsadm -C` command (Solaris Version 7 and 8 only) to force Solaris to clean up device links.
- Enter the `reboot -r` command to shut down your server and force a reconfiguration boot.
- Ignore them. The `format` command will show the disks as "unknown," because there is nothing there to respond to SCSI commands. As long as nothing attempts to access these units, you will not have a problem. This option works well if you are adding and deleting cloned units for backup purposes. You may add and delete new units using the same target and LUN repeatedly.

spmgr add WWLUNID [target LUN]

This command verifies access to the new unit and adds that device to the Secure Path configuration. At the same time, the configuration files are updated.

This command requires administrative commands before and after use. Prior to using `spmgr add`, new units must be found by the system and after the add, units must be claimed by the system. The following command sequence must be done at least once for adding single or multiple units.

Syntax:

```
# spmgr add WWLUNID [target LUN]
```

Where:

- WWLUNID is the World Wide LUN ID of the new Unit you are adding on the storage system.
- target LUN (optional) is the target and LUN values to assign for the server

Example:

NOTE: Remember, create the new unit(s) on the storage system before you run this command.

To probe for and attach to new unit(s):

```
# drvconfig
```

To display unmapped WWLUNID(s):

```
# spmgr display -u
```

To add units:

```
# spmgr add WWLUNID1 [target LUN]
```

```
# spmgr add WWLUNID2 [target LUN]
```

```
# spmgr add WWLUNIDn [target LUN]
```

To attach new units and create device files:

```
# drvconfig; devlinks; disks
```

spmgr delete WWLUNID | device

This command verifies the device and if correct, deletes the device from the Secure Path configuration. These actions occur only on the server where the command was issued. For shared storage, the unit must be deleted on each server that has access to it.

This command requires administrative steps after it is used. These steps are discussed in more detail in "The add and delete WWLUNID Commands" on page 4–36.

Syntax:

```
# spmgr delete WWLUNID | device
```

Example:

```
# /opt/CPQswsp/bin/spmgr delete fireD12
```

Where: *fireD12* is an alias used for the WWLUNID

To identify the WWLUNIDs:

```
# spmgr display -dv
```

To delete units:

```
# spmgr delete WWLUNID1  
# spmgr delete WWLUNID2  
# spmgr delete WWLUNIDn
```

To remove orphaned device files:

```
# devfsadm -C
```

Removing/Upgrading Secure Path

This chapter describes how to remove and upgrade Secure Path software.

Removing Secure Path Software

Removing the Secure Path software will restore the server to a single path, RAID storage environment. Under a single path configuration, the HSG80 and HSG60 controllers must be set into Transparent Failover mode. The steps to accomplish the transition of the HSGx0 controllers to Transparent Failover mode are described in Appendix A.

1. On the specific server(s), invoke the Sun package remove function and select CPQswsp as shown below:
2. Go to the directory `/opt/steam/bin` (the default area), or the directory selected during the installation of the Solaris Solutions kit.

```
# pkgrm CPQswsp
```

```
#cd /opt/steam/bin
```

3. Enter the following command:

```
#!/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 `hsx.conf` and `swsp.conf` files.

The following steps will 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.

4. Select Option 20, *Add/Change Adapters* and then Option 4, *Modify Adapters*.
 - a. Select each adapter and reselect
 - The mode of operation
 - The desired targets

- The desired number of LUNs
 - 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`.
5. Restart 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 or HSG60 dual-redundant controllers must be restored to Transparent Failover mode.

The steps to perform the transition to Transparent Failover mode are documented in Appendix A.

Upgrading Secure Path

NOTES:

This version of Secure Path does not support FC-AL or Differential SCSI configurations. If you are upgrading from one of these modes, convert your configuration to Fibre Channel Switched Fabric (FC-SW) mode before proceeding. Only FC-SW mode is supported by this release.

The final Secure Path device files will probably change during the upgrade process. It is the responsibility of the system administrator to ensure that the appropriate system files are updated with the new device files. To simplify this process, the upgrade will create a text file that lists the old (pre-upgrade) device files and the new device files that replace them (`/opt/CPQswsp/devices.xref`). You must ensure that all Solaris system files that reference Secure Path device files are updated with information from the `devices.xref` file. These files may include those listed below:

`/etc/vfstab`

`/etc/dfstab`

`/etc/vfsmnt`

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

Existing Configuration	Intended Configuration	Process	Page
V2.0, V2.1 Hub/Arbitrated Loop	V3.0, Switched Fabric	Fresh Install	page 5–3
V2.1 Switched Fabric	V3.0, Switched Fabric	Upgrade	page 5–5



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.

Converting a V2.0 or V2.1 Hub/Arbitrated Loop to a V3.0 Switch Fabric

To upgrade Secure Path V2.0 or V2.1 in an existing FC Arbitrated Loop to Secure Path V3.0 in a switch-based FC Fabric configuration requires the following prerequisites:

- Maintain existing mapping of target/LUNs before and after the change of configuration modes to preserve existing targets as seen by the *format* command.
- Modify the Secure Path configuration files to accommodate the transition from the ALPAs of the loop environment to the WWPNS of the Switch/Fabric environment.
- Keep existing UNITS on the RAID constant during the configuration conversion. (New UNITS may be added after the conversion, as documented in the information on adding units in Chapter 4.)

IMPORTANT: This procedure requires the Secure Path Software to be removed and re-installed. An upgrade will not work, and it is not supported. Therefore, this conversion requires a full Secure Path release CD-ROM.

To upgrade the software and convert the configuration, perform the following procedure:

1. Before proceeding with this upgrade refer to Table 2–1 to verify that your system meets the prerequisites.
2. Perform a complete system backup, according to your normal procedures.
3. Document your server file systems, mount points, and device files, as these may need to be changed after the upgrade.
4. Remove Secure Path V2.0 or V2.1 by entering the following Solaris command:
pkgrm CPQswsp

5. Convert the RAID storage system from loop mode to fabric and multi-bus mode and record the WWPNs assigned to each port used in the Secure Path configuration. Refer to the SANworks Solution Software documentation for instructions.
6. Move the corresponding cables from the Fibre Channel hubs to Fibre Channel switches.
7. 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. Invoke the SANworks Solution software configuration utility at the server by entering:

```
# /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, when the WWPN is requested, using the values as recorded in step 4. Associate the correct adapter to the specific controller port on the RAID system.
8. Reboot the server with a reconfiguration boot. The following is recommended:

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

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 at least two paths. This condition must be met before proceeding to the next step.
9. Install Secure Path V3.0. Refer to Chapter 3 for installation information.

Secure Path V3.0 configuration utility, *spconfig*, generates new configuration files in */kernel/drv*, specifically, *hsx.conf* and *swsp.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.
10. Reboot your system, as per the Secure Path installation instructions.

11. Compare the new device files created by Secure Path V3.0 with the device files that you documented at the beginning of this procedure. If the device files for your LUNs have changed, you need to update your system accordingly. Some files that you might need to modify are:

```
/etc/vfstab
```

```
/etc/dfstab
```

```
/etc/vfsmnt
```

Upgrading a V2.1 Switched Fabric to V3.0 Switched Fabric

This upgrade installation can only be installed on a server running Secure Path V2.1x in switched fabric mode. Any other configuration must use the conversion process identified on page 5–3.

1. Perform a complete system backup, according to your normal procedures.
2. Document your server file systems, mount points, and device files, since these may change after the upgrade.
3. Check to make sure that *vold*, the volume management daemon, is running by entering the following command:

```
# ps -ea | grep vold
```

- If *vold* is currently running:
 - a. Insert the Secure Path V3.0 CD-ROM into the CD-ROM Drive.
 - b. Check that the volume manager has automatically mounted the CD-ROM, by entering the following command:

```
# 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 by entering the following command:

```
# cd /cdrom/sp_v30_sun/solaris
```

- d. Continue with step 4.

- If *vold* is not currently running:
 - a. Insert the Secure Path V3.0 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/solaris
```

4. Run the pkgadd utility with the upgrade option by entering the following command:

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

After the Secure Path software is updated, the conversion utility automatically executes.

5. After the conversion is complete, reboot your server with a reconfiguration boot.

```
# touch /reconfigure
```

```
# reboot
```

6. Secure Path 2.x only supported one port per controller. If you want to use both ports, perform the following steps:

a. Connect the second ports on the controllers to the appropriate switches. Refer to Table 2-1 on page 2-8 for a cabling diagram.

b. Invoke the SANworks Solution software configuration utility by entering:

```
# /opt/steam/bin/config.sh
```

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

d. Select Option 2, *Add an Adapter or WWP*N, to find and configure the WWPNs that you just added.

e. Reboot your server with a reconfiguration boot according to the instructions on the screen.

f. Run the spconfig utility to finish the Secure Path configuration.

```
# /opt/CPQswsp/bin/spconfig
```

g. Reboot your server with a reconfiguration boot according to the instructions on the screen.

7. After your server has rebooted, verify that your LUNs are on-line. Using the information you documented in step 2, and the contents of the /opt/CPQswsp/devices.xref file, update your system files to reflect the changed device files, if required.

HSG80 and HSG60 Controller Failover Transitions

This appendix describes the process and steps to set dual-redundant HSG80 and HSG60 controllers from one failover state to another. The failover states are Transparent Failover, Multiple-bus Failover and No failover.

After establishing a serial connection to the controller, choose one of the following types of failover transitions to change the controller states that are described in this appendix.

- Changing from Transparent Failover to No Failover Mode, on page A-2
- Changing from Transparent Failover to Multiple-bus Failover Mode, on page A-3
- Changing from Multiple-bus Failover to No Failover and then to Transparent Failover Mode, on page A-5

Establishing a Serial Connection to the Controller

1. 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 and HSG60 actions in the steps below are assumed to be through this serial connection.

2. Verify the current state of the controllers 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. Enter the following command at the CLI prompt:

```
CLI> set nofailover
```

This action will cause the OTHER_CONTROLLER to shut down.

2. Enter the following command to verify the change to no 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
-> 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. Enter the following command to verify the change in controller state:

```
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
```

IMPORTANT: 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. Enter the following command at the CLI prompt:

```
CLI> set nofailover
```

This action will cause the `OTHER_CONTROLLER` to shut down.

2. Enter the following command at the CLI prompt to verify the change to *no 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
    -> 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 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
```

4. 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_controller
```

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.

5. 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
```

6. If the RAID Array had connections prior to making this transition, examine the connections by entering the following command:

```
CLI> show connections
```

7. Inspect the last column, "offset value."

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


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.

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

1. Check to see if there are connections on the storage system. For HSGx0 controllers, enter the following command:

```
CLI> show connections
```

2. Delete all connections by entering the following command for each connection that is shown (if any):

```
CLI> delete connection_name
```

NOTE: The connections will be regenerated later.

3. Check to see if there are units on the storage system.

```
CLI> show units
```

4. Delete all units by entering the following command for each unit (Dn) that is shown (if any):

```
CLI> delete dn
```

NOTE: The UNITS will be restored after the controller state is changed. Compaq recommends 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.

5. If the controllers are currently in a failover mode, enter the following command to shut down the OTHER_CONTROLLER:

```
CLI> set nofailover
```

6. Verify the current state of the controller, by entering the following command:

```
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 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.

- Verify the current state of the controller by entering the following command:

```
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
```

- When the OTHER_CONTROLLER is available, enter the following command to copy all unit and configuration information to the OTHER_CONTROLLER and restart it.

```
CLI> set failover copy=this_controller
```

- Verify the controller state by entering the following command. When restarted, the controller pair will be bound in Transparent Failover mode.

```
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 dual-redundancy with ZG80200290
  -> In dual-redundant configuration
```

- Restore the UNIT to storage set mapping that was recorded earlier by entering the following command:

```
CLI> add unit dn storage_set_name
```

CAUTION: Do not initialize the storagesets. This action will destroy data on the storagesets.

12. Restart both controllers by entering the following commands:

CLI> restart other_controller

CLI> restart this_controller

NOTE: Restarting both controllers allows connections to be reacquired. You can also accomplish this by rebooting the servers.

Glossary

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

Controller

A controller is a hardware device that facilitates communication between a host and one or more LUNs organized as an array. The HSG80 and HSG60 array controllers are supported for use with Secure Path.

Controller States

- **Critical**—Reported for a controller pair bound in multi-bus failover mode when only one of the controllers is available. This state may mean a failed or offline condition, since the server cannot communicate with the other controller at this time.
- **Operational**—The controller is available with a good status
- **Unknown**—The server cannot communicate with this controller.

Device States

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

- **Critical**—Only one path remains available to the storage unit.
- **Degraded**—At least one or more paths are failed to the storage unit.
- **Operational**—The Secure Path device can be accessed on at least one path.
- **Unknown**—Unable to communicate with the unit. This may indicate no available path or a failed device.
- **Dead**—All paths used by this Secure Path device have failed.

Fabric

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

HBA

A Host Bus Adapter is an I/O device that serves as the interface connecting a host system to the SAN (Storage Area Network).

LUN

A Logical Unit Number is the actual unit number assigned to a device at the RAID system controller.

Path

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

Path States and Attribute

- **Active**—Currently used for the I/O stream.
- **Available**—Available on the active controller for the I/O stream.
- **Failed**—Currently unusable for the I/O stream.
- **Quiesced**—Path is valid but the user has moved all I/O from it.
- **Standby**—The path is valid on the standby controller.
- **Preferred**—A path that is preferred for the I/O stream, across reboots.

SAN

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

State

State is an attribute that describes the current operational condition of an object. See Path, Path States and Attribute, Controller States, and Device States.

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