

installation and reference guide

HP StorageWorks Secure Path 3.0F Service Pack 1 for HP-UX 11.00 and Secure Path 3.0F Service Pack 1 Workgroup Edition for HP-UX 11.00



Part number: AA-RV17D-TE
Fourth edition: December 2005



Legal and notice information

© Copyright 2000–2005 Hewlett-Packard Development Company, L.P.-NaN

Hewlett-Packard Company makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

This document contains proprietary information, which is protected by copyright. No part of this document may be photocopied, reproduced, or translated into another language without the prior written consent of Hewlett-Packard. The information contained in this document is subject to change without notice. The only warranties for HP products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

Hewlett-Packard Company shall not be liable for technical or editorial errors or omissions contained herein. The information is provided "as is" without warranty of any kind and is subject to change without notice. The warranties for Hewlett-Packard Company products are set forth in the express limited warranty statements for such products. Nothing herein should be construed as constituting an additional warranty.

Printed in the US.

HP StorageWorks Secure Path 3.0F Service Pack 1 for HP-UX 11.00 and Secure Path 3.0F
Service Pack 1 Workgroup Edition for HP-UX 11.00

Contents

About this guide	7
Overview	7
Intended audience	7
Related documentation	8
Document conventions and symbols	8
HP technical support	9
HP-authorized reseller	9
Helpful websites	9
1 Secure Path for Active-Passive disk arrays	11
Overview	11
Features	12
Software components	13
Drivers	13
Agent	14
Management tools	14
Controller ownership	14
Path definition	15
Secure Path operation	15
Failback Options	15
Load balancing	16
Path verification	16
Path management behavior summary	17
Secure Path for Active-Passive disk arrays hardware setup	17
Hardware setup overview	17
Installing a new Secure Path configuration	18
Configuring switches	18
Configuring the HSG80-based StorageWorks array	19
Configuring optional HSG80-based array features	21
Setting up additional SCSI-2 LUNs	21
Setting a preferred unit to a controller	23
Using SCSI-3	23
Managing the command console LUN in SCSI-2 mode	23
Configuring the HSV100/110 based StorageWorks array	24
System configuration	24
Configuring SCSI-3 for HSG80-based systems	25
What to do if ioscan does not see all paths to the array	26
Installing Secure Path for Active-Passive disk arrays	27
Installing Secure Path	28
Completing the Secure Path installation	28
Managing Secure Path for Active-Passive disk arrays	29
Secure Path Manager overview	30
spmgr commands	30
spmgr common terms	32
Displaying configuration information	32
Controller states	32
Path states	33
Device states	33
Understanding LUN and path instance numbering	33
Displaying header information	34
Displaying difference between HSG and HSV controllers	34

The display command	35
The alias and unalias commands	42
Setting storage system parameters	43
The set command	43
The log command	45
The notify command	46
Path management	47
The select command	47
Preferred controller	48
The prefer and unprefer commands	50
Impact of load balancing and active paths	51
The restore command	51
The quiesce command	52
The restart command	53
The add and delete commands	54
Adding LUNs	55
Deleting LUNs	57
The clean command	59
The update command	60
Making add and delete persistent across reboots	60
Secure Path persistence across reboots	61
Removing and upgrading Secure Path for Active-Passive disk arrays	61
Removing Secure Path software	62
Upgrading Secure Path software	62
Upgrade requirements	62
Upgrade preparation	62
Upgrading from the Web	65
Troubleshooting Secure Path for Active-Passive disk arrays	65

2 Secure Path for Active-Active disk arrays 69

Features	69
ULM services	69
Dynamic load balancing	70
Automatic failover	70
Automatic path recovery	70
Online device discovery	70
Installing Secure Path for Active-Active disk arrays	70
System requirements	71
Installing Secure Path	71
Upgrading from the Web	71
Removing Secure Path	72
Command line interface	72
The autopath set command	73
The autopath display command	73
List of all arrays connected to a host	74
Details of all LUNs connected from an array	74
Display autopath discover status	75
List of array controllers connected to the host	75
Display the LUN info of the Lun using a device path	76
Display the LUN info of the Lun using a LUN WWID	76
Display all LUNs connected to the host	77
The autopath help command	77
The autopath recover command	79
The autopath discover command	79
The autopath retrieve command	79
The autopath set_lbpolicy command	79
The autopath set_prepath command	80
Troubleshooting Secure Path for Active-Active disk arrays	80
Recovering after a failure	80
Secure Path messages	81

3 Secure Path Workgroup Edition for Virtual Array (VA) and Modular Smart Array (MSA)1500 disk arrays	83
Features	83
ULM services	83
Dynamic load balancing	84
Automatic failover	84
Automatic path recovery	84
Online device discovery	84
Installing Secure Path Workgroup Edition for VA and MSA 1500 disk arrays	85
System requirements	85
Installing Secure Path	85
Upgrading from the Web	86
Removing Secure Path	86
Command line interface	86
The autopath set command	87
The autopath display command	87
List of all arrays connected to a host	88
Details of all LUNs connected from an array	88
Display autopath discover status	89
List of array controllers connected to the host	89
Display the LUN info of the Lun using a device path	90
Display the LUN info of the Lun using a LUN WWID	90
Display all LUNs connected to the host	91
The autopath help command	92
The autopath recover command	93
The autopath discover command	93
The autopath retrieve command	93
The autopath set_lbpolicy command	93
The autopath set_prefpath command	94
Troubleshooting Secure Path Workgroup Edition for VA and MSA 1500 disk arrays	94
Recovering after a failure	94
Secure Path messages	95
 Glossary	 97
 Index	 99

Tables

1 Document conventions	8
2 Path management behavior summary of Secure Path	17
3 Target or LUNS per array comparison chart with dual fabric	21
4 spmgr commands	30
5 spmgr common terms	32
6 Controller states for Secure Path 3.0F SP1 Active-Passive disk arrays	32
7 Path states for Secure Path 3.0F SP1 Active-Passive disk arrays	33
8 Device states for Secure Path 3.0F SP1 Active-Passive disk arrays	33
9 Section terms	55
10 Add and delete operation procedures	58
11 Secure Path for Active-Passive events, messages, and syslog entries	66
12 Events, responses, and security level for supported events	68
13 Secure Path for Active-Active disk array event messages	81
14 Secure Path Workgroup Edition for VA and MSA 1500 event messages	95

About this guide

This guide describes HP StorageWorks Secure Path for Active-Passive disk arrays, Secure Path for Active-Active disk arrays, and Secure Path Workgroup Edition for Modular Smart Array (MSA) and Virtual Array (VA) software. This installation and reference guide provides information to help you:

- Understand Secure Path technology.
- Determine hardware and software prerequisites.
- Install Secure Path software.
- Manage Secure Path.

Overview

This document covers the following topics:

- [Chapter 1](#) addresses Secure Path 3.0F SP1 for Active-Passive disk arrays, which includes:
 - HP StorageWorks disk array EMA 16000
 - HP StorageWorks disk array ESA 12000 or EMA12000
 - HP StorageWorks disk array MA 6000
 - HP StorageWorks disk array RA 8000 or MA 8000
- [Chapter 2](#) addresses Secure Path 3.0F SP1 for Active-Active disk arrays, which includes:
 - HP StorageWorks disk array EVA 4000
 - HP StorageWorks disk array EVA 6000
 - HP StorageWorks disk array EVA 8000
 - HP StorageWorks disk array MSA 1500
 - HP StorageWorks disk array VA 7100
 - HP StorageWorks disk array VA 7110
 - HP StorageWorks disk array VA 7400
 - HP StorageWorks disk array VA 7410
 - HP StorageWorks disk array XP 48
 - HP StorageWorks disk array XP 128
 - HP StorageWorks disk array XP 256
 - HP StorageWorks disk array XP 512
 - HP StorageWorks disk array XP 1024
 - HP StorageWorks disk array XP 10000
 - HP StorageWorks disk array XP 12000
- [Chapter 3](#) addresses Secure Path 3.0F SP1 Workgroup Edition for VA and MSA 1500 disk arrays, which includes:
 - HP StorageWorks disk array MSA 1500
 - HP StorageWorks disk array VA 7100
 - HP StorageWorks disk array VA 7110
 - HP StorageWorks disk array VA 7400
 - HP StorageWorks disk array VA 7410

Intended audience

This guide is intended for use by system administrators who are experienced with the following:

- Data processing and direct-access storage device subsystems and their basic functions.
- Operating systems, including commands and utilities
- Any of the storage system disk arrays described in [Overview](#).

Related documentation

In addition to this guide, HP provides the *HP StorageWorks Secure Path 3.0F Service Pack 1 for HP-UX 11.00 and Secure Path 3.0F Service Pack 1 Workgroup Edition for HP-UX 11.00 release notes*.

Document conventions and symbols

Table 1 Document conventions

Convention	Element
Medium blue text: Related documentation	Cross-reference links and e-mail addresses
Medium blue, underlined text (http://www.hp.com)	Web site addresses
Bold font	<ul style="list-style-type: none"> • Key names • Text typed into a GUI element, such as into a box • GUI elements that are clicked or selected, such as menu and list items, buttons, and check boxes
<i>Italic font</i>	Text emphasis
Monospace font	<ul style="list-style-type: none"> • File and directory names • System output • Code • Text typed at the command line
<i>Monospace, italic font</i>	<ul style="list-style-type: none"> • Code variables • Command-line variables
Monospace, bold font	Emphasis of file and directory names, system output, code, and text typed at the command line

WARNING!

Indicates that failure to follow directions could result in bodily harm or death.

CAUTION:

Indicates that failure to follow directions could result in damage to equipment or data.

IMPORTANT:

Provides clarifying information or specific instructions.

NOTE:

Provides additional information.

HP technical support

Telephone numbers for worldwide technical support are listed on the HP support web site: <http://www.hp.com/support/>.

Collect the following information 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

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

HP recommends that customers sign up online using the Subscriber's choice web site: <http://www.hp.com/go/e-updates>.

- Subscribing to this service provides you with e-mail updates on the latest product enhancements, newer versions of drivers, and firmware documentation updates as well as instant access to numerous other product resources.
- After signing up, you can quickly locate your products by selecting Business support and then Storage under Product Category.

HP-authorized reseller

For the name of your nearest HP-authorized reseller:

- In the United States, call 1-800-345-1518.
- In Canada, call 1-800-263-5868.
- Elsewhere, visit the HP web site: <http://www.hp.com>. Then click Contact HP to find locations and telephone numbers.

Helpful websites

For other product information, see the following HP web sites:

- <http://www.hp.com>
- <http://www.hp.com/country/us/eng/prodserv/storage.html>
- <http://www.hp.com/support/>
- <http://www.docs.hp.com>

1 Secure Path for Active-Passive disk arrays

HP StorageWorks Secure Path is a server-based software product that enhances HP StorageWorks RAID array storage systems by providing automatic path recovery from server-to-storage-system connection failures. Secure Path supports multiple Input/Output (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 I/O requests to an alternate path.

This chapter provides the following Secure Path information:

- [Overview](#)
- [Features](#)
- [Software components](#)
- [Secure Path operation](#)
- [Secure Path for Active-Passive disk arrays hardware setup](#)
- [Installing Secure Path for Active-Passive disk arrays](#)
- [Managing Secure Path for Active-Passive disk arrays](#)
- [Removing and upgrading Secure Path for Active-Passive disk arrays](#)
- [Troubleshooting Secure Path for Active-Passive disk arrays](#)

Overview

Secure Path is a high-availability software product that manages and maintains continuous data access to the following HP StorageWorks storage systems:

- EMA 12000
- EMA 16000
- MA 8000
- RA 8000

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 storage system.

By using 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 paths in a Secure Path hardware configuration. Each path originates at a unique HBA port on a server and ends at a unique RAID controller port in the storage system.

Figure 1 illustrates basic Secure Path hardware configurations. The physical connections define two separate paths. Each path originates at a unique storage area network (SAN) HBA on a server and ends at a port on a separate RAID controller on the storage system.

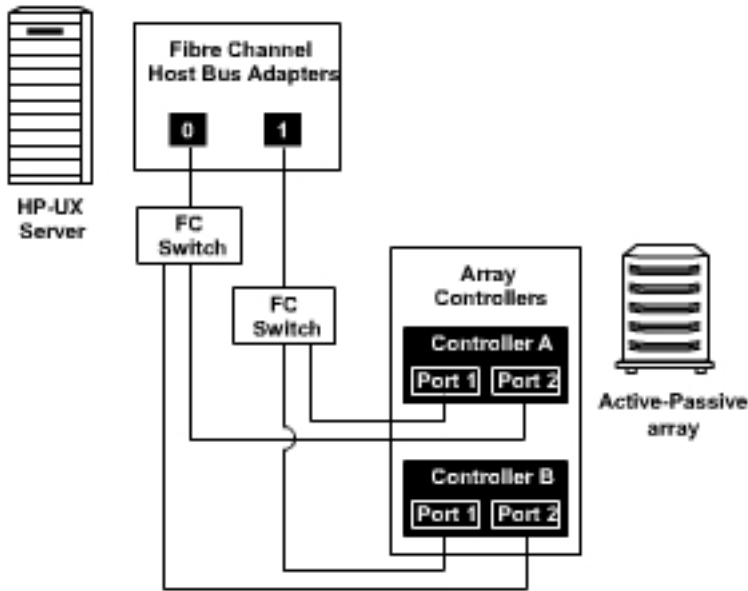


Figure 1: Basic Secure Path Fibre Channel configuration

Secure Path disk array enables dual StorageWorks RAID controllers to operate in an Active-Passive mode, 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 access to storage units (LUNs) may be moved between paths using the Secure Path Management utility `spmgr`.

Secure Path takes advantage of the Active-Passive array preferred path unit attribute. Available storage units are 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 Active-Passive RAID storage systems, 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 gathers alternate paths through available SAN switches, controllers, controller ports, and HBAs. Path failover is completed seamlessly, without process disruption or data loss.

Following replacement of a failed adapter, cable, controller, or attached components, 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, you can configure your storage units using RAID levels 0, 1, or 5.

Features

Secure Path for Active-Passive disk arrays provides the following features:

- Allows StorageWorks dual-controller RAID systems and host servers equipped with multiple HBAs, redundant physical connectivity along with Fibre Channel SAN-switched fabric paths.
- Monitors each path and automatically re-routes I/O to a functioning alternate path if an HBA, cable, switch, or controller failure occurs.
- Determines the status of available storage units and physical paths through path verification diagnostics.
- Monitors and identifies failed paths and failed over storage units.

- Facilitates static load balancing, which allows movement of devices between controllers.
- Automatically restores failed over storage units to repaired paths with auto failback capability enabled.
- Implements anti-thrash filters to prevent failover or 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 or failback actions transparently without disrupting applications.
- Facilitates remote management using the `spmgr` utility.
- Allows the co-existence of Secure Path for Active-Passive disk arrays and Secure Path for Active-Active disk arrays on the same host.
- Allows the connectivity of both Active-Passive disk arrays and Active-Active disk arrays through the same HBA.

Software components

This section describes the software components of Secure Path for Active-Passive disk arrays for HP-UX, including:

- [Drivers](#)
- [Agent](#)
- [Management tools](#)
- [Controller ownership](#)
- [Path definition](#)

Drivers

The following 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 of a LUN 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.

[Figure 2](#) illustrates the driver model structure.

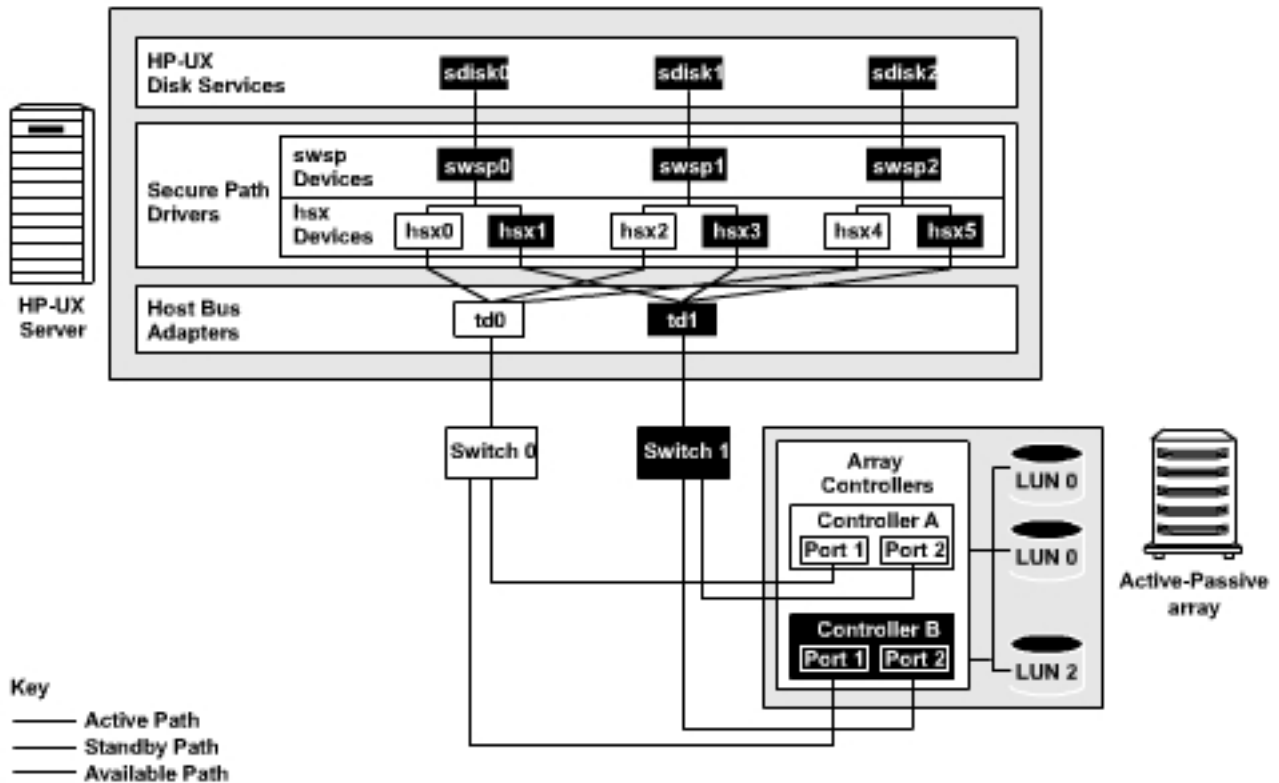


Figure 2: Driver model structure

Agent

The Secure Path agent (*spagent*) is a daemon process that provides an interface for Secure Path applications and utilities to communicate to the Secure Path drivers. The *spagent* daemon also provides notification of path-change events through e-mail. You do not need to run the *spagent* daemon for Secure Path drivers to provide full failover functionality. However, if you want an e-mail notification, then you must run the *spagent* daemon. The only supported method to start and stop the Secure Path agent is the *spinit* script.

The *spinit* script starts and stops the Secure Path agent `/sbin/spagent`.

Management tools

The Secure Path Manager (*spmgr*) is a command-line utility that allows you to monitor and manage Secure Path devices and to change the configuration settings of the drivers. See [Managing Secure Path for Active-Passive disk arrays](#) for a complete description of *spmgr* commands.

The *spinit* script starts and stops the Secure Path agent `/sbin/spagent`.

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 LUN's 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 a failure on the active controller.
- 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.



NOTE:

Secure Path automatically retries I/O requests that terminate in error due to ownership transfers. Active-Passive disk arrays 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, RAID controllers, and the ports on the controllers. Because the Secure Path driver component is positioned between the HBA driver and the system SCSI disk driver, the Secure Path driver distinguishes the 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. Secure Path cannot detect these paths and cannot manage them. 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.

Secure Path automatically sets the path state and reflects the status of the current active path. Because of path failures, the currently active path may be different from what you expect. See [Table 7](#) for a list and description of path states.

Secure Path operation

This section describes the following:

- [Failback Options](#)
- [Load balancing](#)
- [Path verification](#)

Path failover occurs automatically when a selected set of error conditions is detected. Secure Path normally performs path failover only when your I/O is active or you have enabled the path verification. However, it is possible for `spmgr` to show some units with a common failed path in the failover state, while other units remain accessible through that path. Units remain in the failed path if there is no I/O or until they are polled.

Failover follows a 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:
When a failure occurs, Secure Path marks the path failed and switches to the next available path connected to the same controller, if there is one.
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:
When a failure occurs, Secure Path marks the affected path as failed. This removes it from the list of usable paths for the LUN.
 - 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 the other controller.

Failback Options

Secure Path lets you set the path failback option to manual mode or automatic mode.

- In manual mode, you must enter a management utility command to restore devices to their preferred path. The operation is performed even if system I/O is in process to the selected device.
- In automatic 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, the path state is set to active and I/O is routed through this path.

Load balancing

When enabled without selecting a policy, load balancing allows multiple paths between a host and a specific LUN to be used in a round-robin fashion. Using multiple paths spreads the load across all components in the RAID storage system and maximizes performance.

Load balancing may not be used in environments that have device reservations as a lock mechanism because 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 systems are used.

When load balancing is enabled, the Secure Path driver by default, marks all the owning controller as active. This is true when the following conditions occur:

- A host boots up.
- Secure Path fails over a LUN from one controller to the other.
- You manually move a selected LUN between controllers using the Secure Path management utility, `spmgr`.

Secure Path supports four types of load balancing policies:

- Round Robin — I/O is routed through the paths of the active controller in a round-robin fashion.
- Least I/O — I/O is routed through the path that has the least amount of I/O requests.
- Least Service Time — I/O is routed through the path that has the least completion time for an I/O request.
- Least Bandwidth — I/O is routed through the path that has the least amount of bytes queued.

Path verification

When enabled with `spmgr`, path verification causes Secure Path to periodically test the availability of all paths to all LUNs 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 changes from available to failed.

If a path marked failed passes path verification, the path state is set to available, and if `auto-restore` is enabled, the path becomes active. If the path is on the active controller, it is marked preferred.

Path management behavior summary

Table 2 provides the summary of path management behavior for Secure Path.

Table 2 Path management behavior summary of Secure Path

Feature	Behavior or action
Startup	Chooses the preferred path to the controller to which the LUN is online. Marks the preferred path active. If no path is marked preferred, selects one and makes it the active path.
Active path failure	Marks the active path as failed. Redirects I/O through available path. If there are no available path, failover occurs to a standby path on the other controller.
Available or standby path failure	Performs path verification. Marks failed path as failed.
Path repaired	Marks the path available or standby, depending on which controller has the online device. If auto-failback is enabled and the path was the active path prior to the path failure, it makes the path the active path.

You can use the `spmgr` utility to customize the management of your configuration. See [Managing Secure Path for Active-Passive disk arrays](#) for more information on `spmgr` customization.

Secure Path for Active-Passive disk arrays hardware setup

This section provides the following Secure Path hardware setup information:

- [Hardware setup overview](#)
- [Installing a new Secure Path configuration](#)
- [Configuring switches](#)
- [Configuring the HSG80-based StorageWorks array](#)
- [Configuring optional HSG80-based array features](#)
- [Configuring the HSV100/110 based StorageWorks array](#)
- [System configuration](#)
- [Configuring SCSI-3 for HSG80-based systems](#)
- [What to do if ioscan does not see all paths to the array](#)

Hardware setup overview

The following procedure outlines the hardware setup:

1. Prior to setting up your hardware, perform the following verifications:
 - All users have logged off the server.
 - All array file systems have been backed up and unmounted.
 - All volume groups have been exported.
2. Configure the StorageWorks array with your HP server, as described in [Installing a new Secure Path configuration](#).
3. Configure the switches as described in [Configuring switches](#).
4. Configure the RAID array, as described in [Configuring the HSG80-based StorageWorks array](#).
5. Perform system configuration, as described in [System configuration](#).

Installing a new Secure Path configuration

Perform the following steps before connecting the StorageWorks array to your host system:

1. Verify that HP-UX 11.00 is running.
2. Verify that the required HP OS patches (as described in the *HP StorageWorks Secure Path 3.0F Service Pack 1 for HP-UX 11.00 and Secure Path 3.0F Service pack 1 Workgroup Edition for HP-UX 11.00 release notes*) are installed, by entering the following command:

```
# swlist patch_name
```
3. Use an FC utility to determine the World Wide Name (WWN) of the Fibre Channel (FC) adapters within the server.

NOTE:

The appropriate FC utilities are `fcmsutil` and `fcutil`.

An example of the `fcmsutil` command follows this paragraph. Use the output of this command to record the WWN of the HBAs that are connected to the array. This information is required to set up the host connection to the HSV-based array and for verification of your configuration.

```
# fcmsutil /dev/td0
```

The instance number for the HBA is `td0`. The system displays the following:

```
Vendor ID is = 0x00103c
Device ID is = 0x001028
TL Chip Revision No is = 2.3
PCI Sub-system Vendor ID is = 0x00103c
I Sub-system ID is = 0x000006
Topology = PTTOPT_FABRIC
Local N_Port_id is = 0x011500
N_Port Node World Wide Name = 0x50060b000009ce61
N_Port Port World Wide Name = 0x50060b000009ce60
Driver state = ONLINE
Hardware Path is = 0/2/0/0
Number of Assisted IOs = 59812
Number of Active Login Sessions = 2
```

In this example, record the N_Port Port World Wide Name, `50060b000009ce60`. Do this for each HBA that is connected in the Secure Path configuration.

Complete the following steps to connect the array to your host system:

1. Connect FC cables between the A5158A, A6795A, or A6685A FC adapters and the ports on the HP SAN switch.
2. Connect FC cables from each Active-Passive array controller port to the HP SAN switch.
3. Complete the procedure described in [Configuring switches](#).

NOTE:

HP recommends this configuration to optimize storage component availability.

Configuring switches

To configure switches, complete the following steps:

1. Turn on the power to the SAN switches.
2. Log on to the switch.

**NOTE:**

For more information, refer to the Fibre Channel SAN switch management guide that was shipped with your switch.

3. At the `switch:admin` prompt, verify that the switch is in `Fabric` mode and not in `QuickLoop` mode by entering the following command:
`switch:admin> qlShow`
 - If the switch responds `Switch is not in QuickLoop mode`, go to [step 4](#).
 - If the switch is in `QuickLoop` mode, disable `QuickLoop` mode by entering the following command:
`switch:admin> qlDisable`
The switch responds by displaying the following information:
`Setting switch to Fabric mode.`
`Committing configuration...done.`
`Re-enable FL_ports`
4. Power up the StorageWorks array and complete the procedure described in [Configuring the HSG80-based StorageWorks array](#) or in [Configuring the HSV100/110 based StorageWorks array](#).

Configuring the HSG80-based StorageWorks array

To configure the HSG80-based array, complete the following steps:

1. Establish a terminal connection to the top controller's Command Line Interpreter (CLI) port. Refer to the *HSG80 ACS Solution Software for HP-UX installation and configuration guide* for help in making that connection.
2. Enter the following CLI commands to see your existing array configuration:
`HSG80> show this_controller`
`HSG80> show other_controller`
3. Determine whether your array is in transparent failover or multiple-bus mode and whether it is configured for loop or fabric. If your array is in transparent failover and is configured for fabric, execute the following steps.
4. Configure the RA8000, MA8000, ESA12000, or EMA12000 array for fabric connectivity and for multiple-bus operation by accessing the CLI. For more information about the CLI and configuring the array, see the *HSG80 ACS Solution software for HP-UX installation and configuration guide* and the *HSG80 array controller CLI reference guide*. These documents came with your HSG80 ACS Solution Software for HP-UX Solution Software Platform Kit.
5. Enter the following commands to set the array for SAN-switched fabric:
`HSG80> set this_controller port_1_topology=offline`
`HSG80> set this_controller port_1_topology=fabric`
`HSG80> set other_controller port_1_topology=offline`
`HSG80> set other_controller port_1_topology=fabric`
`HSG80> set this_controller port_2_topology=offline`
`HSG80> set this_controller port_2_topology=fabric`
`HSG80> set other_controller port_2_topology=offline`
`HSG80> set other_controller port_2_topology=fabric`
6. Configure the RAID system controllers for multiple-bus failover mode by entering the following commands in order as shown:
`HSG80> set nofailover`

△ **CAUTION:**

The other controller shuts down and you must manually restart it by momentarily pressing reset on the controller's front panel. Wait for two minutes for the controller to boot before proceeding. Ignore the "controller misconfigured" messages.

```
HSG80> set multibus_failover copy=this_controller
```

7. Wait for two minutes for the controllers to reboot before proceeding.
The controller restarts in multiple-bus mode.
8. Verify that both controllers are configured for multiple-bus mode and that the array is in SCSI-2 mode by entering the following commands:

```
HSG80> show this_controller  
HSG80> show other_controller
```
9. If the array is in SCSI-2 mode and you want to use the SCSI-3 mode, verify that unit D0 is unassigned. If it is assigned, delete D0 and reassign. To do this, enter the following command:

```
HSG80> delete D0
```


Go to [step 13](#).

 **NOTE:**

If you are planning to use SCSI-3 mode, see [Configuring SCSI-3 for HSG80-based systems](#). The array should be in SCSI-2 mode at this point.

10. If the array is not in SCSI-2 mode, set the array to SCSI-2 mode by entering the following command:

```
HSG80> set this_controller scsi_version=scsi-2
```
11. Restart the controllers to have SCSI-2 take effect by entering the following commands:

```
HSG80> restart other_controller  
HSG80> restart this_controller
```


Wait for two minutes for the controllers to reboot before proceeding.
12. Verify that the controllers are now in SCSI-2 mode by entering the following command:

```
HSG80> show this_controller
```
13. Perform the following steps if this is a new factory-configured array or one that is being re-configured. The array's internal connection table may contain connections that are out of date.
 - a. Review the array's internal connection table by entering the following command:

```
HSG80> show connections
```
 - b. Delete all connections to this host that are shown in the array's internal connection table. The first time the server scans the Fibre Channel bus during boot, the new connections are registered.
 - c. Delete each connection by entering the following command:

```
HSG80> delete connection_name
```


Connection_name is one of the names listed in the array's internal connection table, which is displayed when you ran the `show connections` command in [step 13, step a](#).
14. Complete the array setup by creating LUNs and assigning LUN unit numbers. To do this note the following information:
 - Refer to the *HSG80 ACS Solution Software for HP-UX installation and configuration guide* that came with your StorageWorks Solution Software Kit for details.
 - If you are re-configuring an array set up for SCSI-2 that already has LUNs configured, you may use these units without re-configuring as long as you are using units D0 through D7. But, if you are using offset LUNs D8 through D199, you must re-configure these units.

- In a SCSI-3 array, you can use units D1 through D127. Units D128 through D199 must be re-configured.

 **NOTE:**

Using Secure Path 3.0F SP1 with SCSI-3 mode requires using ACS 8.7 or later.

15. Select and follow procedures described in [Configuring optional HSG80-based array features](#) as needed. When you have completed any optional array feature, perform the procedure described in [System configuration](#), to configure the system for Secure Path.

Configuring optional HSG80-based array features

This section provides the following optional HSG80-based array feature setup information and procedures, including:

- [Setting up additional SCSI-2 LUNs](#)
- [Setting a preferred unit to a controller](#)
- [Using SCSI-3](#)
- [Managing the command console LUN in SCSI-2 mode](#)

Setting up additional SCSI-2 LUNs

The HP-UX 11.0sdisk driver allows only 8 LUNs per target. RA8000, MA8000, ESA12000, or EMA12000 arrays normally present the LUNs as a single target. The array can be set up to present a second target of another 8 LUNs for a maximum of 16 LUNs for the array.

Refer to [Table 3](#), when deciding which configuration to use.

Table 3 Target or LUNS per array comparison chart with dual fabric

Highest availability	Lower availability	Highest availability
8 LUNs per array 2 HBAs per server	16 LUNs per array 2 HBAs per server	16 LUNs per array 4 HBAs per server
4 paths per LUN	2 paths per LUN	4 paths per LUN
Load balancing (across 2 HBAs and 2 controller ports)	No load balancing	Load balancing (across 2 HBAs)

With the architecture of the RA8000, MA8000, ESA12000, or EMA12000 array, load balancing can only be accomplished across ports of the selected controller in a redundant controller pair.

1. Complete all configuration steps described in [Hardware setup overview](#).
During the boot sequence, the `ioscan` creates a connection table entry in the array. Modifications to the array's connection table enable the second target of LUNs.
2. Enter the following command for each A5158A, A6795A, or A6685A adapter:
`# fcmsutil /dev/td#`
3. Record the adapter's N_Port Port World Wide Name (the last 4 hex digits should suffice) on a configuration schematic.
4. Establish a CLI connection to the array and enter the following command:
`HSG80> show connections`
A connection table similar to the following is displayed:
Connection Unit
Name Operating system Controller Port Address Status Offset
!NEWCON13 HP THIS 1 011000 OL this 0
HOST_ID=5006-0B00-0009-DB13 ADAPTER_ID=5006-0B00-0009-DB12

```

!NEWCON14 HP OTHER 1 021000 OL other 0
HOST_ID=5006-0B00-0009-DB13 ADAPTER_ID=5006-0B00-0009-DB12
!NEWCON15 HP OTHER 2 021000 OL other 0
HOST_ID=5006-0B00-0009-DD71 ADAPTER_ID=5006-0B00-0009-DD70
!NEWCON16 HP THIS 2 011000 OL this 0
HOST_ID=5006-0B00-0009-DD71 ADAPTER_ID=5006-0B00-0009-DD70

```

In this example, you can see that the adapter `-DB12` is connected to port 1 of *this* controller with a connection name of `!NEWCON13` and to port 1 of *other* controller with a connection name of `!NEWCON14`.

The connection names are assigned by the array. You can change the connection name as per your convenience or for setting up Selective Storage Presentation for using the array as part of a SAN. For more information, refer to “Restricting Host Access” section in the *HSG80 ACS Solution Software for HP-UX installation and configuration guide*.

5. Select two paths that you want to assign to the second target on the configuration map.



NOTE:

This assignment **MUST** allow each adapter to reach opposite controllers (*this* and *other*) through opposite switches.

For example, in the previous table, select either `!NEWCON13` and `!NEWCON15`, or `!NEWCON14` and `!NEWCON16`.

6. Enter the following commands for the selected pair:

```

HSG80> set !newcon13 unit_offset=10
HSG80> set !newcon15 unit_offset=10

```

7. Initialize the LUNs that you want to define for the second target, using procedures described in the *HSG80 ACS Solution Software for HP-UX installation and configuration guide*.

8. To view all the LUNs, enter the following command:

```

HSG80> show devices

```

Up to 8 devices is displayed as `used` by units D0 through D7, and your new devices is displayed as `not used` by assignment.

9. Add the new devices as units D10 through (or up to) D17. For example:

```

HSG80> add unit D10 M9
HSG80> add unit D11 DISK40300

```

Keep adding devices up to a maximum of D17.

The array now identifies units from D10 to D17 with a unit offset of 10, as a second target of LUNs 0 to 7.

10. Enter the following command at the server console:

```

# ioscan -fn (to see the new units)
# insf -e (to install special files for each new unit)

```

An `ioscan -fnk` now shows all new LUNs. You can see these new LUNs only on half of the original paths, and the old LUNs is seen on the other half of the original paths.

11. If you do not see all or part of the new LUNs following the `ioscan`, complete the procedure described in [What to do if ioscan does not see all paths to the array](#).



NOTE:

This irregularity results from HP-UX tables that are used by the OS for maintaining accurate I/O system persistence across reboots and is not a cause for concern.

Setting a preferred unit to a controller

In multiple-bus failover mode, you can specify units to be normally selected by a specific controller of a controller pair. This process is called preferring and is useful in static load balancing.

Units can be preferred to one controller or the other by the `preferred_path` switch of the `ADD UNIT` or `SET UNIT` command. You must use this option of preferring a unit to a controller if you intend to use the preferred path feature in Secure Path.

For example, enter the following command to prefer unit `D5` to this controller, and then later set a preferred path to that unit using the Secure Path `spmgr` utility `prefer` command:

```
HSG80> set D5 preferred_path=this_controller
```

Using SCSI-3

This section describes the following requirements for SCSI-3:

- Secure Path 3.0F SP1 requires the HSG80 controllers to be at ACS firmware 8.7 or later for SCSI-3 operation with extended LUN support. To enable extended LUN support, the HSG80 operating system mode parameter must be set to `HP_VSA`.
- The Command Console LUN (CCL) is required for SCSI-3, and the CCL is the first array unit (`D0`). This reduces the number of available LUNs by one on the HP-UX system.

NOTE:

To facilitate a clean and understandable `ioscan` output during installation, do not enable SCSI-3 until instructed in [System configuration](#).

See [Configuring optional HSG80-based array features](#), if you want to configure an optional feature, or continue with [System configuration](#) to configure the system for Secure Path.

Managing the command console LUN in SCSI-2 mode

The StorageWorks array is factory-configured with a virtual LUN, located on Controller A, LUN 0. This device is called the Command Console LUN (CCL) and it enables the array to get recognized by some host systems as soon as it is attached to the Fibre Channel switch and configured into the operating system. The CCL also serves as a communications device for the StorageWorks Command Console (SWCC) Agent. The CCL identifies itself to the host via a unique identification string. This string, `HSG80CCL`, is returned in response to the SCSI Inquiry command.

The following list describes the CLI commands that affect CLL:

- The CCL is enabled upon delivery. Determine its address by entering the following CLI command:

```
HSG80> show this_controller
```

- Disable the CCL by entering the following CLI command:

```
HSG80> set this_controller nocommand_console_lun
```

- Enable the CCL by entering the following CLI command:

```
HSG80> set this_controller command_console_lun
```

In dual-redundant controller configurations, these commands alter the setting of the CCL on both controllers.

When the CCL is enabled, its ID is the lowest-numbered available LUN. When creating LUNs and logical units on the RAID array using the CLI, you must reserve the address of the CCL to `D0`, and you must not use this address (`D0`) for a data LUN. However, if the CCL's LUN is assigned to a LUN, the CCL floats to the next-lowest LUN that is available.

 **NOTE:**

On HP servers running Secure Path, the floating nature of the CCL could result in unreliable unit assignments when adding or deleting units. HP recommends that D0 be left unassigned if the CCL is required or that the CCL is disabled if it is not going to be used.

Configuring the HSV100/110 based StorageWorks array

Before beginning the configuration, collect and record the following host information:

- Host LAN name.
- Host IP address.
- Fibre Channel adapter World Wide Names that is configured for Secure Path.

Use a supported Web browser to access the Command View EVA management appliance.

 **NOTE:**

Refer to the online Command View EVA help system or the *Storage Management Appliance Element Manager for Enterprise Only* user guide for information on these procedures. All of these procedures need to be completed for your host to use the virtual disks.

Before your host servers can use the virtual disks, ensure that you have completed the following:

1. Initialize the storage system and create disk groups. When you first view the EVA from the Command View EVA software, the storage pool is presented as *un-initialized* storage. Follow documented procedures for initializing the storage system and creating disk groups.
2. Add the host to the storage system. Before the host can use the storage system's virtual disks, the host WWN of one HBA must be known to the storage system. Adding the host creates a path from the storage system to one host adapter.
3. Add ports to all host adapters. From the host properties page, use Add Port to add connections to the remaining HBA host adapters.
4. Create and present virtual disks to the host. Follow the steps to create the virtual disk family, virtual disks, and present the disks to the host.

Several options are available for selecting a path preference and mode for a virtual disk. To optimize load balancing, the load should be evenly distributed between controller A and controller B. The boot default selected controller may be chosen by setting the controller `Preferred path` or `mode`. HP recommends that you use either Path A - Failover only or Path B - Failover only. This mode allows Secure Path to control failback to the original controller following a controller failure and replacement.

 **NOTE:**

Path A - failover or failback and Path B - failover or failback are not supported on Secure Path for HP-UX. This feature is designed for operating systems that cannot run Secure Path.

System configuration

To configure the system for Secure Path, follow the steps below:

1. Power on the server and boot HP-UX.
During the boot process, device special files are created for each logical unit configured on the Active-Passive controller and are assigned to each LUN or virtual disk configured on the Active-Passive controller. Because Secure Path is not yet installed, you should see an instance of a LUN for every path to the array. For example, if you have 2 adapters, 2 switches, and 2 connections from each switch to the array, you have 4 distinct device instances (paths) to each LUN that is configured on the array.

- Before installing Secure Path, verify that you can see all your Active-Passive storage devices by entering the following command:

```
# ioscan -fnk
```

If you do not see all or part of the new LUNs following the `ioscan` command, perform the procedure described in [What to do if ioscan does not see all paths to the array](#). This anomaly results from HP-UX tables that are used by the OS to maintain accurate I/O system persistence across reboots and is not a cause for concern.

The following table shows a normal array with a single LUN:

```
Class I H/W Path Driver S/W State H/W Type Description
=====Ba 1
0/2 lba CLAIMED BUS_NEXUS Local PCI Bus Adapter (782) Fc 0
0/2/0/0 td CLAIMED INTERFACE HP Tachyon TL/TS Fibre Channel Mass
Storage Adapter /dev/td0 fcp 0 0/2/0/0.1 fcp CLAIMED INTERFACE
FCP Domain ext_ bus 7 0/2/0/0.1.18.255. 0 fcpdev CLAIMED
INTERFACE FCP Device Interface target 7 0/2/0/0.1.18.255. 0.0
tgt CLAIMED DEVICE disk 23 9 0/2/0/0.1.18.255. 0.0.0 sdisk
CLAIMED DEVICE DEC HSG80 /dev/dsk/c7t0d0 /dev/rdisk/c7t0d0 ext_bu
s 9 0/2/0/0.1.19.255. 0 fcpdev CLAIMED INTERFACE FCP Device
Interface target 8 0/2/0/0.1.19.255. 0.0 tgt CLAIMED DEVICE
disk 24 1 0/2/0/0.1.19.255. 0.0.0 sdisk CLAIMED DEVICE DEC HSG80
/dev/dsk/c9t0d0 /dev/rdisk/c9t0d0 ba 2 0/4 lba CLAIMED BUS_NEXUS
Local PCI Bus Adapter (782) fc 1 0/4/0/0 td CLAIMED INTERFACE HP
Tachyon TL/TS Fibre
Channel Mass Storage Adapter /dev/td1 fcp 1 0/4/0/0.1 fcp CLAIMED
INTERFACE FCP Domain ext_ bus 13 0/4/0/0.1.18.255. 0 fcpdev
CLAIMED INTERFACE FCP Device Interface target 9 0/4/0/0.1.18.255.
0.0 tgt CLAIMED DEVICE disk 34 6 0/4/0/0.1.18.255. 0.0.0 sdisk
CLAIMED DEVICE DEC HSG80 /dev/dsk/c13t0d0 /dev/rdisk/c13t0d0 ext_
bus 15 0/4/0/0.1.19.255. 0 fcpdev CLAIMED INTERFACE FCP Device
Interface target 10 0/4/0/0.1.19.255. 0.0 tgt CLAIMED DEVICE
disk 34 8 0/4/0/0.1.19.255. 0.0.0 sdisk CLAIMED DEVICE DEC HSG80
/dev/dsk/c15t0d0 /dev/rdisk/c15t0d0
```

- Choose one of the following options:
 - If you are using SCSI-3, proceed to [Configuring SCSI-3 for HSG80-based systems](#) to continue the installation.
 - If you are using SCSI-2, proceed to [Installing Secure Path for Active-Passive disk arrays](#) to continue the installation.

Configuring SCSI-3 for HSG80-based systems

To configure your SCSI-3 for HSG80-based systems, follow the steps below:

- Establish a terminal connection to the top controller's CLI port to set the Operating System mode for each ConnectionName path as shown in the following example:

```
HSG80> show connections
Connection Unit
Name Operating System Controller Port Address Status Offset
!NEWCON1 WINNT OTHER 1 011500 OL other 0
HOST_ID=5006-0B00-0009-CE61ADAPTER_ID=5006-0B00-0009-CE60
!NEWCON2 WINNT THIS 1 021500 OL this 0
HOST_ID=5006-0B00-0009-CE61ADAPTER_ID=5006-0B00-0009-CE60
!NEWCON3 WINNT THIS 2 021500 OL this 0
HOST_ID=5006-0B00-0009-D8C7ADAPTER_ID=5006-0B00-0009-D8C6
!NEWCON4 WINNT OTHER 2 011500 OL other 0
HOST_ID=5006-0B00-0009-D8C7 ADAPTER_ID=5006-0B00-0009-D8C6
```

2. Change the operating system mode for each path shown to HP for SCSI-2 or HP_VSA for SCSI-3. To do so, enter the following set of commands:

```
HSG80> set !NEWCON1 operating_system=HP (or HP_VSA)
HSG80> set !NEWCON2 operating_system=HP (or HP_VSA)
HSG80> set !NEWCON3 operating_system=HP (or HP_VSA)
HSG80> set !NEWCON4 operating_system=HP (or HP_VSA)
```

 **NOTE:**

The array must be at firmware revision ACS 8.7 or later to use the SCSI-3 protocol and the HP_VSA mode.

3. Verify that all connections are now in HP mode by entering the following command:

```
HSG80> show connections
```

4. Verify that the array is in SCSI-2 mode by entering the following command:

```
HSG80> show this_controller
```

 **NOTE:**

If you want the array in SCSI-2 mode, stop here.

If you want the array in SCSI-3 mode, complete [step 5](#) through [step 6](#).

5. Set the array to SCSI-3 mode by entering the following command:

```
HSG80> set this_controller scsi_version=scsi-3
```

6. Restart the controllers by entering the following commands, to have SCSI-3 take effect:

```
HSG80> restart other_controller
HSG80> restart this_controller
```

 **NOTE:**

Wait two minutes for the controllers to reboot before proceeding.

7. Verify that the controllers are now in SCSI-3 mode by entering the following command:

```
HSG80> show this_controller
```

8. Proceed to [Installing Secure Path for Active-Passive disk arrays](#), to continue the installation.

What to do if ioscan does not see all paths to the array

If your server has been factory integrated, or if you are adding units with SCSI-2 CCL enabled, changing array unit offsets, or adding array unit offsets, `ioscan` may not see part or all of the added or changed paths. This problem is caused by HP-UX tables that are used by the OS for maintaining accurate I/O system persistence across reboots. Enter the following series of commands to update system tables for accurate subsequent `ioscans`:

```
# fcmsutil /dev/td0 get remote all (to obtain all Target N_Port_ids in the
form 0x011200 for attached arrays)
# fcmsutil /dev/td0 replace_dsk Target N_Port_id#1
# fcmsutil /dev/td0 replace_dsk Target N_Port_id#2
...
...
# fcmsutil /dev/td0 replace_dsk Target N_Port_id#n
# fcmsutil /dev/td1 get remote all (to obtain all Target N_Port_ids in the
form 0x011200 for attached arrays)
# fcmsutil /dev/td1 replace_dsk Target N_Port_id#1
# fcmsutil /dev/td1 replace_dsk Target N_Port_id#2
...
...
```

```

# fcmsutil /dev/td1 replace_dsk Target N_Port_id#n
# fcmsutil /dev/tdn get remote all (to obtain all Target N_Port_ids in the
form 0x011200 for attached arrays)
...
...
...
# ioscan -fn

```

For example, if your server has HBAs `td0` and `td1`, then you need to issue the following command for both HBAs:

```

# fcmsutil /dev/td0 get remote all
Target N_Port_id is = 0x011000
Target state = DVS_UNOPENED
Symbolic Name = DEC HSG80 YC04
Port Type = N_PORT
Target Port World Wide Name = 0x50001fe100166c33
Target Node World Wide Name = 0x50001fe100166c30
Common Service parameters (all values shown in hex):
^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
Version_Hi: 9 Version_Low: 9
BB_Credit: 0 Ciro: 1
Alt_BBcred: 0 Rxsz: 800
Conseq: ff RO_Bitmap: 1
Resolution: 0 EDTOV(ms): 7d0
Vendor version (in hex) 43504330 34003030 0 0
-----
Target N_Port_id is = 0x011100
Target state = DVS_UNOPENED
Symbolic Name = DEC HSG80 YC04
Port Type = N_PORT
Target Port World Wide Name = 0x50001fe100166c32
Target Node World Wide Name = 0x50001fe100166c30
Common Service parameters (all values shown in hex):
^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
Version_Hi: 9 Version_Low: 9
BB_Credit: 0 Ciro: 1
Alt_BBcred: 0 Rxsz: 800
Conseq: ff RO_Bitmap: 1
Resolution: 0 EDTOV(ms): 7d0
Vendor version (in hex) 43504330 34003030 0 0
-----

```

From this example output, use Target N_Port_ids `0x011000` and `0x011100` and run the following commands:

```

# fcmsutil /dev/td0 replace_disk 0x011000
# fcmsutil /dev/td0 replace_disk 0x011100

```

 **NOTE:**

These commands must be issued for each HBA and for each Target N_Port_id on the server.

Installing Secure Path for Active-Passive disk arrays

The installation process installs Secure Path drivers, management utilities, and manual pages. This section provides the following procedures and information:

- [Installing Secure Path](#)
- [Completing the Secure Path installation](#)

Installing Secure Path

The Secure Path for HP-UX CD-ROM kit contains scripts that requires administrator access to install the Secure Path depot (package). The following procedure describes how to install Secure Path software:

1. Ensure that all users have logged off the server and that all I/O from the server has ceased.
2. Back up the entire system according to normal procedures.
3. Insert the Secure Path for HP-UX CD-ROM into the CD-ROM drive.
4. Verify that the `pfs_mountd` and `pfsd` daemons are running by entering the following command:

```
# ps -ef | grep pfs
```

If these daemons are not listed, start them by entering the following commands:

```
# pfs_mountd &
```

```
# pfsd &
```

5. Mount the CD-ROM by entering a command similar to the following:

```
# pfs_mount /dev/dsk/cdrom_device_file /mnt_directory
```

Example:

```
# pfs_mount /dev/dsk/c2t1d0 /cdrom
```

In the previous example, `cdrom_device_file` is `c2t1d0` and the `mnt_directory` is `/cdrom`.

6. Change to the Secure Path installation directory in the CD-ROM, by entering the following command:

```
# cd /cdrom
```

7. Install the Secure Path software on the server using the provided shell script by entering the following command:

```
# ./install.sh
```

NOTE:

You must always use the `install.sh` script to install Secure Path. Do not use the `swinstall` command to install the Secure Path depot package.

8. Select Secure Path 3.0F SP1 for HP-UX for Active-Passive disk array when prompted, and follow the on-screen instructions.

The system reboots after successful installation of Secure Path 3.0F SP1 for HP-UX for Active-Passive disk array.

NOTE:

- At least 100 MB of free disk space is required in the `/tmp` file system.
- The script checks the server for required drivers and patches before it installs Secure Path.

Completing the Secure Path installation

After a successful installation and the subsequent reboot, the following occurs:

- The server reboots HP-UX with a new kernel containing Secure Path and the Secure Path Manager (`spmgr`) utility.
- An `ioscan` discloses new disk instances for each Active-Passive LUN configured on the server.
- Secure Path claims all units that have been presented to the host from the array and numbers them sequentially starting with target 0, LUN 0.

- Secure Path is enabled with the following default values:
 - Auto-Restore-off
 - Load Balancing-off
 - Path Verification-on
 - Verification Period–30 seconds
 - Paths preferred-none
 - Console event logging of critical messages
 - Syslog event logging of critical and warning messages
 - Mail event logging of critical, warning, and informational messages enabled to send to the root account

Use `spmgr` to customize your configuration. See [spmgr commands](#) for more information on the `spmgr` utility.

When you have completed configuring the storage system, you must run `spmgr update` so that the configuration persists across the next reboot of the server. You do not need to reboot at this time. For specific procedural information, see [Secure Path persistence across reboots](#) for more details.

Secure Path installs the following utilities:

- The Secure Path agent (`/sbin/spagent`) provides an interface for Secure Path applications to communicate with the Secure Path drivers. The `spagent` script starts after Secure Path installation and at system boot (for subsequent reboots) and must run for `spmgr` to operate. The `spinit` script (`/sbin/init.d/spinit`) starts and stops the `spagent`.
- The Secure Path management utility (`/sbin/spmgr`) displays device information, actively manages paths to each device, and sets driver options such as load balancing, path verification, and auto-restore. See [spmgr commands](#) for more information.
- The `spvgactivate` script (`/sbin/init.d/spvgactivate`) activates the LVM volume groups during boot time. This is required because the LVM volume groups created with Secure Path devices are not activated as part of the boot-up-time LVM configuration since the persistence module of Secure Path is not loaded at that time.
- The Man pages for `spmgr`, `spagent`, `spinit`, `hsx`, and `swsp`.

If you are using StorageWorks Command Console (SWCC) to manage an HSG80 environment, all devices that existed prior to the install are now hidden behind the `hsx` and `swsp` drivers, and new names are presented to the `sdisk` SCSI class driver.

To update the new device names, complete the following procedures:

1. Execute the `ioscan` command to determine the new device name.
2. Refer to the *HSG80 ACS Solution Software for HP-UX* installation and configuration guide and perform the following procedures:
 - a. Modify the access device with the new name.
 - b. Enable the option to start the agent during system boot.
 - c. Restart the agent.

Managing Secure Path for Active-Passive disk arrays

This section describes the user interface for the Secure Path for Active-Passive 3.0F SP1 management utility `spmgr`, including:

- [Secure Path Manager overview](#)
- [Displaying configuration information](#)
- [Setting storage system parameters](#)
- [Path management](#)
- [Preferred controller](#)
- [The add and delete commands](#)
- [Secure Path persistence across reboots](#)

**NOTE:**

Examples are based on the HSG80 controller, but all actions are identical for the HSV100/110 controllers.

Secure Path Manager overview

The `spmgr` utility lets you monitor and manage devices, storage systems, and paths to units that are in the Secure Path for Active-Passive configuration. It also lets you modify the configuration to repair, replace, or reconfigure devices. The `spmgr` utility relies on `spagent` to handle calls to the driver (`swsp`).

This section contains the following information:

- [spmgr commands](#)
- [spmgr common terms](#)

spmgr commands

Table 4 lists the `spmgr` command options. Their format and syntax are presented and described in the sections following the table.

Table 4 `spmgr` commands

Command	Options or arguments	Description
<code>spmgr add</code>	<i>WWLUNID target LUN</i> <i>-r WWNN all</i>	Adds a new device to the Secure Path for Active-Passive configuration.
<code>spmgr alias</code>	<i>alias_name old_name</i> <i>no argument</i>	Assigns an alias to an object.
<code>spmgr clean</code>	<i>-d [WWLUNID]</i> <i>-r [WWNN]</i> <i>all</i>	Cleans device data from the Secure Path's stale device list.
<code>spmgr delete</code>	<i>WWLUNID</i> <i>device</i> <i>-r WWNN all</i>	Removes a device from the Secure Path for Active-Passive configuration
<code>spmgr display</code>	<i>-a[v] adapter</i> <i>-c[v] controller_ser_num</i> <i>-d[v] device</i> <i>-r[v] WWNN</i> <i>-p path-Instance</i> <i>-s</i> <i>-u</i> <i>no argument</i>	Displays information about configured Secure Path for Active-Passive devices.
<code>spmgr log</code>	<i>-c 0, 1...3</i> <i>-l 0, 1...3</i> <i>-n 0, 3</i> <i>no argument</i>	Sets logging to the console, system log file, and e-mail notification.
<code>spmgr notify</code>	<i>add severity_level</i> <i>e-mail_address</i> <i>delete e-mail_address</i> <i>no argument</i>	Manages e-mail address and event logging severity to each e-mail recipient.

Command	Options or arguments	Description
<code>spmgr prefer</code>	<i>path_instance</i>	Assigns preferred attribute to a path.
<code>spmgr passwd</code>		Provides security on the server side to restrict client access.
<code>spmgr quiesce</code>	<i>-a adapter</i> <i>-c controller_ser_num</i> <i>-p path_instance</i>	Moves I/O to an alternative object and temporarily removes the selected object from use.
<code>spmgr refreshdisplay</code>		Refreshes the array controller serial numbers. 1
<code>spmgr restart</code>	<i>-a adapter</i> <i>-c controller_ser_num</i> <i>-p path_instance</i> <i>all</i>	Returns a previously quiesced object to an active, available, or standby state.
<code>spmgr restore</code>	<i>-d device</i> <i>-r WWNN</i> <i>all</i>	Restores one or more devices to their preferred I/O path.
<code>spmgr select</code>	<i>-c controller_ser_num [-d device]</i> <i>-p path_instance</i>	Selects a path or controller for I/O. Also, initiates a LUN movement if necessary.
<code>spmgr set</code>	<i>-a on off WWNN</i> <i>-b on off rr lb li ls WWNN</i> <i>-f interval</i> <i>-p on off WWNN</i>	Enables or disables Secure Path features like load balancing, path verification.
<code>spmgr unalias</code>	<i>alias_name old_name</i>	Removes an alias.
<code>spmgr unprefer</code>	<i>path_instance</i>	Removes a preferred path attribute.
<code>spmgr update</code>	<i>no argument</i>	Updates the persistent parameter file.

¹Only the controller serial number is updated and not the controller status. This is because the controller status is determined by the status of the paths going through that controller.

 **NOTE:**

Commands entered 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.

The changes to the configuration settings performed by the following commands are persistent across system reboots and Secure Path upgrades:

- `spmgr add`
- `spmgr delete`
- `spmgr log`
- `spmgr prefer`
- `spmgr set`
- `spmgr unprefer`

The changes to the configuration settings performed by the following commands are persistent across system reboots but not persistent across Secure Path upgrades:

- `spmgr alias`
- `spmgr unalias`
- `spmgr notify`

spmgr common terms

Table 5 describes the common `spmgr` terms. For a more complete list of Secure Path for Active-Passive terms, refer to the glossary provided at the end of this guide.

Table 5 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	A device that is managed by Secure Path for Active-Passive and identified by its 32-digit World Wide LUN Identifier (<code>WWLUNID</code>).
Adapter	The operating system ID of the HBA.
Storage System Array WWNN	A storage system is identified by its 16-digit World Wide Node Name (<code>WWNN</code>).
Controller serial number	The controller is identified by a unique serial number. The serial number of the HSG80 is a 10-character alphanumeric string.

Displaying configuration information

This section provides the following information:

- [Controller states](#)
- [Path states](#)
- [Device states](#)
- [Understanding LUN and path instance numbering](#)
- [Displaying header information](#)
- [Displaying difference between HSG and HSV controllers](#)
- [The display command](#)
- [The alias and unalias commands](#)

Controller states

Table 6 lists and describes the possible controller states for Secure Path 3.0F SP1 for Active-Passive disk arrays.

Table 6 Controller states for Secure Path 3.0F SP1 Active-Passive disk arrays

Controller state	Description
Critical	A controller pair bound in multi-bus failover mode when only one of the controllers is available. The Critical state may mean a failed or offline condition because the server cannot communicate with the controller at this time.
Operational	The controller is available with a good status.
Unknown	The server cannot communicate with this controller.

Path states

Table 7 lists and describes the path states reported by Secure Path for 3.0F SP1 for Active-Passive disk arrays.

Table 7 Path states for Secure Path 3.0F SP1 Active-Passive disk arrays

Path state	Description
Active	The path is currently used for the I/O stream.
Available	The path is available on the active controller for the I/O stream.
Failed	The path is currently unusable for the I/O stream.
Quiesced	The path is valid, but has been made unavailable for I/O.
Standby	The path is valid on the standby controller.
Preferred	The path is preferred for the I/O stream, across reboots.



NOTE:

The `preferred_path` attribute is preferred for the I/O stream, across reboots. It may not be assigned to either a failed or a quiesced path.

Device states

Table 8 lists and describes the device states for Secure Path 3.0F SP1 for Active-Passive disk arrays.

Table 8 Device states for Secure Path 3.0F SP1 Active-Passive disk arrays

Device state	Description
Critical	Only one path remains available to the storage unit.
Degraded	One or more paths to the storage unit are failed.
Operational	All paths are available to the storage unit.
Failed	Paths are available but an inquiry to the device returns a not-ready state even after retries.

Understanding LUN and path instance numbering

When Secure Path for Active-Passive is installed or when an array is added to a configuration, Secure Path for Active-Passive numbers LUNs sequentially starting with target 0 LUN 0. This sequential numbering may not match the numbering of units on the array. For example, unit D12 on an HSG80 may have a device instance number of `c12t0d6` as seen in the `spmgr display` output. The `c12` is the next available instance number when the array was added and the `t0d6` is simply the next LUN added following `c12t0d5`.

It is possible in most cases, however, to map the device instance number back to the array unit number by using the path instance number. In most cases, the path instance target or LUN doublet is the octal equivalent of the array unit number as seen by Secure Path for Active-Passive arrays.

For example, here is a partial output of an `spmgr display` command:

```
TGT/LUN Device WWLUN_ID H/W_Path #_Paths
0/ 3 c12t0d3 6000-1FE1-0016-6C30-0009-2030-2549-000A 4
255/0.0.3
Controller Path_Instance HBA Preferred? Path_Status
ZG20302549 no
c4t0d4 td1 no Active
c10t0d4 td3 no Available
```

```

Controller Path_Instance HBA Preferred? Path_Status
ZG20400420 no
c6t0d4 td1 no Standby
c8t0d4 td3 no Standby
TGT/LUN Device WWLUN_ID H/W_Path #_Paths
0/ 4 c12t0d4 6000-1FE1-0016-6C30-0009-2030-2549-000E 4
255/0.0.4
Controller Path_Instance HBA Preferred? Path_Status
ZG20302549 no
c4t6d3 td1 no Active
c10t6d3 td3 no Available
Controller Path_Instance HBA Preferred? Path_Status
ZG20400420 no
c6t6d3 td1 no Standby
c8t6d3 td3 no Standby

```

Convert the path instance target and LUN octal value to decimal. The decimal value is the array unit or virtual disk number.

In this example, to determine the array's unit number for device `c12t0d3`, convert the path instance `c4t0d4` target or LUN octal doublet `04` to a decimal number `04`. The HSG80 array's `D4` is mapped to Secure Path for Active-Passive device `c12t0d3`.

For the example's second device `c12t0d4`, the path instance `c4t6d3` yields an octal doublet `63` that converts to a decimal `51`. The server, therefore, sees a unit number `51(D51)` for an HSG80 from the array.

If you are configuring an HSG80-based array, this conversion must account for unit offsets if they are used. If the unit number on the array is `D25` and the unit offset is `20`, the server sees a unit number of `5` (`25` minus `20`), and the path instance for that unit is in the form of `c#t0d5`.

If you are using an HSV110 or HSG80-based array, virtual disk numbers or unit numbers greater than `128/127`, respectively, do not follow the above convention. For a virtual disk or unit number greater than `128`, Secure Path for Active-Passive assigns a new `c` instance number, drops the most significant bit (subtracts `128`), and assigns the path instance number. For example, if an HSV110 presents a virtual disk number `138` to the server, Secure Path for Active-Passive assigns a device number `cyt1d2`, where `y` is a new `c` number and `t1d2` is derived from `138 - 128 = 10` converted to an octal `12`.

Displaying header information

Due to the possible complexity of the Secure Path for Active-Passive configuration and the possibility of shared storage or clustered software across multiple servers, the display information always has the following 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

```

Displaying difference between HSG and HSV controllers

All general examples in this document use the HSG80 serialization format and actual HSG80 examples. The HSG80 and HSV110 Array Controllers present objects to Secure Path for Active-Passive arrays in identical ways. Therefore, there are no differences in the way you manage settings, paths, and devices using the `spmgr` utility.

There are, however, two differences in serialization of array objects that allow you to quickly determine which type of array is being displayed. The following examples list the differences:

```

HSG80
Controller Serial Number ZG10506981
Array World Wide Node Name (WWNN) 5000-1FE1-0010-5B00
World Wide LUN ID (WWLUNID)
6000-1FE1-0010-5B00-0009-1050-6981-1234

HSV110
Controller Serial Number P4889B29LC01J
Array World Wide Node Name (WWNN) 5000-1FE1-0015-0AE0
World Wide LUN ID (WWLUNID)

```

 **NOTE:**

The location of the sequence 1234 in the WWLUNID examples is unique for each LUN and is in a different position for the array types.

The display command

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

 **NOTE:**

You can use the verbose flag with only 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
-s
-u
(no argument)
```

The section describes the following for each of these command switches:

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

This section contains the following:

- [# spmgr display](#)
- [# spmgr display -a\[v\] HBA](#)
- [# spmgr display -c\[v\] controller_serial_number](#)
- [# spmgr display -d\[v\] device_instance](#)
- [# spmgr display -p path_instance](#)
- [# spmgr display -r\[v\] WWNN](#)
- [# spmgr display -s](#)
- [# spmgr display -u](#)
- [# spmgr refreshdisplay](#)

spmgr display

When you enter the `spmgr display` command, 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:

```
# spmgr display
Server: hp.mydomain.com Report Created: Thu, Sep 13 16:11:50
```

```

2004
Command: spmgr display
=====
Storage: 5000-1FE1-0010-5B00
Load Balance: Off Auto-restore: Off
Path Verify: On Verify Interval: 30
HBAs: td0 td1
Controller: ZG10505167, Operational
ZG10506981, Operational
Devices: c16t0d0 c16t0d1
TGT/LUN Device WWLUN_ID H/W_Path #_Paths
0/ 0 c16t0d0 6000-1FE1-0010-5B00-0009-1050-6981-0013 4
0/0/255.0.0.0
Controller Path_Instance HBA Preferred? Path_Status
ZG10505167 c4t0d0 td0 no Standby
c10t0d0 td1 no Standby
Controller Path_Instance HBA Preferred? Path_Status
ZG10506981 no
c5t0d0 td0 no Active
c11t0d0 td1 no Available
TGT/LUN Device WWLUN_ID H/W_Path #_Paths
0/ 1 c16t0d1 6000-1FE1-0010-5B00-0009-1050-6981-0014 4
0/0/255.0.0.1
Controller Path_Instance HBA Preferred? Path_Status
ZG10505167 no
c4t0d1 td0 no Standby
c10t0d1 td1 no Standby
Controller Path_Instance HBA Preferred? Path_Status
ZG10506981 no
c5t0d1 td0 no Active
c11t0d1 td1 no Available

```

spmgr display -a[v] HBA

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

Syntax:

```

# spmgr display -a
-a v
-a HBA_number
-a v HBA_number

```

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

Example:

```

# spmgr display -a
Server: hp.mydomain.com Report Created: Thu, Sep 13 16:11:50
2004
Command: spmgr display -a
Adapters in the Secure Path
Configuration
=====
td0, td1

```

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

Example:

```

# spmgr display -av
Server: hp.mydomain.com Report Created: Wed, Aug 15 14:51:23 2004
Command: spmgr display -av
Adapter Hardware Path Driver Version
=====
td0 0/2/0/0 N/A

```

```
td1 0/4/0/0 N/A
```

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:

```
# spmgr display -av td0
Server: hp.mydomain.com Report Created: Wed, Aug 15 14:56:25
2004
Command: spmgr display -av td0
=====
Adapter: td0
Hardware Path: 0/2/0/0
Storage: 5000-1FE1-0010-5B00
0 c19t0d0 ZG10505167 td0 0/0/255.0.0.0 c14t0d0
WWNN: 5000-1FE1-0010-5B00 Path State: Standby
1 c19t0d0 ZG10506981 td0 0/0/255.0.0.0 c15t0d0
WWNN: 5000-1FE1-0010-5B00 Path State: Active
2 c19t0d1 ZG10505167td0 0/0/255.0.0.1 c14t0d1
WWNN: 5000-1FE1-0010-5B00 Path State: Standby
3 c19t0d1 ZG10506981 td0 0/0/255.0.0.1 c15t0d1
WWNN: 5000-1FE1-0010-5B00 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 four possible forms:

Syntax:

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

Example:

```
# spmgr display -c
Server: hp.mydomain.com Report Created: Thu, Sep 13 16:30:23 2004
Command: spmgr display -c
Current Controller List
=====
ZG10505167, ZG10506981
```

Example:

```
# spmgr display -cv
Server: hp.mydomain.com Report Created: Thu, Sep 13 16:30:23 2004
Command: spmgr display -cv
Controller: ZG10505167 Status: Operational
Vendor: HP
WWNN: 5000-1FE1-0010-5B00
HBAs: td0, td1
Controller: ZG10506981 Status: Operational
Vendor: HP
WWNN: 5000-1FE1-0010-5B00
HBAs: td0, td1
```

Example:

```
# spmgr display -c ZG10505167
Server: hp.mydomain.com Report Created: Thu, Sep 13 16:39:49 2004
Command: spmgr display -c ZG10505167
Controller: ZG10505167 Status: Operational
Vendor: HP
WWNN: 5000-1FE1-0010-5B00
HBAs: td0, td1
```

Example:

```
# spmgr display -cv ZG10505167
```

```

Server:hp.mydomain.com Report Created: Thu, Sep 13:16:41:17 2004
Command: spmgr display -cv ZG10505167
Controller: ZG10505167 Status: Operational
Vendor: HP

```

```

WWNN: 5000-1FE1-0010-5B00
HBAs: td0, td1
Item Device Controller HBA Parent Instance
=====
0 c16t0d0 ZG10505167 td0 0/0/255.0.0.0 c4t0d0
WWNN: 5000-1FE1-0010-5B00 Path State: Standby
1 c16t0d0 ZG10505167 td1 0/0/255.0.0.0 c10t0d0
WWNN: 5000-1FE1-0010-5B00 Path State: Standby
2 c16t0d1 ZG10505167 td0 0/0/255.0.0.1 c4t0d1
WWNN: 5000-1FE1-0010-5B00 Path State: Standby
3 c16t0d1 ZG10505167 td1 0/0/255.0.0.1 c10t0d1
WWNN: 5000-1FE1-0010-5B00 Path State: Standby
4 c16t0d2 ZG10505167 td0 0/0/255.0.0.2 c4t0d2
WWNN: 5000-1FE1-0010-5B00 Path State: Standby
5 c16t0d2 ZG10505167 td1 0/0/255.0.0.2 c10t0d2
WWNN: 5000-1FE1-0010-5B00 Path State: Standby

```

spmgr display -d[v] device_instance

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

Syntax:

```

# spmgr display -d
-dv
-d device_instance
-dv device_instance

```

Example:

```

# spmgr display -d
Server:hp.mydomain.com Report Created: Thu, Sep 13 16:44:25 2004
Command: spmgr display -d
Devices by Storage System
=====
Devices: c16t0d0 c16t0d1

```

Example:

```

# spmgr display -dv
Server:hp.mydomain.com Report Created: Thu, Sep 13 16:50:04 2004
Command: spmgr display -dv
Device: c16t0d0 Status: Operational [4 paths (2/0/2)]
Storage: 5000-1FE1-0010-5B00
LUN ID: 6000-1FE1-0010-5B00-0009-1050-6981-0013
Preferred Controller: None
HBAs: td0 td1
Device: c16t0d1 Status: Operational [4 paths (2/0/2)]
Storage: 5000-1FE1-0010-5B00
LUN ID: 6000-1FE1-0010-5B00-0009-1050-6981-0014
Preferred Controller: None
HBAs: td0 td1
etc.

```

 **NOTE:**

Secure Path for Active-Passive disk arrays displays path states using the following convention:
[total number of paths (active/failed/offline)]
Actual numerical equivalents replace the text.
For example, the following attributes are displayed as [10 paths (8/0/2)]:
Total paths = 10, Active = 8, Failed = 0, Offline = 2

Example:

```
# spmgr display -d c16t0d2
Server:hp.mydomain.com Report Created: Thu, Sep 13 16:51:43 2004
Command: spmgr display -d c16t0d2
Device: c16t0d2 Status: Operational [4 paths (2/0/2)]
Storage: 5000-1FE1-0010-5B00
LUN ID: 6000-1FE1-0010-5B00-0009-1050-6981-0015
Preferred Controller: None
HBAs: td0 td1
```

Example:

```
# spmgr display -dv c16t0d2
Server:hp.mydomain.com Report Created: Thu, Sep 13 16:51:43 2004
Command: spmgr display -d c16t0d2
Device: c16t0d2 Status: Operational [4 paths (2/0/2)]
Storage: 5000-1FE1-0010-5B00
LUN ID: 6000-1FE1-0010-5B00-0009-1050-6981-0015

Preferred Controller: ZG10506981
HBAs: td0 td1
Item Device Controller HBA Parent Instance
= = = = =
0 c16t0d2 ZG10505167 td0 0/0/255.0.0.2 c4t0d2
WWNN: 5000-1FE1-0010-5B00 Path State: Standby
1 c16t0d2 ZG10506981 td0 0/0/255.0.0.2 c5t0d2
WWNN: 5000-1FE1-0010-5B00 Path State: Active [P]
2 c16t0d2 ZG10505167 td1 0/0/255.0.0.2 c10t0d2
WWNN: 5000-1FE1-0010-5B00 Path State: Standby
3 c16t0d2 ZG10506981 td1 0/0/255.0.0.2 c11t0d2
WWNN: 5000-1FE1-0010-5B00 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:

```
# spmgr display -p c6t0d0
Server:hp.mydomain.com Report Created: Thu, Sep 13 12:16:14 2004
Command: spmgr display -p c6t0d0
Path: c6t0d0 Adapter: td0
Controller: ZG10506770 Status: Operational
Device: c17t0d0 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 four possible forms:

Syntax:

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

Example:

```
spmgr display -r
Server: hp.mydomain.com Report Created: Wed, Aug 15 15:19:38
2004
Command: spmgr display -r
Storage Systems List
=====
Storage: 5000-1FE1-0010-5B00
Storage: 5000-1FE1-0010-59F0
```

Example:

```
# spmgr display -rv
Server: hp.mydomain.com Report Created: Wed, Aug 15 15:21:02 2004
Command: spmgr display -rv
Storage Systems List
=====
Storage: 5000-1FE1-0010-5B00
Load Balance: Off Auto-restore: Off
Path Verify: On Verify Interval: 30
HBAs: td0 td1
Controller: ZG10505167, Operational
ZG10506981, Operational
Devices: c19t0d0 c19t0d1 c19t0d2 c19t0d3
Storage: 5000-1FE1-0010-59F0
Load Balance: Off Auto-restore: Off
Path Verify: On Verify Interval: 30
HBAs: td0 td1
Controller: ZG10504878, Operational
ZG10505136, Operational
Devices: c21t0d0 c21t0d1 c21t0d2 c21t0d3 c21t0d4
c21t0d5
etc.
```

Example:

```
# spmgr display -r 5000-1FE1-0010-59F0
Server: hp.mydomain.com Report Created: Wed, Aug 15 15:24:14
2004
Command: spmgr display -r 5000-1FE1-0010-59F0
Storage Systems List
=====
Storage: 5000-1FE1-0010-59F0
Load Balance: Off Auto-restore: Off
Path Verify: On Verify Interval: 30
HBAs: td0 td1
Controller: ZG10504878, Operational
ZG10505136, Operational
Devices: c21t0d0 c21t0d1 c21t0d2 c21t0d3 c21t0d4 c21t0d5
```

Example:

```
# spmgr display -rv 5000-1FE1-0010-59F0
Server: hp.mydomain.com Report Created: Wed, Aug 15 15:26:49 2004
Command: spmgr display -rv 5000-1FE1-0010-59F0
Storage Systems List
=====
Storage: 5000-1FE1-0010-59F0
Load Balance: Off Auto-restore: Off
Path Verify: On Verify Interval: 30
HBAs: td0 td1
Controller: ZG10504878, Operational
ZG10505136, Operational
```



```

Devices: c21t0d0 c21t0d1 c21t0d2 c21t0d3 c21t0d4 c21t0d5
Path Information: [P] = Preferred
Item Device Controller HBAHardware Path Instance
= = = = =
0 c21t0d0 ZG10504878 td0 0/0/255.1.0.0 c11t0d0
WWNN: 5000-1FE1-0010-59F0 Path State: Standby
1 c21t0d0 ZG10505136 td0 0/0/255.1.0.0 c12t0d0
WWNN: 5000-1FE1-0010-59F0 Path State: Active
2 c21t0d0 ZG10504878 td1 0/0/255.1.0.0 c13t0d0
WWNN: 5000-1FE1-0010-59F0 Path State: Standby
3 c21t0d1 ZG10505136 td1 0/0/255.1.0.1 c18t0d1
WWNN: 5000-1FE1-0010-59F0 Path State: Available
4 c21t0d1 ZG10504878 td0 0/0/255.1.0.1 c11t0d1
WWNN: 5000-1FE1-0010-59F0 Path State: Standby
5 c21t0d1 ZG10505136 td0 0/0/255.1.0.1 c12t0d1
WWNN: 5000-1FE1-0010-59F0 Path State: Active
6 c21t0d1 ZG10504878 td1 0/0/255.1.0.1 c13t0d1
WWNN: 5000-1FE1-0010-59F0 Path State: Standby
7 c21t0d1 ZG10505136 td1 0/0/255.1.0.1 c18t0d1
WWNN: 5000-1FE1-0010-59F0 Path State: Available
8 c21t0d2 ZG10504878 td0 0/0/255.1.0.2 c11t0d2
WWNN: 5000-1FE1-0010-59F0 Path State: Standby

```

spmgr display -s

This command requires no parameter and returns a display of all undiscovered units for each storage system. This switch provides the list of units by storage system and reports the WWLUN ID for each. You can use the information gathered from this display to clean stale data from Secure Path for Active-Passive configuration.

Example:

```

#spmgr display -s
Server:hp.mydomain.com Report Created: Wed, Aug 15 15:42:37 2004
Command: spmgr display -s
Undiscovered Units Listing
= = = = =
Storage: (fire) 5000-1FE1-0000-1290
LUN ID: 6000-1FE1-0000-1290-5000-1FE1-0000-4321
6000-1FE1-0000-1290-5000-1FE1-0000-4334

Storage: (jazzy) 5000-1FE1-0003-4420
LUN ID: 6000-1FE1-0000-9320-5000-1FE1-9321-5733

```

spmgr display -u

This command requires no parameter and displays all unattached units for each storage system. This switch provides the list of units by storage system and reports the WWLUN ID for each. You can use the information gathered from this display to add a unit to the Secure Path for Active-Passive configuration.

Example:

```

#spmgr display -u
Server:hp.mydomain.com Report Created: Wed, Aug 15 15:42:37
2004
Command: spmgr display -u
Unattached Units Listing
= = = = =
Storage: (fire) 5000-1FE1-0000-1290
LUN ID: 6000-1FE1-0000-1290-5000-1FE1-0000-4321
6000-1FE1-0000-1290-5000-1FE1-0000-4334
Storage: (jazzy) 5000-1FE1-0003-4420
LUN ID: 6000-1FE1-0000-9320-5000-1FE1-9321-5733

```

spmgr refreshdisplay

This command updates the serial number of all the available array controllers.

Syntax:

```
# spmgr refreshdisplay
```

The alias and unalias commands

Secure Path for Active-Passive supports the use of aliases. Aliases replace longer strings for shorter strings.

Example:

The 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 displayed by a `spmgr` command, the alias name is shown in parentheses before the term for which it substitutes.

Example:

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

The alias is `fire`.

The `alias` command lets you do the following:

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

This section contains the following:

- `# spmgr alias alias_name old_name`
- `# spmgr unalias`
- `# spmgr alias`

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
```

The following example creates the alias `Birdtop` for the controller serial number `ZG66654211`.

```
# 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.

```
# spmgr unalias Birdtop
```

spmgr alias

Use the `spmgr alias` command to display the alias table.

Syntax:

```
# spmgr alias
```

Example:

```

# spmgr alias
Server: hp.mydomain.com Report Created: Wed, Aug 15 15:42:37
2004
Alias:old_string
=====
bob:5000-1fe1-0000-1231
jim:5000-1fe1-0000-1233
fredt:ZG111298235442
fredb:ZG238817633215
=====

```



NOTE:

- When you run the `spmgr display` command, the screen output uses both the alias, if any, and the standard storage system WWNN or controller serial number. The alias is enclosed in parentheses (`alias_name`).
- For a command set that requires a parameter, it is assumed that the parameter or its alias may be input. You cannot alias a command.

Setting storage system parameters

The Secure Path 3.0F SP1 for Active-Passive driver has options that allows you to enable or disable on a storage system or global basis. You can turn off or on these options dynamically. These changes occur within 45 seconds.

This section contains the following information:

- [The set command](#)
- [The log command](#)
- [The notify command](#)

The set command

The `spmgr set` command allows you to enable storage system-specific settings for Secure Path for Active-Passive disk arrays, including:

- Load balancing—Secure Path for Active-Passive implements various types of load balancing algorithms to effectively use all of the available paths to a unit for I/O. By default, the load balancing is disabled.
- Path verification—The driver checks the state of all possible paths to all units at a selectable period or frequency. By default, the 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. By default, auto-restore is disabled.

Syntax:

```
#spmgr set [option]
```

Options:

- `-b <on|off> [WWNN]` — Enables or disables load balancing.
- `-b <type> [WWNN]` — Enables a load balancing algorithm.

The following are the load balancing types:

- `rr` - Round Robin
- `li` - Least I/O
- `ls` - Least Service Time
- `lb` - Least Bandwidth
- `-p <on|off> [WWNN]` — Enables or disables path verification.
- `-a <on|off> [WWNN]` — Enables or disables auto-restore.

- `-f <value>` — Sets the path verification period (in seconds).

 **NOTE:**

WWNN is the World Wide Node Name of the Array.

The `set` command includes the following:

- `# spmgr set -a on | off WWNN`
- `# spmgr set -b on | off | rr | lb | li | ls WWNN`
- `# spmgr set -p on | off WWNN`
- `# spmgr set -f (1...65535 seconds)`

`# spmgr set -a on | off WWNN`

This command enables or disables the auto-restore feature of the driver. When auto-restore is enabled, it directs the driver to monitor the state of the paths. If the preferred path fails and then later returns to service, the driver automatically re-routes 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 continues along the current path until another event changes the active path. By default, the setting is disabled (off).

 **NOTE:**

If you enable auto-restore using `spmgr set -a on` command and select a new path using the `spmgr select path` command, the selected path stays selected and is not auto-restored. Auto-restore returns to the currently active path only if that path has failed and the failure has been repaired.

 **NOTE:**

On a server reboot, it does not matter if auto-restore is on or off, or if paths have been preferred or not. The active path comes up on the last path probed and *not necessarily on the preferred path*. You must run the `spmgr restore all` command to restore all active paths to their preferred paths.

`# spmgr set -b on | off | rr | lb | li | ls WWNN`

This command enables or disables the load balancing option of the driver. This command also allows you to set the type of load balancing algorithm to be used for path selection. The default load balancing algorithm is `round robin`. When load balancing is enabled, it allows I/O to be sent to the unit along all available paths per the selected algorithm. When load balancing is disabled, the I/O is sent along the preferred path (if one is selected) or the I/O will use the first available path. By default, the setting is disabled (off).

`# 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. By default the setting is enabled (on).

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

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

The path verification interval is the same for all LUNs. The setting is retained even if all LUNs are deleted. Any new LUN added to the Secure Path configuration assumes the path verification interval that is currently set.

The log command

The `spmgr log` command lets you enable logging from the Secure Path for Active-Passive device to the `syslog`, console, and e-mail notification.

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. For example:

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

The `log` command includes the following:

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

`# 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, messages of that severity and higher are written to the `syslog` file. The default setting is 2.

`# spmgr log -c 0,1..3`

This command sets the level of logging to the `console`. When you select level 1..3, messages of that severity and higher are displayed on the `console`. The default setting 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 setting is 3. Level 0 is provided for disabling all notification messages.

`# spmgr log`

The `spmgr log` command displays the current logging settings.

Example:

```
# spmgr log
Server: hp.mydomain.com Report Created: Wed, Aug 15 15:42:37
2004
CurrentLog Options
=====
Syslog, enabled,level 2
Console, disabled,level 0
```

```
Notify, enabled, level 3
=====
```

The notify command

The `spmgr notify` command lets you manage the distribution of the three classes of event reports (critical, warning, and informational) via an e-mail address list.

Syntax:

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

This section contains the following information:

- [Severity levels](#)
- [# spmgr notify add](#)
- [# spmgr notify delete](#)
- [# spmgr notify](#)

Severity levels

Messages from the Secure Path for Active-Passive devices are one of the following three severity levels:

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

The `notify` command sends event notices 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 e-mail_address
```

Example:

```
# spmgr notify add 3 john.doe@oscar.edu.it
```

In the example, `Severity_level` is 3 and the `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 e-mail_address
```

Example:

```
# spmgr notify delete julie.smith@hollywood.edu
```

In the example, the `email_address julie.smith@hollywood.edu` is deleted from the notification list.

spmgr notify

This command displays the list of users to be notified.

Example:

```
# spmgr notify
Server: hp.mydomain.com Report Created: Wed, Aug 15 15:42:37
2004
Command: spmgr notify
Current Log Options
Severity Mode e-mail_address
= = = = =
1 M elizabeth.bradshaw@dork.com
3 M evil.knevil@jump.net
2 M harry.houdini@magic.org
= = = = =
```

Path management

Secure Path for Active-Passive 3.0F SP1 supports up to 32 paths to an HSG or HSV unit on a storage system. Given the very large number of paths that can be configured for a single system, the `spmgr` utility is available to manage and monitor those paths.

The path management tasks include:

- Selecting 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.

If the paths are 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
```

You can use the following options with the `select` command:

- # `spmgr select -a HBA`
- # `spmgr select -a HBA -d device`
- # `spmgr select -c controller_serial_number`
- # `spmgr select -c controller_serial_number -d device`
- # `spmgr select -p path_instance`

spmgr select -a HBA

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

Example:

```
# spmgr select -a td0
```

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:

```
# spmgr select -a td0 -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 for Active-Passive device 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:

```
# spmgr select -c ZG10505167
```

Result: The Secure Path for Active-Passive device 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 for Active-Passive device 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:

```
# spmgr select -c ZG10505167 -d c21t0d2
```

Result: The Secure Path for Active-Passive device 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. Therefore, no other switches or parameters are required to identify the path.

Example:

```
# spmgr select -p c18t0d1
```

Result: The Secure Path for Active-Passive device marks path `c18t0d1` as the selected path for I/O.

Preferred controller

This section contains the following information:

- [The prefer and unprefer commands](#)
- [Impact of load balancing and active paths](#)
- [The restore command](#)
- [The quiesce command](#)
- [The restart command](#)

The term preferred path means that the paths are being referred to the preferred controller LUN attribute on the array.

To set the preferred controller LUN attribute on the array, complete the following steps:

1. For HSG80, use the `ADD` or `SET` command and the `preferred_path` attribute for preferring a unit to *this* or *other* controller. For example, you can assign a unit as preferred to *this* controller by entering the following command:

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

2. For HSV110, log onto the HSV Element Manager and complete the following steps for preferring a virtual disk to controller A or controller B:
 - a. Select the virtual disk you want to modify in the Navigation pane.
 - b. Set the Preferred Path/Mode to Path A-Failover Only or Path B-Failover Only on the Virtual Disk Active Properties page.
 - c. Click Save Changes at the top of the Content pane to direct the system to process the change.
A status page is displayed indicating the status of the modification completed successfully.
 - d. Click OK.
An updated properties page is displayed.

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 HSG80 or HSV110 management utilities.

Because Secure Path can have more than one path to each controller, you 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 lets you control 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.

For the preferred path feature to work, you must set either the preferred controller LUN attribute on the array or the preferred path attribute on Secure Path, or both the preferred controller and preferred path attributes.

Following are the examples of preferred path priority:

- **Controller attribute priority**
The preferred controller attribute has priority over the preferred path attribute. For example, if you have preferred controller A to a LUN and have also set the preferred path to that LUN as a path to controller B, a restore or reboot results in a path on controller A being selected as active.
- **Controller attribute and path priority**
If you have preferred controller A to a LUN and have also set the preferred path to that LUN as a path to controller A, a restore or reboot results in the preferred path on controller A being selected as active.
- **Path priority**
If you have no controller preferred to a LUN and have a preferred path set for that LUN, then a restore or reboot results in the preferred path being selected as active.

To set the preferred controller LUN attribute for the HSG80, use the HSG80 `ADD` or `SET` commands and the preferred-path attribute for preferring a unit to *this* or *other* controller. For example, you can assign a unit as preferred to *this* controller by entering the following command:

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

To set the preferred controller LUN attribute for the HSV110, log on to the Command View EVA and complete the following steps for preferring a virtual disk to controller A or controller B:

1. Select the virtual disk you want to modify in the navigation pane.
2. Set the Preferred Path/Mode to Path A-Failover Only or Path B-Failover Only on the Virtual Disk Active Properties page.

3. Click Save Changes at the top of the Content pane to direct the system to process the change. A status page is displayed indicating the status of the modification completed successfully.
4. Click OK. An updated properties page is displayed.

 **NOTE:**

Path A - Failover/failback and Path B - Failover/failback are not supported on Secure Path for HP-UX. This feature is designed for operating systems that cannot run Secure Path.

At any time you 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 and restarts, 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. Therefore, the path may be maintained permanently until removed or another preferred path is selected.

The prefer and unprefer commands

To support adding and removing preferred paths, `spmgr` provides two commands, `spmgr prefer` and `spmgr unprefer`. These two commands each require the path instance parameter.

 **NOTE:**

The results of these commands are stored in configuration files, and the files persist across reboots. Because these commands make dynamic changes to the driver in kernel space, `spmgr update` must be executed for the new configuration to persist across reboots. See [Secure Path persistence across reboots](#), for more details.

This section contains the following information:

- [# spmgr prefer path_instance](#)
- [# spmgr unprefer 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 the specified `path_instance` to the Secure Path driver's configuration file and upon reboot of the server, the preferred paths get restored.

Syntax:

```
# spmgr prefer path_instance
```

For this command to execute properly, you need to supply the `path_instance` on the command line. The `path_instance` is provided in the `spmgr display` listings.

Example:

```
# spmgr prefer c21t0d5
```

[# 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: path verification

```
# spmgr unprefer c21t0d5
```

Impact of load balancing and active paths

Preferred path and selected path are meaningless designations when you enable 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, as a default, the Secure Path for Active-Passive device attempts to use all the available paths to a LUN in a round-robin fashion.

If load balancing is enabled and you set the path as preferred, the system performs the following actions:

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

If load balancing is enabled and you select a path, the system performs the following actions:

- If the path is on the standby controller, I/O moves to the standby controller and the selected path is one of the active paths.
- If the path is on the active controller, the path continues to be used as one of the set of active paths.

The restore command

Once a path has failed or has been taken offline by one or more events, the `spmgr restore` command lets you restore one or more LUNS to their preferred I/O path. This command lets you manually restore all or part of a configuration when the auto-restore feature is disabled.

The `restore` command provides the following options:

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

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` transitions all LUNs to their preferred controller and their adapter if they are specified. By using one or more of the switches for this command, you have full control of restoring preferred paths to the Secure Path for Active-Passive configuration.

The use of this command assumes the following important conditions:

- Paths were preferred previously. If paths to some LUNs are not preferred, no action is performed on those units.
- Load balancing is currently disabled. If load balancing is currently enabled, no action is performed on any path.



NOTE:

The `restore` command returns successfully if no restore action is taken by the driver. For example, if the preferred path has failed and a `restore` is issued, the command returns successfully.

Syntax:

```
spmgr restore [option]
```

Options:

```
-d <device> -- Restores all paths to the given device.  
-r [WWNN] -- Restores all paths to the given array.  
all -- Full system-wide restore.
```



NOTE:

WWNN is the World Wide Node Name of the Array.

spmgr restore -d device

This command restores a preferred path to the indicated device.

Syntax:

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

Example:

```
# spmgr restore -d c21t0d2
```

spmgr restore -r WWNN

This command restores a preferred path to the indicated storage system.

Syntax:

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

Example:

```
# spmgr restore -r 5000-1FE1-0010-5B00
```

spmgr restore all

This command restores all LUNs to their preferred paths and preferred controller. If there is no preferred controller, the current controller becomes the default controller. If there is no preferred path, the current path becomes the default path.

Syntax:

```
# spmgr restore all
```

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 `quiesce` command provides the following options:

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

Only the adapters and controllers are supported for Secure Path 3.0F SP1 for Active-Passive disk arrays. Also, quiescing individual paths is supported to allow other fabric infrastructures, such as switches, to remove and replace.

Syntax:

```
# spmgr quiesce [option]
```

Options:

```
-a <adapter>  
-c <controller_ser_num>  
-p <path instance>
```

spmgr quiesce -a HBA

When this command is invoked, `spmgr` moves all active I/O using this HBA to paths available on other HBAs. The paths of the specified HBA are marked as quiesced and no further I/O is sent along those paths until the HBA returns to service with the corresponding `restart` command.

You can verify these actions by entering the following command to view the current path state.

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

Use this feature to move I/O to another adapter as the first step to replacing an HBA.

Example:

```
# spmgr quiesce -a td0
```

spmgr quiesce -c controller_serial_number

When this command is invoked, `spmgr` moves all active I/O using this controller to paths on the other controller of the storage system. The paths of the specified controller are marked as quiesced and no further I/O is sent along that path until the controller returns to service with the `restart` command.

You can verify these actions by entering the following command to view the current path state.

```
# spmgr display -c controller_serial_number
```

Use this feature to move I/O to another adapter as the first step to upgrade or replace a controller.

Example:

```
# spmgr quiesce -c ZG11233409
```

spmgr quiesce -p path_instance

When this command is invoked, `spmgr` moves 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 is marked as quiesced and no further I/O is sent along that path until the `restart` command returns the path to service.

You can verify these actions by entering the `spmgr display` command to view the current path state.

Example:

```
# spmgr quiesce -p c12t0d5
```

The restart command

Object restarting changes 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 [option]
```

Options:

```
-a <adapter>  
-c <controller_ser_num>  
-p <path instance>  
all - Full system-wide restart
```

NOTE:

The `restart` command returns successfully if no restart action is taken by the driver. For example, if a `restart` is issued to a path that is not quiesced, the command returns successfully.

The `restart` command provides the following options:

- # spmgr restart -a HBA

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

`spmgr restart -a HBA`

When this command is invoked, `spmgr` verifies the existence of the HBA and then uses the HBA to change the state of the paths to available or standby. If the auto-restore feature is enabled and a path using that HBA is the preferred path, the path is made as the active path.

Example:

```
# spmgr restart -a td0
```

`spmgr restart -c controller`

When this command is invoked, `spmgr` verifies the existence of the controller and then changes 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 is made as the active path.

Example:

```
# spmgr restart -c fire-top
```

`spmgr restart -p path_instance`

When this command is invoked, `spmgr` verifies the existence of the path and then changes 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 is made as the active path.

Example:

```
# spmgr restart -p c12t0d5
```

`spmgr restart all`

When this command is invoked, `spmgr` verifies the existence of all components on quiesced paths and changes 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 are made as the active path.

The add and delete commands

Secure Path for Active-Passive disk arrays enables the dynamic addition and deletion of LUNs by using the `spmgr add` and `spmgr delete` commands. Secure Path 3.0F SP1 for Active-Passive disk arrays supports LUN addition and removal differently than Secure Path 3.0.

Secure Path 3.0F SP1 enables `ioscan` to claim all new storage in a manner more familiar to HP-UX system administrators. However, this change does add some steps to the `spmgr add` and `spmgr delete` commands.

This section contains the following information:

- [Adding LUNs](#)
- [Deleting LUNs](#)
- [The clean command](#)
- [The update command](#)
- [Making add and delete persistent across reboots](#)

Table 9 lists the terms that has special meaning for the `spmgr` command.

Table 9 Section terms

Term	Description
add	Refers to using <code>spmgr</code> to add a LUN or all LUNs of an array to the Secure Path for Active-Passive configuration.
delete	Refers to using <code>spmgr</code> to remove a LUN or all LUNs of an array from the Secure Path for Active-Passive configuration.
present	Refers to using the StorageWorks array utilities to add a unit or virtual disk so that the server or host can see it.
unpresent	Refers to using the StorageWorks array utilities to remove a unit or virtual disk so that the server or host cannot see it.

Adding LUNs

The `spmgr add` command provides the following options:

- `# spmgr add WWLUNID`
- `#spmgr add -r WWNN all`

During installation, all HSG80 units and HSV110 virtual disks that are presented to the server are added and attached by Secure Path for Active-Passive disk arrays.

Complete the following steps to add storage after installation:

1. Present the units or virtual disks to the storage system.
2. Run `ioscan` to add and attach the new storage.
3. Run `insf` to install and assign device files.
4. Run `spmgr update` to update the persistent parameter file.

 **NOTE:**

The `spmgr add` command is not required to be used for adding new storage.

To add units or virtual disks that have been previously deleted using `spmgr delete` and are displayed in the `spmgr display -u` list of unattached devices, complete the following steps:

1. Run `spmgr add` to add the LUNs to Secure Path for Active-Passive array.
2. Run `ioscan` to claim the LUNs.
3. Run `insf` to install and assign device files.
4. Run `spmgr update` to update the parameter file.

 **NOTE:**

To configure a LUN under Secure Path during new LUN discovery or during the `spmgr add`, resources, `c#t#d#` value, and system memory must be available. If any of these resources are not available, the LUN will be in an unmapped state and is displayed as part of the unattached list. To map such LUNs and bring them under Secure Path active list, ensure that the above resources are available, and you run `ioscan`.

`spmgr add WWLUNID`

This command verifies the indicated unit and adds that unit to the system.

Syntax:

```
# spmgr add WWLUNID
```

 **NOTE:**

WWLUNID is the World Wide LUN ID of the new unit to add on the storage system.

Example:

```
# spmgr add 6000-1FE1-0005-B480-0009-9341-4111-00FB
```

When this command is invoked, the Secure Path for Active-Passive device searches for the unit and, if it is available, adds it to the data.

This command requires that you use administrative commands before and afterwards. Before running the `spmgr add` command, the system must find the new array units and after running the `spmgr add` command, units must be claimed by the system. This command sequence must be done at least once for adding single or multiple units.

Example:

```
# spmgr display -u (to identify unmapped WWLUNIDs)
# spmgr add WWLUNID1 [target LUN]
# spmgr add WWLUNID2 [target LUN]
# spmgr add WWLUNIDn [target LUN]
# ioscan -fnCdisk (for the Server to claim newly added units)
# insf -e (to install and assign device files)
```

 **NOTE:**

The driver settings can override the values you have supplied for the target and LUN.

#spmgr add -r WWNN all

This command identifies all unclaimed units for the specified array and adds them all to the Secure Path for Active-Passive configuration.

Syntax:

```
# spmgr add -r WWNN all
```

 **NOTE:**

WWNN is the World Wide Node Name of the array that adds all its units to the Secure Path for Active-Passive configuration.

Example:

```
# spmgr add -r 5000-1FE1-0000-1234 all
```

When this command is invoked, the Secure Path for Active-Passive device searches for all unclaimed units associated with the specified array and, if available, adds them to the data. At the same time, the configuration files gets updated.

This command requires that you use administrative commands before and afterwards. Before running the `spmgr add` command, new array units must be found by the system and after running the `spmgr add` command, units must be claimed by the system. This command sequence must be done at least once for adding single or multiple units.

Example:

```
# spmgr display -u (to identify the WWNN of the array with unmapped units)
# spmgr add -r WWNN all
# ioscan -fnC disk (for the server to claim newly added units)
# insf -e (to install and assign device files)
```


Deleting LUNs

The `spmgr delete` command provides the following options:

- `#spmgr delete WWLUNID | device`
- `# spmgr delete -r WWNN all`

To unrepresent a storage device or array from the Secure Path for Active-Passive configuration, complete the following steps:

1. Delete the device or array from Secure Path for Active-Passive arrays using the `spmgr delete` command.
2. Remove or unrepresent the device from the array.



NOTE:

If a device that has been deleted and unrepresented is subsequently re-presented to the array, the device (or devices) is brought into Secure Path for Active-Passive arrays in the unattached (`spmgr display -u`) list. The Secure Path for Active-Passive device keeps track of the device deleted status as long as the server has not been rebooted.

Complete the following steps to delete a LUN from the attached list of LUNs and have that device be seen as unattached using the `spmgr display -u` command:

1. Run `spmgr delete` command to remove the LUN.
2. Run `ioscan` to unattach the device.
3. Run `spmgr update` to update the persistent parameter file.

Table 10 summarizes the procedures needed to successfully execute all add and delete operations. It also compares Secure Path 3.0F SP1 operations with native HP-UX and with Secure Path 3.0 add and delete operations.

Table 10 Add and delete operation procedures

Add/delete operation	Secure Path 3.0	Secure Path 3.0A	Secure Path 3.0B or later	Storage not managed by Secure Path
Initial configuration persistence	Persistent after installation	spmgr update rebuild kernel	spmgr update kadmin -L swspData config -M swspData -u	Persistent after installation
Present units from the array	Present units ioscan/insf spmgr display - u spmgr add ioscan rebuild kernel	Present unitsioscan/insf spmgr update rebuild kernel	Present unitsioscan/insf spmgr update kadmin -L swspData config -M swspData -u	Present units ioscan/insf
Add LUNs from spmgr display -u unattached list	spmgr add ioscan/insf rebuild kernel	spmgr add ioscan/insf rebuild kernel	spmgr add ioscan/insf spmgr update kadmin -L swspData config -M swspData -u	N/A
Unpresent units from the array	spmgr delete unpresent units ioscan rebuild kernel	spmgr delete unpresent units ioscan rebuild kernel	spmgr delete Unpresent units spmgr update kadmin -L swspData config -M swspData -u	Unpresent units
Delete LUNs from the spmgr display -u unattached list	spmgr delete ioscan rebuild kernel	spmgr delete ioscan spmgr update rebuild kernel	spmgr delete ioscan spmgr update kadmin -L swspData config -M swspData -u	N/A

#spmgr delete WWLUNID | device

This command verifies the device and, if correct, removes the device from the Secure Path for Active-Passive 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.

Syntax:

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

Example:

```
# spmgr delete fireD12
```

The alias `fireD12` is used for the WWLUNID.

After the delete, use the following command sequence at least once to delete single or multiple units from the system.

Example:

```
# spmgr display (to identify WWLUNIDs)
# spmgr delete WWLUNID1
# spmgr delete WWLUNID2
# spmgr delete WWLUNIDn
```

 **NOTE:**

If the units are being unrepresented or removed from the array, you do not need to execute the following command: `# ioscan -fnC disk` (for the server to unclaim deleted units)

spmgr delete -r WWNN all

This command identifies all unclaimed units for the specified array and deletes them all from the Secure Path for Active-Passive configuration. This command can take up to 15 minutes to complete for the maximum number of units (256).

Syntax:

```
# spmgr delete -r WWNN all
```

WWNN is the World Wide Node Name of the array that has all of its units deleted from the Secure Path for Active-Passive configuration.

Example:

```
# spmgr delete -r 5000-1FE1-000-1234 all
```

This command verifies the array and, if correct, deletes all of the array's devices from the configuration.

These actions occurs only on the server where the command is issued. For shared storage, the unit must be deleted on each server that has access to it.

Example:

```
# spmgr display (to identify the WWNN of the array to be deleted)
# spmgr delete -r WWNN all
```

 **NOTE:**

If the units are being unrepresented or removed from the array, you do not need to execute the following command: `# ioscan -fnC disk` (for the server to unclaim newly deleted units)

The clean command

The `spmgr clean` command provides the following options:

- # `spmgr clean -d WWLUNID`
- # `spmgr clean -r WWNN`
- # `spmgr clean all`

The `clean` command cleans the stale persistent information.

Syntax:

```
# spmgr clean [option]
```

Options:

```
-d <WWLUNID>-Cleans LUN configuration data from the stale device list.
-r <WWNN>-Cleans all the array configuration data from the stale
  device list.
all -- Full system-wide clean.
```

 **NOTE:**

WWNN is the World Wide Node Name of the Array and WWLUNID is the World Wide LUN Name of the Device.

spmgr clean -d WWLUNID

This command verifies and cleans the indicated unit from Secure Path for Active-Passive configuration.

Syntax:

```
# spmgr clean -d WWLUNID
```

Example:

```
# spmgr clean -d 6000-1FE1-0000-9320-5000-1FE1-9321-5733
```

spmgr clean -r WWNN

This command identifies all undiscovered units for the specified array and cleans the persistent data of those units from the Secure Path for Active-Passive configuration.

Syntax:

```
# spmgr clean -r WWNN
```

Example:

```
# spmgr clean -r 5000-1FE1-0003-4420
```

spmgr clean all

This command identifies all undiscovered units on the system and cleans the persistent data of those units from the Secure Path for Active-Passive configuration.

Syntax:

```
# spmgr clean all
```

The update command

The update command uses current Secure Path driver parameters to update the persistent parameter file.

Syntax:

```
# spmgr update
```

Following the on-screen instructions, enter the following commands:

```
# kmadmin -L swspData  
# config -M swspData -u
```

Making add and delete persistent across reboots

Secure Path changes are stored in configuration files that are updated only when you execute the `spmgr` commands. When storage is added and deleted by the server, a configuration file is updated by subsequently running another `spmgr` command. The following commands modifies the driver persistent parameter (configuration) file:

- `spmgr add`
- `spmgr delete`
- `spmgr set`
- `spmgr prefer and`
- `spmgr unprefer`

The `spmgr update` command updates the persistent parameter file.

 **NOTE:**

The results of commands that change configuration settings, are stored in files and the files persist across reboots. See [Secure Path persistence across reboots](#) for more details.

Secure Path persistence across reboots

Certain Secure Path commands require changes to the kernel. Configuration changes to add and delete LUNs, prefer and unprefer paths, change logging preferences, and set parameters (auto-restore, load balancing, path verification, and verification period) are stored permanently in configuration files. A reboot of the server does not alter these files.

After changing configuration information with `spmgr` commands, execute the following sequence of commands to provide persistence of configuration changes across reboots:

```
# spmgr update
# kmadmin -L swspData
# config -M swspData -u
```

After changing configuration information using the following commands, `spmgr prefer`, `spmgr unprefer`, `spmgr log`, and `spmgr set`, execute the following command sequences to provide configuration persistence across reboots:

```
# kmadmin -L swspData
# config -M swspData -u
```

Rebooting the server after making configuration changes without running `spmgr update` command (when required, as previously mentioned), boots the system with the kernel containing out-of-date configuration files. The settings that are lost cannot be recovered.

Rebooting the server after making configuration changes and running `spmgr update` (when required, as previously mentioned), but without running `kmadmin -L swspData` and `config -M swspData -u`, boots the system with the kernel containing out-of-date configuration files. At this point, any change to the Secure Path configuration modifies the configuration files to add that change to the old configuration. If this error is detected at this point (in this case, the Secure Path configuration check `init` script fails), the most recent configuration files can still be recovered. A redundant copy of the last configuration is saved and can be copied into place.

Complete the following steps to recover from this situation:

1. Enter the following command:

```
# cp/tmp/CPQswsp/space.h.dd-yyyymm-dd:hh:mm/usr/conf/km.d/swspData/space.h
```

 **NOTE:**

In the copy command sequence `dd-yyyymm-dd:hh:mm` is the time of the most recent reboot.

2. Enter the following command:

```
# kmadmin -L swspData
# config -M swspData -u
```

3. Reboot the system.

Removing and upgrading Secure Path for Active-Passive disk arrays

This section describes how to remove or upgrade Secure Path for Active-Passive disk arrays, including:

- [Removing Secure Path](#)
- [Upgrading Secure Path software](#)

Removing Secure Path software

After removing the Secure Path software, restore the server to a single-path RAID storage environment. Under a single-path configuration, the HSG80 controllers must be set into transparent failover mode. Consult your *HSG80 ACS Solution Software for HP-UX installation and configuration guide* for details.

You can remove Secure Path either by using HP's `SD` utility or the System Administration Manager (SAM). When you remove Secure Path, all files, including configuration files, are removed.

You can use SAM or enter the following command to remove Secure Path::

```
# swremove -x autoreboot=true CPQswsp,r=*
```

NOTE:

After Secure Path is removed, you must reconfigure the array for transparent failover mode. Refer to your *HSG80 ACS Solution Software for HP-UX installation and configuration guide* for details. Refer to your *HSG80 ACS Solution Software for HP-UX installation and configuration guide* for details.

Upgrading Secure Path software

This section describes the requirements and procedures to upgrade Secure Path software, including:

- [Upgrade requirements](#)
- [Upgrade preparation](#)
- [Upgrading from the Web](#)

Upgrade requirements

The following requirements must be met to ensure a successful installation:

- At least 100 MB of free disk space is required in the `/tmp` file system for installation.
- The system must have an additional 10 MB of space in `/usr` and 10 MB in `/opt`.

Upgrade preparation

This section contains the following information:

- [Backing-up the LVM configuration settings](#)
- [Preparing Active-Passive systems for upgrade](#)

Backing-up the LVM configuration settings

When upgrading an existing Secure Path 3.0 configuration to Secure Path 3.0F SP1, because there is a change in the device signature assignment from 3.0 to 3.0F SP1, LVM configuration settings need to be recorded before you upgrade to Secure Path 3.0F SP1. In addition, the backed-up configuration settings need to be restored after completing the upgrade procedure.

Complete the following steps to back up the LVM configuration settings before the upgrade process:

1. Record the volume groups and the corresponding physical volumes that belong to Secure Path devices by entering the following command:

```
# vgdisplay -v
```
2. Display and record the corresponding `WWLUNID` for each physical volume belonging to Secure Path by entering the following command:

```
# spmgr display
```

Follow [step 3](#) through [step 6](#) to collect and prepare your system for the upgrade. Repeat these steps for each Secure Path volume group.

3. Deactivate each volume group associated with Secure Path devices by entering the following commands as needed:

```
# vgchange -a n Volume_Group1
```

 **NOTE:**

Before deactivating the volume group, ensure that all the logical volumes of the volume group are unmounted.

4. Record the minor number for the volume group with the following command:

```
# ll /dev/Volume_Group1/group
```

 **NOTE:**

The minor number is in the form of 0xNN0000. The *NN* is unique and runs from 00 to FF. See the man page for `vgcreate`.

5. Export each volume group associated with Secure Path devices using the following command, and record the name of each unique map file for each volume group exported in the previous steps:

```
# vgexport -m mapfile1 Volume_Group1
```

6. Prepare for the post-install import of volume groups using the following commands:

```
# mkdir /dev/Volume_Group1
```

```
# mknod /dev/Volume_Group1/group c 64 minor_number1
```

7. Repeat [step 3](#) through [step 6](#) for each volume group containing Secure Path devices.

8. Verify the recorded information. It should be in the form of:

```
Volume_Group1 wwlunid1 wwlunid2 wwlunid3 minor_number1 mapfile1
```

```
Volume_Group2 wwlunid4 wwlunid5 minor_number2 mapfile2
```

```
Volume_Group3...etc
```

Following the upgrade reboot, no Secure Path based file systems are mounted on the system.

9. To re-establish LVM volumes and mount the volumes, complete the following steps:

- a. Record the new device instance number (`cxtxdx`) corresponding to each WWLUNID recorded above using the following display command:

```
# spmgr display
```

- b. Verify the recorded information using the following form:

```
Volume_Group1 wwlunid1 wwlunid2 wwlunid3 minor_number1 mapfile1  
device1 device2 device3
```

```
Volume_Group2 wwlunid4 wwlunid5 minor_number2 mapfile2 device4  
device5
```

```
Volume_Group3... etc.
```

- c. For all Secure Path volume groups, use the following commands to establish the file systems:

```
# vgimport -m mapfile1 Volume_Group1 device1 device2 device3
```

```
# vgimport -m mapfile2 Volume_Group2 device4 device5
```

```
# vgimport... etc.
```

```
# mount -a
```

Preparing Active-Passive systems for upgrade

Secure Path 3.0F SP1 requires ACS 8.7 or later in SCSI-3 mode. It continues to support ACS 8.6 and later in SCSI-2 mode. Because 3.0F SP1 with ACS 8.7 or later enables the support of up to 127 LUNs per array, HP recommends that you configure the array for SCSI-3 operation.

If you are upgrading an existing Secure Path 3.0 configuration and are adding EVA systems to the configuration, perform the upgrade on the existing HSG80-based storage first, and then add the HSV100/110-based storage. For this, complete the steps described in [Secure Path for Active-Passive disk arrays hardware setup](#) once the Secure Path 3.0F SP1 upgrade is complete and verified.

This procedure does not change your existing StorageWorks device file assignment or modify any existing logical volumes. It does add and attach all new or unattached LUNs seen by your server, and depending on the existing target or LUN numbering, adds these devices in non-sequential order.

Complete the following steps to add and attach all new or unattached LUNs:

1. Verify that your server and storage configuration meets the software, patch, firmware, and hardware revision levels defined in the *HP StorageWorks Secure Path 3.0F Service Pack 1 for HP-UX 11.00 and Secure Path 3.0F Service Pack 1 Workgroup Edition for HP-UX 11.00 release notes*.
2. Ensure all users have logged off the server and that all I/O from the server has ceased.
3. Perform a complete system backup, according to your normal procedures and document your server file systems, mount points, and device files.
4. Select one of the following SCSI option:
 - If you want to continue to use SCSI-2 and ACS 8.6 or later, proceed to [Upgrading from the Web](#) section.
 - If you are using SCSI-2 and want to use SCSI-3, you must first change the array in SCSI-3 mode. Complete the procedure listed in [Using SCSI-3](#) section.

Keep the following in mind:

- Secure Path 3.0F SP1 requires ACS 8.7 or later for use with SCSI-3 mode. Upgrade the HSG80 controllers to ACS 8.7 or later using the instructions supplied in the Platform Kit's Maintenance and Service Guide.
 - The rolling upgrade method that upgrades ACS 8.7-3 to ACS 8.8 (described in the *Maintenance and Service Guide for Solution Software 8.8 for HP-UX*) fails if the server is running application I/O to the array that is being upgraded. You must quiesce all I/O to the array before starting the rolling upgrade procedure.
5. Change the HSG80 operating system mode from HP to HP_VSA using the array's CLI interface (ACS 8.7 or later) by entering the following command:

```
HSG80> show connections
```

A connection table similar to the following is displayed:

```
Connection Unit
Name Operating system Controller Port Address Status Offset
!NEWCON13 HP OTHER 1 offline 0
HOST_ID=5006-0B00-0009-CE61 ADAPTER_ID=5006-0B00-0009-CE60
!NEWCON14 HP OTHER 2 offline 0
HOST_ID=5006-0B00-0009-D8C7 ADAPTER_ID=5006-0B00-0009-D8C6
!NEWCON15 HP THIS 1offline 0
HOST_ID=5006-0B00-0009-CE61 ADAPTER_ID=5006-0B00-0009-CE60
!NEWCON16 HP THIS 2offline 0
HOST_ID=5006-0B00-0009-D8C7 ADAPTER_ID=5006-0B00-0009-D8C6
```

6. Using the connection names for the server that you are upgrading, change the operating system mode by entering the following commands:

```
HSG80> set !NEWCON13 operating_system=hp_vsa
HSG80> set !NEWCON14 operating_system=hp_vsa
HSG80> set !NEWCON15 operating_system=hp_vsa
HSG80> set !NEWCON16 operating_system=hp_vsa
```

7. Verify the change by entering the following command:

```
HSG80> show connections
```

The resulting output looks similar to the following:


```

Connection Unit
Name Operating system Controller Port Address Status Offset
!NEWCON13 HP_VSAOTHER 1 offline 0
HOST_ID=5006-0B00-0009-CE61 ADAPTER_ID=5006-0B00-0009-CE60
!NEWCON14 HP_VSAOTHER 2 offline 0
HOST_ID=5006-0B00-0009-D8C7 ADAPTER_ID=5006-0B00-0009-D8C6
!NEWCON15 HP_VSA THIS 1offline 0
HOST_ID=5006-0B00-0009-CE61 ADAPTER_ID=5006-0B00-0009-CE60
!NEWCON16 HP_VSA THIS 2offline 0
HOST_ID=5006-0B00-0009-D8C7 ADAPTER_ID=5006-0B00-0009-D8C6

```

Upgrading from the Web

To upgrade your Secure Path for Active-Passive disk arrays software, access the upgrade package at: <http://www.hp.com/country/us/eng/prodserv/storage.html>.

This package is intended as an upgrade only. The patch depot upgrades only AutoPath 2.xx.xx or Secure Path 3.0x to Secure Path 3.0F SP1.

Complete the following steps for a successful upgrade:

1. Copy the upgrade tar package to a temporary directory (for example, /tmp/).
2. Unbundle the upgrade files by entering the following commands:


```
# cd /tmp/Securepath
# tar xvf sp_v30FSP1_hp_web.tar
```
3. Verify that the directory contains the installation script `install.sh` and the following patch depots:


```
HPswsp_v30FSP1
CPQswsp_v30FSP1
```
4. Install Secure Path software on the server using the provided shell script by entering the following command:


```
# ./install.sh
```
5. Select Secure Path 3.0F SP1 for HP-UX for Active-Passive disk arrays when prompted. Follow the on-screen instructions.

When the installation is complete and the server reboots, a subsequent `swlist` displays the following Secure Path output:

```

#
# Product(s) not contained in a Bundle
CPQswsp A.3.0F.01F.00F HP StorageWorks Secure Path Device Driver,
utilities, and upgrade patch for Active-Passive class of disk
arrays.

```

Troubleshooting Secure Path for Active-Passive disk arrays

You or an HP service representative can perform troubleshooting, depending upon your HP service contract. If you are unable to resolve an error condition, ask your HP service representative for assistance.

Table 11 lists Secure Path events, sample user notification messages, and sample `syslog` messages.

Table 11 Secure Path for Active-Passive events, messages, and syslog entries

Event description	User notification messages	Syslog entry
All paths to the LUN has failed.	All paths for Target/LUN 0/2 (WWID=600508B40001492000 001600000C00000) on controller P4889B49IM failed.	WARNING: CPQswsp: Target/LUN 0/2 (WWID=600508B40001492000 001600000C00000) on controller P4889B49IM failed.
A new LUN is added. A quiesced LUN has been restored to Secure Path.	Availability for LUN 600508B4000149C001 A00001E20000 changed to ALIVE.	CPQswsp: Availability for LUN 600508B4000149C001 A00001E20000 changed to ALIVE.
A path to the end LUN has failed.	Path c42t0d2 Failed (LUN 600508B4000149C001 A00001E20000 Controller P4889B49IM Array.	CPQswsp: Path c42t0d2 Failed (LUN 600508B4000149C001 A00001E20000 Controller P4889B49IM Array. 50001FE100150AE0 HBA td3).
A path to the end LUN has either quiesced the controller or HBA connecting to that LUN or the LUN has failed.	Availability for LUN 600508B4000149C001 A00001E20000 changed to DEAD.	WARNING: CPQswsp: Availability for LUN 600508B4000149C001 A00001E20000 changed to DEAD.
Occurs when there are no free c##t##d## values available for mapping the LUN.		CPQswsp: Mapping error. Cause: No free c##t##d## available for mapping for the unit 600508B40001492000 016000005B0000. The unit will be kept in the unattached list. To map this unit, clean up any stale undiscovered units present using 'spmgr clean [option]' and run ioscan.
Occurs when there is a failure in allocating memory required for the 'swsp' node creation.		CPQswsp: Allocation error. Cause: Failed to allocate memory for the 'swsp' node of the unit 600508B40001492000 016000005B0000. The unit will be kept in the unattached list. To map this unit, free up memory and run ioscan
Occurs usually when the unit which was deleted in the previous boot using the spmgr delete command is not discovered during boot scan of this session.		CPQswsp: The unit 600508B40001492000 016000005B0000 is not discovered and not associated with any of the discovered Arrays. So the persistent data of this unit will be deleted.
Occurs when there is an error in reading the persistent data of the LUN and which resulted in associating this LUN's persistent data with the wrong array		CPQswsp: Mapping error. Cause: Error in reading the persistent data in the previous boots. This will result in the change of c##t##d## value of the LUN 600508B40001492000 016000005B0000

Event description	User notification messages	Syslog entry
Occurs when there is an error reading the persistent data of the interface node of the array in the previous boots and thus allowing some other interface node to get the same h/w address value. In the subsequent boot, if the first interface node's persistent data is read properly, then there is more than one interface node having the same h/w address value which results in duplicate entries		CPQswsp: Mapping error. Cause: Due to error in reading the persistent data in the previous boots, there are duplicate entries for the swsp h/w address 2. This may result in the change of c#t#d# values of the LUNs configured for the above h/w address on the Array 50001FE150003440.
Occurs when there is an error reading the persistent data of the LUN in the previous boots and thus allowing some other LUN to get the same c#t#d# value. In the subsequent boot, if the first LUN's persistent data is read properly, then there is more than one LUN having the same c#t#d# value which results in duplicate entries		CPQswsp: Mapping error. Cause: Due to error in reading the persistent data in the previous boots, there are duplicate entries for the mapping data of hw_addr 2, target 1, lun 0. This may result in the change of c#t#d# value of the LUN 600508B40001492000 016000005B0000
Occurs when a device is unrepresented before deleting the device with the spmgr delete command, and you add a new device with the same virtual disk or unit number as the old device, as the new device is bound to the WWLUNID of the old deleted device. This leaves the newly added LUN in an inconsistent state.		Multiple luns [lun: <WWLUNID> & lun: <WWLUNID>] present at target/lun [target]/[lun] on array <array WWN>. To obtain proper data ensure the c#t#d# at the specified target and lun is not busy/mounted and Run ioscan & insf -e respectively. ¹

¹ This message appears only if you have enabled the path polling. Execute ioscan ; insf -e command to recover from this situation. Else, refer to the LUN collision section in HP StorageWorks Secure Path 3.0F SP1 for HP-UX 11.00 and HP-UX 11.00 Workgroup Edition release notes to recover from this situation.

Table 12 describes the way that Secure Path reports an event, such as a failure or state change to the server through the Secure Path driver (*hsx*) or agent (*spagent*).

The Response action column shows where the event is logged.

- LOG is the `/var/adm/syslog/syslog.log` file
- CONSOLE is the root console, and
- NOTIFY is e-mail notification

The Level column indicates the criticality of the event and is used by `spmgr` to allow the system administrator to route events to specific users.

Table 12 Events, responses, and security level for supported events

Event	Response action	Level
Path failed	LOG+CONSOLE+NOTIFY	WARNING
Failover condition detected	LOG+CONSOLE+NOTIFY	CRITICAL
Failover start	LOG+CONSOLE+NOTIFY	INFORMATIONAL
Failover complete	LOG+CONSOLE+NOTIFY	INFORMATIONAL
Restore start	LOG+CONSOLE+NOTIFY	INFORMATIONAL
Restore complete	LOG+CONSOLE+NOTIFY	INFORMATIONAL
Restore failed	LOG+CONSOLE+NOTIFY	INFORMATIONAL
Excessive restores	LOG+CONSOLE+NOTIFY	WARNING - auto-restore is disabled until next time quantum (1 hour)
Availability changed	LOG+CONSOLE+NOTIFY	CRITICAL
Select start	LOG+CONSOLE+NOTIFY	INFORMATIONAL
Select complete	LOG+CONSOLE+NOTIFY	INFORMATIONAL
Select failed	LOG+CONSOLE+NOTIFY	WARNING
Unit attention	LOG	INFORMATIONAL
Secure Path started	LOG+CONSOLE	INFORMATIONAL
Configuration change	LOG+CONSOLE+NOTIFY	INFORMATIONAL
Active path changed	LOG+CONSOLE+NOTIFY	INFORMATIONAL
New LUN added	LOG+CONSOLE+NOTIFY	INFORMATIONAL
New path added	LOG+CONSOLE+NOTIFY	INFORMATIONAL
Path verification On/Off changed	LOG	INFORMATIONAL

2 Secure Path for Active-Active disk arrays

HP StorageWorks Secure Path 3.0F SP1 for Active-Active disk array provides automatic I/O path failover, failback, recovery, and load balancing for host systems configured with multiple host adapters and connections to disk arrays.

This chapter provides the following Secure Path information:

- [Features](#)
- [ULM services](#)
- [Dynamic load balancing](#)
- [Online device discovery](#)
- [Installing Secure Path for Active-Active disk arrays](#)
- [Upgrading from the Web](#)
- [Removing Secure Path](#)
- [Command line interface](#)
- [Troubleshooting Secure Path for Active-Active disk arrays](#)

Features

Secure Path for Active-Active disk arrays provides enhanced data availability with the following features:

- Automatic path failover to an alternate path
- Automatic path recovery after failed path is serviced
- Automatic failback when a path recovers from failure
- Dynamic load balancing over multiple paths
- Command-line user interface (CLI) for Secure Path management
- Ability to reestablish previous load-balancing policy after rebooting through the CLI
- Supports upto 32 paths to an end LUN

The HP StorageWorks Secure Path software performs dynamic load balancing of data flow through multiple paths. It detects multiple paths to each logical device and distributes the data load among the paths for optimum performance.

The user interface lets a system administrator define load-balancing policies and preferred paths, and view device path information. Secure Path manages paths according to the balancing policy, ensuring that no single path is a performance bottleneck.

ULM services

Secure Path uses the SCSI Upper Layer Module (ULM) interface to provide flexible configuration and layering of modules above the SCSI disk drivers.

If you are configuring Secure Path into HP-UX 11.00 64-bit operating systems and want it to coexist with other pseudo drivers, register Secure Path with the ULM services for each LUN path you want the Secure Path to control.

Dynamic load balancing

This section contains the following information:

- [Automatic failover](#)
- [Automatic path recovery](#)

Secure Path performs dynamic load balancing while monitoring each path to ensure that the I/O transaction is completed. The load-balancing policy is selected by the administrator.

The dynamic load-balancing policy prevents any path from becoming overloaded, and it helps to prevent the congestion that occurs when many I/O operations are directed to common devices along the same path.

If a preferred path is used for a device, the entire I/O for that particular device flows through the preferred path and no load balancing is done by Secure Path for that device.

NOTE:

Increased performance is not always realized with Virtual Array (VA) systems. In most cases, the best performance is provided by using preferred paths.

Automatic failover

In the event of a failure of any part of a path between the disk array and a server, Secure Path automatically switches to an alternate path, dropping the failed path out of the I/O rotation without any loss of data. The failover is not visible to applications, so normal operation continues without downtime.

For troubleshooting information, see [Troubleshooting Secure Path for Active-Active disk arrays](#) section.

Automatic path recovery

When a path fails, it is no longer used. After the path has been repaired and returned to normal, Secure Path automatically begins using the path with the designated load-balancing policy. No user action is necessary.

Online device discovery

If there are any changes in the SAN configuration such as addition or deletion of paths or devices, these changes can be updated in Secure Path for Active-Active arrays for maximum and efficient utilization of resources.

The `autopath discover` command updates the SAN configuration changes to the list of Secure Path for Active-Active devices without a system reboot, and the `autopath delete` command removes a device from autopath control.

NOTE:

Discovery of new Path or LUN is effective only if you execute `ioscan` and `insf -e` before executing the `autopath discover` command.

Installing Secure Path for Active-Active disk arrays

This section describes the minimum system requirements and procedures for installing Secure Path for Active-Active disk arrays, including:

- [System requirements](#)
- [Installing Secure Path](#)

**NOTE:**

You must have `root` account privileges to install Secure Path software.

System requirements

To install Secure Path, your system must conform to the following requirements:

- HP-UX 11.00 64-bit operating system
- Administrator `root` access to the host system
- SCSI ULM Services B.11.00.01 for HP-UX 11.00

For specific installation requirements for your system, contact your HP account representative.

**NOTE:**

Refer to the *HP StorageWorks Secure Path 3.0F Service Pack 1 for HP-UX 11.00 and Secure Path 3.0F Service Pack 1 Workgroup Edition for HP-UX 11.00 release notes* for details about the supported configuration.

Installing Secure Path

Before installing Secure Path on HP-UX 11.00, ensure that SCSI ULM services is installed on your system.

**NOTE:**

To install Secure Path, you must have superuser (`root`) access on the HP-UX host.

To install Secure Path, complete the following steps:

1. Log on to the HP-UX system as superuser (`root`).
 2. Insert the Secure Path installation CD-ROM into the CD-ROM drive.
 3. Mount the CD-ROM on your file system.
 4. Change to the directory in which the CD-ROM is mounted. For example, if the CD-ROM is mounted to a directory called `/cdrom`, change the directory by entering the following command:

```
# cd /cdrom/
```
 5. Install Secure Path software on the server using the provided shell script by entering the following command:

```
# ./install.sh
```
 6. Select Secure Path 3.0F SP1 for HP-UX for Active-Active disk arrays when prompted. Follow the on-screen instructions.
-

**NOTE:**

Installation of the Secure Path package creates `/Autopath` and `/HPswsp` directory under `/opt` directory. The `changes.log` file is copied into `/Autopath` directory, and the `master`, `system`, and `mod.o` files are copied into `/HPswsp` directory.

Upgrading from the Web

To upgrade your Secure Path for Active-Active disk array software, access the upgrade package at: <http://www.hp.com/country/us/eng/prodserv/storage.html>.

This package is intended as an upgrade only. The patch depot upgrades AutoPath 2.xx.xx or Secure Path 3.0x to Secure Path 3.0F SP1.

Complete the following steps for a successful upgrade:

1. Copy the upgrade tar package to a temporary directory (for example, /tmp).
2. Unbundle the upgrade files by entering the following commands:

```
# cd /tmp/Securepath
# tar xvf sp_v30FSP1_hp_web.tar
```
3. Verify that the directory contains the installation script `install.sh` and the following directories:

```
HPswsp_v30FSP1
CPQswsp_v30FSP1
```
4. Install Secure Path software on the server using the provided shell script by entering the following command:

```
# ./install.sh
```
5. Select Secure Path 3.0F SP1 for HP-UX for Active-Active disk arrays when prompted. Follow the on-screen instructions.

When the installation is complete and the server reboots, a subsequent `swlist` displays the following Secure Path output:

```
#
# Product(s) not contained in a Bundle
HPswsp A.3.0F.01F.00F HP StorageWorks Secure Path Device
Driver and utilities for Active-Active disk arrays.
```

Removing Secure Path

You can remove Secure Path by using the `HP SD` utility. When you remove Secure Path, all files, including configuration files are removed.

Complete the steps below to remove Secure Path from your system:

1. Log on to the HP-UX system as superuser (`root`).
2. Run the `swremove` command from the command line as follows:

```
# swremove -x autoreboot=true HPswsp
```
3. Alternatively, you can launch the interactive session of `swremove` and the select HPswsp HP StorageWorks Secure Path Driver and Utilities for Active-Active disk arrays product for removal.

The system reboots after removal is completed.

Command line interface

You can use the Secure Path command line interface (CLI) only on those hosts that are connected to devices with the `HPswsp` driver installed.

This section contains information about the commands supported by this interface along with their syntax, including:

- [The `autopath set` command](#)
- [The `autopath display` command](#)
- [The `autopath help` command](#)
- [The `autopath recover` command](#)
- [The `autopath discover` command](#)
- [The `autopath retrieve` command](#)
- [The `autopath set_lbpolicy` command](#)

- [The autopath set_prefpath command](#)

The autopath set command

The `autopath set` command sets the load balancing policy for an autopath device.

Syntax:

description : set SecurePath configuration parameters

usage:

```
autopath set {option}
```

options:

```
-l <WWID> -b <policy name>-sets load balancing policy for the LUN
  WWID : World Wide Node Name of the LUN
  Policy name: the load balancing policy to set
```

valid policies are

```
RR      : Round Robin.
SST     : Shortest Service Time.
SQL     : Shortest Queue Length.
NLB/OFF : No Load Balancing.
```

```
-t <device path> <value>-sets time out value for the LUN
  device path: device special file e.g./dev/dsk/c#t#d#
```

value:

```
-1      : infinite retry (default)
0       : abort immediately on all paths fail condition
1-86400 : timeout period in seconds
```

Example:

```
# autopath set -l 6005-08B4-0001-499C-0001-F000-0163-0000 -b sql
```

```
# autopath set -t /dev/dsk/c160t0d1 86400
```

NOTE:

- Secure Path 3.0F SP1 supports infinite retry only for VxFS file systems.
 - If the file system changes from VxFS to HFS, the `autopath set -t` command is not effective. The default behavior of HFS file system applies.
 - If a device configured under HFS file system encounters an *All Paths Fail* condition, the I/O restarts only if the path on which original I/O is sent down is active.
-

The autopath display command

The `autopath display` command displays details about Secure Path devices, such as alternate paths to a Secure Path device, associated status, and load-balancing policy settings.

This section contains the following information about the `autopath display` command:

- [List of all arrays connected to a host](#)
- [Details of all LUNs connected from an array](#)
- [Display autopath discover status](#)
- [List of array controllers connected to the host](#)
- [Display the LUN info of the Lun using a device path](#)
- [Display the LUN info of the Lun using a LUN WWID](#)
- [Display all LUNs connected to the host](#)

List of all arrays connected to a host

The `autopath display -r` command displays a list of all connected arrays to the host.

Syntax:

```
autopath display -r
```

Example:

```
#autopath display -r
```

```
=====
HPswsp Version      : A.3.0F.01F.00F
=====
Array IDs
=====
060B-0000-14E2-E050
060B-0000-1534-1C50
=====
```

Details of all LUNs connected from an array

The `autopath display -r <Array ID>` command displays details of all LUNs connected from an array.

Syntax:

```
autopath display -r <Array ID>
```

Example:

```
# autopath display -r 5006-0b00-0010-3f42
```

```
=====
HPswsp Version      : A.3.0F.01F.00F
=====
Auto Discover       : OFF
=====
Array WWN           : 060B-0000-14E2-E050
=====
Lun WWN             : E000-0100-0000-0000-5000-0000-0000-0000
Load Balancing Policy : No Load Balancing
Lun Timeout         : Infinite Retry (-1)
=====
Device Path          Status
=====
/dev/dsk/c149t0d1    Active
/dev/dsk/c150t0d1    Active
/dev/dsk/c141t0d1    Active
/dev/dsk/c142t0d1    Active
=====
Lun WWN             : E000-0200-0000-0000-5F00-0000-0000-0000
Load Balancing Policy : No Load Balancing
Lun Timeout         : Infinite Retry (-1)
=====
Device Path          Status
=====
```

```

/dev/dsk/c149t0d2      Active
/dev/dsk/c150t0d2      Active
/dev/dsk/c141t0d2      Active
/dev/dsk/c142t0d2      Active

```

```
=====
```

Display autopath discover status

The `autopath discover` command displays the newly added devices.

Syntax:

```
# autopath discover help
```

```
description : discover the newly added device(s) and also recognize
the status of old device(s)
```

usage:

```
autopath discover [option]
```

options:

```
ON   : Enables the auto discover devices feature
OFF  : Disables the auto discover devices feature
```

```
-----
```

List of array controllers connected to the host

The `autopath display -c` command displays a list of controllers connected to the host.

Syntax:

```
autopath display -c
```

Example:

```
# autopath display -c
```

```
=====
```

```
HPswsp Version      : A.3.0F.01F.00F
```

```
=====
```

```
Array ID            : 060B-0000-14E2-E050
```

```
-----
```

```
Controller Ids
```

```
-----
```

```
0PR0-2195-2880
```

```
0PR0-2195-0720
```

```
=====
```

```
=====
```

```
Array ID            : 060B-0000-1534-1C50
```

```
-----
```

```
Controller Ids
```

```
-----
```

```
0PR0-2208-1550
```

```
0PR0-2208-1700
```

```
=====
```

Display the LUN info of the Lun using a device path

The `autopath display <device path>` command displays the LUN info of the Lun using the device path.

Syntax:

```
autopath display <device path>
```

Example:

```
# autopath display /dev/dsk/c151t0d4
```

```
=====
HPswsp Version      : A.3.0F.01F.00F
=====
Array WWN           : 060B-0000-1534-1C50
=====
Lun WWN             : 1C00-0400-0000-0001-7800-0000-0000-0000
Load Balancing Policy : No Load Balancing
Lun Timeout         : Infinite Retry (-1)
=====
Device Path          Status
=====
/dev/dsk/c151t0d4    Active
/dev/dsk/c153t0d4    Active
/dev/dsk/c143t0d4    Failed
/dev/dsk/c145t0d4    Failed
=====
```

Display the LUN info of the Lun using a LUN WWID

The `autopath display -l <LUN WWID>` command displays the LUN info of the Lun using the LUN WWID.

Syntax:

```
autopath display -l<LUN WWID>
```

Example:

```
# autopath display -l 1C00-0400-0000-0001-7800-0000-0000-0000
```

```
=====
HPswsp Version      : A.3.0F.01F.00F
=====
Array WWN           : 060B-0000-1534-1C50
=====
Lun WWN             : 1C00-0400-0000-0001-7800-0000-0000-0000
Load Balancing Policy : No Load Balancing
Lun Timeout         : Infinite Retry (-1)
=====
Device Path          Status
=====
/dev/dsk/c151t0d4    Active
/dev/dsk/c153t0d4    Active
/dev/dsk/c143t0d4    Active
/dev/dsk/c145t0d4    Active
=====
```

=====

Display all LUNs connected to the host

The `autopath display [all]` command displays details about all LUNs connected to the host.

Syntax:

```
autopath display
autopath display all
```

Example:

```
# autopath display
```

=====

```
HPswsp Version      : A.3.0F.01F.00F
```

=====

```
Auto Discover       : OFF
```

=====

```
Array WWN          : 060B-0000-14E2-E050
```

=====

```
Lun WWN            : E000-0100-0000-0000-5000-0000-0000-0000
```

```
Load Balancing Policy : No Load Balancing
```

```
Lun Timeout        : Infinite Retry (-1)
```

=====

```
Device Path                Status
```

=====

```
/dev/dsk/c149t0d1          Active
```

```
/dev/dsk/c150t0d1          Active
```

```
/dev/dsk/c141t0d1          Active
```

```
/dev/dsk/c142t0d1          Active
```

=====

```
Lun WWN            : E000-0200-0000-0000-5F00-0000-0000-0000
```

```
Load Balancing Policy : No Load Balancing
```

```
Lun Timeout        : Infinite Retry (-1)
```

=====

```
Device Path                Status
```

=====

```
/dev/dsk/c149t0d2          Active
```

```
/dev/dsk/c150t0d2          Active
```

```
/dev/dsk/c141t0d2          Active
```

```
/dev/dsk/c142t0d2          Active
```

=====

```
Lun WWN            : E000-0300-0000-0000-6000-0000-0000-0000
```

```
Load Balancing Policy : No Load Balancing
```

```
Lun Timeout        : Infinite Retry (-1)
```

=====

```
Device Path                Status
```

=====

```
/dev/dsk/c149t0d3          Active
```

The autopath help command

The `autopath help` command lists all the `autopath` commands. It also displays syntax of an `autopath` command and its usage.

Syntax:

```
# autopath help [command]
```

Example:

```
usage: autopath <command>
```

command:

```
add: enables addition of a LUN from unattached-list to Secure Path's device list. LUN is brought under Secure Path's control only after execution of autopath discover command
```

```
delete: deletes LUNs from the Secure Path's active device list  
discover: discovers the newly added device and also recognize the status of old device
```

```
display: displays accessible storage information  
set: sets SecurePath configuration parameters  
set_lbpolicy: sets load balancing policy  
set_prepath: sets preferred path  
retrieve: retrieves the persistence setting  
recover: starts the recover daemon to recover the failed devices  
help: displays this help message
```

Example:

```
# autopath help discover
```

```
description: discover the newly added device and also recognize the status of old device
```

```
usage:  
autopath discover [option]
```

options:

```
ON      : Enable the auto discover devices feature  
OFF     : Disable the auto discover devices feature
```

Example:

```
# autopath help add
```

```
description: enables addition of a LUN from unattached-list to Secure Path's device list. LUN is brought under Secure Path's control only after execution of the autopath discover command
```

```
usage:  
autopath add {option} {device path | WWLUNID | Array Type}
```

option:

```
-l      -- for entering the WWLUNID  
-r      -- for entering the Array Type
```

```
device path : -- device special file e.g./dev/dsk/c#t#d#  
WWLUNID :    -- World Wide Node Name of the LUN  
Array Type : -- Array Type( XP/VA/EVA-AA/MSA-AA )
```

Example:

```
# autopath help delete
```

```
description: delete LUNs from the SecurePath's active device list
```

```
usage:  
autopath delete <device path | {option} {WWLUNID | Array Type}>
```

```
device path : -- device special file e.g./dev/dsk/c#t#d#
```

```
option:
  -l      -- for entering the WWLUNID
  -r      -- for entering the Array Type

WWLUNID : -- World Wide Node Name of the LUN
Array Type :-- Array Type( XP/VA/EVA-AA/MSA-AA )
```

The autopath recover command

The `autopath recover` command spawns a process to enable automatic path recovery. This process is activated automatically during system boot.

If the process is terminated or is not invoked automatically, you can invoke this from the command line to enable the automatic path recovery feature.

Syntax:

```
autopath recover
```

For more information, see [Automatic path recovery](#) section.



NOTE:

If a device configured under HFS file system encounters an *All Paths Fail* condition, the I/O restarts only if the path on which original I/O is sent down by Secure Path is active.

The autopath discover command

The `autopath discover` command discovers any new devices or paths added, or any existing devices or paths deleted, and updates the data to the list of Secure Path for Active-Active devices.

Syntax:

```
autopath discover
```

Example:

```
# autopath discover
Discovery of New Paths / LUNs will be effective only if ioscan
and insf -e are executed prior to autopath discover
autopath: Initiating Autopath Discover...
autopath: Discover in progress...
autopath: Discover successful.
```

The autopath retrieve command

The `autopath retrieve` command restores the Secure Path load-balancing policy, preferred path settings, and deleted LUNs across system reboots. Retrieval of settings may not be effective if you have made SAN configuration changes for the host.

Syntax:

```
autopath retrieve
```

Example:

```
# autopath retrieve
```

The autopath set_lbpolicy command

The `autopath set_lbpolicy` command sets the load-balancing policy for the specified device path.

Syntax:

```
autopath set_lbpolicy <{policy name} {path}>
```

```
description: sets load balancing policy

usage:
  autopath set_lbpolicy <{policy name}> {path}>

  Policy name: The load balancing policy to set

  Valid policies are
  RR          : Round Robin.
  SST         : Shortest Service Time.
  SQL         : Shortest Queue Length.
  NLB/OFF    : No load Balancing.
  Path       : Device Special File e.g./dev/dsk/c#t#d#
```

Example:

```
# autopath set_lbpolicy RR /dev/dsk/c0t0d0
```

The autopath set_prefpath command

The `autopath set_prefpath` command sets the preferred device path to a Secure Path device. When the path details are displayed with the `autopath display` command, the preferred path is marked (pp).

Syntax:

```
autopath set_prefpath path
```

The parameter `path` specifies the physical device path.

Example:

```
# autopath set_prefpath /dev/dsk/c4t0d0
```

Troubleshooting Secure Path for Active-Active disk arrays

You or an HP service representative can perform troubleshooting, depending upon your HP service contract. If you are unable to resolve an error condition, ask your HP service representative for assistance.

This section contains the following information:

- [Recovering after a failure](#)
- [Secure Path messages](#)

Recovering after a failure

When a path fails, it is no longer used by Secure Path. After the path is repaired, Secure Path automatically begins using the path with the designated load-balancing policy. No user action is necessary.

 **NOTE:**

If a path to the device has been serviced and the device recovery does not occur, check whether the `autopath recover` process has been terminated inadvertently. If so, restart the recovery process by executing the `autopath recover` command.

For more information, see [The autopath recover command](#).

Secure Path messages

Secure Path reports error, diagnostic messages, and informational messages to the `/var/adm/syslog/syslog.log` file. You can enter the `dmesg` command to view the messages reported by Secure Path.

Table 13 lists the messages that may exist in the Secure Path log file.

Table 13 Secure Path for Active-Active disk array event messages

Event	Syslog message
DISCOVER RUNNING	AUTOPATH : autopath discover command is already running on this host
RETRIEVE RUNNING	AUTOPATH : autopath retrieve command is already running on this host
RECOVER RUNNING	AUTOPATH : autopath recover daemon is already running on this host
INVALID DEVICE PATH	AUTOPATH : invalid device path entered
IOCTL FAILURE	AUTOPATH : command failed
NOT AN AUTOPATH DEVICE	AUTOPATH : not a valid Secure Path device
NO AUTOPATH DEVICE	AUTOPATH : no Secure Path device found
SET POLICY SUCCESS	AUTOPATH : load balance policy set successfully for 0x1f040000
SET NEXT PATH AS PREF PATH	AUTOPATH : path is not up, so the next active path is set as Preferred Path
SET PREFERRED PATH SUCCESS	AUTOPATH : Preferred Path set successfully for 0x1f040000
NO ALTERNATE LINKS PRESENT	AUTOPATH : no alternate links present
RECOVER IOCTL FAILED	AUTOPATH : recover command failed
INVALID DEVICE ENTRY	AUTOPATH : invalid device entry
INVALID LB POLICY	AUTOPATH : invalid load balancing policy
DEVICE OPEN FAILED	AUTOPATH : device open failed
DEVICE BUSY	AUTOPATH : device busy
MEMORY ALLOCATION FAILURE	AUTOPATH : not enough memory
DISCOVER IN PROGRESS	AUTOPATH: autopath discover is in progress. please try later
DELETE IN PROGRESS	AUTOPATH: autopath delete is in progress. please try later
ALL LUNS DELETED	AUTOPATH : LUNs in this array are not configured under SecurePath control
AUTOPATH DRIVER NOT FOUND	AUTOPATH : HPswsp component missing or corrupted
FILE OPEN FAILED	AUTOPATH : file open failed
FILE READ FAILED	AUTOPATH : file read failed
FILE WRITE FAILED	AUTOPATH : file write failed
FILE SEEK FAILED	AUTOPATH : file seek pointer movement failed

Event	Syslog message
FILE NOT FOUND	AUTOPATH: persistence file not found or corrupted. Command cannot proceed
FILE NOT FOUND CREATING NEW	AUTOPATH: persistence file not found. Proceeding to create one
FILE UPDATE DONE	AUTOPATH : persistence file updation done successfully
FILE OPERATIONS FAILED	AUTOPATH: persistence file operations failed. Hence persistence could not be retrieved
UNINSTALL IN PROGRESS	AUTOPATH: un-install in progress. Aborting the command execution
UNINSTALL ABORT	AUTOPATH: cannot un - install hpap module, one of the paths on which I/O / Open was issued originally is failed
UNINSTALL ABORT	AUTOPATH: Cannot un - install hpap module, The following Device(s) have I/O's Queued
DEVICE ACCESS FAILED MESSAGE	AUTOPATH : Warning: Unable to access device
MAXIMUM LUN COUNT REACHED MESSAGE	AUTOPATH: Warning: LUN count reached maximum value of %d. Last device recognised is
MAXIMUM PATH COUNT REACHED MESSAGE	AUTOPATH: Warning: Cannot add path 0x1f040000 as an alternate link. Path count to end device reached maximum value of 0x1f040000
ULM REGISTER FAILED MESSAGE	AUTOPATH: Warning: Cannot register path 0x1f040000 as an Auto Path device. Path is already registered
PATH FAILED MESSAGE	AUTOPATH: Path 0x1f040000 failed! Rerouting to alternate path
ALL PATHS FAILED MESSAGE	AUTOPATH : All the paths to the end device 0x1f040000 failed
PATH RECOVERED MESSAGE	AUTOPATH : Path 0x1f040000 recovered
DD DEVICE BUSY	AUTOPATH : Device Busy : 0x1f040000
LUN COLLISION	AUTOPATH : LUN collision occurred at 0x1f040000
DRIVER REGISTRATION FAILURE	AUTO PATH: Warning: Could not Install HPAP Driver ret = 0x1f040000
DATA STRUCTURE INITIALIZATION FAILURE	AUTOPATH: data structure initialization failed
DRIVER DE-REGISTRATION FAILURE	AUTOPATH: Failure in Uninstalling HPAP driver

3 Secure Path Workgroup Edition for Virtual Array (VA) and Modular Smart Array (MSA)1500 disk arrays

HP StorageWorks Secure Path 3.0F SP1 Workgroup Edition for VA and MSA 1500 disk array provides automatic I/O path failover, failback, recovery, and load balancing for host systems configured with multiple host adapters and connections to disk arrays.

This chapter provides the following Secure Path information:

- [Features](#)
- [ULM services](#)
- [Dynamic load balancing](#)
- [Online device discovery](#)
- [Installing Secure Path Workgroup Edition for VA and MSA 1500 disk arrays](#)
- [Upgrading from the Web](#)
- [Removing Secure Path](#)
- [Command line interface](#)
- [Troubleshooting Secure Path Workgroup Edition for VA and MSA 1500 disk arrays](#)

Features

Secure Path Workgroup Edition for VA and MSA 1500 disk arrays provides enhanced data availability with the following features:

- Automatic path failover to an alternate path
- Automatic path recovery after failed path is serviced
- Automatic failback when a path recovers from failure
- Dynamic load balancing over multiple paths
- Command-line user interface (CLI) for Secure Path management
- Ability to reestablish previous load-balancing policy after reboot through the CLI
- Ability to add new devices and paths without rebooting
- Supports upto 32 paths to an end LUN

The HP StorageWorks Secure Path software performs dynamic load balancing of data flow through multiple paths. It detects multiple paths to each logical device and distributes the data load among the paths for optimum performance.

The user interface lets a system administrator define load-balancing policies and preferred paths, and view device path information. Secure Path manages paths according to the balancing policy, ensuring that no single path is a performance bottleneck.

ULM services

Secure Path uses the SCSI Upper Layer Module (ULM) interface to provide flexible configuration and layering of modules above the SCSI disk drivers.

If you are configuring Secure Path into HP-UX 11.00 64-bit operating systems and want it to coexist with other pseudo drivers, register Secure Path with the ULM services for each LUN path you want the Secure Path to control.

Dynamic load balancing

This section contains the following information:

- [Automatic failover](#)
- [Automatic path recovery](#)

Secure Path performs dynamic load balancing while monitoring each path to ensure that the I/O transaction is completed. The load-balancing policy is selected by the administrator.

The dynamic load-balancing policy prevents any path from becoming overloaded, and it helps to prevent the congestion that occurs when many I/O operations are directed to common devices along the same path.

If a preferred path is used for a device, the entire I/O for that particular device flows through the preferred path and no load balancing is done by Secure Path for that device.

NOTE:

Increased performance is not always realized with Virtual Array (VA) systems. In most cases, the best performance is provided by using preferred paths.

Automatic failover

In the event of a failure of any part of a path between the disk array and a server, Secure Path automatically switches to an alternate path, dropping the failed path out of the I/O rotation without any loss of data. The failover is not visible to applications, so normal operation continues without downtime.

For troubleshooting information, see [Troubleshooting Secure Path Workgroup Edition for VA and MSA 1500 disk arrays](#) section.

Automatic path recovery

When a path fails, it is no longer used. After the path has been repaired and returned to normal, Secure Path automatically begins using the path with the designated load-balancing policy. No user action is necessary.

Online device discovery

If there are any changes in the SAN configuration such as addition or deletion of paths or devices, these changes can be updated in Secure Path Workgroup Edition for VA and MSA 1500 arrays for maximum and efficient utilization of resources.

The `autopath discover` command updates the SAN configuration changes to the list of Secure Path for VA and MSA 1500 devices without a system reboot, and the `autopath delete` command removes a device from an autopath control.

NOTE:

Discovery of new Path or LUN is effective only if you execute `ioscan` and `insf -e` before executing the `autopath discover` command.

Installing Secure Path Workgroup Edition for VA and MSA 1500 disk arrays

This section describes the minimum system requirements and procedures for installing Secure Path Workgroup Edition for VA and MSA 1500 disk arrays, including:

- [System requirements](#)
- [Installing Secure Path](#)



NOTE:

You must have `root` account privileges to install Secure Path software.

System requirements

To install Secure Path, your system must conform to the following requirements:

- HP-UX 11.00 64 bit operating system
- Administrator `root` access to the host system
- SCSI ULM Services B.11.00.01 for HP-UX 11.00

For specific installation requirements for your system, contact your HP account representative.



NOTE:

Refer to the *HP StorageWorks Secure Path 3.0F Service Pack 1 for HP-UX 11.00 and Secure Path 3.0F Service Pack 1 Workgroup Edition for HP-UX 11.00 release notes* for details about the supported configuration.

Installing Secure Path

Before installing Secure Path on HP-UX 11.00, ensure that SCSI ULM services is installed on your system.



NOTE:

To install Secure Path, you must have superuser (`root`) access on the HP-UX host.

To install Secure Path, complete the following steps:

1. Log on to the HP-UX system as superuser (`root`).
2. Insert the Secure Path installation CD-ROM into the CD-ROM drive.
3. Mount the CD-ROM on your file system.
4. Change to the directory in which the CD-ROM is mounted. For example, if the CD-ROM is mounted to a directory called `/cdrom`, change the directory by entering the following command:

```
# cd /cdrom/
```
5. Install Secure Path software on the server using the provided shell script by entering the following command:

```
#!/install.sh
```
6. Select Secure Path for VA and MSA 1500 disk arrays when prompted. Follow the on-screen instructions.

When the installation is complete, the server reboots.

Installation of the Secure Path package creates `/Autopath` and `/HPswsp` directory under `/opt` directory. The `changes.log` file is copied into `/Autopath` directory, and the `master`, `system`, and `mod.o` files are copied into `/HPswsp` directory.

Upgrading from the Web

To upgrade your Secure Path Workgroup Edition for VA and MSA 1500 disk array software, access the upgrade package at: <http://www.hp.com/country/us/eng/prodserv/storage.html>.

This package is intended as an upgrade only. The patch depot upgrades Secure Path 3.0x Workgroup Edition to Secure Path 3.0F SP1 Workgroup Edition.

Complete the following steps for a successful upgrade:

1. Copy the upgrade tar package to a temporary directory (for example, `/tmp`).
2. Unbundle the upgrade files by entering the following commands:

```
# cd /tmp/Securepath
# tar xvf sp_v30FSP1_hp_WE_web.tar
```
3. Verify that the directory contains the installation script `install.sh` and the following directory:
`HPswsp_WE_v30FSP1.`
4. Install Secure Path Workgroup Edition software on the server using the provided shell script by entering the following command:

```
# ./install.sh
```

When the installation is complete and the server reboots, a subsequent `swlist` displays the following Secure Path Workgroup Edition output:

```
#
# Product(s) not contained in a Bundle
HPswsp A.3.0F.01F.00F HP StorageWorks Secure Path Workgroup
Edition Device Driver and utilities for VA and MSA1500 Disk Arrays.
```

Removing Secure Path

You can remove Secure Path by using the `HP SD` utility. When you remove Secure Path, all files, including configuration files are removed.

Complete the steps below to remove Secure Path from your system:

1. Log on to the HP-UX system as superuser (`root`).
2. Run the `swremove` command from the command line as follows:

```
# swremove -x autoreboot=true HPswsp
```
3. Alternatively, you can launch the interactive session of `swremove` and the select HP StorageWorks Secure Path Workgroup Edition Device Driver and Utilities for VA and MSA 1500 Disk Arrays product for removal.

The system reboots after removal is complete.

Command line interface

You can use the Secure Path command line interface (CLI) only on those hosts that are connected to devices with the `HPswsp` driver installed.

This section contains information about the commands supported by this interface along with their syntax, including:

- [The `autopath set` command](#)
- [The `autopath display` command](#)

- [The autopath help command](#)
- [The autopath recover command](#)
- [The autopath discover command](#)
- [The autopath retrieve command](#)
- [The autopath set_lbpolicy command](#)
- [The autopath set_prefpath command](#)

The autopath set command

The `autopath set` command sets the load balancing policy for an autopath device.

Syntax:

description : set SecurePath configuration parameters

usage:

```
autopath set {option}
```

options:

```
-l <WWID> -b <policy name>-sets load balancing policy for the LUN
  WWID : World Wide Node Name of the LUN
  Policy name: the load balancing policy to set
```

valid policies are

```
RR      : Round Robin.
SST     : Shortest Service Time.
SQL     : Shortest Queue Length.
NLB/OFF : No Load Balancing.
```

```
-t <device path> <value>-sets time out value for the LUN
  device path: device special file e.g./dev/dsk/c#t#d#
```

value:

```
-1 : infinite retry (default)
0  : abort immediately on all paths fail condition
1-86400 : timeout period in seconds
```

Example:

```
# autopath set -l 6005-08B4-0001-499C-0001-F000-0163-0000 -b sql
```

```
# autopath set -t /dev/dsk/cl60t0d1 86400
```

NOTE:

- Secure Path 3.0F SP1 supports infinite retry only for VxFS file systems.
 - If the file system changes from VxFS to HFS, the `autopath set -t` command does not automatically set the timeout value for a LUN as *infinite retry*.
 - If a device configured under HFS file system encounters an *All Paths Fail* condition, the I/O restarts only if the path on which original I/O is sent down by Secure Path is active.
-

The autopath display command

The `autopath display` command displays details about Secure Path devices, such as alternate paths to a Secure Path device, associated status, and load-balancing policy settings.

This section contains the following information about the `autopath display` command:

- [List of all arrays connected to a host](#)
- [Details of all LUNs connected from an array](#)
- [Display autopath discover status](#)

- List of array controllers connected to the host
- Display the LUN info of the Lun using a device path
- Display the LUN info of the Lun using a LUN WWID
- Display all LUNs connected to the host

List of all arrays connected to a host

The `autopath display -r` command displays a list of all connected arrays to the host.

Syntax:

```
autopath display -r
```

Example:

```
#autopath display -r
```

```
=====
HPswsp Version      : A.3.0F.01F.00F
=====
Array IDs
=====
060B-0000-14E2-E050
060B-0000-1534-1C50
=====
```

Details of all LUNs connected from an array

The `autopath display -r <Array ID>` command displays details of all LUNs connected from an array.

Syntax:

```
autopath display -r <Array ID>
```

Example:

```
# autopath display -r 5006-0b00-0010-3f42
```

```
=====
HPswsp Version      : A.3.0F.01F.00F
=====
Auto Discover       : OFF
=====
Array WWN           : 060B-0000-14E2-E050
=====
Lun WWN             : E000-0100-0000-0000-5000-0000-0000-0000
Load Balancing Policy : No Load Balancing
Lun Timeout         : Infinite Retry (-1)
=====
Device Path         Status
=====
/dev/dsk/c149t0d1   Active
/dev/dsk/c150t0d1   Active
/dev/dsk/c141t0d1   Active
/dev/dsk/c142t0d1   Active
=====
```



```

Lun WWN                : E000-0200-0000-0000-5F00-0000-0000-0000
Load Balancing Policy : No Load Balancing
Lun Timeout            : Infinite Retry (-1)
=====
Device Path            Status
=====
/dev/dsk/c149t0d2      Active
/dev/dsk/c150t0d2      Active
/dev/dsk/c141t0d2      Active
/dev/dsk/c142t0d2      Active
=====

```

Display autopath discover status

The `autopath discover` command displays the newly added devices.

Syntax:

```
# autopath discover help
```

```
description : discover the newly added device(s) and also recognize
the status of old device(s)
```

usage:

```
autopath discover [option]
```

options:

```
ON   : Enables the auto discover devices feature
OFF  : Disables the auto discover devices feature
-----
```

List of array controllers connected to the host

The `autopath display -c` command displays a list of controllers connected to the host.

Syntax:

```
autopath display -c
```

Example:

```
# autopath display -c
```

```
=====
HPswsp Version        : A.3.0F.01F.00F
=====
```

```
Array ID              : 060B-0000-14E2-E050
-----
```

```
Controller Ids
-----
```

```
0PR0-2195-2880
0PR0-2195-0720
=====
```

```
=====
Array ID              : 060B-0000-1534-1C50
-----
```

```
Controller Ids
-----
```

```
0PR0-2208-1550
0PR0-2208-1700

```

Display the LUN info of the Lun using a device path

The `autopath display <device path>` command displays the LUN info of the Lun using the device path.

Syntax:

```
autopath display <device path>
```

Example:

```
# autopath display /dev/dsk/c151t0d4
```

```
=====
HPswsp Version      : A.3.0F.01F.00F
=====
Array WWN           : 060B-0000-1534-1C50
=====
Lun WWN             : 1C00-0400-0000-0001-7800-0000-0000-0000
Load Balancing Policy : No Load Balancing
Lun Timeout         : Infinite Retry (-1)
=====
Device Path          Status
=====
/dev/dsk/c151t0d4    Active
/dev/dsk/c153t0d4    Active
/dev/dsk/c143t0d4    Failed
/dev/dsk/c145t0d4    Failed
=====
```

Display the LUN info of the Lun using a LUN WWID

The `autopath display -l <LUN WWID>` command displays the LUN info of the Lun using the LUN WWID.

Syntax:

```
autopath display -l<LUN WWID>
```

Example:

```
# autopath display -l 1C00-0400-0000-0001-7800-0000-0000-0000
```

```
=====
HPswsp Version      : A.3.0F.01F.00F
=====
Array WWN           : 060B-0000-1534-1C50
=====
Lun WWN             : 1C00-0400-0000-0001-7800-0000-0000-0000
Load Balancing Policy : No Load Balancing
Lun Timeout         : Infinite Retry (-1)
=====
Device Path          Status
=====
/dev/dsk/c151t0d4    Active
/dev/dsk/c153t0d4    Active
=====
```

```
/dev/dsk/c143t0d4      Active
/dev/dsk/c145t0d4      Active
```

=====

Display all LUNs connected to the host

The `autopath display [all]` command displays details about all LUNs connected to the host.

Syntax:

```
autopath display
autopath display all
```

Example:

```
# autopath display
```

=====

```
HPswsp Version      : A.3.0F.01F.00F
```

=====

```
Auto Discover       : OFF
```

=====

```
Array WWN           : 060B-0000-14E2-E050
```

=====

```
Lun WWN             : E000-0100-0000-0000-5000-0000-0000
Load Balancing Policy : No Load Balancing
Lun Timeout         : Infinite Retry (-1)
```

=====

```
Device Path          Status
```

=====

```
/dev/dsk/c149t0d1    Active
/dev/dsk/c150t0d1    Active
/dev/dsk/c141t0d1    Active
/dev/dsk/c142t0d1    Active
```

=====

```
Lun WWN             : E000-0200-0000-0000-5F00-0000-0000
Load Balancing Policy : No Load Balancing
Lun Timeout         : Infinite Retry (-1)
```

=====

```
Device Path          Status
```

=====

```
/dev/dsk/c149t0d2    Active
/dev/dsk/c150t0d2    Active
/dev/dsk/c141t0d2    Active
/dev/dsk/c142t0d2    Active
```

=====

```
Lun WWN             : E000-0300-0000-0000-6000-0000-0000
Load Balancing Policy : No Load Balancing
Lun Timeout         : Infinite Retry (-1)
```

=====

```
Device Path          Status
```

=====

```
/dev/dsk/c149t0d3    Active
```

The autopath help command

The `autopath help` command lists all the autopath commands. It also displays syntax of an autopath command and its usage.

Syntax:

```
# autopath help [command]
```

Example:

```
usage: autopath <command>
```

command:

```
add: enables addition of a LUN from unattached-list to
Secure Path's device list. LUN is brought under Secure Path's
control only after execution of autopath discover command
```

```
delete: deletes LUNs from the Secure Path's active device list
discover: discovers the newly added device and also recognize
the status of old device
```

```
display: displays accessible storage information
```

```
set: sets SecurePath configuration parameters
```

```
set_lbpolicy: sets load balancing policy
```

```
set_prepath: sets preferred path
```

```
retrieve: retrieves the persistence setting
```

```
recover: starts the recover daemon to recover the failed devices
```

```
help: displays this help message
```

Example:

```
# autopath help discover
```

```
description: discover the newly added device and also recognize
the status of old device
```

usage:

```
autopath discover [option]
```

options:

```
ON      : Enable the auto discover devices feature
```

```
OFF     : Disable the auto discover devices feature
```

Example:

```
# autopath help add
```

```
description: enables addition of a LUN from unattached-list to
Secure Path's device list. LUN is brought under Secure Path's
control only after execution of the autopath discover command
```

usage:

```
autopath add {option} {device path | WWLUNID | Array Type}
```

option:

```
-l      -- for entering the WWLUNID
```

```
-r      -- for entering the Array Type
```

```
device path :    -- device special file e.g./dev/dsk/c#t#d#
```

```
WWLUNID :      -- World Wide Node Name of the LUN
```

```
Array Type :   -- Array Type( XP/VA/EVA-AA/MSA-AA )
```

Example:

```
# autopath help delete
```

```

description: delete LUNs from the SecurePath's active device list

usage:
  autopath delete <device path | {option} {WWLUNID | Array Type}>

  device path :      -- device special file e.g./dev/dsk/c#t#d#
  option:
    -l          -- for entering the WWLUNID
    -r          -- for entering the Array Type

  WWLUNID :      -- World Wide Node Name of the LUN
  Array Type :-- Array Type( XP/VA/EVA-AA/MSA-AA )

```

The autopath recover command

The `autopath recover` command spawns a process to enable automatic path recovery. This process is automatically activated during system boot.

If the process is terminated or is not invoked automatically, you can invoke this from the command line to enable the automatic path recovery feature.

Syntax:

```
autopath recover
```

For more information, see [Automatic path recovery](#) section.

The autopath discover command

The `autopath discover` command discovers any new devices or paths added, or any existing devices or paths deleted, and updates the data to the list of Secure Path for Active-Active devices.

Syntax:

```
autopath discover
```

Example:

```

# autopath discover
Discovery of New Paths / LUNs will be effective only if ioscan
and insf -e are executed prior to autopath discover
autopath: Initiating Autopath Discover...
autopath: Discover in progress...
autopath: Discover successful.

```

The autopath retrieve command

The `autopath retrieve` command restores the Secure Path load-balancing policy, preferred path settings, and deleted LUNs across system reboots. Retrieval of settings may not be effective if you have made SAN configuration changes for the host.

Syntax:

```
autopath retrieve
```

Example:

```
# autopath retrieve
```

The autopath set_lbpolicy command

The `autopath set_lbpolicy` command sets the load-balancing policy for the specified device path.

Syntax:

```
autopath set_lbpolicy <{policy name} {path}>
```

description: sets load balancing policy

usage:

```
autopath set_lbpolicy <{policy name}> {path}>
```

Policy name: The load balancing policy to set

Valid policies are

```
RR      : Round Robin.
SST     : Shortest Service Time.
SQL     : Shortest Queue Length.
NLB/OFF : No load Balancing.
Path    : Device Special File e.g./dev/dsk/c#t#d#
```

Example:

```
# autopath set_lbpolicy RR /dev/dsk/c0t0d0
```

The autopath set_prefpath command

The `autopath set_prefpath` command sets the preferred device path to a Secure Path device. When the path details are displayed with the `autopath display` command, the preferred path is marked (pp).

Syntax:

```
autopath set_prefpath path
```

The parameter `path` specifies the physical device path.

Example:

```
# autopath set_prefpath /dev/dsk/c4t0d0
```

Troubleshooting Secure Path Workgroup Edition for VA and MSA 1500 disk arrays

You or an HP service representative can perform troubleshooting, depending upon your HP service contract. If you are unable to resolve an error condition, ask your HP service representative for assistance.

This section contains the following information:

- [Recovering after a failure](#)
- [Secure Path messages](#)

Recovering after a failure

When a path fails, it is no longer used by Secure Path. After the path is repaired, Secure Path automatically begins using the path with the designated load-balancing policy. No user action is necessary.

 **NOTE:**

If a path to the device has been serviced and the device recovery does not occur, check whether the `autopath recover` process has been terminated inadvertently. If so, restart the recovery process by executing the `autopath recover` command.

For more information, see [The autopath recover command](#).

Secure Path messages

Secure Path reports error, diagnostic messages, and informational messages to the `/var/adm/syslog/syslog.log` file. You can enter the `dmesg` command to view the messages reported by Secure Path.

Table 14 lists the messages that may exist in the Secure Path log file.

Table 14 Secure Path Workgroup Edition for VA and MSA 1500 event messages

Event	Syslog message
DISCOVER RUNNING	AUTOPATH : autopath discover command is already running on this host
RETRIEVE RUNNING	AUTOPATH : autopath retrieve command is already running on this host
RECOVER RUNNING	AUTOPATH : autopath recover daemon is already running on this host
INVALID DEVICE PATH	AUTOPATH : invalid device path entered
IOCTL FAILURE	AUTOPATH : command failed
NOT AN AUTOPATH DEVICE	AUTOPATH : not a valid Secure Path device
NO AUTOPATH DEVICE	AUTOPATH : no Secure Path device found
SET POLICY SUCCESS	AUTOPATH : load balance policy set successfully for 0x1f040000
SET NEXT PATH AS PREF PATH	AUTOPATH : path is not up, so the next active path is set as Preferred Path
SET PREFERRED PATH SUCCESS	AUTOPATH : Preferred Path set successfully for 0x1f040000
NO ALTERNATE LINKS PRESENT	AUTOPATH : no alternate links present
RECOVER IOCTL FAILED	AUTOPATH : recover command failed
INVALID DEVICE ENTRY	AUTOPATH : invalid device entry
INVALID LB POLICY	AUTOPATH : invalid load balancing policy
DEVICE OPEN FAILED	AUTOPATH : device open failed
DEVICE BUSY	AUTOPATH : device busy
MEMORY ALLOCATION FAILURE	AUTOPATH : not enough memory
DISCOVER IN PROGRESS	AUTOPATH: autopath discover is in progress. please try later
DELETE IN PROGRESS	AUTOPATH: autopath delete is in progress. please try later
ALL LUNS DELETED	AUTOPATH : LUNs in this array are not configured under SecurePath control
AUTOPATH DRIVER NOT FOUND	AUTOPATH : HPswsp component missing or corrupted
FILE OPEN FAILED	AUTOPATH : file open failed
FILE READ FAILED	AUTOPATH : file read failed
FILE WRITE FAILED	AUTOPATH : file write failed
FILE SEEK FAILED	AUTOPATH : file seek pointer movement failed

Event	Syslog message
FILE NOT FOUND	AUTOPATH: persistence file not found or corrupted. Command cannot proceed
FILE NOT FOUND CREATING NEW	AUTOPATH: persistence file not found. Proceeding to create one
FILE UPDATE DONE	AUTOPATH : persistence file updation done successfully
FILE OPERATIONS FAILED	AUTOPATH: persistence file operations failed. Hence persistence could not be retrieved
UNINSTALL IN PROGRESS	AUTOPATH: un-install in progress. Aborting the command execution
UNINSTALL ABORT	AUTOPATH: cannot un - install hpap module, one of the paths on which I/O / Open was issued originally is failed
UNINSTALL ABORT	AUTOPATH: Cannot un - install hpap module, The following Device(s) have I/O's Queued
DEVICE ACCESS FAILED MESSAGE	AUTOPATH : Warning: Unable to access device
MAXIMUM LUN COUNT REACHED MESSAGE	AUTOPATH: Warning: LUN count reached maximum value of %d. Last device recognised is
MAXIMUM PATH COUNT REACHED MESSAGE	AUTOPATH: Warning: Cannot add path 0x1f040000 as an alternate link. Path count to end device reached maximum value of 0x1f040000
ULM REGISTER FAILED MESSAGE	AUTOPATH: Warning: Cannot register path 0x1f040000 as an Auto Path device. Path is already registered
PATH FAILED MESSAGE	AUTOPATH: Path 0x1f040000 failed! Rerouting to alternate path
ALL PATHS FAILED MESSAGE	AUTOPATH : All the paths to the end device 0x1f040000 failed
PATH RECOVERED MESSAGE	AUTOPATH : Path 0x1f040000 recovered
DD DEVICE BUSY	AUTOPATH : Device Busy : 0x1f040000
LUN COLLISION	AUTOPATH : LUN collision occurred at 0x1f040000
DRIVER REGISTRATION FAILURE	AUTO PATH: Warning: Could not Install HPAP Driver ret = 0x1f040000
DATA STRUCTURE INITIALIZATION FAILURE	AUTOPATH: data structure initialization failed
DRIVER DE-REGISTRATION FAILURE	AUTOPATH: Failure in Uninstalling HPAP driver

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 HSV110 controllers are supported for use with Secure Path.
controller states	<ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• 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 composed 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	<ul style="list-style-type: none">• 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.
port a	The relative number of an HBA. A specific port number is determined according to its order of discovery by the Windows operating system and includes SCSI, Fibre Channel, and IDE adapter types.
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 also <i>Path</i> , <i>Path States</i> , <i>Controller States</i> , and <i>Device States</i> .

Index

Symbols

spmgr
 add WWLUNID, 55, 56
 display (default), 35
 display -s, 41
 display -u, 41
 log -c, 45
 log -l, 45
 log -n, 45, 45
 notify, 47
 notify add, 46
 notify delete, 46
 quiesce - a controller, 53
 quiesce - a HBA, 53
 quiesce - c controller, 53
 quiesce - c path_instance, 53
 quiesce - p path_instance, 53
 refreshdisplay, 41
 restart -p path_instance, 54
 restart -a HBA, 54
 restart -c controller, 54
 restart -p path_instance, 54
 restore all, 52
 restore all paths to device, 52
 restore all paths to storage system, 52
 select -c controller_serial_number, 48
 select -p path_instance, 48
 set -f, 44
 set -p, 44

A

active paths and load balancing, 51
active state, 33
adding
 LUNs, 54
 Secure Path to an existing configuration, 18
 SP to an existing RA/MA8000 or
 ESA/EMA12000 Configuration, 18
 WWLUNID, 55, 56
addresses
 delete, 46
 display, 47
 notify, 46, 46, 47
alias
 defining, 42
 displaying, 42
available state, 33

C

commands
 autopath discover, 79, 93

autopath display, 73, 87
autopath help, 77
autopath retrieve, 79, 93
autopath set_lbpolicy, 79, 93
autopath set_prepath, 80, 94
display, 35, 35
log, 45
notify, 46
set, 43
 spmgr, 30
configuration information, displaying, 32
configuration tool, 14
console, logging, 45
controllers
 preferring a unit, 23
 quiesce, 53
 restart -cx11 x11 spmgr, 54
 states
 critical, 32
 operational, 32
conventions
 text symbols, 8
critical state, 32

D

defining
 alias, 42
 unalias, 42
deleting LUNs, adding and, 54
device states, 33
display -s, # spmgr, 41
display -u, # spmgr, 41
display command, 35
 # spmgr, 35
 log settings, 45
displaying
 alias, an, 42
 configuration information, 32
 path states, 39
drivers
 HPswsp, 72, 86
 hsx, 13
 sdisk, 21
 swsp, 13
dual RAID controllers, 13

E

enable notification, logging, 45
enterprise virtual array
 array, configuring, 24
 HSV element manager, 24

F

failback options, 15
failed state, 33
failover, 15, 70, 84
fcmsutil utility, 18

H

hardware setup, HSx, 17
HBA
 restart -a, x11 # spmgr, 54
 restart -a,x11 # spmgr, 54
HP
 Subscriber's choice web site, 9
HP SD utility, 72, 86
HPswsp driver, 72, 86
HSx
 installing software, 27
 removing software, 61
hsx driver, 67

I

installation
 silent, 15
installing
 HSx software, 27
 msa 1500, workgroup edition software, 85
 new HSx configuration, 18
 va, workgroup edition software, 85
 xp and va software, 71
installing
 Multipathing software, 13
ioscan
 commands, 26
 running, 55

L

load balancing, 16, 43, 70
 active paths, 51
load distribution
 described, 16
 disabled, 15
 enabled, 15
log command, 45
 console, 45
 enable, 45
 settings display, 45
LUNS
 adding and deleting, 54
 restoring, 52

M

management tools, 14
msa 1500, workgroup edition
 command line interface, 86
 commands
 discover, 93

 display, 87
 retrieve, 93
 set_lbpolicy, 93
 set_prepath, 94
installing, 85
messages, diagnostic, 95
recovery, 94
requirements, system, 85
troubleshooting, 94
uninstalling, 86
upgrading software, 86
multiple-bus mode, 12

N

notification, 45, 45
notification severity levels, 46
notify
 add, 46
 address, 46
 command, 46
 delete address, 46
 display addresses, 47

O

offline state, 33
operational state, 32
optional array features, 21

P

path
 definition
 management behavior, 17
 verification, 16
 management, 47
 management behavior summary, 17
 selecting, controller_serial_number, 48
 states, 33
 verification
 defined, 16
 interval, setting, 44
 parameters, 43
 setting, 44
path_instance
 quiesce, 53
 restart -p x11 x11 # spmgr, 54
 select, 48
paths
 load balancing and active paths, 51
 restoring to device, 52
 restoring to storage system, 52
 selecting, 47
PREFERRED_PATH unit attribute, 12
preferring, unit to a controller, 23

Q

quiesce

- a x11 # spmgr, 53
- c x11 # spmgr, 53
- p x11 # spmgr, 53

quiesced objects, restarting, 53

quiescing configuration objects, 52

R

recovery after failure, 94

refreshdisplay, # spmgr, 41

related documentation, 8

restarting quiesced objects, 53

restore all

- LUNs, 52
- paths to device, 52
- paths to storage system, 52

S

SCSI Upper Layer Module (ULM), 69, 83

SCSI-2, using, 64

SCSI-3, using, 23

sdisk driver, 21

Secure Path

- basic configuration, illustrated, 11
- installing
 - HSx software, 27
 - msa 1500, workgroup edition software, 85
 - new HSx configuration, 18
 - va, workgroup edition software, 85
 - xp and va software, 71
- overview, 11
- removing HSx software, 61
- software components, 13
- spagent, 14
- spmgr, 14
- technical description, 11
- technology, 12
- uninstalling msa 1500, workgroup edition software, 86
- uninstalling va, workgroup edition software, 86
- uninstalling xp and va software, 72

selecting paths, 47

services

- ULM, 69

set commands, 43

- path
 - verification interval, 44
 - path verification, 44
 - storage system parameters, 43

setting up additional LUNs, 21

severity levels, notification, 46

spagent, 14, 67

spmgr

- alias, 42
- commands, 30
- common terms, 32
- controller states, 32

- display -s, 41
- display -u, 41
- displaying an alias, 42
- log -c, 45
- log -l, 45
- log -n, 45, 45
- notify
 - delete, 46
- notify add, 46
- notify display, 47
- overview, 30
- quiesce - a controller, 53
- quiesce - a HBA, 53
- quiesce - c controller, 53
- quiesce - p path_instance, 53
- refreshdisplay, 41
- restart -a HBA, 54
- restart -c controller, 54
- restart -p path_instance, 54
- restore all, 52
- restore all paths to device, 52
- restore all paths to storage system, 52
- select -p path_instance, 48
- select controller_serial_number, 48
- set path verification, 44
- set path verification interval, 44
- unalias, 42

states

- controller, 32
- device, 33
- path, 33
- standby, 33

storage system parameters, setting, 43

Subscriber's choice, HP, 9

swsp driver, 13

symbols in text, 8

syslog, 45

T

technical description of Secure Path, 11

text symbols, 8

troubleshooting

- msa 1500 workgroup edition, 94
- msa 1500 workgroup edition messages, 95
- va workgroup edition, 94
- VA workgroup edition messages, 95
- xp and va diagnostic messages, 81

ttarget/LUNS per array comparison chart, 21

U

ULM services, 69, 83

unalias, defining, 42

uninstalling

- HSx software, 61
- msa 1500, workgroup edition software, 86
- va, workgroup edition software, 86
- xp and va software, 72

unit, preferring a controller, 23

- upgrading
 - msa 1500, workgroup edition software, [86](#)
 - va, workgroup edition software, [86](#)
 - xp and va software, [71](#)
- utilities
 - HP SD, [72](#), [86](#)

V

- va, workgroup edition
 - command line interface, [86](#)
 - commands
 - discover, [93](#)
 - display, [87](#)
 - retrieve, [93](#)
 - set_lbpolicy, [93](#)
 - set_prefpath, [94](#)
 - device addition and deletion, [84](#)
 - disk arrays, va, [84](#)
 - failover, automatic, [84](#)
 - installing, [85](#)
 - load balancing, [84](#)
 - messages, diagnostic, [95](#)
 - path recovery, automatic, [84](#)
 - recovery, [94](#)
 - requirements, system, [85](#)
 - services, ULM, [83](#)
 - troubleshooting, [94](#)
 - uninstalling, [86](#)
 - upgrading software, [86](#)
 - verifying a path, [16](#)

W

- web sites
 - HP Subscriber's choice, [9](#)
- world wide name
 - fcmsutil utility and, [18](#)
 - spmgr and, [44](#)

X

- xp and va
 - command line interface, [72](#)
 - commands
 - discover, [79](#)
 - display, [73](#)
 - help, [77](#)
 - retrieve, [79](#)
 - set_lbpolicy, [79](#)
 - set_prefpath, [80](#)
 - device addition and deletion, [70](#)
 - diagnostic messages, [81](#)
 - disk arrays, va, [70](#)
 - failover, automatic, [70](#)
 - installing, [71](#)
 - load balancing, [70](#)
 - path recovery, automatic, [70](#)
 - requirements, system, [71](#)
 - services, ULM, [69](#)
 - uninstalling, [72](#)
 - upgrading software, [71](#)