Compaq StorageWorks

Release Notes

Secure Path V2.1 for Sun Solaris

November, 2000

This document summarizes features and characteristics of the SANworks Secure Path product, Version 2.1 for Sun Solaris systems using StorageWorks HSG80 Array Controllers configured for Fibre Channel Arbitrated Loop (FC-AL) or Fibre Channel Fabric (FC-SW). It provides information not covered elsewhere in the product documentation.

Intended Audience

This document is intended for individuals responsible for installing, configuring and maintaining SANworks Secure Path V2.1 in their Sun Solaris server environment using StorageWorks Fibre Channel RAID Array 8000 or Enterprise Storage Array 12000 storage systems with HSG80 Array controllers.

IMPORTANT

Read this entire document before installing or upgrading the software.

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Secure Path Kit Contents

The SANworks Secure Path Version 2.1 software kit consists of the following:

- A customer letter
- The Secure Path documentation set:
  - **Product Description** – *COMPAQ SANworks Secure Path Version 2.1 for Sun Solaris – A High-Availability Fibre Channel Solution for Sun Solaris Platforms*
  - **Installation and Reference Guide** – *COMPAQ SANworks Secure Path V2.1 for Sun Solaris*
  - **Warranty Card**
  - **Release Notes** – *COMPAQ SANworks Secure Path V2.1 for Sun* (This document*)*
- A CD-ROM containing documentation and Secure Path Solution Software V2.1 for Sun Solaris.

Visit our Web Site for the Latest Information

Check our web for the latest drivers, technical tips and documentation for SANworks Secure Path at:

<div align="center">

http://www.compaq.com/products/storageworks

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1.0   OPERATING SYSTEM SUPPORT

Table 1 lists the hardware and software supported by SANworks Secure Path Software Version 2.1.

Table 1 Minimum System Requirements

Host Feature	Requirement
Platform	SPARC Ultra SPARC
Architectures	4d 4u
Operating System	Solaris 2.6 Solaris 2.7 **(32-bit mode only)**
Free Disk	500KB, before any log files
Fibre Channel Adapter	Compaq/JNI FC64-1063 (DS-SWSA4-SC) Compaq/JNI FCI-1063 (SWSA4-PC)
Fibre Channel Hub	Compaq 7-port hub 242795-B21 (DS-SWXHX-07) Compaq 12-port hub 245573-B22 (DS-DHGGB-AB)
SAN Switches Note: This list supercedes an earlier list in the Installation and Reference Guide, AA-RKYDC-TE	Compaq 8-port 380591-B21 (DS-DSGGA-AA) Compaq 8-port 380591-B22 (DS-DSGGA-AC) Compaq 8-port 158222-B21 (DS-DSGGB-AA) Compaq 8-port 158223-B21 (DS-DSGGB-AB) Compaq 16 port 380578-B21 (DS-DSGGA-AB) Compaq 16 port 380578-B22 (DS-DSGGA-AD) Compaq 16 port 158224-B21 (DS-DSGGB-BA) Compaq 16 port 158225-B21 (DS-DSGGB-BB)
Controller	HSG80 Controller operating Firmware ACS Version 8.5F

2.0   INSTALLATION PREREQUISITES

2.1 Hardware Prerequisites for Secure Path:

1. Two paths must exist between each server and storage system. Each path must consist of a separate:

   - Host Bus Adapter -

        On systems that support multiple I/O boards, Compaq recommends that each host bus adapter be installed on separate I/O boards to eliminate the I/O board as a single point of failure.

   - Fibre Channel Hub or Fibre Channel (SAN) Switch

   - HSG80 Controller -

        The RAID storage system must be configured for Fibre Channel Arbitrated Loop (FC-AL) or Fibre Channel Fabric (FC-SW) in Multiple-bus Failover Mode.

2. Supports a maximum of 2 RAID systems per server configured with 1 pair of adapters.

3. Supports a maximum of 64 LUNs per RAID system

2.2 Software Prerequisite for Secure Path:

1. StorageWorks Solutions Software V8.5 for Sun Solaris must be installed and configured for the respective mode: *hub and loop*, or *switch and fabric*.

2. At least one LUN on the RAID storage system must be visible on two paths (one path from each adapter) prior to the installation of Secure Path V2.1.

   It is strongly recommended that a complete storage configuration be done prior to the installation of Secure Path

3.0   INSTALLATION ISSUES

3.1 New Installation or Upgrade Installation

To upgrade Secure Path V 2.0 (supported Loop) to V2.1, follow the installation instructions in Chapter 4 of the *SANworks Secure Path V2.1 for Sun Solaris Installation and Reference Guide*, and invoke the upgrade by entering:

 # pkgadd -a upgrade pkgs

The upgrade will preserve the existing configuration files, but copy the newer Secure Path software to the respective locations. Following the upgrade, Compaq strongly recommends that the server be rebooted.

3.2 More Than Two Paths Will Cause Secure Path to Panic

WARNING: Secure Path requires that **only two** paths exist from the server to the LUN on the RAID storage system. Should a configuration be constructed such that more than two paths are available to the Secure Path implementation, the system will panic on reboot.

Corrective Action:

- Running Solaris V2.6: Boot from another device (another disk or an Installation CD), mount the disk with the failed Secure Path installation and delete the file */kernel/drv/mda.conf*

- Running Solaris V2.7: Boot the system in 64-bit mode and delete the file */kernel/drv/mda.conf*

Correct the configuration and verify that only two paths exist to each of the LUNs on the RAID storage system.

- Remove Secure Path. (**# pkgrm CPQswsp**)

- Invoke the Sun Solaris Solutions V8.5 configurator, **install_dir**/steam/bin/config.sh and regenerate entries for the adapters that will be used in Secure Path. This action will regenerate the entries in **/kernel/drv/sd.conf**

- Reboot with a reconfigure and verify that only two paths exist from adapters to the LUN(s) on the RAID storage system.

- Install Secure Path V2.1 as described in the *SANworks Secure Path V2.1 for Sun Solaris Installation and Reference Guide*,

3.3 Automatic Configuration of Secure Path Devices (spconfig)

During the installation process, *spconfig* is automatically run to create and modify the Secure Path driver configuration files. For the simple case of 2 host adapters on the server, the *spconfig* utility runs and completes the configuration. For more complex cases, *spconfig* may not complete the configuration because there is an incomplete configuration or there are more than 2 adapters from which to choose.

If *spconfig* cannot configure the existing configuration, it raises an error status to the installation script. The installation will post a message that the *spconfig* utility must be run interactively before rebooting the server. This procedure is described in Chapter 4 of the *SANworks Secure Path V2.1 for Sun Solaris Installation and Reference Guide*, in the section titled *Responding to a Configuration Error*.

3.4 Secure Path on Solaris 7 – Only Supported in 32-bit Mode

- If the server has previously had a StorageWorks RAID system installed on Solaris 7 in 64-bit mode, you must set the FC adapter driver to boot in 32-bit mode. By default, the 64-bit Sbus adapter is configured to operate in 32-bit mode and changes are needed only if it had previously been set to run in 64-bit mode. Perform the following steps:

    1. Open the file */etc/system* with a text editor.

    2. Locate the StorageWorks edits marked by, **Start of CPQfcaw edits*

    3. Locate the line that reads *set fcaw:force32=1* If it has been commented out, uncomment it. (In this file, use the "*" character for the comment).

    4. Verify your edit, and save the */etc/system* file when you are finished.

    5. Shut down and reboot the system for the changes to take effect.

- If after installing Secure Path and rebooting the server, the targets are not visible using *format*, it is possible that the system has been booted in 64-bit mode. To verify this, issue the following command:

    ```
    # isainfo -b
    ```

    This will report the current bit-mode of the kernel, 32 or 64.

    If the kernel is in 64-bit mode, reboot the kernel in 32-bit mode using the following command:

    ```
    # reboot - "diskN kernel/unix"
    ```

If the kernel is in 32-bit mode, check the configuration. See Chapter 6 of the *SANworks Secure Path V2.1 for Sun Solaris Installation and Reference Guide* for details.

3.5 *spconfig* Error Messages

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

Error Message	Description	Corrective Action
Cannot have a Fabric target less than 16	*spconfig* believes that this server has more than 50 pairs of adapters to configure for Secure Path	Contact Compaq Support
No valid devices were found	*spconfig* is unable to find any devices connected to a RAID storage system in Multiple-bus mode with two paths and at least one LUN	Verify that all prerequisites stated in Chapter 4 of the *Secure Path V2.1 for Sun Solaris Installation and Reference Guide* have been met
Previous CPQswsp entries have been found in *sd.conf*	*spconfig* detects another version of Secure Path is installed	If Secure Path V2.0 is installed, install V2.1 using the **upgrade** switch for pkgadd, as noted in Section 3.1.
The CPQhsg80 package is not installed or has not been configured	*spconfig* is unable to locate the CPQhsg80 header in one of the Solaris configuration files. This message typically indicates that the StorageWorksV8.5 Solution Software for Solaris has not been installed	Verify that all prerequisites stated in Chapter 4 of the *Secure Path V2.1 for Sun Solaris Installation and Reference Guide* have been met
-p (*path*) not found or command line switches not passed properly.	An incorrect path or path command format was entered for the location of *sd.conf*	Verify that the correct command format containing the path is provided, as follows: **# /opt/CPQswsp/bin/spconfig –o –p /kernel/drv**
Out of Memory in *function_name*	Insufficient system memory exists for spconfig to build its required information structures.	Close unnecessary applications and/or reduce the number of concurrent users using memory. Invoke the *spconfig* command with the -o switch. See above.

continued

Error Message	Description	Corrective Action
Could not write *file_name* or *file_name* appears to be corrupted	Typically an indication that unexpected manual edits have been made to the file causing an inability to read or write. In rare cases, a corrupt file has been encountered.	Verify that the correct file entries have been made.
Invalid inquiry data was returned from /dev/rdisk link	*spconfig* found invalid data while building a data representation for the Secure Path devices	Verify that all prerequisites stated in Chapter 4 of the *Secure Path V2.1 for Sun Solaris Installation and Reference Guide* have been met
NULL buffer passed to function_name	*spconfig* found an internal inconsistency with the data representation of this configuration	Verify that all prerequisites stated in Chapter 4 of the *Secure Path V2.1 for Sun Solaris Installation and Reference Guide* have been met

4.0   OPERATING CONSTRAINTS

4.1 Limit on Number of Secure Path Devices

A maximum number of 128 Secure Path devices are supported per Solaris server.

4.2 Restriction on Using Secure Path Device as a Boot Device

Secure Path devices cannot be used as boot devices.

4.3 Solaris 2.7 Support

Secure Path on Solaris 7 is supported only in 32-bit mode.

4.4 Limit on Number of Paths per LUN

Only 2 paths per LUN on a RAID storage system are supported.

4.5 Per-instance Adapter Configuration

Secure Path V2.1 supports Fibre Channel Arbitrated Loop (FC-AL) mode and Fibre Channel Fabric (FC-SW) which requires a pair of host adapters. The pair of adapters must both be Sbus (fcaw) or PCI (fca-pci) adapters. Mixed host bus adapter configurations are not supported.

For multiple pairs of adapters on the same server, pairs of Sbus (fcaw) and pairs of PCI (fca-pci) are supported. Another way of stating this restriction: The same type of driver must be used for a Secure Path pair of adapters.

> **NOTE**
>
> The Compaq 32-bit Sbus Fibre Channel adapter (p/n DS-SWSA4-SB) is **not** supported in a Secure Path configuration.

4.6 Dynamic Reconfiguration Support

Solaris Dynamic Reconfiguration (DR) **is not supported** for Solaris V2.6 with Secure Path V2.1.

Solaris Dynamic Reconfiguration (DR) **is supported** for Solaris V2.7 with Secure Path V2.1.

4.7 Veritas Volume Manager

Veritas Volume Manager Version 3.0.2 is supported with Secure Path V2.1 for

Sun Solaris.

> ### IMPORTANT
>
> **IF Veritas Volume Manager is currently installed the procedures in Section 4.7.1 MUST be performed.**

> #### IMPORTANT NOTE
>
> **Veritas Volume Manager 2.5.1 and 2.6.1 are supported if DMP is disabled.**

The steps to disable DMP for VxVM are as follows:

```
# mv /kernel/drv/vxdmp /kernel/drv/DNRvxdmp
```

```
# mv /kernel/drv/vxdmp.conf /kernel/drv/DNRvxdmp.conf
```

```
# cd /dev/vx ; rm -rf dmp rdmp
```

```
# ln -s /dev/dsk dmp
```

```
# ln -s /dev/rdsk rdmp
```

Edit the file /etc/system and comment out the following entry:

```
forceload drv/vxdmp
```

Perform a reconfiguration boot, as follows:

```
# touch /reconfigure
```

```
# reboot
```

4.7.1 Installing SANworks Secure Path V2.1 when Veritas Volume Manager is Currently Installed

This release note assumes that the CPQhsg80 package for Sun Solaris version 8.5 is already installed and the HSG80 targets are under Veritas Volume Manager control. It is also assumed that the system is set up with a single Fibre Channel host bus adapter to RAID storage system configuration. To install Secure Path when Veritas Volume Manager is already installed, proceed as follows:

1. Start the Veritas Volume Manager Disk Administrator by entering:

    # **vxdiskadm**

2. Select Option 9, "Remove access to (deport) a disk group".

---

3. At the following prompt that appears, list all disk groups. Enter:

   Enter name of disk group [<group>,list,q,?] (default: list) **list**

4. At the next prompt, specify all disk groups that contain HSG units that are to be deported.

   Units to be deported may not exist in group *rootdg*. If unsure whether a unit is an HSG80 unit or not, use the format command and look at the device description.

   IMPORTANT NOTE: When prompted if you want to "Disable (offline) the indicated disks?" select "**yes**".

5. Power down the system, install the new adapter, and bring the system back up, as described in Chapter 3 of the *SANworks Secure Path v2.1 for Sun Solaris Installation and Reference Guide*.

6. Upon system reboot, start the Veritas Volume Manager Disk Administrator, using the command:

   # vxdiskadm

7. Select option 11, "Disable (offline) a disk device".

8. At the following prompt that appears, list all disk devices. Enter:

   Select a disk device to disable [<address>,list,q,?] **list**

9. At the next prompt that queries disk devices to disable (offline), specify all disk devices that contain HSG units that are to be disabled.

   In the example below, d0, d1 and d2 have been disabled (offlined).

DEVICE	DISK	GROUP	STATUS
c0t0d0	rootdisk	rootdg	online
c1t65d0	-	-	offline
c1t65d1	-	-	offline
c1t65d2	-	-	offline
c2t65d0	-	-	offline
c2t65d1	-	-	offline
c2t65d2	-	-	offline

10. Quit from the Veritas Volume Manager Disk Administrator

11. Install the Secure Path package according to the standard installation procedures defined in Chapter 4 of the *SANworks Secure Path v2.1 for Sun Solaris Installation and Reference Guide*.

12. Reboot the system with a configuration boot (per installation instructions).

13. Start the Veritas Volume Manager Disk Administrator using the command:

    # vxdiskadm

14. Select option 8, "Enable access to (import) a disk group".

15. At the following prompt that appears, list all disk groups. Enter:

    Enter name of disk group [<group>,list,q,?] (default: list) **list**

16. At the next prompt, import all device groups that were previously deported.

17. Quit from the Veritas Volume Manager Disk Administrator.

18. Ensure that the correct disks are under Veritas Volume Manager control by entering:

    # vxdisk list

The coexistence of Secure Path with Volume Manager is now established.

NOTE

If Secure Path for Sun Solaris is removed, this process must again be followed to ensure access to Veritas Volume Manager controlled volumes and proper operation of the Sun Solaris server.

4.7.2 Possible Error Messages

There is a competition between the startup of Secure Path and Volume Manager configuration daemon.

Volume Manager will start up without errors as long as one disk configured in *rootdg* is not a Secure Path device.

However, if Volume Manager is configured with Secure Path devices only, messages similar to the following will be displayed on the console during boot:

```
VXVM STARTING IN BOOT MODE...
VXVM:VXCONFIGD: ERROR: ENABLE FAILED: ERROR IN DISK GROUP
CONFIGURATION COPIES
NO VALID DISK FOUND CONTAINING DISK GROUP; TRANSACTIONS ARE DISABLED.
VXVM:VXCONFIGD: FATAL ERROR: ROOTDG CANNOT BE IMPORTED DURING BOOT
 .
 .
 .
```

```
VXVM GENERAL STARTUP...
VXVM:VXCONFIGD: ERROR: ENABLE FAILED: ERROR IN DISK GROUP
CONFIGURATION COPIES
NO VALID DISK FOUND CONTAINING DISK GROUP; TRANSACTIONS ARE DISABLED.
VXVM: VOLD IS NOT ENABLED FOR TRANSACTIONS
NO VOLUMES STARTED
VXVM:VXRECOVER: ERROR: IPC FAILURE: CONFIGURATION DAEMON IS NOT
ACCESSIBLE
```

Once Volume Manager completes its startup process, enable Secure Path devices by issuing the following commands:

```
# vxdctl enable
# vxdg import disk_group
# xvvol -g disk_group startall
```

Repeat the last two commands for each disk group.

4.8 SPMT Considerations

When using the Secure Path Management Tool, *spmt*, there are two important considerations:

1. Some of the operations that may be performed with *spmt* will not complete immediately. If */opt/CPQswsp/bin/ldinfo* is invoked, it is possible that the device state changes have not completed and invalid information will be displayed. It is recommended that a grace period of 15 seconds be allowed for changes to fully be effected. This time allotment should be adjusted for systems with heavy I/O and a large number of LUNs.

2. It is possible to issue consecutive commands that will require the RAID controllers to be manually reset. One such combination is to shutdown this using the cli command to a target (**spmt cli –t N shutdown this**) and then attempt to shutdown another target with the same command (**spmt cli –t M shutdown this**). All *spmt* command are documented in Chapter 5 of the SANworks Secure Path V2.1 for Sun Solaris *Installation and Reference Guide.*

4.9 Partitioned Storage Sets

While each partition of a partitioned storage set is identified and defined as other units on the RAID storage system, the HSG80 controller imposes a restriction that **all partitions must be assigned to the same controller and the same host.**

Under Secure Path, if partitions (units) have a preferred path set at the controller, then all such partitions must have the same preferred path as the failover and failback events will apply to all partitions in that same storage set.

5.0   KNOWN PROBLEMS

5.1 Removal of Unused /dev/*dsk Entries

A prerequisite for the installation of Secure Path is that at least one LUN is visible from two paths (one path per adapter) through the Solutions Software for SUN Solaris. When the server defines the paths, device files in /dev/dsk and /dev/rdsk are created pointing to the specific c*X*t*Y*d*Z*.

When a Secure Path fresh installation is completed, and the reconfigure boot is performed, the /dev/dsk and /dev/rdsk files are removed by the Solaris as they are Secure Path targets and no longer Solution Software targets.

Under Solaris V2.6, the /dev/*dsk file cleanup is performed correctly.

> **Under Solaris V2.7, the /dev/*dsk cleanup is not performed at all.**
>
> When the system has booted, and *format* is used to list the current devices, the display may show any combination of the old c*X*t*Y*d*Z* and Secure Path targets with the pseudo/ldLite identification. It appears that some or all of the Secure Path targets have not been created.
>
> <u>Corrective action</u>: **Issue the following command to remove the extraneous device files. # /opt/CPQswsp/bin/rmnodev**
>
> Perform a configuration reboot and use *format* to verify that all targets of Secure Path are visible.

5.2 CCL Device Automatically Configured by *spconfig*

The Command Console LUN (CCL) is used by the server to communicate with the storage system. For the HSG80, it is a virtual LUN that can relocate itself as necessary on the RAID system.

The CCL may be in one of two states at the controller: Enabled or Disabled. In Compaq platform kits for Sun Solaris installations, it is recommended to disable the CCL. This is because the CCL is neither readable nor writeable for normal I/O and *format* will be unable to label it. However, it is available for inquiry at a code/program level.

In the Secure Path implementation, if the CCL is enabled, an entry for the CCL is created in two configuration files documented in Chapter 6 of the Installation and Reference Guide. The files: */kernel/drv/ldLite.conf* and *mda.conf* will contain entries for the CCL and have the form, WWPN plus the string " -4853-4738-3043-434C". These entries are added to each file but commented out.

If this installation has a user-written application that performs inquires directly to the controller under program control, then the entries should be uncommented and the system rebooted with a configuration boot.

NOTE

If this installation has a user-written application that uses the CCL, adding or deleting units on the subsystem may cause the CCL to move to another LUN. Adjustments must be made to the *ldLite.conf*, *mda.conf* and possibly the *sd.conf* file to reflect this change.

USE HSG80> SHOW THIS_CONTROLLER and HSG80> SHOW OTHER_CONTROLLER to verify the LUN ID of the CCL.

5.3 Completing the Removal of Secure Path

- Removing Secure Path Device Files

    During the installation and configuration of the Secure Path software, a new set of device files are created in the */dev/dsk* and */dev/rdsk* directories.

    After the package remove process, these files remain in both areas. These files will be removed if the server is re-booted as follows:

    ```
    # touch /reconfigure
    ```

    ```
    # reboot
    ```

    An alternate method is to visit each directory area and using

    ```
    # ls -l | grep  "pseudo/ldLite"
    ```

    to identify the device files that were created by Secure Path. These device files will be of the form c*X*t*Y*d*Z* and when the controller is identified (X is 3 for example) the files may be removed with

    ```
    # rm /dev/[r]dsk/c3*
    ```

    or

    ```
    # rm /dev/dsk/c3*  and  # rm /dev/rdsk/c3*
    ```

6.0   AVOIDING PROBLEM SITUATIONS

6.1 Create Only Two Paths to a RAID Storage Unit

WARNING: Secure Path requires that **only two** paths exist from the server to the LUN on the RAID storage system. Should a configuration be constructed such that more than two paths are available to the Secure Path implementation, the system will panic on reboot.

Corrective Action:

- Under Solaris V2.6: Boot from another device (another disk or an Installation CD), mount the disk with the failed Secure Path installation and delete the file */kernel/drv/mda.conf*

- Under Solaris V2.7: Boot the system in 64-bit mode and delete the file */kernel/drv/mda.conf*

Correct the configuration and verify that only two paths exist to each of the LUNs on the RAID storage system.

- Remove Secure Path (**# pkgrm CPQswsp**)

- Invoke the Sun Solaris Solutions V8.5 configurator, **install_dir**/steam/bin/config.sh and regenerate entries for the adapters that will be used in Secure Path. This action will regenerate the entries in **/kernel/drv/sd.conf**

- Reboot with a reconfigure and verify that only two paths exist from adapters to the LUN(s) on the RAID storage system.

- Install Secure Path V2.1 as described in the *SANworks Secure Path V2.1 for Sun Solaris Installation and Reference Guide*,

6.2 Adding and Deleting LUNs

When LUNs are added or removed on the RAID storage system after Secure Path has been initially configured, the Secure Path configuration files must be edited to reflect the change. Full details are provided in Chapter 4 of the *SANworks Secure Path V2.1 for Sun Solaris Installation and Reference Guide*.

7.0   SHARED STORAGE CONFIGURATIONS

7.1 Instructions for Shared Storage Configurations that include Secure Path and Selective Storage Presentation.

In this Release Note, the majority of the configurations are implemented with Secure Path for Solaris as a means of creating a fully redundant, failover tolerant system. These configurations are designed to employ the Selective Storage Presentation (SSP) features of the HSG80 Array Controller Software (ACS) allowing the sharing of storage by multiple servers.

Secure Path for Solaris engineering did not consider these capabilities during the design and implementation of V2.1 of Secure Path for Solaris. As a result, two of the features of SSP that are used to enable multiple servers to share storage must be **manually** implemented for each of the configurations that require Secure Path. These features are **connection** OFFSETs and **unit** ENABLE_ACCESS_PATHs.

7.1.1 UNITs vs. LUNs

The terms *unit* and *LUN* are often confused and/or used interchangeably.

On a RAID array, the controller supports **units**. Units are created under the HSG80 controller and are identified as D*n,* where *n* is a value in the range of 0-199. Thus, units of D0 or D23 or D190 may be created on the RAID array. Units are references to the storage entities at the RAID array from the controller point of view.

Since multiple RAID arrays may have identical unit names, e.g. D12, the HSG80 controller assigns a unique identification for each storage device. The unique storage device has a 32 character hexadecimal value (e.g. 6000-1FE1-0001-ED10-0009-9281-0311-0001). This designation is called a *LUN ID* by the HSG80 controller. This exception will be explicitly noted in the discussion.

From the server side, however, the storage entity is a logical unit number or LUN. The server's view has LUNs 0, 1, 2 for example, but this does not necessarily mean that they are mapped to D0, D1, D2 on the RAID array. The actual mapping is dependent on the configuration that has been created and the server's view of it.

The term **unit** will refer to the entity on the RAID array while the term **LUN** will refer to the logical unit number as seen from the server.

7.1.2 Connection OFFSETs

By default, connections are established when a path is completed from a HBA to a port on the HSG80 controller. For each path, there is one connection established in a connection table within the HSG80. By default, the controller assigns zero (0) as the connection starting point for units on the RAID Array. In other words, in the case of multiple connections, all are assigned, by default, a connection offset of 0.

A user may change this "view starting point" by setting an offset on a connection. By this we mean defining a value greater then 0. For the first server, *server1* we retain the default of 0 and for another, *server2*, we can define an offset of 50. *Server1* will see all Units from 0 and above while *server 2* will see units from 50 and above. While this offset assignment provides separation for the two servers, there are units that can be seen by both servers, those above 50.

The true power of offsets is to allow multiple systems to share storage and identify the same set of LUNs from the server side. This is accomplished by the connection offset being subtracted from the unit being presented to the connection.

For example, if a connection is assigned an offset of 10, and presented units D10, D11, D12 and D13, the server will see LUN 0, 1, 2, 3 on that connection. Thus four non-clustered servers may use connection offsets of 10, 20, 30, and 40 to define LUNs of 0, 1, 2, 3 when the controller is configured with units as follows:

server1 - Units D10, D11, D12, D13   with offset 10 yields LUNs of 0,1, 2, 3

server2 - Units D20, D21, D22, D23   with offset 20 yields LUNs of 0,1, 2, 3

server3 - Units D30, D31, D32, D33   with offset 30 yields LUNs of 0,1, 2, 3

server4 - Units D40, D41, D42, D43   with offset 40 yields LUNs of 0,1, 2, 3

7.1.3 Unit ENABLE_ACCESS_PATH

By default, units may be seen by all connections with the exception of those that are not in the view starting point (i.e., offset). In the example above, server1 had visibility to all units from 10 and above, server2 had visibility units from 20 and above, and so on.

ENABLE_ACCESS_PATH is another Selective Storage Presentation feature that provides a stricter mechanism, allowing a unit to be accessed by as few as one connection or as many as all connections.

ENABLE_ACCESS_PATH allows the installer/maintainer to specify which connection(s) may have access to specific units. The ENABLE_ACCESS_PATH setting grants or denies a connection name access to the unit of the RAID array.

So, if we want to restrict access for a unit to a specific server, we must know its connection(s) and assign that access accordingly. Each connection name is associated with the HBA identification and port on the HSG80 controller. It is highly recommended that installers rename connections using the node name or other unique designations for easy identification and maintenance.

Using the connection name, we can ENABLE_ACCESS or DISABLE_ACCESS_PATH to each and every unit on the RAID array. Note that prior to changing ACCESS_PATHs, it is necessary to clear all existing ENABLE_ACCESS_PATH assignments with the CLI command:

HSG80> **SET Dn DISABLE_ACCESS_PATH = all**

For example, we may have connections to/from four servers. The connection names have been changed from the defaults to: SERVER1, SERVER2, SERVER3, SERVER4

We may have offsets on the connections but offsets simply relocate zero for us from the server's point of view.

We have units D12, D22, D32, D42, D43.

We can add ACCESS control as follows:

HSG80> **SET D12 DISABLE_ACCESS_PATH = all**
HSG80> **SET D12 ENABLE_ACCESS_PATH = SERVER1**

HSG80> **SET D22 DISABLE_ACCESS_PATH = all**
HSG80> **SET D22 ENABLE_ACCESS_PATH = SERVER2**

HSG80> **SET D32 DISABLE_ACCESS_PATH = all**

HSG80> **SET D32 ENABLE_ACCESS_PATH = SERVER3**

HSG80> **SET D42 DISABLE_ACCESS_PATH = all**
HSG80> **SET D42 ENABLE_ACCESS_PATH = SERVER4, SERVER1**

HSG80> **SET D43 DISABLE_ACCESS_PATH = all**
HSG80> **SET D43 ENABLE_ACCESS_PATH = ALL**

From the access controls placed on the units, we see that D12, D22, D32 allow only one server to access each unit exclusively. Unit D42 allows two servers access to it and D43 allows all servers to access it.

7.1.4 Applying OFFSETS and ENABLE_ACCESS_PATH to Secure Path Shared Storage Configurations

When the configurator for Secure Path is invoked, it examines all the units that are configured on the HSG80 system(s). If the unit is part of a storage system in multiple-bus mode, regardless of the state of OFFSETS or ENABLE_ACCESS_PATHs, it includes that unit as part of the configuration. Thus, the configuration files will contain entries for all units, without OFFSETS and without regard for the ACCESS controls placed on the units.

The configuration files created by the Secure Path installation are:

/kernel/drv/mda.conf and **/kernel/drv/ldLite.conf**

The configuration file that the Solaris OS provides for the sd driver is:

/kernel/drv/sd.conf

Sample configuration files are shown below and will be used as the starting point for changes that will be made manually in the discussion.

7.1.5 Sample Configuration Files

/kernel/drv/mda.conf

This file contains entries of two hardware paths to each unit. These paths are distinguished by the parent parameter, which identifies each adapter and the target value.

```
# Compaq SANworks Secure Path
# mda.conf - Hardware Configuration file for mda driver
#
#       name            "mda"                   - required
#       parent          restrict parent HBA
#       target          SCSI target-ID
#       lun             SCSI logical unit number
#       qdepth          depth of command queue (1,..,64)
#
# MDA will only attach device instances for Compaq SANworks HSGx0
# disk array targets.
#
#
# First Paths
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=0 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=1 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=2 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=3 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=4 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=5 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=6 qdepth=32;

 … intervening entries removed for readability …

name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=60 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=61 qdepth=32;


# Second Paths
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=0 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=1 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=2 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=3 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=4 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=5 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=6 qdepth=32;
```

… intervening entries removed for readability …

```
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=60 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=61 qdepth=32;
```

/kernel/drv/ldLite.conf

This file contains a mapping of a target value assigned to each UNIT (Called a LUN ID at the controller) as defined by the storage system controllers.

Each targ**N**-devName value is a pointer to a sd.conf entry for SCSI binding. The value of **N** maps to the same entry in the sd.conf file for the SCSI class driver.

```
# Compaq SANworks Secure Path
# ldLite.conf - Configuration file for ldLite driver
#
name="ldLite" parent="pseudo" class="scsi" instance=0;

# Specify the target number assigned to Secure Path devices.
# Each entry in this file is terminated by a semi-colon and is
# of the form:
#
# targ<num>-devName = "nnnn-nnnn-nnnn-nnnn-nnnn-nnnn-nnnn-nnnn";
#
# where
#    <num> is the target number assigned to this device
#    "nnnn-nnnn-..." is the LUN_ID of the unit as reported by the Array
#
# example:
# targ9-devName = "6000-1FE1-0001-6A70-0009-9200-4671-0007";
#
targ0-devName       = "6000-1FE1-0005-B470-0009-9500-5030-001B"; # D0
targ1-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0014"; # D1
targ2-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0013"; # D2
targ3-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0016"; # D3
targ4-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0017"; # D4
targ5-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0018"; # D5
targ6-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0019"; # D6

**********************************************************************
targ7-devName is not used. 7 is reserved for the SCSI initiator This
forces the numbering between targN value and the unit number to be off
count by 1 in our example.

However, if the units on the RAID array were not created in consecutive
integer order, D1, D2, etc then targN values would reflect first,
second, third, fourth, etc. units of the RAID array. For example, if
D21, D34, D37, D53 were the only units created, then the ldLite.conf
entries would appear as:

targ0-devName       = "6000-1FE1-0005-B470-0009-9500-5030-001B"; # D21
targ1-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0014"; # D34
targ2-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0013"; # D37
targ3-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0016"; # D53
**********************************************************************
```

```
targ8-devName        = "6000-1FE1-0005-B470-0009-9500-5530-0020"; # D7
targ9-devName        = "6000-1FE1-0005-B470-0009-9500-5530-0021"; # D8
```

… intervening entries removed for readability …

```
targ61-devName       = "6000-1FE1-0005-B470-0009-9500-5530-004F"; # D60
targg62-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0048"; # D61
```

/kernel/drv/sd.conf

This configuration file contains entries for all SCSI class devices. By default, the
file contains entries of 0-6 and 7-15 as 7 is reserved for the SCSI initiator. When
Secure Path is installed and the number of LUNs exceeds the entries of sd.conf,
extra entries are added to provide target/LUN bindings.

The sd.conf file with the added Secure Path entries is shown below. From our
example, Secure Path would add entries for targ16 through targ61 as Secure Path
devices.

```
#
# Copyright (c) 1992, by Sun Microsystems, Inc.
#
#ident "@(#)sd.conf 1.8   93/05/03 SMI"
name="sd" class="scsi" target=0 lun=0;
name="sd" class="scsi" target=1 lun=0;
name="sd" class="scsi" target=2 lun=0;
name="sd" class="scsi" target=3 lun=0;
name="sd" class="scsi" target=4 lun=0;
name="sd" class="scsi" target=5 lun=0;
name="sd" class="scsi" target=6 lun=0;
name="sd" class="scsi" target=8 lun=0;
name="sd" class="scsi" target=9 lun=0;
name="sd" class="scsi" target=10 lun=0;
name="sd" class="scsi" target=11 lun=0;
name="sd" class="scsi" target=12 lun=0;
name="sd" class="scsi" target=13 lun=0;
name="sd" class="scsi" target=14 lun=0;
name="sd" class="scsi" target=15 lun=0;

# CPQswsp: start of Secure Path edits. Caution: do not remove!
This line is used  by pkgadd/pkgrm.
name="sd" parent="/pseudo/ldLite@0" target=16 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=17 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=18 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=19 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=20 lun=0;
```

… intervening entries removed for readability …

```
name="sd" parent="/pseudo/ldLite@0" target=59 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=60 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=61 lun=0;
# CPQswsp: end of Secure Path edits. Caution: do not remove! This
line is used by pkgadd/pkgrm.
```

7.1.6 Editing mda.conf , ldLite.conf and sd.conf

The recommended method is to first revise the mda.conf for ACCESS control. If, for example, the server is to have access to the last 16 units on the RAID array, (D46-D61) then all entries in each file that are not for D46 - D61 are deleted. The updated files are shown below.

mda.conf - modified for ACCESS control

```
 # Compaq SANworks Secure Path
# mda.conf - Hardware Configuration file for mda driver
#
#       name            "mda"                   - required
#       parent          restrict parent HBA
#       target          SCSI target-ID
#       lun             SCSI logical unit number
#       qdepth          depth of command queue (1,..,64)
#
# MDA will only attach device instances for Compaq SANworks HSGx0
# disk array targets.
#
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=46 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=47 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=48 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=49 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=50 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=51 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=52 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=53 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=54 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=55 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=56 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=57 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=58 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=59 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=60 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=61 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=46 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=47 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=48 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=49 qdepth=32;
```

```
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=50 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=51 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=52 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=53 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=54 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=55 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=56 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=57 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=58 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=59 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=60 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=61 qdepth=32;
```

/kernel/drv/ldLite.conf - modified for ACCESS control

Recall that the server has access to units D46 through D61 while targ**N** values in
ldLite may not map identically to each unit value. Carefully inspect and remove
the unneeded entries.

```
# Compaq SANworks Secure Path
# ldLite.conf - Configuration file for ldLite driver
#
name="ldLite" parent="pseudo" class="scsi" instance=0;

# Specify the target number assigned to Secure Path devices.
# Each entry in this file is terminated by a semi-colon and is
# of the form:
#
# targ<num>-devName = "nnnn-nnnn-nnnn-nnnn-nnnn-nnnn-nnnn-nnnn";
#
# where
#     <num> is the target number assigned to this device
#     "nnnn-nnnn-..." is the LUN_ID of the unit as reported by the Array
#
# example:
# targ9-devName = "6000-1FE1-0001-6A70-0009-9200-4671-0007";
#
targ47-devName      = "6000-1FE1-0005-B470-0009-9500-5530-003A"; # D46
targ48-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0042"; # D47
targ49-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0043"; # D48
targ50-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0044"; # D49
targ51-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0045"; # D50
targ52-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0046"; # D51
targ53-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0047"; # D52
targ54-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0041"; # D53
targ55-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0049"; # D54
targ56-devName      = "6000-1FE1-0005-B470-0009-9500-5530-004A"; # D55
targ57-devName      = "6000-1FE1-0005-B470-0009-9500-5530-004B"; # D56
targ58-devName      = "6000-1FE1-0005-B470-0009-9500-5530-004C"; # D57
targ59-devName      = "6000-1FE1-0005-B470-0009-9500-5530-004D"; # D58
targ60-devName      = "6000-1FE1-0005-B470-0009-9500-5530-004E"; # D59
targ61-devName      = "6000-1FE1-0005-B470-0009-9500-5530-004F"; # D60
targ62-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0048"; # D61
```

The second step is to adjust the mda.conf entries for the OFFSET value on the two connections. (Both connections must have the same OFFSET value if the server is to have a correct view of the LUNs). In this example, we shall assume that the OFFSET value is 40.

Since the offset value is 40, we must subtract that value from the LUN value in mda.conf. For example, for the first entry of mda.conf, the LUN value was 46. Since Secure Path did not honor the OFFSET value of 40, we must make the adjustment.

Before OFFSET is applied.

```
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=46 qdepth=32;
```

After OFFSET is applied.

```
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=6 qdepth=32;
```

This same adjustment is done for all mda.conf entries as shown below.

```
# Compaq SANworks Secure Path
# mda.conf - Hardware Configuration file for mda driver
#
#       name              "mda"                    - required
#       parent            restrict parent HBA
#       target            SCSI target-ID
#       lun               SCSI logical unit number
#       qdepth            depth of command queue (1,..,64)
#
# MDA will only attach device instances for Compaq SANworks HSGx0
# disk array targets.
#
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=6 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=7 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=8 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=9 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=10 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=11 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=12 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=13 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=14 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=15 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=16 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=17 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=18 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=19 qdepth=32;
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=20 qdepth=32;
```

```
name="mda" parent="/sbus@f,0/fcaw@0,0" target=125 lun=21 qdepth=32;

name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=6 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=7 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=8 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=9 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=10 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=11 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=12 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=13 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=14 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=15 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=10 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=17 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=18 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=19 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=20 qdepth=32;
name="mda" parent="/sbus@b,0/fcaw@0,0" target=124 lun=21 qdepth=32;
```

/kernel/drv/sd.conf - extra entries removed

Since our server has access to units D46 to D61, we would remove the unused
entries that were added by Secure Path. The corrected set of entries are shown
below. Note that the header and trailer lines of "CPQswsp…" are preserved for
package removal, *pkgrm.*

```
#
# Copyright (c) 1992, by Sun Microsystems, Inc.
#
#ident      "@(#)sd.conf      1.8   93/05/03 SMI"
name="sd" class="scsi" target=0 lun=0;
name="sd" class="scsi" target=1 lun=0;
name="sd" class="scsi" target=2 lun=0;
name="sd" class="scsi" target=3 lun=0;
name="sd" class="scsi" target=4 lun=0;
name="sd" class="scsi" target=5 lun=0;
name="sd" class="scsi" target=6 lun=0;
name="sd" class="scsi" target=8 lun=0;
name="sd" class="scsi" target=9 lun=0;
name="sd" class="scsi" target=10 lun=0;
name="sd" class="scsi" target=11 lun=0;
name="sd" class="scsi" target=12 lun=0;
name="sd" class="scsi" target=13 lun=0;
name="sd" class="scsi" target=14 lun=0;
name="sd" class="scsi" target=15 lun=0;

# CPQswsp: start of Secure Path edits. Caution: do not
remove! This line is used by pkgadd/pkgrm.

name="sd" parent="/pseudo/ldLite@0" target=47 lun=0;
```

```
name="sd" parent="/pseudo/ldLite@0" target=48 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=49 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=50 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=51 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=52 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=53 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=54 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=55 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=56 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=57 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=58 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=59 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=60 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=61 lun=0;
name="sd" parent="/pseudo/ldLite@0" target=62 lun=0;

# CPQswsp: end of Secure Path edits. Caution: do not remove! This line
is used by pkgadd/pkgrm.
```

7.1.6 Multiple Servers

For each server sharing the same storage, each with ACCESS control and OFFSETs, the same process is applied to each server's mda.conf, ldLite.conf and sd.conf files.

In mda, the parent strings will reflect the different adapters on each server. The ldLite.conf values will be identical for all servers as those are controller defined.

The initial values for each Server are listed in the table below. The updated configuration files for each Server are then listed. Updates to `/kernel/drv/sd.conf` are not shown. Note that Server #4 was used in the discussion above and is not repeated in the display below. The headers for each file have been removed for readability.

The changes have been made are to the existing configuration files at each server. Additionally, since each server see a small number of target/LUNS, it is possible to renumber the entries in the ldLite.conf file and then renumber (if necessary) the set of values in sd.conf. For example, the first entry in ldLite.conf of:

```
targ47-devName="6000-1FE1-0005-B470-0009-9500-5530-003A"; # D46
```

could be renumbered to:

```
targ0-devName="6000-1FE1-0005-B470-0009-9500-5530-003A"; # D46
```

and the corresponding entry in sd.con:

```
name="sd" parent="/pseudo/ldLite@0" target=47 lun=0;
```

could be renumbered to:

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

This document has shown the existing file entries as a consistent view from all four servers and only OFFSETs and ENABLE_ACCESS_PATHs have been shown.

Server Number	Connection Offset Value	Unit by Connection Access control
1	0 (the default)	D0 - D14
2	15	D15 - D30
3	30	D31 - D45
4	40	D46 - D61

Server #1 Access D0-D14; Offset = 0

```
# mda.conf entries
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=0 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=1 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=2 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=3 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=4 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=5 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=6 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=7 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=8 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=9 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=10 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=11 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=12 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=13 qdepth=32;
name="mda" parent="/sbus@2,0/fcaw@0,0" target=125 lun=14 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=0 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=1 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=2 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=3 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=4 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=5 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=6 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=7 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=8 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=9 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=10 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=11 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=12 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=13 qdepth=32;
name="mda" parent="/sbus@6,0/fcaw@0,0" target=124 lun=14 qdepth=32;
```

```
# ldLite.conf entries
targ0-devName       = "6000-1FE1-0005-B470-0009-9500-5030-001B"; # D0
targ1-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0014"; # D1
targ2-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0013"; # D2
targ3-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0016"; # D3
targ4-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0017"; # D4
targ5-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0018"; # D5
targ6-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0019"; # D6
targ8-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0015"; # D7
targ9-devName       = "6000-1FE1-0005-B470-0009-9500-5530-001B"; # D8
targ10-devName      = "6000-1FE1-0005-B470-0009-9500-5030-0027"; # D9
targ11-devName      = "6000-1FE1-0005-B470-0009-9500-5530-001A"; # D10
targ12-devName      = "6000-1FE1-0005-B470-0009-9500-5530-001D"; # D11
targ13-devName      = "6000-1FE1-0005-B470-0009-9500-5530-001E"; # D12
targ14-devName      = "6000-1FE1-0005-B470-0009-9500-5530-001F"; # D13
targ15-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0020"; # D14
```

Server #2 Access D15-D30; Offset = 15

```
# mda.conf entries
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=0 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=1 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=2 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=3 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=4 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=5 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=6 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=7 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=8 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=9 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=10 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=11 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=12 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=13 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=14 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@5" target=125 lun=15 qdepth=32;

name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=0 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=1 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=2 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=3 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=4 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=5 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=6 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=7 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=8 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=9 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=10 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=11 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=12 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=13 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=14 qdepth=32;
name="mda" parent="/pci@1f,4000/fibre-channel@4" target=124 lun=15 qdepth=32;
```

```
# ldLite.conf entries
(Note: The targ values could be renumbered from 0 to 17.
       The sd.conf entries would then have to be adjusted.
targ16-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0021"; # D15
targ17-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0022"; # D16
targ18-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0023"; # D17
targ19-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0024"; # D18
targ20-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0026"; # D19
targ21-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0027"; # D20
targ22-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0028"; # D21
targ23-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0029"; # D22
targ24-devName      = "6000-1FE1-0005-B470-0009-9500-5530-002A"; # D23
targ25-devName      = "6000-1FE1-0005-B470-0009-9500-5530-002B"; # D24
targ26-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0025"; # D25
targ27-devName      = "6000-1FE1-0005-B470-0009-9500-5530-002D"; # D26
targ28-devName      = "6000-1FE1-0005-B470-0009-9500-5530-002E"; # D27
targ29-devName      = "6000-1FE1-0005-B470-0009-9500-5530-002F"; # D28
targ30-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0030"; # D29
targ31-devName      = "6000-1FE1-0005-B470-0009-9500-5530-0031"; # D30
```

Server #3 Access D31-D45; Offset = 30

```
# mda.conf entries
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=1 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=2 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=3 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=4 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=5 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=6 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=7 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=8 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=9 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=10 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=11 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=12 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=13 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=14 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@2" target=125 lun=15 qdepth=32;

name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=1 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=2 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=3 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=4 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=5 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=6 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=7 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=8 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=9 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=10 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=11 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=12 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=13 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=14 qdepth=32;
name="mda" parent="/pci@1f,5000/fibre-channel@3" target=124 lun=15 qdepth=32;
```

```
#ldLite.conf entries
(Note: The targ values could be renumbered from 0 to 15.
       The sd.conf entries would then have to be adjusted.
targ32-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0032"; # D31
targ33-devName       = "6000-1FE1-0005-B470-0009-9500-5530-002C"; # D32
targ34-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0034"; # D33
targ35-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0035"; # D34
targ36-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0036"; # D35
targ37-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0037"; # D36
targ38-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0038"; # D37
targ39-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0039"; # D38
targ40-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0033"; # D39
targ41-devName       = "6000-1FE1-0005-B470-0009-9500-5530-003B"; # D40
targ42-devName       = "6000-1FE1-0005-B470-0009-9500-5530-003C"; # D41
targ43-devName       = "6000-1FE1-0005-B470-0009-9500-5530-003D"; # D42
targ44-devName       = "6000-1FE1-0005-B470-0009-9500-5530-003E"; # D43
targ45-devName       = "6000-1FE1-0005-B470-0009-9500-5530-003F"; # D44
targ46-devName       = "6000-1FE1-0005-B470-0009-9500-5530-0040"; # D45
```

Server #4 Access D46-D61; Offset = 40

```
Server #4 was used in the discussion example.
```