

**RA8000/ESA12000 and
MA8000/EMA12000 Solution
Software V8.5b for Sun Solaris**

Installation Reference Guide

Sixth Edition (April 2000)
Part Number AA-RFBQF-TE
Compaq Computer Corporation

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RA8000/ESA12000 and MA8000/EMA12000 Solution Software V8.5b for Sun Solaris Installation
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About This Guide

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

Text Conventions

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

Keys	Keys appear in boldface. A plus sign (+) between two keys indicates that they should be pressed simultaneously.
USER INPUT	User input appears in a different typeface and in uppercase.
<i>FILENAMES</i>	File names appear in uppercase italics.
Menu Options, Command Names, Dialog Box Names	These elements appear in initial capital letters.
COMMANDS, DIRECTORY NAMES, and DRIVE NAMES	These elements appear in uppercase.
Type	When you are instructed to <i>type</i> information, type the information without pressing the Enter key.
Enter	When you are instructed to <i>enter</i> information, type the information and then press the Enter key.

Symbols in Text

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



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



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

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

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

Symbols on Equipment

These icons may be located on equipment in areas where hazardous conditions may exist.



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

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



Any RJ-45 receptacle marked with these symbols indicates a Network Interface Connection.

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



Any surface or area of the equipment marked with these symbols indicates the presence of a hot surface or hot component. If this surface is contacted, the potential for injury exists.

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



Power Supplies or Systems marked with these symbols indicate the equipment is supplied by multiple sources of power.

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

Rack Stability



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

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

Getting Help

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

Compaq Technical Support

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

In North America, call the Compaq Technical Phone Support Center at 1-800-OK-COMPAQ¹. This service is available 24 hours a day, 7 days a week.

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

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

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

Compaq Website

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

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

Compaq Authorized Reseller

For the name of your nearest Compaq Authorized Reseller:

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

Installing StorageWorks Solution Software V8.5b on your Host System

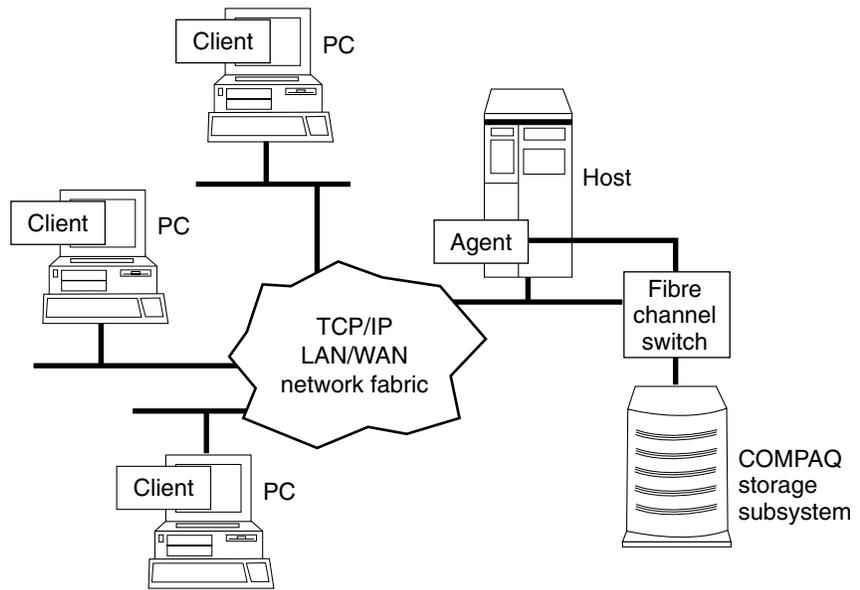
This chapter describes how to install StorageWorks Solution Software V8.5 on your Sun Server, and configure the Command Console Agent.

1.1 Introducing the SWCC Agent and Client

StorageWorks Command Console (SWCC) Agent is a companion application to the StorageWorks Command Console (SWCC) Client graphical user interface (GUI) program. The Agent serves as the Client's assistant in configuring, operating, and monitoring your storage subsystems. The Agent connects to SWCC Client sessions via the TCP/IP network protocol, as shown in Figure 1-1.

The Agent can also be used as a standalone application without the SWCC Client. In this mode of operation, the SWCC Agent monitors the status of the subsystems and provides local and remote notification in the event of a failure. Local notification can be via email and/or the Syslog facility. Remote notification can be made via SNMP messages to an SNMP Monitor application. In the absence of the SWCC Client, RAID system configuration must be done through the terminal port using the Command Line Interpreter (CLI).

The SWCC Agent is loaded on your system as part of the RAID Manager (CPQhsg80) software package.



CX07220

Figure 1-1. Command console client/agent connection

1.1.1 Minimum Requirements

Before installing the StorageWorks Solution Software, verify that your host system meets the minimum requirements detailed in Table 1-1.

Table 1-1
Minimum System Requirements

Host Feature	Requirement
Platform	SPARC, Ultra SPARC
Architectures	4m (S10 and S20 only), 4d, 4u
Operating System	Solaris 2.6, 2.7 (32-bit mode), 2.7 (64-bit mode)
Free Disk	500KB, before any log files

continued

Table 1-1
Minimum System Requirements *continued*

Host Feature	Requirement
Fibre Channel (FC) Adapter	Compaq/JNI FC-1063 (SWSA4-SB) or Compaq/JNI FC64-1063 (SWSA4-SC) or Compaq/JNI FCI-1063 (SWSA4-PC)
SCSI Adapters (optional)	Compaq/PTI SBS450, Sun X1065A, Sun X6541A
Controller	HSG80 Array Controller operating Firmware ACS Version 8.5

NOTE: This release of the RA8000/ESA12000 and MA8000/EMA12000 has been qualified with the following Sun Solaris patches installed:

Version	Patch Number	Patch Description
2.6	106226-01	format
	105600-07	isp
	105181-16	kernel
	106125-05	patchadd
2.7	108148-01	prtconf
	106541-07	kernel
	107544-02	fsck

1.2 Installing and Configuring Your RAID System

The following steps are intended as a basic overview for installing your RAID system. Some steps have more detailed instructions and you will be directed where to find this information within this chapter or guide.

1. Install a supported Fibre Channel (FC) adapter in your Sun SPARC system. Refer to Table 1-1 for a list of supported adapters, and refer to the adapter manual for installation procedures.

2. Unpack your RAID system and install the PCMCIA cards in the controllers.

NOTE: This release of Solution Software requires ACS version 8.5 software.

3. Power ON your RAID system and allow the cache batteries to charge before proceeding.
4. Connect your Sun system (or PC) to the RAID Array's maintenance (RS-232) port and configure your RAID Array using the Command Line Interpreter (CLI). You may also create storagesets for data storage at this time. For details on making this connection, refer to Sections 1.2.2 through 1.2.4 of this chapter. For further discussions of creating storagesets using the CLI, see Chapter 3 of this guide.
5. Cable the Fibre Channel adapter and RAID Array to the switch(es). Refer to *Appendix C* of this guide for basic switch setup instructions.
6. Reboot the Sun SPARC system.
7. Load the StorageWorks Solutions Software and configure your adapter/port bindings. If you will be using the SWCC Agent and Client, you should also configure your SWCC Agent at this time. For more information on installing and configuring SWCC agent, refer to Section 1.3 of this chapter. For more information on configuring your Sun system to work with either arbitrated loop or fabric attached storage, refer to *Appendix B* of this guide.
8. Reboot your Sun system, and create partitions and filesystems on the new units you created.

1.2.1 Accessing the Command Line Interpreter (CLI)

The CLI is a command line user interface to the HSG80 controller. It provides a series of commands for you to create a configuration for the subsystem through the controller's firmware.

This chapter describes only the CLI commands required to create an initial configuration on the controller.

See *Chapter 3* of this guide for detailed descriptions of all CLI commands.

You must make a serial connection to the HSG80 controller to access the CLI.

The three methods of accomplishing the connection are:

- Using an ASCII terminal.

- Using a PC running a communications program.
- Using a SUN system with the “tip” command.

See Command Line Interpreter in the *Compaq StorageWorks HSG80 Array Controller ACS V8.5 CLI Reference Guide* for detailed descriptions of all CLI commands.

1.2.2 Connecting the Cable to a PC or ASCII Terminal

To connect a maintenance terminal or PC to a HSG80 Controller follow these steps:

1. Locate the connecting cable that came with the HSG80 array controller. It has an RJ12 connector (similar to standard telephone plug) on one end and a 9-pin serial connector on the other end.
2. Plug the serial connector into the 9-pin serial port/com port 1 of the PC. If a 9-pin serial port is not available on a PC, use the 9-pin to 25-pin adapter (P/N: 12-45238-01) supplied with your subsystem.
3. Plug the RJ12 connector from the PC or maintenance terminal into the maintenance port on the HSG80 Controller (see Figure 3-6).
4. Note which serial port on the PC you use; you will need that information if using a communications program.

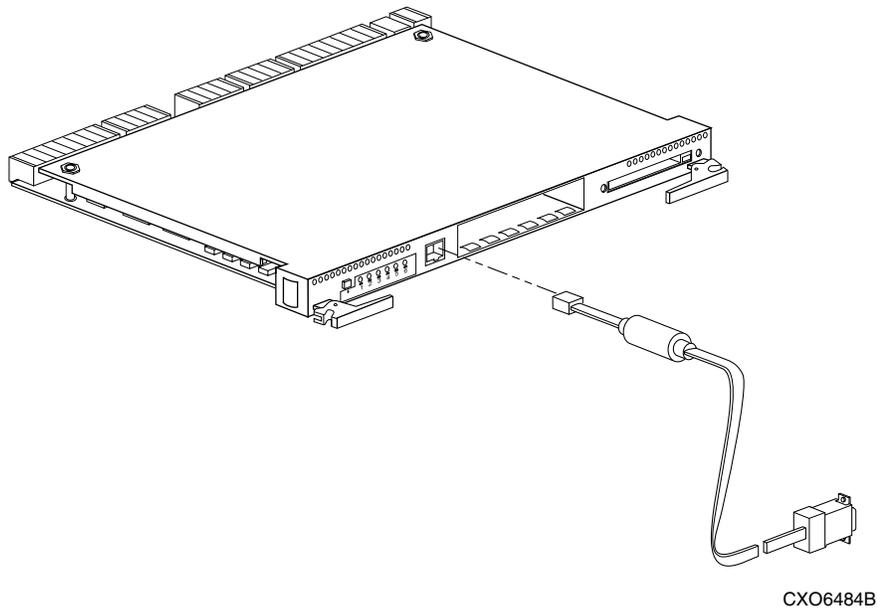


Figure 1-2. Making a serial connection to the HSG80 controller

1.2.3 Establishing Connection with a SPARC System

To setup your SPARC system for connection with the HSG80 Controller, follow these steps:

1. Use the supplied serial cable, and the 9 to 25 pin RS-232 adapter (P/N=12-45238-01) to connect the serial port on the SPARC system to the serial port on the RAID Array controller.
2. If you use a SUN A/B Serial Splitter Cable, and/or you attach the controller to serial port #1, you may need to modify the *remote* file to specify *ttya* as follows:

Open the file `/etc/remote` with an editor.

Locate the lines:

```
hardwire:\  
:dv:/dev/ttyb:br#9600...
```

Change `ttyb` to `ttya`.

Save the file.

1. Open a *terminal window* from the Desktop Program menu.
2. Start the Terminal Interface Program (TIP), at the prompt type: tip hardware and press the **Enter** key.
3. Press the **Enter** key again and the CLI prompt appears in the window similar to the following:

```
HSG80>
```

1.2.4 Establishing Connection with a Maintenance Terminal

To establish a connection between a maintenance terminal and the controller, follow these steps:

1. After connecting the maintenance terminal cable to the controller, press the Enter key. The CLI prompt appears in the window similar to the following:

```
HSG80 >
```

2. To view the status of the controller, type:

```
HSG80 > SHOW THIS_CONTROLLER FULL
```

The controller displays information similar to the following example: (dual redundant configuration shown)

```
Controller:
  HSG80 ZG74100091 Software V85F-0, Hardware E01
  NODE_ID      = 5000-1FE1-FF00-0170
Allocation_Class=0
SCSI_Version=2
  Configured for dual-redundancy with ZG74100121
  In dual-redundant configuration
  Device Port SCSI address 7
  Time: 28-SEP-1998 21:03:32
Host PORT_1:
  Reported PORT_ID = 5000-1FE1-FF00-0171
  PORT_1_TOPOLOGY = Fabric (fabric up)
  Address = 210113
Host PORT_2:
  Reported PORT_ID = 5000-1FE1-FF00-0172
  PORT_2_TOPOLOGY = Fabric (Standby)
  Address = 210213
```

Cache:
128 megabyte write cache, version 0012
Cache is GOOD
Battery is GOOD
No unflushed data in cache
CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
Mirrored Cache:
Not enabled
Battery:
FULLY CHARGED
Expires:
NOCACHE_UPS
Extended information:
Terminal speed 9600 baud, eight bit, no parity, 1 stop bit
Operation control: 00000000 Security state code: 21429
Configuration backup disabled

NOTE: Verify that the output of the "SHOW THIS" command from your system is similar to that shown. If the controller presents a NODE_ID of all zeros (0000-0000-0000-0000), You must set the NODE_ID correctly before proceeding. Refer to *Compaq StorageWorks HSG80 Array Controller ACS V8.5 Configuration Guide*, for more information.

3. Verify that the SCSI_VERSION is set to SCSI-2. If it is not, use the following command to set SCSI-2 mode:

SET THIS SCSI_VERSION = SCSI-2

4. If you will be connecting to a FC switch, you must set the port topology to "FABRIC" and restart both controllers. Type these commands:

SET THIS PORT_1_TOPOLOGY = OFFLINE

SET THIS PORT_2_TOPOLOGY = OFFLINE

SET THIS PORT_1_TOPOLOGY = FABRIC

SET THIS PORT_2_TOPOLOGY = FABRIC

RESTART OTHER

RESTART THIS

5. To show the connections made by the controller to the server via the switch, type SHOW CONNECTION as the CLI prompt. For basic installation something similar to the following will appear:

Connection

Name	Operating system	Controller	Port	Address	Status	Unit	Offset
!NEWCON01	WINNT	OTHER	1	210013	OL	other	0
		HOST_ID=1000-0000-C920-A6C5		ADAPTER_ID=1000-0000-C920-A6C5			
!NEWCON02	WINNT	THIS	2	210013	OL	this	100

```
HOST_ID=1000-0000-C920-A6C5 ADAPTER_ID=1000-0000-C920-A6C5
HSG80>
```

6. You must change `operating_system` to `Sun` for each connection. The syntax for the command is:

```
set {connection name} operating_system = SUN
```

Where `{connection name}` is the name from the `SHOW CONNECTION` command. In this example you type:

```
set !NEWCON01 operating_system = SUN
```

```
set !NEWCON02 operating_system = SUN
```

7. Finally, type `SHOW CONNECTION` at the `HSG80>` prompt to show the change:

```
Connection
Name Operating system Controller Port Address Status Unit Offset
!NEWCON01 SUN 1 210013 OL other 0
HOST_ID=1000-0000-C920-A6C5 ADAPTER_ID=1000-0000-C920-A6C5
!NEWCON02 SUN 2 210013 OL this 100
HOST_ID=1000-0000-C920-A6C5 ADAPTER_ID=1000-0000-C920-A6C5
HSG80>
```

1.3 Installing the StorageWorks Solution Software Packages

NOTE: Prior to installing the SWCC Agent, ensure that the write-back cache battery is fully charged. This is accomplished by supplying power to the RAID controller for a minimum of 5-6 hours. Otherwise, it may report low batteries and take LUNs offline.

References in this guide to Solaris 2.x should be assumed to mean Solaris 2.6 or 2.7.

The symbol # represents the system prompt.

The StorageWorks Solution Software uses Sun Solaris packaging services. See the *Adding and Removing Packages* section in the *Solaris System Configuration and Installation Guide* for more information about *packages*.

Installing the Solutions Software on Solaris 2.x requires the following major steps:

- Preparing your System for the installation (Section 1.3.1).
- Deciding between Automatic and Manual installation modes (Section 1.3.2).
- Installing and configuring the RAID Manager packages onto hard disk (Section 1.3.3).

1.3.1 Preparing your System for the installation

To prepare your system for the RAID Manager software installation, follow these steps:

1. Back up your entire system according to your normal procedure.
2. Select a system user with superuser privileges (for example: root) as the RAID administrator.
3. Log in as the RAID Administrator.
4. To find a filesystem with at least 500 KB free space, type:

```
# df -k
```

5. Choose a directory in which to install the SWCC software. The default is */opt*, however you may specify any directory. You will need to know this when running the installation script.

NOTE: The “base directory” (referred to when installing the SWCC Agent Software package) will have a “steam” subdirectory created under it. This is the directory that the Agent files will be installed into.

1.3.2 Deciding between Automatic and Manual Installation Modes

The installation script can be run in either *automatic* or *manual* mode. During the installation process the Installation Manager will examine the packages and drivers which are installed on your system for compatibility with the current release of the RAID Manager software.

In both modes of operation, the Installation Manager will examine the following items:

- Solaris operating system version.
- Existence of required patches (and patch versions) on your system.

- Prior versions of Solution Software packages (*DECswm410*, *DECswm450*, *CPQhsz70*, *CPQhsg80*).
- Prior versions of driver packages (*DECptisp*, *CPQfca*, *CPQfcaw*, *CPQfcaPCI*).
- Incompatible versions of driver packages (*PTIptisp*, *JNIfca*, *JNIfcaw*, *JNIfcaPCI*).
- It will also identify and backup any old SWCC Agent configuration files for later upgrading.

The key differences between Automatic and Manual modes is how they handle any problems found.

Automatic mode, as the name suggests, operates entirely automatically. All old or incompatible packages are removed, and the correct new packages are loaded, depending on the FC adapters installed in your system. Therefore, it is important that any FC adapters you want to use are installed prior to running the Installation Manager. You will be prompted for verification prior to any change being made to your system.

Manual mode operates manually. The Installation Manager will identify what steps to take, but the user is responsible for actually entering the correct commands. The Installation Manager will also identify incompatibilities between installed packages and the new packages, and it will recommend the corrective steps. The user is responsible for manually removing old packages and installing the new packages. Be aware that it may take several iterations of running the Installation Manager to resolve all problems.

Automatic mode is the preferred installation method for most users, it is the simplest installation method. Advanced users may want to use manual mode, as it allows the user to customize such things as supported adapters and drivers.

1.3.3 Installing Solution Software V8.5 onto the Hard Disk

You will need approximately 500 KB of permanent space on your hard disk to install and use the SWCC Agent. If you enable logging, some additional disk space will be used by the logfiles in the `/var/adm/steam` directory.

The StorageWorks Solutions Software consists of the following packages (refer to Table 1-2):

Table 1-2
StorageWorks Solution Software Packages

Package	Description
CPQhsg80	SWCC Agent software and system updates required for RAID system operation. This package should always be installed
CPQfcaw	The HBA driver for the CPQ/JNI FC64-1063 Fibre Channel 64-bit Sbus adapter. This package should be loaded when a CPQ/JNI SWSA4-SC adapter is installed in the server, which is typically the case.
CPQfca	The HBA driver for the CPQ/JNI FC-1063 Fibre Channel 32-bit Sbus adapter. This package should be loaded when a CPQ/JNI SWSA4-SB adapter is installed in the server.
CPQfcaPCI	The HBA driver for the CPQ/JNI FCI-1063 32-bit PCI bus adapter. This package should be loaded when a CPQ/JNI SWSA4-PC adapter is installed in the server.
CPQptisp	The HBA driver for the CPQ/PTI SBS450 SCSI adapter. This should only be used when the Sun server is interfaced with existing SCSI RAID systems (RA410, RA450, RA7000), that are attached to a CPQ/PTI SBS-450 SCSI adapter. NOTE: This driver does not support Solaris 2.7 in 64-bit mode. To use the SB5450 SCSI adapter under 64-bit Solaris, set the adapter to Sun emulation mode.

Installing the RAID Manager packages onto hard disk requires the following steps:

1. Mounting the CD-ROM.
2. Loading the Fibre Channel adapter driver package(s). This can be one or more of:
 - CPQfca - To support CPQ/JNI FC-1063 32-bit Sbus adapter
 - CPQfcaw - To support CPQ/JNI FC64-1063 64-bit Sbus adapter
 - CPQfcaPCI - To support CPQ/JNI FCI-1063 32-bit PCI adapter
3. Loading the CPQoptisp package (optional, only required to support legacy RAID systems attached to an SBS-450 SCSI adapter)
4. Loading the CPQhsg80 package.
5. Rebooting your computer.
6. Configuring the CPQhsg80 package.

1.3.3.1 Mounting the CD-ROM

1. Check whether the volume management daemon (`vold`) is currently running. Type:

```
# ps -ea | grep vold
```
2. Follow the steps below for "vold currently running" or "vold not currently running," as applicable:

If *vold* is currently running, then:

- a. Insert the CD-ROM into the CD-ROM Drive.
- b. Use the `mount` command to check that the volume manager has automatically mounted the CD-ROM, by typing:

```
# mount
```

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

- c. Change to the Solaris directory, type:

```
# cd /cdrom/hsg80_v85b_sun/agents/solaris
```

- d. Go on to Section 1.3.3.2 (Installing with Automatic Mode), if you wish to use the Automatic installation method (recommended). Or, you may skip to section 1.3.3.3 (Installing with Manual Mode), if you wish to use the manual installation method. Advanced users may want to use manual mode, as it allows you to customize such things as supported adapters and drivers.

If *vold* is not currently running, then:

- a. Insert the CD-ROM into the CD-ROM drive.
- b. Mount the CD-ROM. For example, type:

```
# mount -F hsfs -r /dev/dsk/c0t6d0s2 /cdrom
```

- c. Change to the Solaris directory, type:

```
# cd /cdrom/agents/solaris
```

- d. Go on to Section 1.3.3.2 (Installing with Automatic Mode), if you wish to use the Automatic installation method (recommended). Or, you may skip to Section 1.3.3.3 (Installing with Manual Mode), if you wish to use the manual installation method. Advanced users may want to use manual mode, as it allows you to customize such things as supported adapters and drivers.

1.3.3.2 Installing with Automatic Mode

To install the RAID Manager software using Automatic mode, follow these steps:

To start the Installation Manager, type:

```
# ./install_stgwks
```

The Installation Manager will first ask you if you want to use *Automatic* or *Manual* mode. Enter “A” to select Automatic mode.

- First, the Installation Manager will verify that you are running a supported version of Solaris, and that you have the correct patches loaded. If this checks out, the Installation Manager will scan your system for supported adapters, and it will display a list of compatible adapter drivers.
- Next, the Installation Manager will prompt you to remove any old or incompatible packages. Follow the on-screen prompts, always accepting the default responses for all questions.

- Next, the Installation Manager will automatically load the correct HBA drivers to support the FC adapters installed in your system. Again, follow the on-screen prompts, always accepting the default responses for all questions.
- Finally, the Installation Manager will automatically load the RAID Manager software package. This consists of the following steps:
 1. First, the Installation Manager prompts you for the package base directory. This directory will have a 'steam' subdirectory, containing the RAID Manager files, created under it. The default directory is /opt.
 2. Next, the Installation Manager will re-scan your system for supported HBA drivers. If any adapter drivers were loaded in previous steps, you must answer "Y" to allow the Installation Manager to re-scan your system.
 3. After scanning for supported adapters, you will be prompted to edit your `sd.conf` file. This edit can be done automatically or manually.
 4. If you chose "A" to automatically edit your `sd.conf` file, support will be added for ALL supported FC adapters, using the default SCSI targets.

These defaults are:

 - Loop mode: Each HBA is configured for LUNs 0 through 15 at targets 64 and 65 (corresponds with ALPAs 71 and 72).
 - Fabric mode: You will be prompted for the SCSI targets to bind through for each HBA, and the World Wide Port Names (WWPNs) to attach to.
 5. After all the files have been loaded and edited, the Installation Manager will exit. You will be prompted to reboot your computer system.
 6. Go on to Section 1.3.3.4, (Shutdown and Reboot your computer system), to complete the installation.

1.3.3.3 Installing with Manual Mode

To install the RAID Manager software using Manual Mode, follow these steps:

To start the Installation Manager, type:

```
# ./install_stgwks
```

The Installation Manager will first ask you if you want to use *Automatic* or *Manual* mode. Enter **M** to select Manual mode.

- First, the Installation Manager will verify that you are running a supported version of Solaris, and that you have the correct patches loaded.
- Next, the Installation Manager will scan your system for old or incompatible drivers and it will display a message describing what command(s) to use to correct the problem. Follow the on-screen prompts to quit the Installation Manager, remove the offending package(s), and re-start Installation Manager.
- Next, the Installation Manager will scan your system for supported adapters. When the scan is complete, the Installation Manager will display a list of supported adapters installed in your system.
- After displaying a list of installed adapters, a menu appears listing the available packages. Follow the on-screen prompts to load the correct adapter driver package for the adapters installed in your system.
- After the adapter driver package has successfully loaded, you are returned to the Installation Manager menu. If you have multiple adapters installed in your system, select additional adapter driver package(s) in this manner until you have successfully loaded a driver package for each adapter you will be using.
- After you have loaded all adapter driver packages that you will need, it is time to install the RAID Manager (CPQhsg80) software package. This consists of the following steps:
 1. First, the Installation Manager prompts you for the package base directory. This directory will have a 'steam' subdirectory, containing the RAID Manager files, created under it. The default directory is /opt.
 2. Next, the Installation Manager will re-scan your system for supported HBA drivers. If you added any adapter driver packages in the previous steps, you must answer "Y" to allow the Installation Manager to re-scan your system.
 3. After scanning for supported adapters, you will be prompted to edit your `sd.conf` file. This edit can be done automatically or manually.
 4. If you chose "A" to automatically edit your `sd.conf` file, support will be added for ALL supported FC adapters, using the default targets. These defaults are:
 - Loop mode: Each HBA is configured for LUNs 0 through 15 at targets 64 and 65 (corresponds with ALPAs 71 and 72).

- Fabric mode: You will be prompted for the SCSI targets to bind through for each HBA, and the World Wide Port Names (WWPNs) to attach to.
5. If you chose “M” to manually edit your sd.conf file, you can chose what FC adapters, and what targets will be supported. By default, LUNs 0 though 15 are configured for each target that you select.
 6. After the RAID Manager package is successfully loaded, select “Q” to exit the Installation Manager. You will be prompted to reboot your computer system.
 7. Go on to Section 1.3.3.4, to complete the installation.

1.3.3.4 Shutdown and Reboot Your Computer System

To shutdown and reboot, do the following:

```
# cd /  
# /etc/shutdown -y -i0 -g0
```

1. Wait for the "ok" *console* prompt, then type:

```
boot boot_device (Where boot_device is the name of your system disk.)
```

2. Wait for your system to perform a reconfiguration boot.

NOTE: During boot, you may see a message like this:

```
WARNING:  
/sbus@2,0/fcaw@1,0/sd@40,0 (sd32): corrupt label - wrong magic number.
```

This is because a LUN you configured earlier is not yet labeled.

1.4 Post-Installation Tasks

After completing the procedures in the previous section, you need to perform the following procedures:

- Configure the SWCC Agent.
- Label any new LUN(s) with the Solaris format command.
- Install and configure the SWCC Client (optional).
- Optimize UNIX filesystem performance (optional).

1.4.1 Configuring the Agent

There are two ways to configure your Agent:

- **install.sh** – This utility is usually used for the first-time configuration or for upgrades. It walks you through each step required for setting up your Agent, providing a simple way to get your Agent configured. It will also identify and upgrade any old Agent configuration files from previous RAID Manager packages. Go to Section 1.4.1.1 for instructions on running *install.sh*.
- **config.sh** – A menu-based administration tool that is usually used to modify your Agent configuration after installation. It provides more options than *install.sh*, so it is recommended for advanced users, or users with unique configuration needs. It can also be used for first-time configuration. Go to Section 1.4.1.2 for instructions on running *config.sh*.

1.4.1.1 Configuring the Agent with install.sh

To run the install program, run the *install.sh* script from the \$BASEDIR/steam/bin directory (usually /opt/steam/bin).

```
# cd /opt/steam/bin
# ./install.sh
```

Follow the on-screen prompts to setup your Agent files. If *install.sh* finds backed-up Agent configuration files, you will be asked if you want to upgrade them. Once you have configured your Agent, you can use the SWCC Client software to create storagesets. Go to *Chapter 2* of this guide for instructions on installing and using the SWCC Client.

1.4.1.2 Configuring the Agent with config.sh

To run the *config* program, run the *config.sh* script from the \$BASEDIR/steam/bin directory (usually /opt/steam/bin).

Type:

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

This displays the main menu shown in Figure 1–3.

```

----- RAID Array v8.5b Configuration Menu -----
Agent Admin Options                               Storage Subsystem Options
-----
 1) Change Agent Password                         12) View Subsystems
 2) Change SNMP Enterprise OID                   13) Add a Subsystem
 3) Start/Stop the Agent                         14) Remove a Subsystem
 4) Toggle Agent Startup on System Boot          15) Modify a Subsystem
 5) Uninstall Agent

Agent Notification Options                         Client Options
-----
 6) Toggle Error Log Notification                16) View Clients
 7) Toggle Mail Notification                     17) Add a Client
 8) View Mail Notification List                  18) Remove a Client
 9) Add User to Mail Notification List           19) Modify a Client
10) Remove User from Mail Notification List
11) Modify Mail Notification List

Exit:                                             Other Options
-----
q) Quit                                          20) Add/Change Adapters
Enter Selection:                                21) High Avail. Options

```

Figure 1-3. Main menu

1.4.1.3 Choosing a Password

Select 1 from the *Agent Admin Options* group to set a password to protect your storage subsystems from unauthorized access. Any client with configuration privileges will be asked for this password when attempting to configure the storage subsystem.

1.4.1.4 Adding a Subsystem

Any storageset belonging to the subsystem can be used for this procedure, but be careful not to delete the LUN from the subsystem when reconfiguring, as this breaks the communication link to the Agent for the entire subsystem.

From the Storage Subsystem Options group, select 12, to View Subsystems. An empty table displays. Before starting the Agent, you must add at least one subsystem you wish to communicate with. Choose option 13, to add a subsystem.

The subsystem name is arbitrary, but use only lower-case characters to specify it. Associate the name with a storage subsystem by picking a LUN name; for example, *c1t65d0*, which the *format* command output displays as belonging to the RAID system. This is evident from the controller number and SCSI target address used.

Append s2 to the device name (*cxydz*) when entering the *character special file name*, as a partition must be specified.

Check that this partition exists by entering *format's partition* and *print* commands.

Enter a monitoring interval; for example, 30 seconds, and press the **Enter** key twice to return to the *Main Menu*.

1.4.1.5 Adding a Client

From the *Client Options* group, select 19, *View Clients* to see the authorized client list.

To add a client, select 17, *Add Client*. First enter the client's network name (for example, myhost). Second enter an Access level code. Specify 2 if the manager/client is allowed to configure the subsystem. Third, add an Error Notification Level (1 for TCP sockets, 2 for SNMP protocol, or 3 for both).

1.4.1.6 Restarting the SWCC Agent

After you make any changes to the SWCC Agent configuration, the SWCC Agent daemon must be stopped and restarted. This ensures that the changes to the configuration files are read by the *steamd* program.

1.4.2 Configuring the Agent within FirstWatch

If you have VERITAS FirstWatch installed, you may configure the StorageWorks Command Console Agent to run under FirstWatch. This allows FirstWatch to start the Agent on the primary host. In the case of a failover, FirstWatch will transition the Agent to the takeover host.

To configure the SWCC Agent to run with FirstWatch, you must have FirstWatch installed and configured. You must also install the SWCC Agent on both hosts and configure the agents identically (subsystem name, notification options and client options). This is required so that when the SWCC Agent is transitioned to the takeover host, all access and notification remains identical.

Once the SWCC agent is configured on both hosts, determine which host will be the primary and which will be the takeover host. On each host, start the configuration utility (see Section “Configuring the Agent with config.sh”) and select 21 from the other options group.

NOTE: Any future configuration changes made on one FirstWatch server must also be made on the other host.

1.4.3 Preparing LUNs for Use by the System

Each LUN created on the RAID Array 8000 appears as a SCSI hard disk to the host. Therefore, it must be labeled before it can be used and, in most instances, a new file system must be created.

1.4.3.1 Labeling LUNs

A LUN is labeled using the */etc/format* utility. The label contains information about the LUN such as controller-type, geometry, and partitions. More details about the use of the format utility may be found in the *Sun 2.x Adding and Maintaining Peripherals* Manual.

1.4.3.2 Labeling a LUN Automatically Using the Format Utility

Sun Solaris releases 2.4 and above have the capability of automatically generating a label for SCSI disks. To access this capability while in the *format* utility, select the desired disk, then from the *Type* menu, select 0.

Example:

format

Searching for disks...done

AVAILABLE DISK SELECTIONS:

0. c0t3d0 <SUN0424 cyl 1151 alt 2 hd 9 sec 80>/.../sd@3,0

1. c1t65d0 <DEC-HSG80-AX-V85F cyl 12841 alt 2 hd 14 sec57>/sd@0,0

Specify disk (enter its number): 1

selecting c1t0d0

[disk formatted]

FORMAT MENU:

disk-	select a disk
type-	select (define) a disk type
partition -	select (define) a partition table
current -	describe the current disk
format -	format and analyze the disk
repair -	repair a defective sector
label -	write label to the disk
analyze -	surface analysis
defect -	defect list management
backup -	search for backup labels
verify -	read and display labels
save -	save new disk/partition definitions
inquiry -	show vendor, product and revision
volname -	set 8-character volume name
quit	

format> **type**

AVAILABLE DRIVE TYPES:

0. Auto configure

1. Quantum ProDrive 80S

2. Quantum ProDrive 105S

3. CDC Wren IV 94171-344

1. SUN0104

5. SUN0207

6. SUN0327

7. SUN0340

8. SUN0424

9. SUN0535

10. SUN0669

11. SUN1.0G

12. SUN1.05

13. SUN1.3G

11. SUN2.1G

15. other

Specify disk type (enter its number)[19]: 0

c1t0d0: configured with capacity of 1.89GB

<DEC-HSG80-AX-V85F cyl 12841 alt 2 hd 14 sec 57>

```

selecting c1t0d0
[disk formatted]
format> label
Ready to label disk, continue? yes
format> quit

```

Note that the default partition layout when using the Automatic mode is of the form,

```

partition 0: ~128MB
partition 1: ~128MB
partition 2: entire disk
partition 6: partition 2 - (partition 0 + partition 1)
partitions 3,4,5,7: empty

```

NOTE: You may modify the partition table by entering "partition" at the format menu prompt level. Remember to label the disk again after any changes to the partition table are made.

Format places an entry for the RAID Array in the */etc/format.dat* file and the *label* command stores the information on the RAID Array. More details about the creation of *format.dat* entries may be found in the Sun *Solaris 2.x Adding and Maintaining Peripherals* Manual.

NOTE: Although the format command will create an HSG80 disk entry in the *format.dat* file, we recommend that you do not try to re-use this definition. Always use type 0 to allow Solaris to retrieve the correct logical geometry for the LUN you are formatting.

1.4.4 Filesystem Creation and Tuning

Before the new LUN can be used by the system, a new filesystem must be created on each partition that will be mounted. The *newfs* command is used to create filesystems, and the *tunefs* command is used to modify existing filesystems. See the man pages for the *newfs* and *tunefs* commands for more information.

To create a new filesystem, use the following command:

```
# newfs -C128 -d0 /dev/dsk/c1t0d0s2
```

To modify an existing filesystem use:

```
# tunefs -a128 -d0 /dev/dsk/c1t0d0s2
```

These commands set *maxcontig* to 128 and *rotational delay* to 0. These recommendations may not optimize your system performance so you may want to experiment with other values.

1.5 Troubleshooting/Avoiding Problem Situations

1.5.1 Agent/Controller Communication

The Command Console Agent communicates with your controller via a virtual disk that you must specify in the *storage.ini* file. There must be at least one virtual disk on your subsystem, so that Agent can communicate with your storage subsystem.

Your subsystem should have been shipped with at least one LUN configured on it to facilitate connection over the host Fibre Channel connection. If your subsystem has no LUNs configured on it, you must temporarily establish a connection via the controller serial maintenance port and use command line interpreter (CLI) commands to create at least one LUN on each of the subsystem's ports. Refer to *Chapter 3* to configure your subsystem with the CLI.

Command Console can use either a normal, user-configured virtual disk or a special virtual disk, called the "Command Console LUN (CCL)" to make a connection with your controllers. The communications LUN is a simulated virtual disk provided by the controller strictly for connecting Command Console with your storage subsystem. Refer to *Appendix E* for more information on the CCL.

Use care in making changes to your virtual disk configuration with Command Console. If the virtual disk the Agent is using to communicate with your subsystem fails or is deleted, the Agent loses its connection with the controller, and the Client loses its connection with your subsystem.

1.5.2 RaidManager Mail Messages

Mail messages sent by the RaidManager are useful in troubleshooting subsystem problems. To receive RaidManager messages, you must enable "email notification" via the Agent installation program option. If you receive a mail message from RaidManager, refer to *Appendix G* for assistance in determining the cause of the problem.

Installing the Command Console Client

This Chapter covers how to install, launch, and use Command Console Client.

2.1 What is Command Console?

The Command Console (CC) Client is a Graphical User Interface (GUI) for StorageWorks Controllers. Command Console consists of two programs:

- Command Console Client is the GUI program designed for use on systems running the Microsoft Windows 2000 or Windows NT Operating Systems. It provides a user-friendly method of configuring, operating, monitoring, and troubleshooting your storage subsystem.
- Command Console Agent is a companion program that enables the CC Client to communicate with your storage subsystems over a network. Agent is available for operation on a variety of popular Host Operating Systems.

The CC Client connects to your storage subsystem via a TCP/IP-compatible network. It sends (via the Agent) CLI commands to your subsystem's Controllers as you perform subsystem configuration, operation, monitoring, and troubleshooting tasks using its graphical interface. It displays subsystem status by interpreting CLI information returned by the subsystem.

Use the procedures within this chapter to:

- Set up Command Console and establish communication with your storage subsystems.
- Configure your storage devices to create host-accessible volumes by:
 - Configuring the Client by adding systems to the Navigation Window.
 - Adding physical devices
 - Creating virtual disks

2.2 Installing Command Console Client

Command Console Client installs from a CD-ROM disk using a standard Windows installation routine on a Windows 2000 or Windows NT platform. The program is self-extracting and stores Command Console Client into the directory C:\Program Files\SWCC by default. During setup, you have the option to change the disk or directory location.

To install Command Console:

1. Place the software CD in the CD-ROM Drive.
2. Run File Manager or Windows Explorer.
3. Navigate to the folder: *drive_letter:\swcc\client\intel*
4. Double-click on Setup.
5. Follow the instructions in the setup program to complete the installation.

Command Console Client installs the Program Group *Command Console*. Client also inserts several selections on the Start menu (Figure 2-1). To start Command Console from the Start Menu, double-click on the HSG80ACS85 Storage Window name.

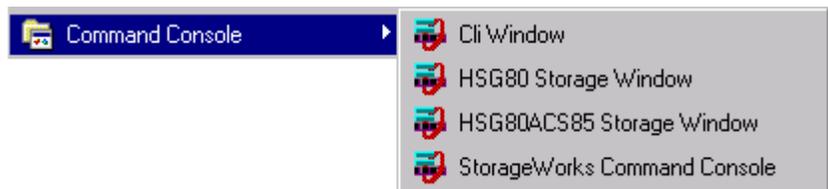


Figure 2-1. Command console client's start menu

2.3 Launching the Command Console Client

Some of the choices Client provides you with at startup are:

- **CLI Window:** HS-series controllers provide a feature called the Command Line Interpreter (CLI) for configuring and monitoring your storage controllers using text-based commands. With the CLI, you can connect a maintenance terminal directly to your controller and manage it using the complete set of CLI commands. You can also use a host-based, virtual terminal, such as Command Console's CLI Window, to make the connection. Refer to *Chapter 3, Creating Your Storage Configuration with the CLI*, for details.
- **HSG80 or HSG80ACS85 Storage Window:** Displays the Storage Window. This choice lets you monitor and configure one storage subsystem using Client's graphical user interface. All connection choices are provided: serial line, SCSI bus and network (TCP/IP).

NOTE: HSG80ACS85 Storage Window is used with RA8000/ESA12000 and MA8000/EMA12000 storage systems using ACS V8.5 software. Older ACS version (8.3) require the HSG80 Storage Window.

- **StorageWorks Command Console:** Displays the Navigation Window. The Navigation Window is a network navigation tool used to manage and monitor storage subsystems over a TCP/IP network. This choice lets you monitor and configure one or many storage subsystems over a network using Client's graphical tools.

2.3.1 Establishing an Initial Host Connection and Verifying Subsystem Setup

NOTE: Prior to making a network connection between the Intel-based System on which you installed the CC Client GUI and your subsystem, you must have completed the steps in this guide to install the CC Agent in your Host System, the CC Client GUI in your Intel-based Client System, and to create a volume on your subsystem. Since the Agent uses a LUN for communication, you cannot make a connection to any subsystem unless the Command Console LUN is enabled or at least one volume has been created on the subsystem.

To establish a network connection proceed as follows:

1. Click on the *Start* button on the taskbar.
2. Click on *Programs*.

3. Click on *Command Console*.
4. Click on *HSG80 Storage Window*.
5. At the Connection Selection dialog box, select the *Network (TCP/IP)* option (Figure 2-2), then click *OK* to display the *Connect Network* dialog box (Figure 2-3).

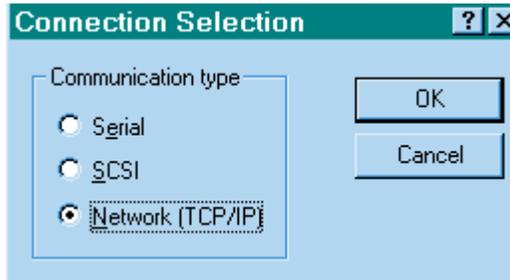


Figure 2-2. Connection selection dialog box

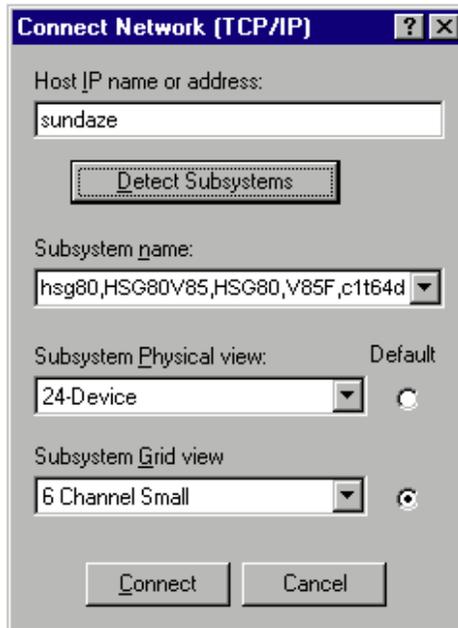


Figure 2-3. Connect network dialog box for storage window

- On the *Connect Network* dialog box, enter the HOST name or IP address where your HSG80 controller is connected. Then click the *Detect Subsystems* button to display the storage subsystem name. Then click *Connect* to connect to your storage subsystem. The Storage Window appears as shown in Figure 2-4. The next step is to configure the properties of the controller.

NOTE: The top window displays the virtual disks that have been created. The bottom windowpane shows the devices you have installed in the RA8000/ESA12000 or MA8000/EMA12000 Fibre Channel Subsystem. On startup, Command Console finds installed drives and displays them in a grid by channel and SCSI ID number.

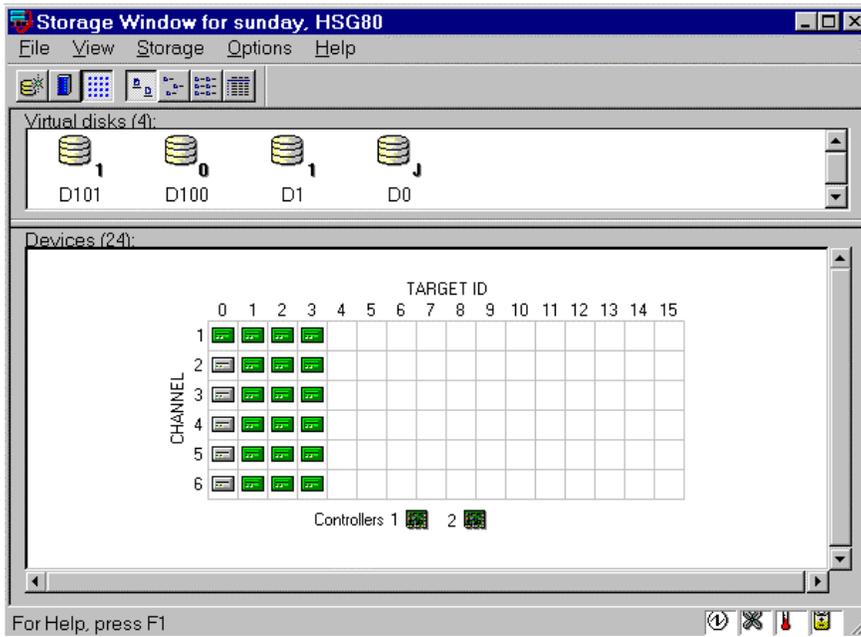


Figure 2-4. Storage window

2.4 Configuring Controller Properties

Your controller's operating parameters are stored in property sheets. Controller property sheets are accessed by double-clicking on a controller icon in the Storage Window or right clicking on the icon and selecting *Properties*. Property sheets are tabbed. To access a sheet, click on its tab.

For changes in any field to take effect, a controller restart is required. The program prompts you for confirmation before it restarts your controller. A restart of the controller will be detected by the host system. Do not make changes to the controller settings when either file systems are mounted on the RAID Array or applications are using the RAID Array. After you initialize a controller restart, there is approximately a 90-second delay while the controller reinitializes.

1. Access the controller's property sheets by double-clicking the controllers' icon in the Storage Window. When you double-click on a controller's icon the *General* controller properties sheet displays (Figure 2-5). The controller has five other property sheets. Each sheet is accessed by clicking on its tab.

Confirm the following:

- Allocation class is 0
- SCSI Version is SCSI-2

(You may also set the time and date.)

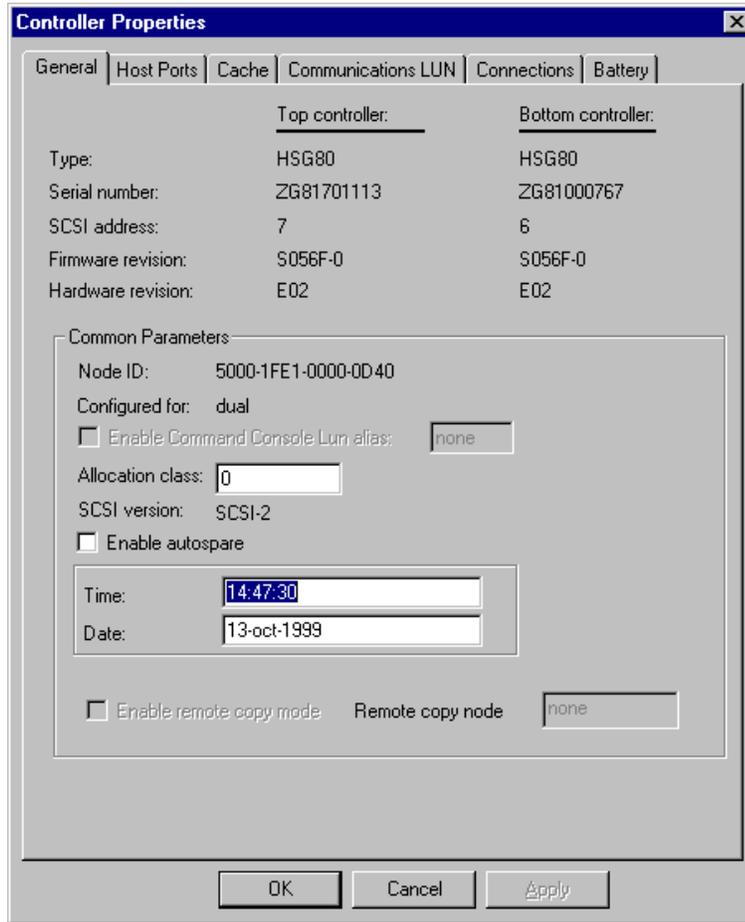


Figure 2-5. General controller properties tab

2. Click the *Host Ports* tab to display the host port operating parameters and verify the host port operating parameters shown in Figure 2-6.

The settings displayed for:

- Port ID
- Actual Topology
- Requested Port Address
- Actual Port Address

will vary depending upon your cabling, loop configuration, ALPA settings and number of host ports in use.

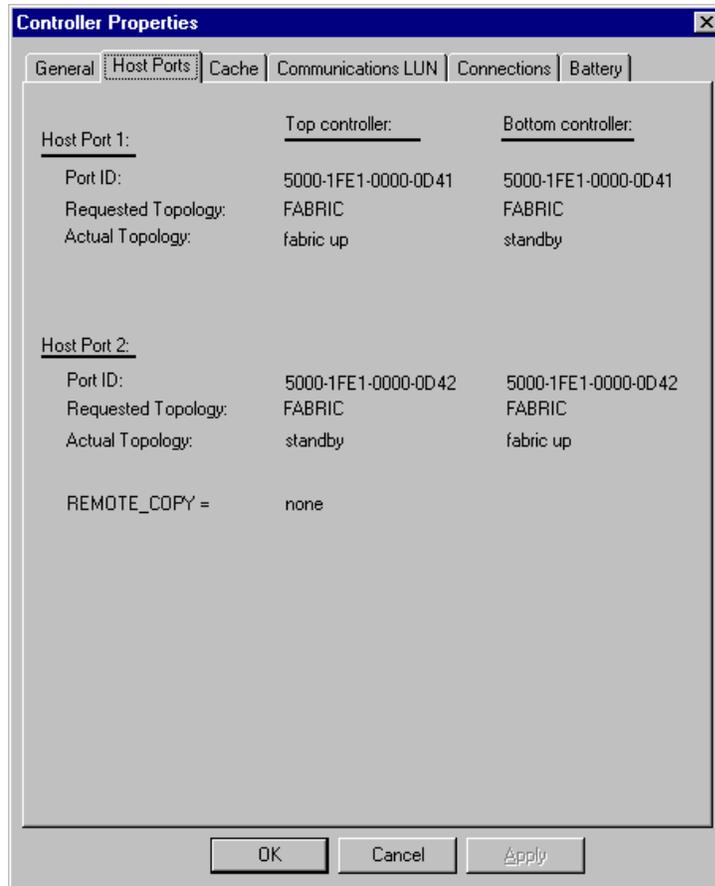


Figure 2-6. Host ports controller properties tab

3. Click the *Cache* tab to check cache size (Figure 2-7).

Confirm the following:

- Cache flush timer is 10 (seconds)
- Respond to internal cache battery condition is selected

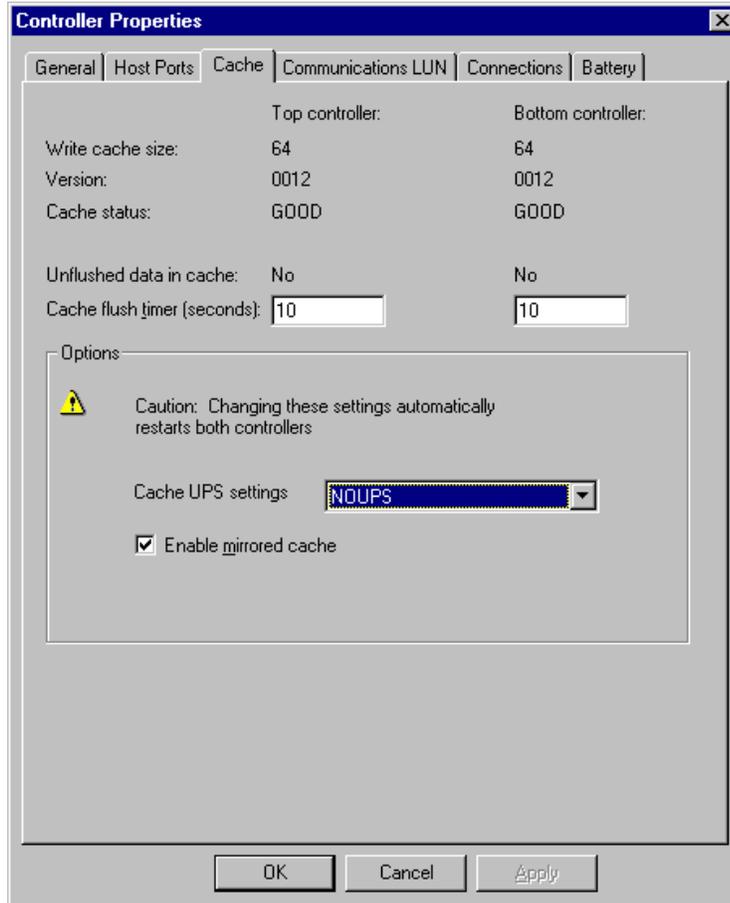


Figure 2-7. Cache controller properties tab

4. Click the *Communications LUN* tab (Figure 2-8).

NOTE: Ensure that *Fixed* is set if you are using the virtual LUN (CCL). Refer to *Appendix E* for more information on the CCL.

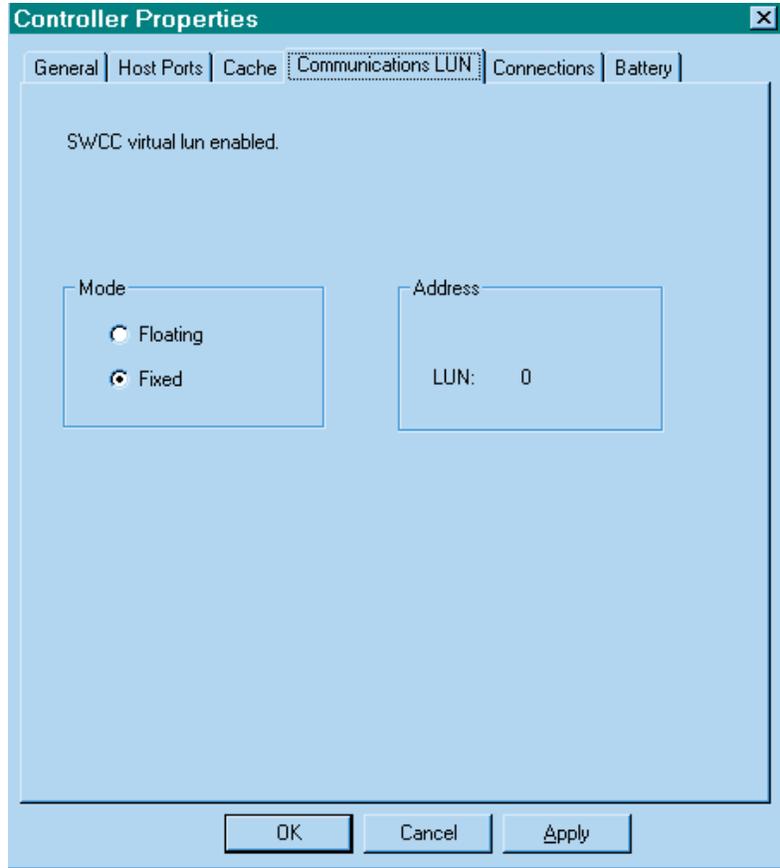


Figure 2-8. Communications LUN controller properties tab

5. Click the *Connections* tab (Figure 2-9).

Confirm the following:

- Use the pull-down menu to change the operating system to Sun.
- Unit Offset should be 0 for Port 1
- Unit Offset should be 100 for Port 2

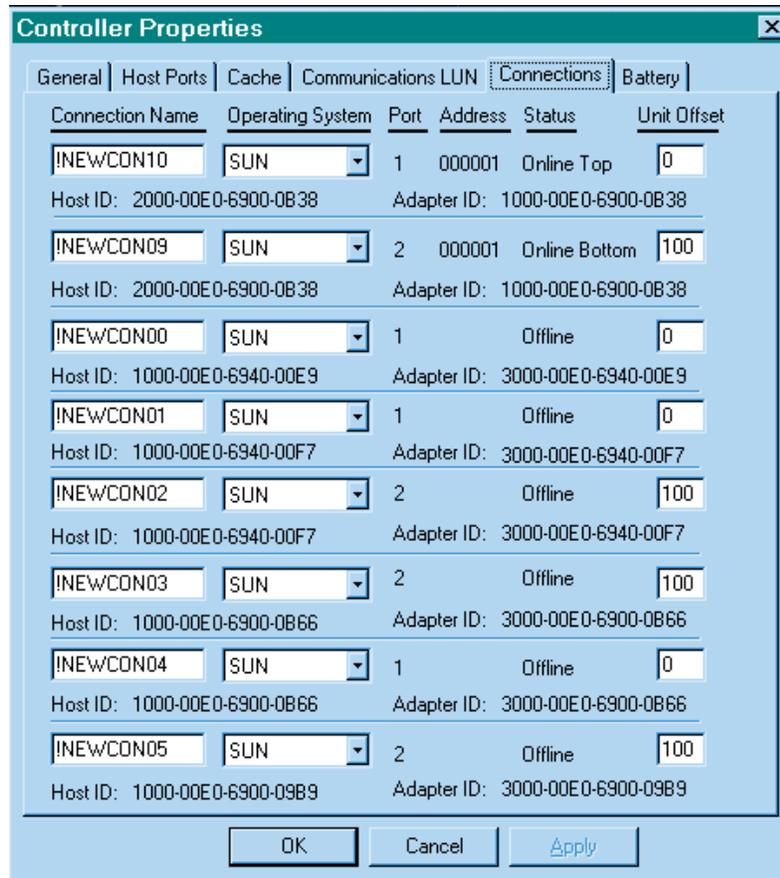


Figure 2-9. Connections controller properties tab

6. Click the *Battery* tab (Figure 2–10).

NOTE: Confirm that the battery is fully charged. If not, wait until it is fully charged before using the system.

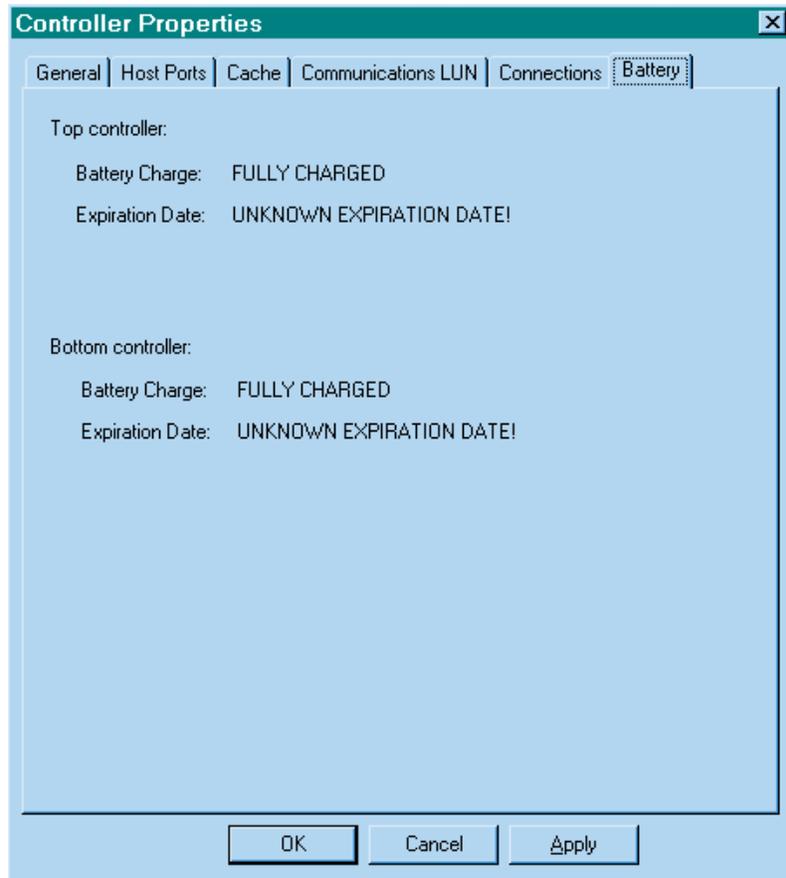


Figure 2-10. Battery controller properties tab

Click on the *Apply* button. Once all of the changes have been made, click the *OK* button to complete controller configuration. The storage window is now displayed. To begin using SWCC to create Virtual Disks, refer to the *Compaq StorageWorks Command Console V2.3 User Guide*, to the section entitled *Creating Your First Virtual Disk*.

2.5 Using the Navigation Window

The Navigation Window is a network management tool that you can use to create, monitor and configure a network of storage subsystems. The Navigation Window has its own Menu Bar. It can be moved and minimized. It can be sized by dragging on its corners and borders. You start building a network of RAID Array 8000 storage subsystems by adding Host Systems to the Navigation Window.

Figure 2-11 shows a navigation window that shows a two-host network with systems *sunday* and *aries*. Subsystem *RA8000* is connected to host *aries*. Subsystems *HSG80* and *HSZ40* are connected to host *sunday*. Folders are shown expanded.

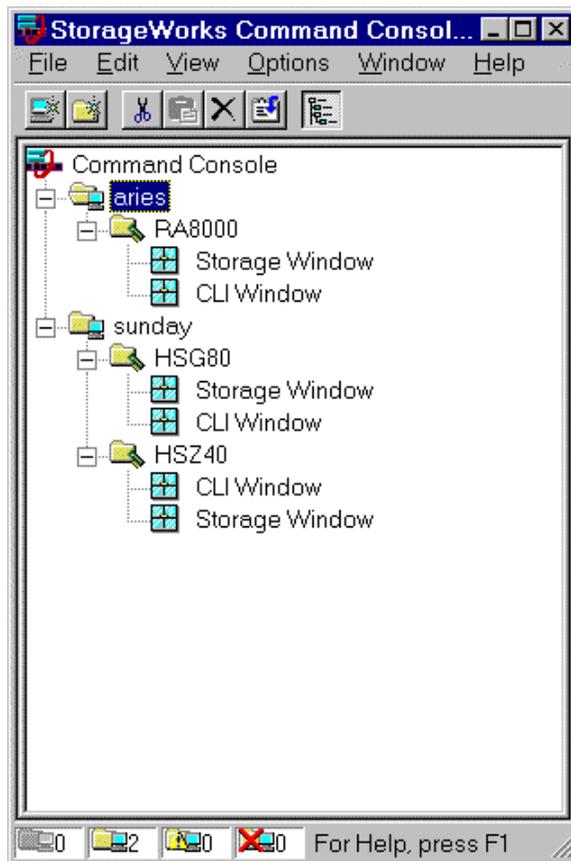


Figure 2-11. Navigation window shows two-host network

2.5.1 Adding a Host System to the Navigation Window

To add a system (see Figure 2-12):

1. From the File menu select *Add System*.
2. Use the *Add System* dialog box to add host systems to the Command Console Client. A system is any machine running a Command Console Agent. Enter the Domain Name Service (DNS) name or the Internet Protocol (IP) address in the “Host name or TCP/IP address text box” and click *Apply*. Refer to the on-line Help menu *Adding a System* if you need more information about entering a system name.



Figure 2-12. Add system from file menu

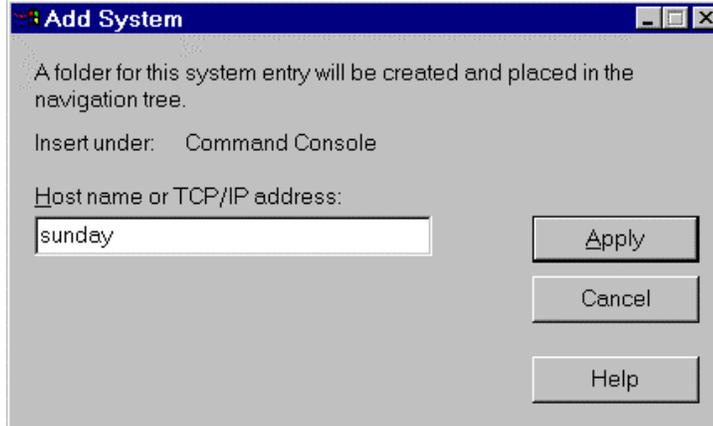


Figure 2-13. Adding a host system

3. After you click the *Apply* button, once the system address is resolved, click *Close* on the Add System dialog box. Client adds an icon for *sunday* in the Navigation Window, as shown in Figure 2-13.

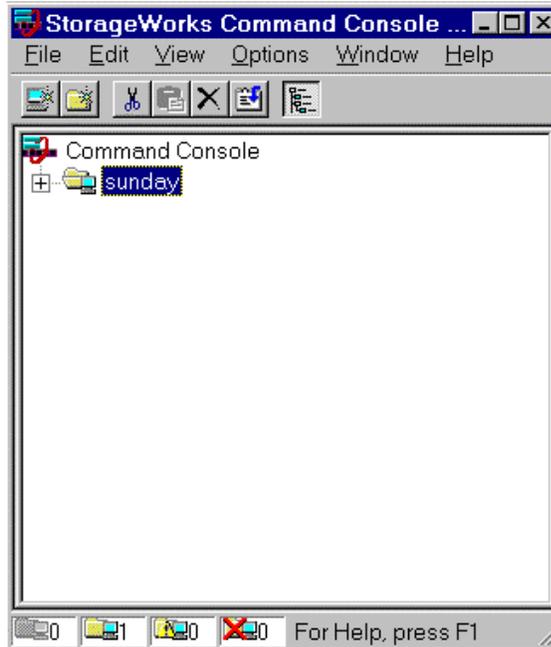


Figure 2-14. "Sunday" added to the navigation window

2.5.2 Deleting a Host System from the Navigation Window

To delete a system:

1. In the Navigation Window, click on and highlight the system that you want to delete.
2. From the Edit menu, select *Delete*.
3. System icon should disappear from Navigation Window.

2.5.3 Creating and Using New General Folders

Use folders to help organize your storage. The Client will automatically create folders when you add a subsystem. You may also create your own folders to help organize your subsystem. Folders can be dragged and dropped within the Navigation Window. In the following example, we have created the folder *My Server* and then dragged and dropped the host *sunday*, in the folder (Figure 2-15). To create a new folder:

1. From the File menu, choose *New Folder*.
2. Name the new folder in the Navigation Window by double-clicking its label and entering a new name.

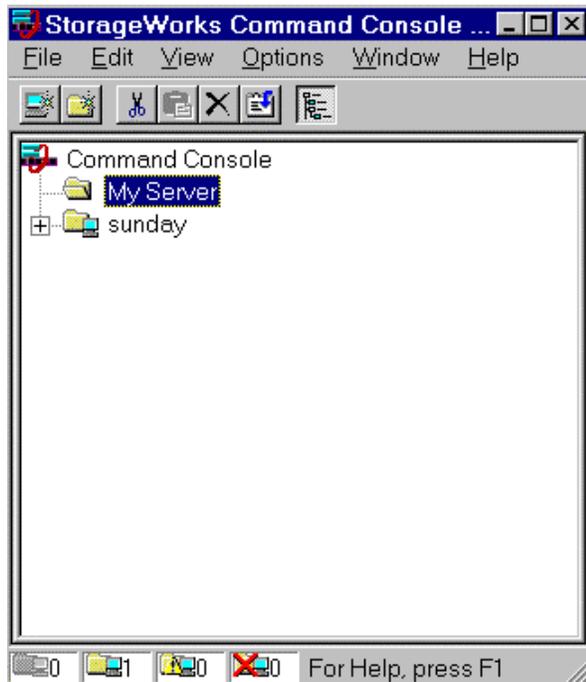


Figure 2-15. Adding a folder

2.5.4 Renaming a Folder

1. Double-click on the folder name in the Navigation Window.
2. Enter the new name. Only general folders that you create can be renamed.

2.5.5 Viewing the Hierarchy in the Navigation Window

1. Click on a folder on the Navigation Window to display its contents.
2. Click the plus signs (+) to display more folders, systems, and controllers. To open a folder, double-click on it.

2.5.6 Viewing and Modifying System Folder Properties

1. Right-click on a system icon in the Navigation Window.
2. Click Properties from the shortcut menu to view the system folder properties.

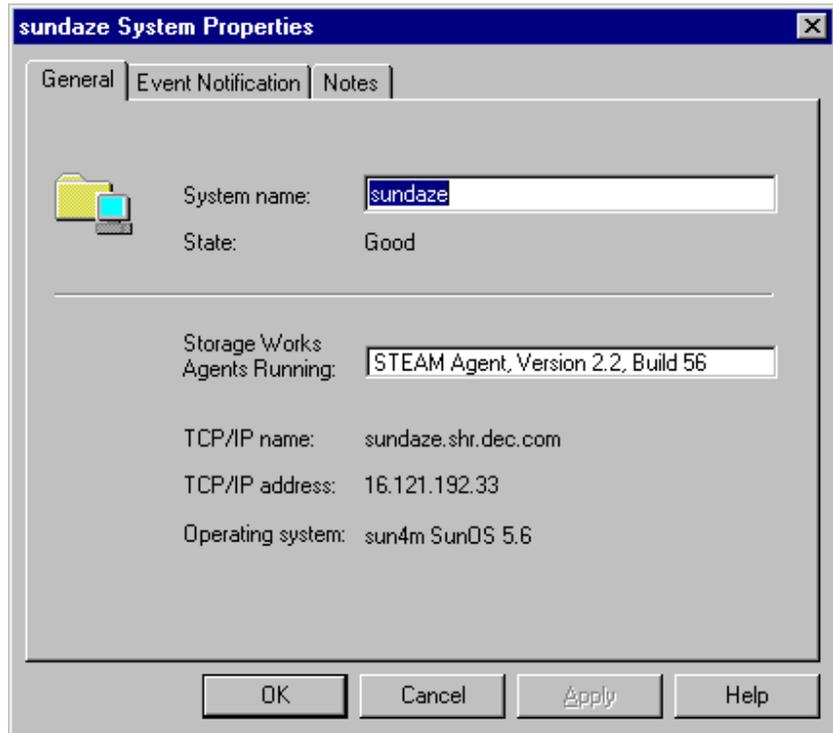


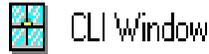
Figure 2-16. System properties

2.5.7 Opening a Storage Window

1. Connect to a storage subsystem.  Storage Window
2. In the Navigation Window, double-click on a system folder.
3. Double-click the Storage Window icon to open a Storage Window.

2.5.8 Opening a CLI Window

Not all controllers support the Command Line Interpreter (CLI) window. If you are familiar with CLI syntax, you can enter commands into the command line area directly underneath the CLI Window Menu Bar. Error messages and system responses are displayed in the message area directly beneath the command line area.



1. Connect to a storage subsystem.
2. In the Navigation Window, double-click on a system folder.
3. Double-click the CLI Window icon to open a CLI Window.

2.6 Choosing a Connection Method

The Client offers three ways to connect to your storage subsystem: over the controller's serial port, the SCSI bus (Windows 2000 and Windows NT Only) or over a TCP/IP network. The serial port and SCSI bus connections are local connections and allow you to connect to only one storage subsystem at a time.

2.6.1 Establishing a Serial Connection

The simplest connection to a storage subsystem is a direct, cable connection from the Client's host system to one of the storage subsystem's serial ports. To establish a serial connection, connect a serial cable from one of the PC's COM ports to the storage subsystem's serial configuration port and proceed as follows:

1. From the Start menu, select Programs, Command Console 2.1, and then the *HSG80 Storage Window* applet.
2. When the Connection Selection dialog box displays, select the *Serial* option, then click OK to display the Connect Serial dialog box (Figure 2-17).
3. On the Serial Connection dialog box, from the drop-down menu, select the PC COM port your controller is connected to, a subsystem physical and grid view, and a baud rate. Next click the Connect button to display the Storage Window. When the Storage Window appears, you are connected to your storage subsystem.

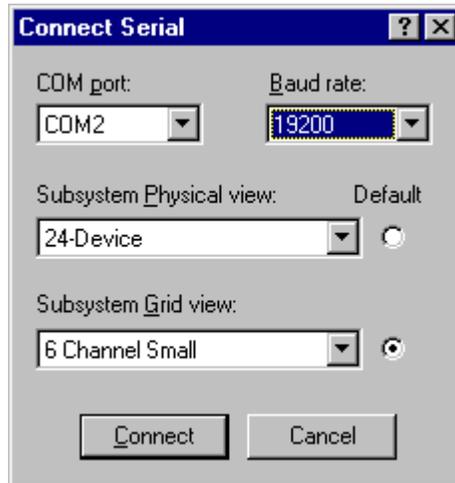


Figure 2-17. Connect serial dialog box

2.7 Creating a Virtual Disk

Before you can create a virtual disk, you must select a host system, open a Storage Window, set the Controller parameters, and make your physical devices known to your Controller.

2.7.1 Add Physical Devices to Your Configuration

You must make the physical devices known to the Controller before you can create virtual disks from them. To add physical devices to the configuration:

1. In the Storage menu, select *Device*, then *Add*.
2. Enter your password if required.
3. When Client prompts you to insert the physical devices (Figure 2–18), insert them in the storage subsystem; then click the **OK** button. Client adds your devices to your configuration and refreshes the Storage Window.



Figure 2-18. Insert devices prompt

Once you have added the physical devices to the storage configuration you can use them to create a number of different types of logical storage units called virtual disks. You can create:

- Single-device virtual disks JBODs (Just a Bunch of Disks)
- Striped virtual disks (RAID 0)
- Mirrored virtual disks (RAID 1)
- Striped mirrored virtual disks (RAID 0+ 1)
- Striped virtual disks with parity (RAID 3/5)

2.7.2 Create a Virtual Disk

1. In the Storage menu, select *Add Virtual Disk*. Virtual Disk Wizard's Step 1 (Figure 2-19) appears. There are five steps in total.
2. Select the RAID level you want to create, then click *Next*.

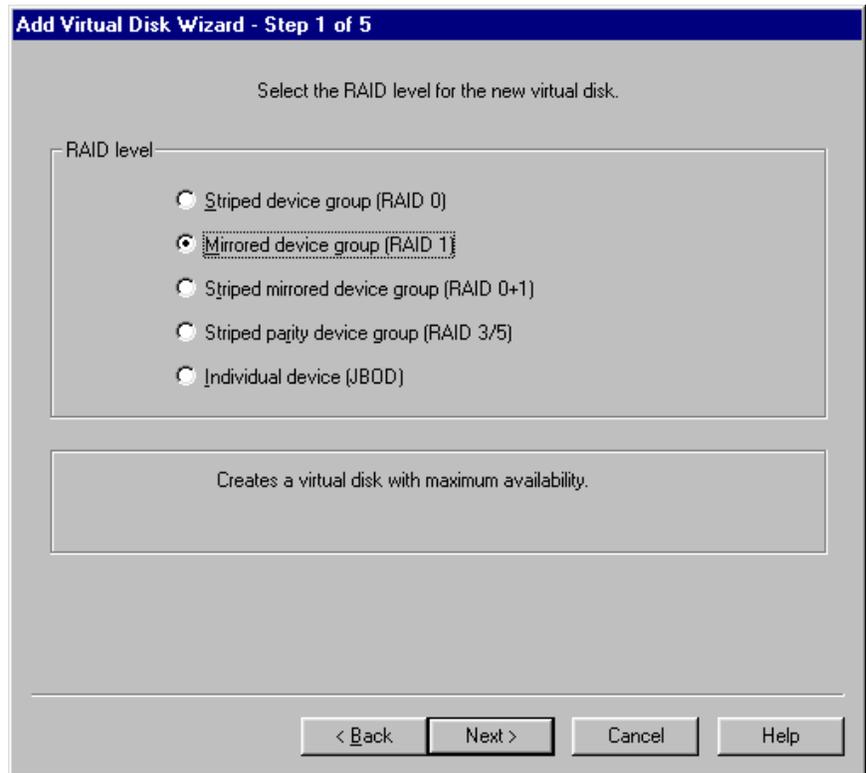


Figure 2-19. Add virtual disk wizard step 1

3. Select the devices you want to include in the virtual disk from a list of available storage devices. You select devices by double-clicking them in the *Available Storage* window in the dialog box. As you click them, they move to the *Selected Devices* window in the dialog box. They are also shown as selected in the Device Window pane of the Storage Window. When you are finished selecting devices, click *Next*.

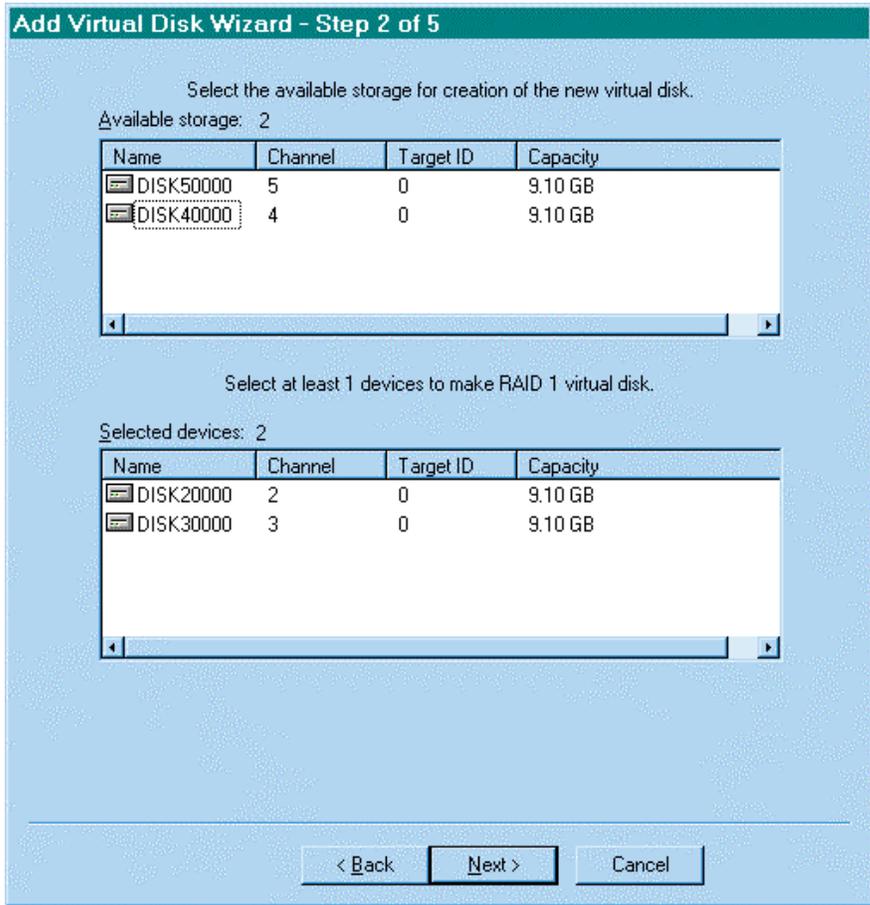


Figure 2-20. Add virtual disk wizard step 2

4. Select the capacity of the virtual disk, then click *Next*. The wizard offers you the option of using only a portion of the capacity of the devices you have selected for your new virtual disk. It displays the total, available capacity of the devices you have selected in the capacity box. Enter the size of the virtual disk you want to create in the box, and click *Next*.

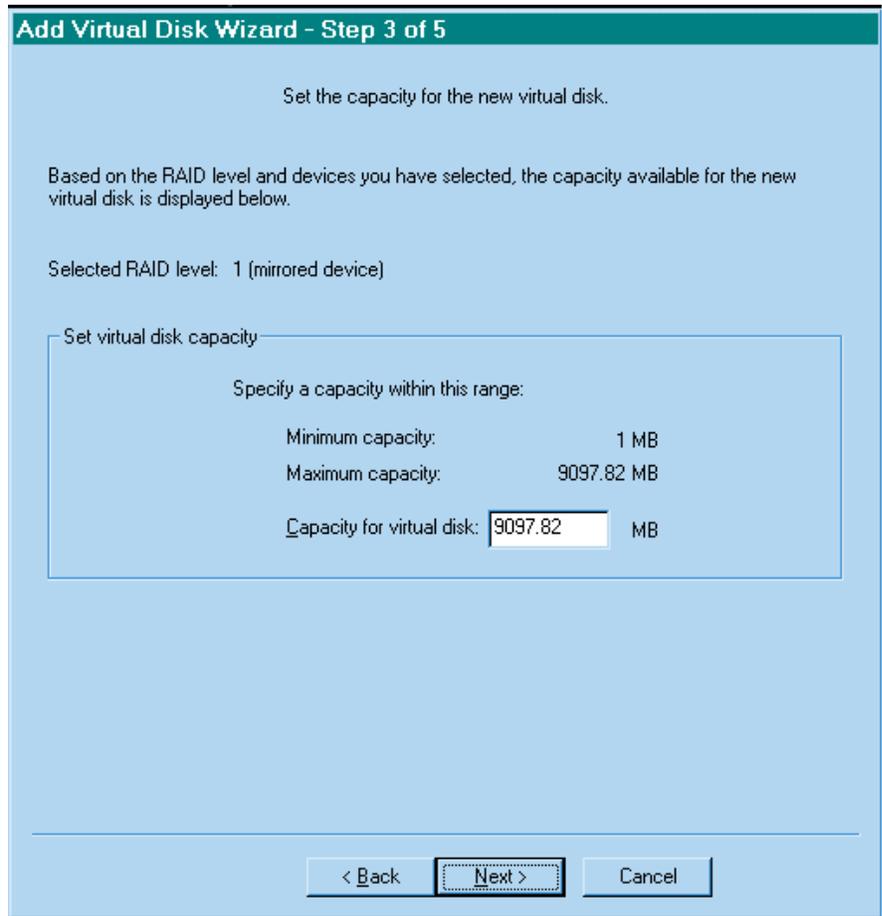


Figure 2-21. Add virtual disk wizard step 3

5. Specify the target ID and Logical Unit Number (LUN), operating parameters, and options of your new virtual disk, then click *Next*.

Add Virtual Disk Wizard - Step 4 of 5

Set the options to be used when creating this new virtual disk.

Virtual Disk Name
Name (i.e..D0 - D199):

Enable writeback cache Enable read cache
 Enable readahead cache Enable writeprotect

Maximum cached transfer: blocks

Host access:

Save controller configuration to virtual disk

Read source:

Replacement policy:

Copy speed:

Strip size (in blocks):

Reconstruction rate:

< Back Next > Cancel

Figure 2-22. Add virtual disk wizard step 4

6. The final Virtual Disk Wizard window, Step 5, recaps the choices you have made in Steps 1 through 4. If you are satisfied with your choices, click *Finish*. Otherwise, use the *Back* button to go return to the previous step and make the necessary changes.

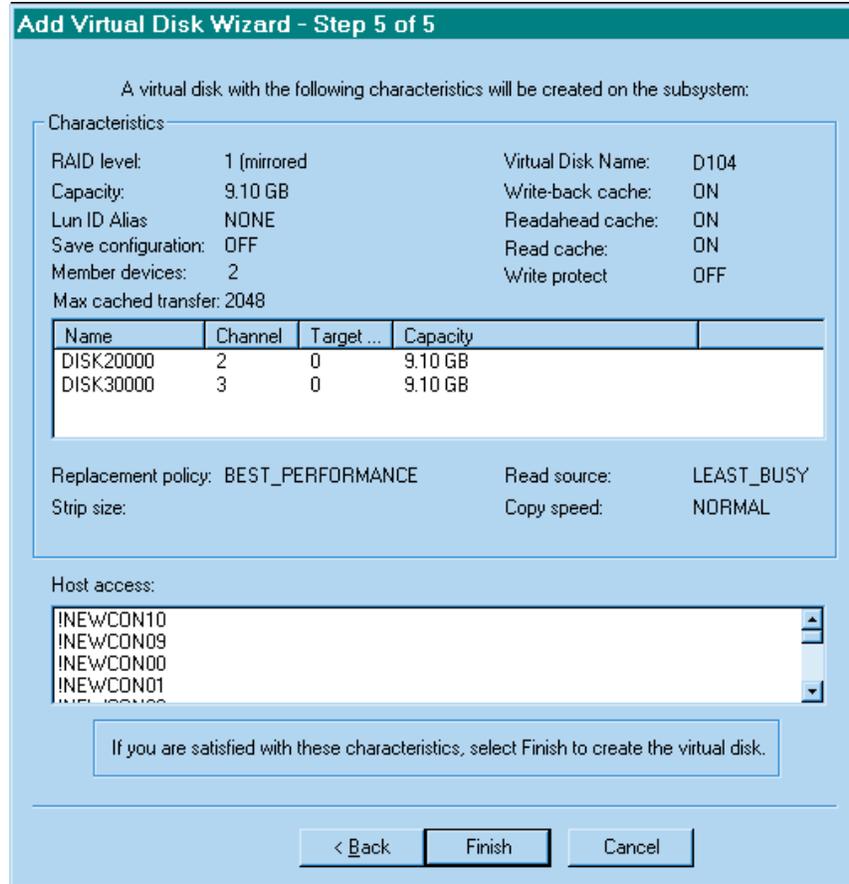


Figure 2-23. Add virtual disk wizard step 5

2.7.3 Delete a Virtual Disk

To delete a virtual disk:

1. Select its icon by clicking on it in the Virtual Disk Window.
2. Choose *Storage* from the Menu Bar; then *Virtual Disk*, then *Delete*.

2.7.4 Saving the Configuration

1. From the Storage menu, click *Controller Configuration*, then *Save*.
2. The Save dialog box appears, enter the desired location and file name.
Your configuration is saved.

Chapter 3

Creating Your Storage Configuration with the CLI

This chapter contains instructions for creating an initial storage configuration using the Command Line Interpreter (CLI). It briefly describes the CLI and how to access it. The configuration steps include: adding devices; creating and initializing RAIDsets, stripesets, mirrorsets, and striped mirrorsets; identifying a storageset as a unit to the host; and verifying and recording the final configuration.

NOTE: To create your storage configuration using the StorageWorks Command Console, refer to *Compaq StorageWorks Command Console V2.3 User Guide*.

Once you complete the physical setup of the RAID Array, configure the devices in your subsystem into storagesets.

To configure the devices in your subsystem into storagesets, you need to:

- Plan your configuration (Refer to *Appendix A*)
- Add disks to the controller
- Create storagesets
- Save the configuration
- Record the configuration

3.1 Configuration Guidelines

Use the following guidelines to configure the HSG80 controller and your host system to optimize system performance.

3.1.1 Controller Device Configuration Guidelines

- The enclosure has six device ports (SCSI buses). Evenly distribute disk devices across the six separate device ports. This permits parallel activities on the controller's available device ports to the attached drives.
- Avoid configuring multiple mirrorsets with the first member being on the same device port. Configure multiple mirrorsets similar to the following example:

```
add mirrorset mirr_1 disk12000 disk20000
add mirrorset mirr_2 disk20100 disk10100
```

3.1.2 Host System Configuration Guidelines

You need to assign a host logical unit number to each storageset or single disk unit that you want your host to know about in your subsystem. The host uses these numbers to indicate the source or destination for every I/O request it sends to the controller.

Each logical unit number contains the following:

- A letter that indicates the kind of devices in the storage unit. For example, D for disk drives
- A number from 0-99 or 100-199

Each HSG80 controller has two host ports, Port 1 and Port 2, as shown in the following figures. Unit numbers D0-D99 are assigned to Host Port 1, unit numbers D100-D199 are assigned to Host Port 2. You can specify a maximum of 64 host logical units per host port, for a total of 128 host units when access is from two Fibre Channel host adapter ports. The last two digits of your unit number specify the Logical Unit Number (LUN), at which Solaris will see the unit. **Ensure that the LUN is specified in your `\kernel\drv\sd.conf` file; failure to do so may prevent Solaris from accessing the unit.** The *CPQhsg80* package enables lun 0 through 15 on each port by default.

To change LUN/Target definitions, use the *config.sh* utility, option 20-add/change adapters.

NOTE: Always assign all partitions of a storageset to the same host port (do not split partitioned storagesets across host ports).

Controller A	Port 1 Active	Port 2 Unused	
EMPTY			
Cache A		EMPTY	

Figure 3-1. Single controller/single host

- For single HSG80 controller configurations connected to a single host you can configure up to 64 host logical units on Controller A - Host Port 1. Valid unit numbers are D0-D99. Controller A - Host Port 2 is unused.

Controller A	Port 1 Active	Port 2 Active	
EMPTY			
Cache A		EMPTY	

Figure 3-2. Single controller/two hosts

- For single HSG80 controller configurations connected to two host systems, for one host you can configure up to 64 host logical units on Controller A - Host Port 1. Valid unit numbers are D0-D99. For the other host, you can configure up to 64 host logical units on Controller A - Host Port 2. Valid unit numbers are D100-D199.

Controller A	Port 1 Active	Port 2 Unused	
Controller B	Port 1 Standby	Port 2 Unused	
Cache A		Cache B	

Figure 3-3. Dual controller/single host

- For dual-redundant HSG80 controller configurations connected to a single host you can configure up to 64 host logical units on Controller A - Host Port 1. Valid unit numbers are D0-D99. Controller B - Host Port 1 is automatically configured as a standby port for these same 64 units. Controller A - Host Port 2 and Controller B - Host Port 2 are unused.

Controller A	Port 1 Active	Port 2 Standby	
Controller B	Port 1 Standby	Port 2 Active	
Cache A		Cache B	

Figure 3-4. Dual controllers/two hosts

For dual-redundant HSG80 controller configurations connected to two host systems, for one host you can configure up to 64 host logical units on Controller A - Host Port 1. Valid unit numbers are D0-D99. Controller B - Host Port 1 is automatically configured as a standby port for these same 64 units.

For the other host you can configure up to 64 host logical units on Controller B - Host Port 2. Valid unit numbers are D100-D199. Controller A - Host Port 2 is automatically configured as a standby port for these same 64 units.

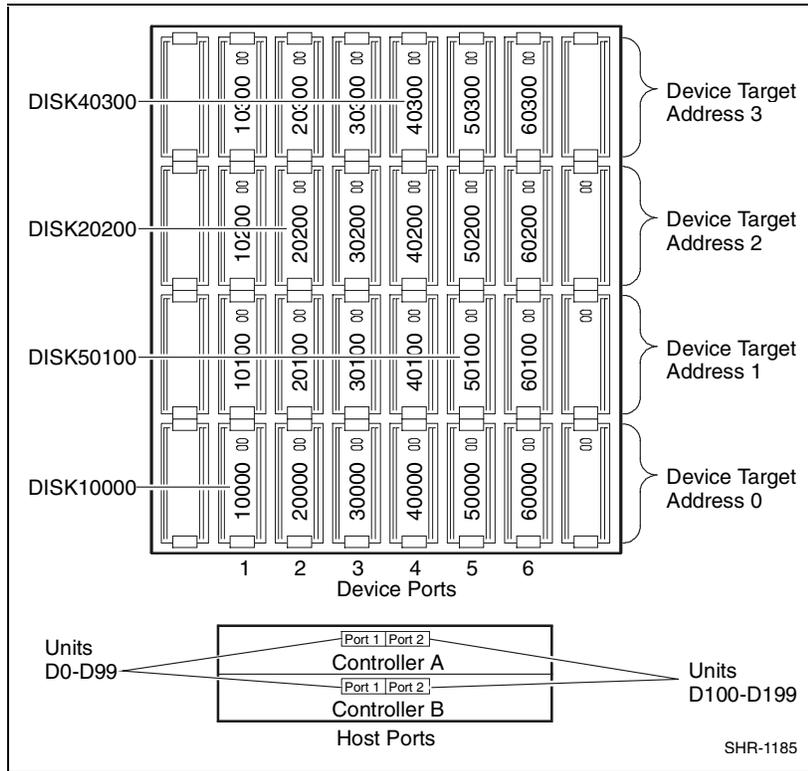


Figure 3-5. Mapping of device ports/targets and host ports in a BA370 enclosure (RA8000/ESA12000)

Model 4214 Disk Enclosure Shelf 1 (Single-Bus)							
Bay	1	2	3	4	5	6	7
SCSI ID	00	01	02	03	04	05	08
	DISK10000	DISK10100	DISK10200	DISK10300	DISK10400	DISK10500	DISK10800
Bay	8	9	10	11	12	13	14
SCSI ID	09	10	11	12	13	14	15
	DISK10900	DISK11000	DISK11100	DISK11200	DISK11300	DISK11400	DISK11500

Model 4254 Disk Enclosure Shelf 1 (Dual-Bus)							
Bay	1	2	3	4	5	6	7
SCSI ID	00	01	02	03	04	05	08
	DISK10000	DISK10100	DISK10200	DISK10300	DISK10400	DISK10500	DISK10800
Bay	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08
	DISK20000	DISK20100	DISK20200	DISK20300	DISK20400	DISK20500	DISK20800

Figure 3-6. Mapping of device ports/targets and host ports in a Model 4214 or Model 4254 disk enclosure (MA8000/EMA12000)

3.2 Accessing the Command Line Interpreter (CLI)

The CLI is a command line user interface to the HSG80 controller. It provides a series of commands for you to create a configuration for the subsystem through the controller's firmware.

This chapter describes only the CLI commands required to create an initial configuration on the controller.

See the *Compaq StorageWorks HSG80 Array Controller ACS Version 8.5 CLI Reference Guide* for detailed descriptions of all CLI commands.

You must make a serial connection to the HSG80 controller to access the CLI.

The three methods of accomplishing the connection are:

- Using an ASCII terminal
- Using a PC running a communications program
- Using a SUN system with the “tip” command

See Command Line Interpreter in the HSG80 RAID Array Controller CLI Reference Manual for detailed descriptions of all CLI commands.

3.2.1 Connecting the Cable to a PC or ASCII Terminal

To connect a maintenance terminal or PC to a HSG80 Controller follow these steps:

1. Locate the connecting cable that came with the HSG80 array controller. It has an RJ12 connector (similar to standard telephone plug) on one end and a 9-pin serial connector on the other end.
2. Plug the serial connector into the 9-pin serial port/com port 1 of the PC. If a 9-pin serial port is not available on a PC, use the 9-pin to 25-pin adapter (P/N: 12-45238-01) supplied with your subsystem.
3. Plug the RJ12 connector from the PC or maintenance terminal into the maintenance port on the HSG80 Controller (see Figure 3–6).
4. Note which serial port on the PC you use; you will need that information if using a communications program.

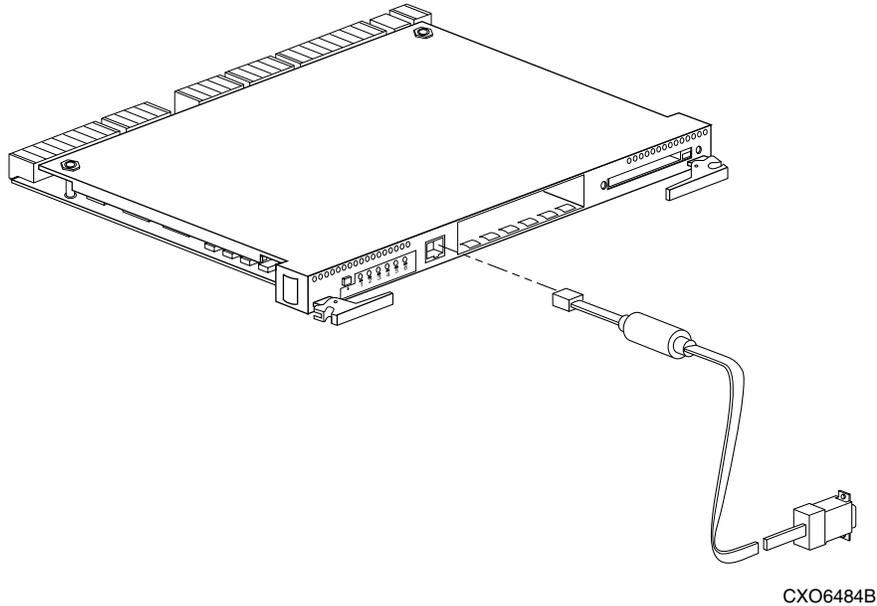


Figure 3-7. Making a serial connection to the HSG80 controller

3.2.2 Establishing Connection with a SPARC System

To setup your SPARC system for connection with the HSG80 Controller, follow these steps:

1. Use the supplied serial cable, and the 9 to 25 pin RS-232 adapter (P/N=12-45238-01) to connect the serial port on the SPARC system to the serial port on the RAID array controller.
2. If you use a SUN A/B Serial Splitter Cable, and/or you attach the controller to serial port #1, you may need to modify the *remote* file to specify *ttya* as follows:

Open the file `/etc/remote` with an editor.

Locate the lines:

```
hardwire:\  
:dv:/dev/ttyb:br#9600...
```

Change `ttyb` to `ttya`.

Save the file.

1. Open a *terminal window* from the Desktop Program menu.
2. Start the Terminal Interface Program (TIP), at the prompt type: tip hardware and press the **Enter** key.
3. Press the **Enter** key again and the CLI prompt appears in the window similar to the following:

```
HSG80>
```

3.2.3 Establishing Connection with a Maintenance Terminal

To establish a connection between a maintenance terminal and the controller, follow these steps:

1. After connecting the maintenance terminal cable to the controller, press the Enter key. The CLI prompt appears in the window similar to the following:

```
HSG80 >
```

2. To view the status of the controller, type:

```
HSG80 > SHOW THIS_CONTROLLER FULL
```

The controller displays information similar to the following example: (dual-redundant configuration shown)

```
Controller:
  HSG80 ZG74100091 Software V85F-0, Hardware E01
  NODE_ID      = 5000-1FE1-FF00-0170
Allocation_Class=0
SCSI_Version=2
  Configured for dual-redundancy with ZG74100121
  In dual-redundant configuration
  Device Port SCSI address 7
  Time: 28-SEP-1998 21:03:32
Host PORT_1:
  Reported PORT_ID = 5000-1FE1-FF00-0171
  PORT_1_TOPOLOGY = Fabric (fabric up)
  Address = 210113
Host PORT_2:
  Reported PORT_ID = 5000-1FE1-FF00-0172
  PORT_2_TOPOLOGY = Fabric (standby)
  Address = 210213
```

Cache:
128 megabyte write cache, version 0012
Cache is GOOD
Battery is GOOD
No unflushed data in cache
CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
Mirrored Cache:
Not enabled
Battery:
FULLY CHARGED
Expires:
NOCACHE_UPS
Extended information:
Terminal speed 9600 baud, eight bit, no parity, 1 stop bit
Operation control: 00000000 Security state code: 21429
Configuration backup disabled

NOTE: Verify that the output of the “SHOW THIS” command from your subsystem is similar to that shown. If the controller presents a NODE_ID of all zeros (0000-0000-0000-0000), refer to *Compaq StorageWorks HSG80 Array Controller ACS V8.5 Configuration Guide* for more information.

3.3 Adding Disks to the Configuration

The CONFIG utility locates and adds disks to the controller. Run the CONFIG utility whenever you add new disks to the controller. Enter the following command to start the configuration utility. The disk numbers will correspond to the disk locations for your subsystem.

HSG80 > **RUN CONFIG**

The controller responds with a display similar to that shown below:

```

Config Local Program Invoked
Config is building its tables and determining what devices exist on the subsystem.
Please be patient.
add disk12000 1 0 0
add disk10100 1 1 0
add disk10200 1 2 0
add disk20000 2 0 0
add disk20100 2 1 0
add disk20200 2 2 0
add disk30000 3 0 0
add disk30100 3 1 0
add disk30200 3 2 0
add disk40000 4 0 0
add disk40100 4 1 0
add disk40200 4 2 0
add disk40300 4 3 0
add disk50000 5 0 0
add disk50100 5 1 0
add disk50200 5 2 0
add disk50300 5 3 0
add disk60000 6 0 0
add disk60100 6 1 0
add disk60200 6 2 0
add disk60300 6 3 0
Config – Normal Termination

```

In this example, the controller has located 21 new disks. The 5 digit number associated with each disk corresponds to a one-digit Device Port Number, a two-digit Target Number and Controller Logical Unit Number. The Controller Logical Unit Number will always be 00. DISK40000, in this example, corresponds to the disk located on Device Port 4, on controller Target 0, and Controller Logical Unit 0. DISK50100 corresponds to the disk located on Device Port 5, controller Target 1, and Controller Logical Unit 0. Figure 3-5 shows the mapping of Device Ports, Targets and Host Ports.

3.4 Creating a RAIDset

RAIDsets stripe user data over multiple drives and calculate parity information for data redundancy. Create RAIDsets to use redundant stripesets in your array. RAIDsets must have at least three members and can have as many as fourteen. This example creates two three member RAIDsets using the ADD RAIDSET command.

```
HSG80 > ADD RAIDSET DVGRPRO DISK12000 DISK20000 DISK30000  
HSG80 > ADD RAIDSET DVGRPR1 DISK40000 DISK50000 DISK60000
```

In this example, “DVGRPRO” and “DVGRPR1” are the names of the RAIDsets, and they are followed by a list of disks to be included in each RAIDset. The names of the RAID sets are user selectable. Performance of your RAIDsets will be optimized if each RAIDset includes disks from different ports as shown in the example.

3.4.1 Initializing a RAIDset

Prior to putting a RAIDset(s) into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the RAIDset and makes this space inaccessible to the host.

When you initialize a RAIDset, you can specify a chunksize. A chunksize is the number of blocks of data that is transferred at one time. By using the default chunksize, the controller will optimize the chunksize by selecting a number equal to the number of blocks in one track of disk data. We recommend using the default chunksize.

```
HSG80 > INITIALIZE DVGRPRO CHUNKSIZE=DEFAULT  
HSG80 > INITIALIZE DVGRPR1 CHUNKSIZE=DEFAULT
```

3.4.2 Adding a RAIDset as a Logical Unit

To make a RAIDset available to the host computer, you must identify it as a host logical unit. For single controller subsystem, the unit numbers may range from D0 through D99 with a maximum of 64 units. These units are associated with Host Port 1. For dual controllers, the unit numbers may range from D0 through D99 for Host Port 1, and from D100 through D199 for Host Port 2, with a maximum of 64 units per Host Port. Add units by using the ADD UNIT command.

```
HSG80 > ADD UNIT D1 DVGRPRO  
HSG80 > ADD UNIT D2 DVGRPR1
```

This example uses D1 and D2, as the first and second units identified on the controller.

3.4.3 Setting Writeback Cache

This feature is enabled by default; but if it is necessary, a single CLI command enables that feature for the entire RAIDset:

```
HSG80 > SET D1 WRITEBACK_CACHE  
HSG80 > SET D2 WRITEBACK_CACHE
```

Where D1 and D2 represent the host logical units of the RAIDsets described above.

3.4.4 Setting Read Ahead Cache

This feature is enabled by default; but if it is necessary, a single CLI command enables that feature for the entire RAIDset:

```
HSG80 > SET D1 READAHEAD_CACHE
```

Where D1 represent the host logical unit of the RAIDsets described above.

3.5 Creating a Stripset

Use stripsets to stripe data across multiple disks. Striping data across multiple disks increases I/O performance compared with the performance of a single disk. Stripsets must have at least two members and can have as many as fourteen. All members must be single disks. This example creates a three-member stripset using the ADD STRIPESET command.

```
HSG80 > ADD STRIPESET DVGRPS0 DISK10100 DISK20100 DISK30100
```

In this example, “DVGRPS0” is the name of the stripset, and it is followed by a list of the disks to be included in the stripset. The names of the stripsets are user selectable. Performance of your stripsets will be optimized if each stripset includes disks from different device ports as shown in the example.

3.5.1 Initializing a Stripset

Prior to putting a stripset into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the stripset and makes this space inaccessible to the host.

When you initialize a stripset, you can specify a chunksize. A chunksize is the number of blocks of data that is transferred at one time. By using the

default chunksize, the controller will optimize the chunksize by selecting a number equal to the number of blocks in one track of disk data. We recommend using the default chunksize.

```
HSG80 > INITIALIZE DVGRPS0 CHUNKSIZE=DEFAULT
```

3.5.2 Adding a Stripese as a Logical Unit

To make a stripeset available to the host computer, you must identify it as a host logical unit. For single or dual controllers on a single host, the unit numbers may range from D0 through D99 with a maximum of 64 units. For dual controllers/two hosts, the unit numbers may range from D0 through D99 for the first host and from D100 through D199 for the second host with a maximum of 64 units per host adapter. Add units by using the ADD UNIT command.

```
HSG80 > ADD UNIT D3 DVGRPS0
```

This example uses D3, since the stripeset is the third unit identified on the controller.

3.5.3 Setting Writeback Cache

This feature is enabled by default; but if it is necessary, a single CLI command enables that feature for the entire stripeset:

```
HSG80 > SET D3 WRITEBACK_CACHE
```

Where D3 represents the host logical unit of the stripeset described above.

3.6 Creating a Mirrorset

Create mirrorsets to increase data availability and achieve data redundancy by maintaining at least two drives that have exactly the same data. Mirrorsets must have at least two members, and can have as many as six. This example creates a two-member mirrorset using the ADD MIRRORSET command.

```
HSG80 > ADD MIRRORSET DVGRPM0 DISK10200 DISK20200
```

In this example, DVGRPMO is the name of the mirrorset, and it is followed by a list of the disks to be included in the mirrorset. The names of the mirrorsets are user selectable. Performance of your mirror sets will be optimized if each mirrorset includes disks from different ports as shown in the example.

3.6.1 Initializing a Mirrorset

Prior to putting a mirrorset into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the mirrorset and makes this space inaccessible to the host.

```
HSG80 > INITIALIZE DVGRPMO
```

3.6.2 Adding a Mirrorset as a Logical Unit

To make a mirrorset available to the host computer, you must identify it as a host logical unit. For single or dual controllers on a single host, the unit numbers may range from D0 through D99 with a maximum of 64 units. For dual controllers/two hosts, the unit numbers may range from D0 through D99 for the first host and from D100 through D199 for the second host with a maximum of 64 units per host adapter. Add units by using the ADD UNIT command.

```
HSG80 > ADD UNIT D4 DVGRPMO
```

3.6.3 Setting Writeback Cache

This feature is enabled by default; but if it is necessary, a single CLI command enables that feature for the entire mirrorset:

```
HSG80 > SET D4 WRITEBACK_CACHE
```

Where D4 represents the host logical unit of the mirrorset described above.

3.7 Creating a Striped Mirrorset

Create a striped mirrorset to achieve high I/O performance and maximum data availability. striped mirrorsets must have at least two mirrorset members, and can have as many as fourteen. All members must be mirrorsets. To create striped mirrorsets, you first create mirrorsets and then you create stripesets with those mirrorsets.

3.7.1 Creating Mirrorsets

These examples create 2, two member mirrorsets for the striped mirrorset.

```
HSG80 > ADD MIRRORSET MIRR_0 DISK30200 DISK40200  
HSG80 > ADD MIRRORSET MIRR_1 DISK50200 DISK60200
```

In these examples, MIRR_0 and MIRR_1 are the names of the mirrorsets. Each is followed by the list of disks to be included in it.

3.7.2 Striping the Mirrorsets

Striped mirrorsets must have at least two members, and can have as many as fourteen. This example uses the ADD STRIPESET command to create a two member stripeset with the mirrorsets that you just created.

```
HSG80 > ADD STRIPESET DVGRPSM0 MIRR_0 MIRR_1
```

In this example, DVGRPSM0 is the name of the striped mirrorset, and it is followed by a list of mirrorsets to include in it. The name of the stripeset is user selectable. Performance of your striped mirrorset will be optimized if each mirrorset includes disks from different device ports as shown the example.

3.7.3 Initializing the Striped Mirrorset

Prior to putting a striped mirrorset(s) into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the striped mirrorset and makes this space inaccessible to the host.

When you initialize a striped mirrorset you can specify a chunksize. A chunksize is the number of blocks of data that is transferred at one time. By using the default chunksize, the controller will optimize the chunksize by selecting a number equal to the number of blocks in one track of disk data. We recommend using the default chunksize.

```
HSG80 > INITIALIZE DVGRPSMO CHUNKSIZE=DEFAULT
```

3.7.4 Adding a Striped Mirrorset as a Logical Unit

To make a striped mirrorset available to the host computer, you must identify it as a host logical unit. For single or dual controllers on a single host, the unit numbers may range from D0 through D99 with a maximum of 64 units. For dual controllers/two hosts, the unit numbers may range from D0 through D99 for the first host and from D100 through D199 for the second host with a maximum of 64 units per host adapter. Add units by using the ADD UNIT command.

```
HSG80 > ADD UNIT D5 DVGRPSMO
```

3.7.5 Setting Writeback Cache

This feature is enabled by default; but if it is necessary, a single CLI command enables that feature for the entire striped mirrorset:

```
HSG80 > SET D5 WRITEBACK_CACHE
```

Where D5 represents the host logical units of the striped mirrorset described above.

3.8 Adding Individual Disks as Logical Units

To use an individual disk in a RA8000/ESA12000 or MA8000/EMA12000 Fibre Channel subsystem, you must initialize it and then add it as a logical unit.

3.8.1 Initializing Individual Disks

Prior to putting an individual disk into service as a logical unit, you must initialize it. The INITIALIZE command copies controller metadata onto a small amount of disk space available on the disk and makes this space inaccessible to the host.

```
HSG80 > INITIALIZE DISK40100  
HSG80 > INITIALIZE DISK50100
```

3.8.2 Adding as Logical Units

To make an individual disk available to the host computer, you must identify it as a host logical unit. For single or dual controllers on a single host, the unit numbers may range from D0 through D99 with a maximum of 64 units. For dual controllers/two hosts, the unit numbers may range from D0 through D99 for the first host and from D100 through D199 for the second host with a maximum of 64 units per host adapter. Add units by using the ADD UNIT command.

```
HSG80 > ADD UNIT D4 DISK40100  
HSG80 > ADD UNIT D5 DISK50100
```

3.9 Adding Devices to the Spareset

It is advisable to add devices to the spareset to create a pool of devices for the controller to use as replacements for devices in a RAIDset, mirrorset or striped mirrorset that fail. If no spareset exists, these redundant types of storagesets will run “reduced,” and you should replace the disabled disk as soon as possible. To create the spareset, identify the drive(s) using the ADD SPARESET command.

```
HSG80 > ADD SPARESET DISK60100
```

In this example, DISK60100 was identified to the controller as a spareset.

NOTE: Please keep in mind that disks in the spareset must have at least the same storage capacity as those disks that they might replace.

3.10 Saving Copies of the Configuration

Use the following INITIALIZE command to save a copy of the entire controller configuration on a device or storageset in the subsystem. Save a

copy of the controller configuration on a device or storageset so that in the event of a controller failure, you will not need to create a new controller configuration.

The controller automatically updates the saved copy of the configuration whenever the configuration changes.

We recommend keeping a copy of the configuration on at least two devices or storagesets.

To save a copy of the configuration on disk, use the INITIALIZE command as follows:

```
HSG80 > INITIALIZE DISK12000 SAVE_CONFIGURATION
```

The controller places a copy of the configuration onto the specified device or storageset and automatically updates this saved copy whenever the configuration changes. To ensure availability of a copy of the configuration, save the configuration on at least two devices.

NOTE: The save configuration option extends the metadata on the storageset by approximately 500 blocks. The remaining user data area can be used by the host operating system as it would any other storageset after a logical unit has been created. ALL disks in the storageset will receive a copy of the configuration data.



CAUTION: If user data already exists on a storageset, do NOT reinitialize it with the *save configuration* option, as this will change the site and position of the user data on the storageset. Compaq recommends backing up user data prior to reinitializing any storageset.

3.11 Recording your Configuration

You have now completed all the steps required to create an initial configuration for your controller. In the following steps, you should verify and record your configuration for future reference. Additional worksheets are provided in this chapter for recording future new or modified configurations.

First, verify the Logical Units you have configured:

```
HSG80 > SHOW UNITS
```

The controller responds with a display similar to that shown below:

LUN	Uses
D1	DVGRPRO
D2	DVGRPR1
D3	DVGRPS0
D4	DISK40100
D5	DISK50100

Next, verify the storagesets you have configured:

HSG80 > **show storagesets**

The controller responds with a display similar to that shown below:

Name	StorageSet	Uses	Used by
DVGRPS0	stripeset	DISK10100 DISK20100 DISK30100	D3
DVGRPSM0	stripeset	MIRR_0 MIRR_1	D5
DVGRPM0	mirrorset	DISK10200 DISK20200	D4
MIRR_0	mirrorset	DISK30200 DISK40200	DVGRPSM0
MIRR_1	mirrorset	DISK50200 DISK60200	DVGRPSM0
DVGRPR0	raidset	DISK12000 DISK20000 DISK30000	D1
DVGRPR1	raidset	DISK40000 DISK50000 DISK60000	D2
SPARESET	spareset	DISK60100	
FAILEDSET	failedset		

Individual devices are not displayed in this report. To display individual devices, enter the following:

HSG80 > **SHOW DEVICES**

Record the above information in the following table. In the event of a controller failure, the information that is recorded here will assist you in reconstruction of the storageset on your RA8000/ESA12000 or MA8000/EMA12000 Fibre Channel subsystem.

Planning Your Storage Configuration

This appendix describes the RAID configuration options and RAID concepts which you need to know to create your storage configuration.

A.1 Planning Your Configuration

RAID stands for Redundant Array of Independent Disks. It is a way of configuring multiple physical disk drives to achieve high data availability and/or larger virtual disk devices. RAID is implemented as a set of multiple storage devices (disks, tapes, and solid-state disks), called an array, and a specialized array controller that manages the distribution of data across the array.

A RAID array, whether it contains two, five, or seven physical drives, can be configured to look like one or more large virtual disk drives. Use a RAID array virtual drive just as you would a physical drive. You can partition it if you want, and you do not need to make any application changes to realize the benefits of RAID. A RAID array provides higher levels of data availability and performance than a single physical disk drive of similar capacity.

Data for a given file is divided into chunks that is then be written across multiple drives. A *chunk* is a group of contiguous data blocks that are stored on a single physical disk drive. By using more than one physical drive, the data is transferred in chunks to multiple physical devices simultaneously, achieving transfer rates greater than each physical disk. Depending on the RAID level used, arrays also provide redundancy to protect the data availability. Arrays provide redundancy in two main ways: by mirroring and by generating parity.

The storage configuration options available depend upon your storage needs and the number of disks that you purchased for your RAID array. Table A-1 describes the storage options available and the minimum number of physical disks required to implement each.

You can use a variety of storageset type containers within a single subsystem, providing you have the disk device resources to support them.

Table A-1
Storage Configuration Options

Storage Method	StoragesetType	Number of Devices	Offers
RAID 3/5 A redundant-stripeset combining the optimized data transfers of RAID 3 with the striping of parity of RAID 5.	RAIDset	3 - 14	Good throughput and read bandwidth for a high request rate of small to medium transfers. High Data Availability.
RAID 0	Stripeset	2 - 14	Good performance for both read and write requests. Provides load balancing with each request requiring a single data operation. Data availability equivalent to that of an individual disk device.

continued

Table A-1
Storage Configuration Options *continued*

Storage Method	StoragesetType	Number of Devices	Offers
RAID 1	Mirrorset	2 - 6 devices per mirrorset, up to 20 mirrorsets per RAID array	Good performance for read requests. High Data Availability
RAID 0 + 1	Striped mirrorsets	2 - 14 mirrorsets	Performance for read requests surpassing that of an unstriped mirrorset since it can achieve load balancing. High Data Availability.
Individual Devices (JBOD)	Disk Drive	1	Provides the storage capacity and access speed of the disk used. If device fails, data is lost.

Once you select the type of storagesets that you want to use in your subsystem, you must create them using an appropriate configuration manager.

Fibre Channel: Considerations for a Loop and Fabric Environment

This appendix is divided into the following three sections:

- **1.0 General Considerations**, is a general discussion of the elements of a Fibre Channel environment.
- **2.0 StorageWorks' Sun Solaris Implementation of Loop and Fabric**, is a discussion of the StorageWorks' implementation of the Sun Solaris' approach for both Fibre Channel loop (FC_AL) and Fibre Channel switch (FC_SW) support at the system level.
- **3.0 Configuration Recipes**, is a recipe section for Arbitrated Loop and switch configurations.

In such a mixed environment of Fibre Channel loop and Fibre Channel switched access, there are specific differences in transport and access to storage subsystems—either on the loop or in the fabric. This appendix will help in the description of the differences and assist in the understanding of the configuration of Solaris servers and adapters for loop and switch support.

B.1 General Considerations

Fibre Channel Configurations are assemblages of servers, storage (RAID Arrays), hubs, switches, and repeaters. Together they present a multitude of options for configuring a storage area network and require attention to their configuration in design, installation, testing, and documentation.

In the simple cases, a configuration can easily be understood and investigated. In more complex configurations, with Fibre Channel's ability to support transmission lengths in terms of miles/kilometers the problems of design, installation, testing and documentation require a greater discipline and control.

This appendix does not attempt to answer the larger question of how to connect the assemblage in an installation but *rather* how to configure the Solaris server and the storage (RAID array) components so that given a path with a loop or switch configuration, the Solaris server and storage will be able to communicate successfully.

B.1.1 The Configurable Objects - Servers

Servers are the computing power and the communication access to the Storage that the computing applications require. In this appendix we are focusing the discussion on Sun servers running the Solaris operating system.

Servers can connect to local storage or RAID Arrays and many have tried to characterize the loading of a server in relation to a "number of " quantities involved in a Server-Storage relationship.

Commonly described in the loading relationships are considerable factors that include: 1) number of adapters on a server and 2) the number of RAID systems that may be connected to an adapter. The current rule of thumb is that a server may have up to 4 adapters and may connect up to 4 RAID arrays. These numbers represent a relatively safe area of loading and are acceptable for most general usage server-storage situations. For some servers (e.g., in the 4m class) these values are may be too high and for some servers (e.g., in the 4u class of Enterprise servers) these numbers may be too low. The maximum number of adapters is only limited by the number of available expansion slots. We have tested up to 24 adapters simultaneously in a mainframe-class machine (E10000).

These numbers, however, do not stand alone when describing a load on a server-storage system. The key value(s) are the actual I/O loading from server to storage. The major components of I/O values are: a) reading vs. writing data, b) the size of the records being read/written, and c) the frequency of data to/from a storage device.

Additionally, another set of parameters has a large impact on the viability of a configuration from the RAID array point of view. The major components such as: a) the nature of the controller (SCSI vs. Fibre), b) the amount of cache on the controller, and c) the configuration of the disks enclosed by the RAID Array.

Where does all this lead? The answer is quite simple but somewhat unacceptable from a "perfect world" point of view. The answer is that a specific configuration may or may not replicate the tested laboratory configuration(s). When treating a specific configuration the best guideline is to empirically determine the viability of a configuration that is outside of the 'safe' guidelines.

Additionally, while a given configuration *may* support the desired I/O quantity, it *may not* support a desired performance characteristic of the I/O. Thus both configuration and performance can be best described with some test trials of a specific configuration.

This appendix does not attempt to answer questions of loading or performance.

B.1.2 The Configurable Objects - Storage

Storage as used in this appendix is a RAID Array. Specifically, RAID arrays that are supported by the Compaq HSG80 family of controllers. This controller supports all of the standard RAID set configurations in a loop or fabric environment. This appendix *does not* attempt to answer the questions of best strategies for RAID set configurations with Fibre Channel.

However, the controller must be configured to either communicate in loop mode or fabric mode. These configuration elements *are* discussed herein.

B.1.3 A Special Note on Controller Pairs (Active-Passive vs. Active-Active)

In dual controller systems, most controller pairs are configured for redundancy which means that the controllers are bound together in a such a way that should one controller fail, the second controller will automatically service the I/O stream, protecting the integrity of the data.

Typically, this redundancy is created for failover protection. Failover can be implemented as either Active-Passive or Active-Active.

Table B-1 Case 1: Active-Passive (Describes the controller pair)			
Channel 1 - Active	Channel 2 - Active	Top Controller	Primary Ch 1, Primary Ch 2
Channel 1 - Passive	Channel 2 - Passive	Bottom Controller	Standby Ch 1, Standby Ch 2

In Case 1, all I/O would be loaded on a single controller, the Top controller, and in the event of a failure the passive channel would handle the I/O from the failed controller. Having the load on a single controller is not a benefit. It is a drawback to the processing power of the controller pair.

Table B-2 Case 2: Active-Active (Describes the controller pair)			
Channel 1 - Active	Channel 2 - Passive	Top Controller	Primary Ch 1, Standby Ch 2
Channel 1 - Passive	Channel 2 - Active	Bottom Controller	Primary Ch 2, Standby Ch 1

In Case 2, we are able to protect both I/O channels as well as distribute the processing load over both controllers.

The fact that one controller is active while the other controller is passive leads to a misnomer of active-passive to describe the redundant pair. The reason that this is a misnomer is the fact that the description is describing a single controller and not the controller pair.

When speaking of a single controller, it is correct to say ACTIVE-PASSIVE as that describes the state of the channels. This is shown with a single controller below.

Table B-3 Example of Active-Passive with a Single Controller			
Channel 1 - Active	Channel 2 - Passive	Top Controller	Primary Ch 1, Standby Ch 2

However, when applied to the **controller pair**, both controllers are active, the correct designation is ACTIVE-ACTIVE.

B.1.4 The Configurable Objects - Hubs

Hubs serve to create the connections within a loop. They also contain port-bypass circuitry to allow malfunctioning nodes to be bypassed, thus allowing the loop to continue to function.

NOTE: We do not support cascading hubs, so the largest supported loop configuration using hubs consists of 12 ports maximum.

B.1.5 The Configurable Objects - Switches

Switches serve to allow multiple connections to each other. With switches, Fibre Channel is removed from some of the limitations of arbitrated loop: throughput, single point of failure, sizing of configuration, etc.

Earlier we noted that the complexity of a configuration can increase dramatically with components added in the Fibre Channel storage network. While switches provide a great deal of flexibility and scalability of storage access and sharing, they also tend to make transparent the path from server to storage. So, this is a *first caution*: **take the time to plan your configuration, test the portions of it and record the various connections and paths.**

From the simplest case of a single server connected to a storage subsystem, we can extend the fabric by adding more subsystems, more switches, or more servers.

Adding switches is probably the easiest. To add a switch, all that must be done is to connect it to the existing fabric. In a fabric configuration of cascaded switches, there is only one *principal* switch. If there are two separate switch configurations then there will be two principal switches and care must be taken when integrating the two switch configurations.

The most common problem encountered when adding a switch to the fabric is domain overlap, especially when interconnecting old (Silkworm 1000 Series) and new (Silkworm 2000 Series) switches. It is important to keep in mind that every switch in a domain must have a unique domain ID. Refer to the documentation that came with your switch for more information on changing domain IDs and cascading switches.

Connecting a server or a switch to another switch is a simple process. The Fibre Channel cables are inserted into the gigabit interface converters (GBICs) that reside in each port of the switch.

So, connections between switches are as easy as connections between server and switch with the added ability of adding more switching capability and/or more storage.

B.1.6 The Fibre Channel Access/Transport paths: Fibre Fabric vs. Fibre Loop.

In a Fibre Loop (simply, loop), a server's Target is specified by the controller's port(s). These ports have physical addresses (PA) and in a loop that is arbitrated, the ports are designated ALPAs or 'arbitrated loop, physical addresses'. Since all servers and storage systems connected to a loop share it, it is important that every port on the loop have a unique ALPA. A complete list of ALPAs that may be used is included in *Appendix D*.

In the Fibre Fabric (simply, fabric) the basic Target becomes the controller's World Wide Node Name (WWNN). The WWNN is the fabric network address for the controller of the RAID array. WWNNs have a format of AAAA-BBBB-CCCC-DDDD where A, B, C, D are alphanumeric characters.

Each controller has two ports and each port has a designated World Wide Port Name (WWPN). In the StorageWorks' Solaris implementation, the specific WWPNs are used to define what nodes in the fabric that Solaris will attempt to bind to.

In summary, we will manage two entities with Fibre Channel: ALPAs for loop and WWPNs for fabric.

B.2 StorageWorks' Sun Solaris Implementation of Loop and Fabric.

B.2.1 Bindings

In general, bindings for drivers may be either dynamic or persistent. The drawbacks to dynamic bindings are threefold: 1) indiscriminate selection of Targets, 2) usage of system resources, and 3) long scanning delays while booting a server.

To remedy these three shortcomings, the StorageWorks' Solaris implementation uses a persistent set of bindings for both the loop and switch implementations.

Loop Bindings

Loop bindings rely on the ALPAs of the controller ports to define the SCSI Targets that Solaris binds to. The StorageWorks Solution software installation process (or the *config.sh* utility) will create entries in the */kernel/drv/sd.conf* file that allow the driver to have a direct entry/path for that Target.

Additionally, modifications are made to the driver configuration files per adapter. The driver files are: *fca.conf* for the 32-bit, JNI SBUS adapter, *fcaw.conf* for the 64-bit, JNI SBUS adapter and the *fca-pci.conf* for the JNI PCI adapter.

Fabric Bindings

Fabric bindings rely on the World Wide Names and the StorageWorks' implementation uses the more specific relationship, the World Wide Port Names(WWPN). Similar to the loop implementation, these WWPNs are the basis for the */kernel/drv/sd.conf* entries that identify a specific fabric access. WWPNs are derived from the WWNN as follows:

If a WWNN is FFFF-SSSS-TTTT-LLL0 the corresponding Port Names are:
 FFFF-SSSS-TTTT-LLL1 for Port 1
 FFFF-SSSS-TTTT-LLL2 for Port 2

By utilizing the WWPN the user has complete control over the mappings (and subsequently the system binding) from a server to a port in the fabric. By enabling the Port Names, we have the flexibility of mapping a server to a specific port of a fabric array or to multiple ports of a fabric array.

Additionally, the user is able to map a server with multiple adapters to multiple arrays in the fabric. And, if we extend the idea across servers, then we have many possibilities of configuring and sharing a storage in a fabric. Thus, in a shorthand version we can connect as follows:

```
Server 1 => Switch => array1, Port 1 & array1, Port 2
Or      Server 1 => Switch => array1, Port 1 & array2, Port 1
```

In every case we can access storage subsystems not directly connected to a single switch by resolving the access path through the fabric to a specific WWPN.

Obviously, this ability brings with it complexity and the need to both design and consider the growth possibilities for the fabric and the storage capability. So, this is a *second caution*: **take the time to plan a configuration, test the portions of it and record the various connections and paths.** This activity will provide a valuable tool for support of Fibre Channel fabric installations.

B.2.2 Loop Connections at the Solaris Level

SCSI Target bindings are defined in the */kernel/drv/sd.conf* file for both loop and fabric definitions. These entries look similar to the following:

```
name="sd" parent="/iommu@f,e0000000/sbus@f,e0001000/fcaw@0,0"
Target=65 lun=1
```

sd.conf entries reflect the choices that the user has made regarding the Targets, and the number of LUNs they wish to map to.

The examples below have been reformatted for clarity and discussion.

B.2.3 Loop Mappings

Three entries from a *sd.conf* file are shown below.

```
name="sd" parent="/sbus@a,0/fcaw@2,0" Target=64 lun=0;
name="sd" parent="/sbus@a,0/fcaw@2,0" Target=64 lun=1;
...
name="sd" parent="/sbus@a,0/fcaw@2,0" Target=64 lun=15;
```

Analysis

Device Class:	name="sd" The device class that we are enabling. The sd driver is the SCSI disk, or Target driver for Solaris.
Adapter Path:	parent="/iommu@f,e0000000/sbus@f,e0001000/fcaw@0,0" Identifies the adapter, the instance and the adapter/driver name. Note that the specific adapter path will vary with the specific architecture of the hardware, and the specific slot the adapter is installed in.
Target:	Target=64 The default bindings for Solaris use Targets of 64 and 65 for Arbitrated Loop. These Targets correspond with ALPAs 72 and 71. If multiple HSG80 controllers are configured on the same loop, you should have Targets 62 and 63 defined also (corresponding with ALPAs 74 and 73).
LUN:	lun=0 The default logical units of 0..15 have been supplied and may be extended to a total of 64.

B.2.4 Fabric Mappings

Two entries from a *sd.conf* file are shown below.

```
name="sd" parent="/iommu@f,e0000000/sbus@f,e0001000/fcaw@1,0" Target=64
lun=0
wwpn="5000-1fe1-0000-13f1";
...
name="sd" parent="/iommu@f,e0000000/sbus@f,e0001000/fcaw@1,0" Target=64
lun=15
ww pn="5000-1fe1-0000-13f1";
```

Analysis

Device Class:	name="sd" The device class that we are enabling. As with the loop settings, the SCSI disk driver is used.
Adapter Path:	parent="/iommu@f,e0000000/sbus@f,e0001000/fcaw@1,0" Identifies the adapter, the instance and the adapter/driver name.
Target:	Target=64 The default bindings for Solaris use Targets 64 and 65 for Fabric. These values are used in conjunction with the WWPN (see below) Unlike loop mode, these Targets are arbitrary; that is, they do not correspond to an ALPA. Targets 64 and 65 are simply used for compatibility with loop mode.
LUN:	lun=0 The default logical units of 0..15 have been supplied and may be extended to a total of 64. (See Adapter Configuration Menu below.)
Fabric Port:	wwpn="5000-1fe1-0000-13f1"; The WWPN that Solaris will attempt to bind to. This WWPN identifies the first port on the HSG80 controller.

B.2.5 The /opt/steam/bin/config.sh utility

When installing the StorageWorks RAID Manager Software, a utility script file is loaded onto the system. While installing the kit, the user may choose an installation directory or take the default, */opt* directory. These discussions assume that the default directory was used (*/opt/steam*).

This utility script has many options and they are documented in the Solaris Getting Started documentation. Our attention here is the ability to configure either loop ALPAs or fabric WWPNs. Both are accomplished with the */opt/steam/bin/config.sh* script.

The menu is shown below.

```
----- RAID array v8.5b Configuration Menu -----
Agent Admin Options                               Storage Subsystem Options
-----
1) Change Agent Password                         12) View Subsystems
2) Change SNMP Enterprise OID                   13) Add a Subsystem
3) Start/Stop the Agent                         14) Remove a Subsystem
4) Toggle Agent Startup on System Boot         15) Modify a Subsystem
5) Uninstall Agent

Agent Notification Options                       Client Options
-----
6) Toggle Error Log Notification               16) View Clients
7) Toggle Mail Notification                   17) Add a Client
8) View Mail Notification List                18) Remove a Client
9) Add User to Mail Notification List         19) Modify a Client
10) Remove User from Mail Notification List
11) Modify Mail Notification List

Exit:                                           Other Options
-----
q) Quit                                        20) Add/Change Adapters
Enter Selection:                               21) High Avail. Options
```

All the options in this menu apply to any subsystem and any server, regardless of the Fibre Channel access that we have chosen.

When the V8.5 kits are being installed, the user has the opportunity to declare the specific type of Fibre Channel configuration for each adapter, either loop or fabric. Additionally, there will be many times that a change must be made to the adapters and we direct our attention to the most powerful option, Option 20, Add/Change Adapters.

When selected , we have the following sub-menu:

--- Adapter Configuration Menu ---
(sd.conf & fc*.conf)

- 1) View Adapters
- 2) Add an Adapter
- 3) Remove an Adapter
- 4) Modify an Adapter
- q) Exit

Enter choice:

NOTE: In the header of this sub-menu we are reminded that actions that are performed here will affect the specific instance mappings in the `/kernel/drv/sd.conf` file as well as the specific driver file, `fca.conf` or `fcaw.conf` or `fca-pci.conf`.

Option 1 - View Adapters

The sample display below shows one SBUS 64-bit Adapter and two PCI Adapters. The SBUS adapter is configured for Arbitrated Loop and the PCI adapters are configured for Fabric mode. Note also that both PCI adapters are communicating with the same World Wide Port Name entities on the Fabric. We do not know anything about the RAID configuration that is employed.

NN Adapter	#	Control.	M	LN	Targets	Port IDs (WWPN)	Driver Path
1 fcaw	0 fcaw	L	16	64,65			/sbus@2,0/fcaw@2,0
2 fibre-channel	0 fca-pci	F	16	64	5000-1fe1-0000-0d41		/pci@a,2000/fibre-channel@2
				65	5000-1fe1-0000-0d42		
3 fibre-channel	1 fca-pci	F	16	64	5000-1fe1-0000-0d41		/pci@b,2000/fibre-channel@2
				65	5000-1fe1-0000-0d42		

-- Hit RETURN to continue --

Option 2 - Add an Adapter

When selecting Option 2, the user will be informed of and prompted for permission to scan the bus(es) on the system and report any adapters not already listed. The steps that follow when adding an adapter are self-explanatory.

Option 3 - Remove an Adapter

When selecting Option 3, the list of adapters will be displayed and the user can either choose to quit the 'remove' operation by pressing **ENTER** or select an adapter by inputting the adapter **NN** (numeric identification at the left in the list). The user must then confirm that this adapter is to be removed from the list.

Option 4 - Modify an Adapter

When selecting Option 5, Modify an Adapter we will see a listing of the adapters and may elect to quit the 'modify' action by pressing **ENTER** or select an adapter to modify by entering the **NN** (numeric identification at the left in the list).

The most important detail to remember is that changing values or the driver mode for one adapter instance will not affect the mode for the other adapter instances. In this way we can have unique instances of each adapter for a specific type of a fibre transport medium, loop or fabric.

NN Adapter	#	Control.	M	LN	Targets	Port IDs (WWPN)	Driver Path
1 fcaw	0	fcaw	L	16	64,65		/sbus@2,0/fcaw@2,0
2 fibre-channel	0	fca-pci	F	16	64	5000-1fe1-0000-0d41	/pci@a,2000/fibre-channel@2
					65	5000-1fe1-0000-0d42	
3 fibre-channel	1	fca-pci	F	16	64	5000-1fe1-0000-0d41	/pci@b,2000/fibre-channel@2
					65	5000-1fe1-0000-0d42	

Select record number NN (Hit RETURN to escape.):

Choose Record 2, and the following dialogue takes place. Each information message or prompt is prefaced with a bullet.

Note: After all prompts have been completed, the user has the option of accepting or rejecting the changes as shown in the change summary. (Shown below)

- **Driver fca-pci is configured for Fabric mode.**

This is always the first statement during modify and serves as a reminder of the mode of the adapter's driver.

- **Do you want to change this mode? [y,N]**

This question prompts for a change of mode. Obviously, given the starting mode of 'fabric', answering 'y' will set the driver for loop mode. Recall however, that to implement loop mode, the ALPAs are used for access.

Similarly, if changing from loop to fabric mode, we would need to supply the WWPNs.

- **Do you want to change the number of LUNs per Target? [y,N]**

By default, the Solaris Platform kit software supplies LUNs 0-15 for a total of 16 LUNs per Target. This number has been found to be more than adequate for many purposes. However, if a change of LUNs per Target is required and the user selects 'y', then the following prompt is displayed:

- **Enter the number of LUNs per Target in a range of 1..64 (default: 16):**

There are now two options available. Either press RETURN to accept the default value of 16 LUNs or enter the desired value.

- **Do you want to change the Target Ids? [y,N]**

The default Targets are 64 and 65. For a server that is communicating to more than one subsystem, we would need to have more than the two Targets. If the user selects 'y', then the following prompt appears:

- **Enter Targets (n= none, default: 64, 65) :**

The user has three options at this point:

- 1) Press RETURN and accept the default Target Ids of 64, 65.
- 2) Enter the new Target Ids. These Ids should be entered as decimal values, separated by spaces. Up to 16 Targets can be entered, and each Target should be in the range of 17—65.
- 3) Enter the letter, 'n'. This value specifies that there are no Targets specified. The impact of this action is very important as it will preserve the adapter in the mode requested but will remove all the *sd.conf* entries for that driver. The result is that the driver will no longer communicate with any Targets.

If the user has selected fabric mode then the next prompt will appear in an attempt to map the Target Ids to the WWPNs.

- **You configured driver fcaw for Fabric Mode.**

B.3 Configuration Recipes

This section is included as a reminder of the steps that must be taken to configure a loop environment or a fabric environment or change from one to the other (loop ⇔ fabric) from the Solaris and storage points of view. This is not intended as a complete configuration guide, but rather a set of macro-level change recipes. Some assumptions have been made in these recipes. For example, it is assumed that the server in question has an adapter to support the Fibre Channel loop or fabric; that a storage system is available that will support a fibre connection, that hubs and switches are available and so on.

NOTE: The next two recipes assume that the Solaris platform kit is being loaded onto the system and a specific mode of operation is being selected.

B.3.1 Loop Configuration(s)

1. Load the Solaris Platform kit and select the Loop mode for the driver when prompted. By default, the Targets that are associated with the adapter are 64, 65.
2. Reboot the system. This is the normal reboot after driver/kit installation.
3. Complete the installation as documented with `# /opt/steam/bin/install.sh`
4. If the server is in a hub configuration with multiple subsystems:
 - ❑ verify that the controller is configured for loop mode and verify that the specific, desired ALPAs are assigned to each destination controller port using the CLI.
 - ❑ verify that the server has the specific ALPAs assigned as Targets for the adapter by using `/opt/steam/bin/config.sh - Option 20 Add/Change Adapters, Option 1, View adapters`.
5. In cases that require a change of ALPAs at the server a reboot of the system will be required. The command `reboot -r` should be used to force a reconfiguration boot.
6. After reboot, the intended Targets should be visible under the *format* listing. This assumes that at least one unit has been created on the subsystem(s).

B.3.2 Fabric Configuration(s)

1. Load the Solaris Platform kit and select the Fabric mode for the driver when prompted. There are no default WWPNs so the software will prompt for the specific WWPNs. When entering the values, case is not important, but the hyphenation is.
2. Reboot the system. This is the normal reboot after driver/kit installation.
3. Complete the installation as documented with `# /opt/steam/bin/install.sh`
4. Verify that the destination subsystem(s) controller(s) are configured for fabric mode using the CLI.
5. If the Targets cannot be seen under the *format* command then a reboot -r of the server will be required. (This assumes that some change was made to the server or controller.)

NOTE: The next two recipes assume that the Solaris platform kit is loaded and everything is running as desired but a change of configuration is required.

B.3.3 Loop to Fabric Reconfiguration

1. Stop I/O to the subsystem. Perform backups, as required.
2. Remove the connections from the hub.
3. Reconfigure the controller(s) from loop to fabric mode using the CLI.
4. Create the connections from server to switch and from switch to subsystem. For configurations with multiple adapters and multiple subsystems verify all the Fibre Channel paths from server to subsystems.
5. At the server(s), reconfigure the adapters to support the fabric WWPNs and remove the unused loop Targets. This is accomplished with `/opt/steam/bin/config.sh` - Option 20 Add/Change Adapters, Option 4, Modify Adapters. This option allows the mode of the driver to be changed and the WWPNs to be added for the configuration. For each adapter that is used in the changed configuration, this modify step must be repeated. For each server in the changed configuration, this modify step must be repeated.

6. The changes from Step 5 require that the server(s) be rebooted (reboot -r) to reinitialize the drivers in the correct mode and acquire the new entries/Targets from the *sd.conf* files as discussed above. Shutdown and power-off the Sun server before rebooting. We have found that the adapters must be power-cycled for reliable operation when changing from loop to fabric mode.
7. Using the *format* command, verify that the units of the subsystem(s) are now available.

B.3.4 Fabric to Loop Reconfiguration

1. Stop I/O to the subsystem. Perform backups as required.
2. Remove connections from the switch and any other intermediate switches to the subsystem.
3. Reconfigure the controller(s) from fabric support to loop using SWCC or the CLI. At this time verify that the intended ALPAs are assigned to the controller ports as desired. The defaults may suffice.
4. Create the connections from server to hub and from hub to subsystem. For configurations with multiple adapters and multiple subsystems verify all the Fibre Channel paths from server to subsystems through the hub(s).
5. At the server(s), reconfigure the adapters to support loop. This is accomplished with */opt/steam/bin/config.sh* - Option 20 Add/Change Adapters, Option 4, Modify Adapters. This option allows the mode of the driver to be changed and the Targets to be verified for the configuration. For each adapter that is used in the changed configuration, this modify step must be repeated. For each server in the changed configuration, this modify step must be repeated.
6. The changes from Step 5 require that the server(s) be rebooted (reboot -r) to reinitialize the drivers in the correct mode and acquire the new entries/Targets from the *sd.conf* files as discussed above. Shutdown and power-off the Sun server before rebooting. We have found that the adapters must be power-cycled for reliable operation when changing from fabric to loop mode.
7. Using the *format* command, verify that the units of the subsystem(s) are now available.

Setting Up the Fibre Channel Switches

C.1 Introduction

The host bus adapters (installed in *Chapter 1*) attach to the storage system through Fibre Channel switches (also called “FC switches” or just “switches”). The switches constitute the fabric connection. This appendix explains how to attach the cables.

NOTE: Power to the host computer, switches, and storage subsystem should be OFF at the start of this procedure. Powering on the equipment in order so the switches can automatically configure the fabric.

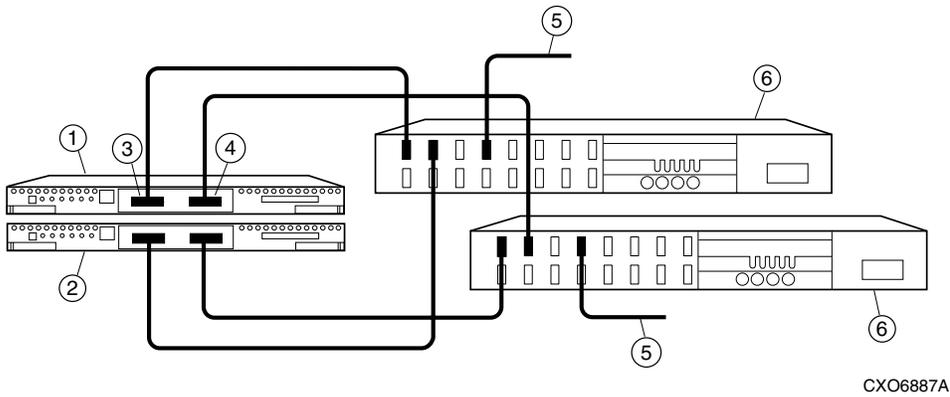
C.2 Cabling

The storage subsystem can contain either one or two controllers. The figures and their keys are as follows:

- Table C-1 is the key to Figure C-1 that shows cabling for systems with two controllers and two FC switches.
- Table C-2 is the key to Figure C-2 that shows cabling for systems with two controllers and one FC switch.
- Table C-3 is the key to Figure C-3 that shows cabling for systems with one controller and one switch.
- Table C-4 is the key to Figure C-4 that shows cabling for systems with one controller and one switch.

Table C-1
Cabling Two Controllers and Two Switches

Figure Legend	Description
❶	Controller A
❷	Controller B
❸	Host port 1
❹	Host port 2
❺	FC cable to host bus adapter
❻	FC switch

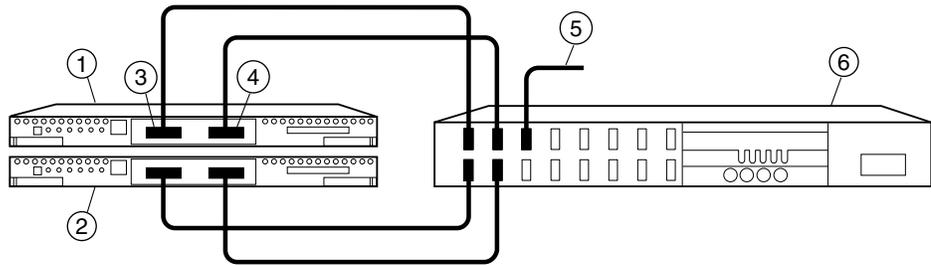


CXO6887A

Figure C-1. Cabling two controllers and two switches

Table C-2
Cabling Two Controllers and One Switch

Figure Legend	Description
①	Controller A
②	Controller B
③	Host port 1
④	Host port 2
⑤	FC cable to host bus adapter
⑥	FC switch

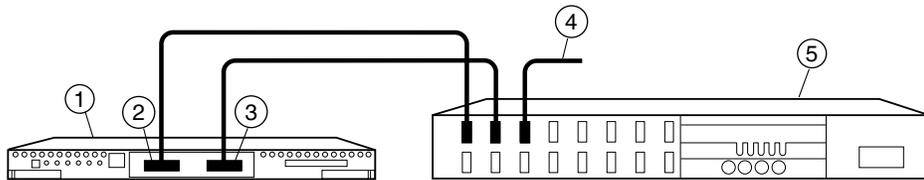


CXO6882A

Figure C-2. Cabling two controllers and one switch

Table C-3
Cabling One Controller and One Switch

Figure Legend	Description
①	Controller
②	Host port 1
③	Host port 2
④	FC cable to host bus adapter
⑤	FC switch

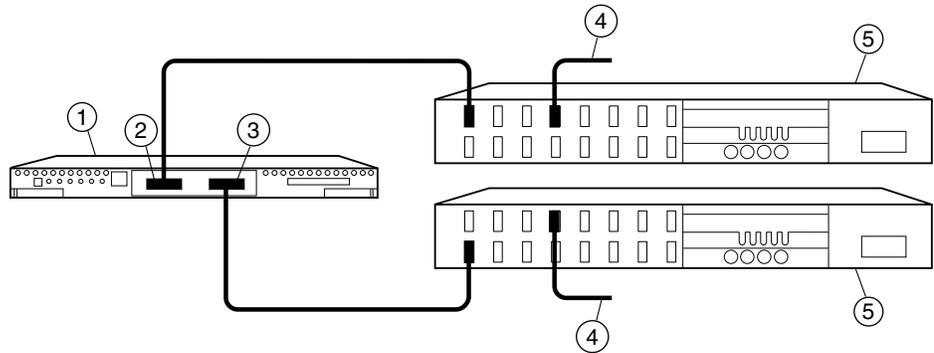


CXO6880A

Figure C-3. Cabling one controller and one switch

Table C-4
Cabling One Controller and Two Switches

Figure Legend	Description
①	Controller
②	Host port 1
③	Host port 2
④	FC cable to host bus adapter
⑤	FC switch



CXO6881A

Figure C-4. Cabling one controller and two switches

Appendix **D**

Valid ALPA Settings

This appendix provides a table of the valid arbitrated loop physical addresses (AL_PAs) available for hard addressing the devices on a fibre channel arbitrated loop.

D.1 Valid AL_PA Settings

Table B-1 lists the AL_PA settings and corresponding SCSI target numbers for hard addressing the fibre channel arbitrated loop using the CPQfca, CPQfcaw, or CPQfcaPCI drivers. Use this table when setting the PORT_1_AL_PA and PORT_2_AL_PA addresses on the HSG80 controller.

The values are ordered from lowest to highest priority. AL_PA = 00 is reserved for the FL_Port. AL_PA 0x01 through 0x70 are reserved for FC adapters installed in a Host system. When setting AL_PA addresses on the HSG80 controllers, use AL_PA 0x71 through 0xEF. The default setting for port 1 is AL_PA=71 and port 2 is AL_PA=72.

If you will be configuring multiple HSG80 controllers on a loop, you must ensure that all ports on a loop have unique AL_PAs. You will also have to manually configure your `\kernel\drv\sd.conf` file to add support for the correct target ids. This can be done with the `config.sh` utility; use Option 20, Add/Change Adapters.

For more information, refer to the `sd(7D)` and `driver.conf(4)` man pages.

Table D-1
Arbitrated Loop Physical Address (ALPA) Settings

AL_PA (hex)	Target (hex)	Target (dec)	AL_PA (hex)	Target (hex)	Target (dec)	AL_PA (hex)	Target (hex)	Target (dec)
EF	00	0	A3	2B	43	4D	56	86
E8	01	1	9F	2C	44	4C	57	87
E4	02	2	9E	2D	45	4B	58	88
E2	03	3	9D	2E	46	4A	59	89
E1	04	4	9B	2F	47	49	5A	90
E0	05	5	98	30	48	47	5B	91
DC	06	6	97	31	49	46	5C	92
DA	07	7	90	32	50	45	5D	93
D9	08	8	8F	33	51	43	5E	94
D6	09	9	88	34	52	3C	5F	95
D5	0A	10	84	35	53	3A	60	96
D4	0B	11	82	36	54	39	61	97
D3	0C	12	81	37	55	36	62	98
D2	0D	13	80	38	56	35	63	99
D1	0E	14	7C	39	57	34	64	100
CE	0F	15	7A	3A	58	33	65	101
CD	10	16	79	3B	59	32	66	102
CC	11	17	76	3C	60	31	67	103
CB	12	18	75	3D	61	2E	68	104
CA	13	19	74	3E	62	2D	69	105
C9	14	20	73	3F	63	2C	6A	106
C7	15	21	72	40	64	2B	6B	107
C6	16	22	71	41	65	2A	6C	108

continued

Table D-1
Arbitrated Loop Physical Address (ALPA) Settings *continued*

AL_PA (hex)	Target (hex)	Target (dec)	AL_PA (hex)	Target (hex)	Target (dec)	AL_PA (hex)	Target (hex)	Target (dec)
C5	17	23	6E	42	66	29	6D	109
C3	18	24	6D	43	67	27	6E	110
BC	10	25	6C	44	68	26	6F	111
BA	1A	26	6B	45	69	25	70	112
B9	1B	27	6A	46	70	23	71	113
B6	1C	28	69	47	71	1F	72	114
B5	1D	29	67	48	72	1E	73	115
B4	1E	30	66	49	73	1D	74	116
B3	1F	31	65	4A	74	1B	75	117
B2	20	32	63	4B	75	18	76	118
B1	21	33	5C	4C	76	17	77	119
AE	22	34	5A	4D	77	10	78	120
AD	23	35	59	4E	78	0F	79	121
AC	24	36	56	4F	79	08	7A	122
AB	25	37	55	50	80	04	7B	123
AA	26	38	54	51	81	02	7C	124
A9	27	39	53	52	82	01	7D	125
A7	28	40	52	53	83	00	7E	126
A6	29	41	51	54	84			
A5	2A	42	4E	55	85			

NOTE: Gray area denotes entries that are reserved for host bus adapters, and should not be used by HSG80 controllers.

Command Console LUN

This appendix discusses the Command Console LUN.

E.1 Command Console LUN

The StorageWorks RAID Array is configured by creating various types of storagesets and associating them with specific IDs called Logical Unit Numbers (LUNs). The Host uses these LUNs to access the underlying storageset. The RAID Array is preconfigured with a virtual LUN, located on Controller A, LUN 0. This device, called the Command Console LUN (CCL), allows the RAID Array to be recognized by the Host System as soon as it is attached to the SCSI bus 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 Inquiry command.

When the CCL is enabled, as it is upon delivery, its address can be determined using the CLI command:

```
HSG80 > SHOW THIS_CONTROLLER
```

The CCL can be disabled using the CLI command:

```
HSG80 > SET THIS_CONTROLLER NOCOMMAND_CONSOLE_LUN
```

The CCL is enabled using the 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. The CCL is enabled only on Host Port 1. At least one storage device must be configured on Host Port 2 before installing the Agent on a Host System connected to Host Port 2. This can be any type of storage device.

Select a storageset that you plan to configure and that is not likely to change. This storageset can be used by the agent to communicate with the RAID Array. Deleting this storageset (LUN) later will break the connection between the agent and the RAID Array.

NOTE: The CCL is a read-only device; the Solaris format command cannot write a disk label on it. Therefore, you will see an error message similar to the following: "(sd32): corrupt label - wrong magic number" while booting Solaris. To prevent this, you may disable the CCL and use another unit as a communication device. Use a unit that is not likely to change, as deleting it will break the connection between the Agent and the RAID Array.

Appendix **F**

For Advanced Users

This appendix provides information about Agent data files and formats for advanced level troubleshooting of agent installation problems.

F.1 For Advanced Users

The fastest and most user-friendly method of configuring an Agent is to use the configuration scripts. Use of the scripts is the recommended method for Agent configuration.

If you wish, however, you can manually configure any Agent by editing the Agent's configuration files with a text editor on the Agent's host system. To configure Command Console Agent for access protection and proper connection with your subsystems, you must edit five ASCII files.

- Services file
- Agent Configuration file
- Client Access file
- Subsystem Identification file
- Mail Notification file

The following sections describe the function of each file, along with the process of editing it.

NOTE: To place any changes in these files in effect, you must stop and restart Agent after you edit them.

NOTES:

- You must use the same port numbers with any clients with which you want to communicate. (For further details, refer to your Windows 2000, Windows 95, or Windows NT documentation).
- If you are running NIS+, you must do one of the following:
 - Add the spgui and spagent port numbers to the NIS+ services table.
 - Or
 - Edit your `/etc/nsswitch.conf` file and ensure that the "files" entry comes before the "[NOTFOUND=return]" entry.

F.1.3 Editing the Agent Configuration File

The agent configuration file, *steam.cfg*, configures Command Console Agent within its operating system.

File Format

The file contains five lines of ASCII text, formatted as follows:

device_special_file_path

The device special file path, */dev*.

agent_executable_file_path

The full path to the *steamd*, *client.ini*, and *storage.ini* files.

encrypted_password

The encrypted password from the password generation program.

manufacturer_name

Your manufacturer name. The default is "Digital Equipment Corporation" You can use up to 80 characters.

snmp_enterprise_assignment

Your SNMP enterprise assignment number. The default is "36.1.15.21.". (Note that this parameter is *not* your numerical TCP/IP address.) If you are unsure about this parameter, use the default or contact your network administrator.

Editing the File

Edit the `$BASEDIR/steam/bin/steam.cfg` file by performing the following actions:

1. Run the password generation program by changing to the directory that the `steamd`, `client.ini`, and `storage.ini` files are installed in and entering the following at a command prompt:

```
sp_passwd "yourpassword"
```

where `"yourpassword"` is a 4 to 16-character text string of your choosing.

The program generates an encrypted password string and displays it on the screen.

2. Use an ASCII editor to modify the `steam.cfg` file you copied during the installation process. Use the encrypted password from Step 1 as line 3 in the file.

Sample File

Following is a sample `steam.cfg` file:

```
/dev
/opt
Q1</Sn_k
Digital Equipment Corporation
36.1.15.21.
```

F.1.4 Editing the Client Access File

The client access file, `client.ini`, configures Command Console Agent for proper operation with its Command Console Client companions. The file is located in the directory `$BASEDIR/steam/etc`.

NOTE: Blank lines are not allowed in the `client.ini` file and the file must end with a carriage return. An embedded blank line or lack of a trailing carriage return may interfere with Agent execution.

File Format

The line for each client system must be in the following format:

```
system_network_addressnotification_methodaccess_allowed <CR>
```

where:

system_network_address

The network name, including the domain information if appropriate, of the remote system to which you wish to grant access. The address may be an alphanumeric alias or a numeric IP address. The address can be up to 128 characters long, including periods. If you are unsure of this address, consult your network administrator.

notification_method

The mechanism you wish Agent to use to notify Client sessions of a fault, where:

- 0 = no notification
- 1 = notify via TCP
- 2 = notify via SNMP
- 3 = notify via both TCP and SNMP

If you are unsure of which mechanism to use, use "1" for this parameter. To avoid significant delays in fault notification, set this parameter to "0" for Clients using RAS connections to the network.

access_allowed

You can configure Agent for three levels of subsystem access:

- Navigation Tree monitoring—Good/Bad indication in the Navigation Tree only. No Storage Window can be opened for the subsystem by this Client.
- Storage Window monitoring—All detailed information about the status of the storage subsystem available in a Storage Window, in addition to Navigation Tree monitoring capabilities.
- Storage Window configuration—Capability of changing the configuration of the storage subsystem in the Storage Window, in addition to monitoring the subsystem in both the Navigation Tree and Storage Window.

The *access_allowed* parameter sets the level of access you are granting to this remote system, where:

0 = Navigation Tree monitoring only. A Storage Window cannot be opened. No Storage Window monitoring or configuration changes allowed.

1 = Navigation Tree and Storage Window monitoring. No storage subsystem configuration changes allowed in the Storage Window.

2 = Navigation Tree monitoring and Storage Window monitoring and configuration access.

<CR>

A carriage return is required at the end of the file.

Editing the File

Use an ASCII editor to modify the *client.ini* file you copied during the installation process. Add a separate line in the file for each system that you wish to grant access to this host system. Use vertical bars (sometimes called the “pipe” character) to delimit the fields. You may add comment lines as long as they start in very first position and begin with the pound character, "#".

Sample File

Following is a sample *client.ini* file. This file enables full access for the remote Client system at network address *dreamon.your.company.com*, and sends fault notifications to Client using the TCP mechanism. It also disables configuration access by Client running on the system at network address *wanderlust.your.company.com*, but still enables asynchronous fault notification via the TCP mechanism.

```
# Access list for system HOST123:  
dreamon.your.company.com|12  
wanderlust.your.company.com|11
```

F.1.5 Editing the Subsystem Identification File

The subsystem identification file, *storage.ini*, configures Agent to communicate with the storage subsystems on the host on which Agent is running. The file is located in the directory *\$BASEDIR/steam/etc*.

NOTE: Blank lines are not allowed in the *storage.ini* file and the file cannot end with a carriage return. An embedded blank line or a trailing carriage return may interfere with Agent execution.

File Format

The line for each system must have the following format:

```
subsystem_name\monitor_interval\Reserved\controller_type\emu_type\this_sn\
other_sn\
fw_version\access_device\ccl_device\num_virtual_disks\device_ID\device_I
Dn
```

where:

subsystem_name

The name you wish to refer to the subsystem by when using the Client GUI. The name must be alphanumeric and can consist of up to 32 characters.

monitor_interval

The time interval, in seconds, between Agent's periodic status checks on this subsystem. The range of intervals is from 1 to 99,999 seconds. If you set this parameter to 0, Agent does not perform periodic status checks on the subsystem.

Reserved

This field is reserved for future use.

controller_type

A numeric identifier for the controller model used in the subsystem, as follows:

NOTE: All controller types may not be supported by your software version. Check the release notes for your specific software version to determine which controllers are supported.

0=HSZ20 controller
 2=HSD40 controller
 3=HSJ40 controller
 4=HSZ40 controller
 5=HSD50 controller
 6=HSJ50 controller
 7=HSZ50 controller
 8=HSZ70 controller
 9=HSZ80 controller
 10=HSG80 controller

emu_type

A numeric identifier for the type of environmental monitoring unit (EMU) used in the subsystem, as follows:

- 0=no EMUs installed
- 1=standard EMUs installed
- 2=enhanced EMUs installed

this_sn

The serial number of the controller with which the Agent is communicating.

other_sn

The serial number of the companion to the controller with which the Agent is communicating.

fw_version

The version number of ACS software running on the RAID Array.

access_device

The device name that identifies this storage subsystem in the operating system. Agent uses this device to communicate with the controller. The name has the format *cxydzs2* where:

- x** = controller number
- y** = target ID
- z** = lun number

For an HSG80 controller with an enabled communications LUN, this field contains the device name representing the communications LUN in the operating system. If the communications LUN is disabled, this device is one of the virtual disks listed in the *device_ID1*/*device_IDn* fields, below.

ccl_device

If a controller communications LUN (CCL), is enabled, this field contains information about that LUN.

For HSG80 controllers, this field contains either of the following:

The text string “disabled”, indicating that the communications LUN is disabled in the controller.

The operating system device name representing the communications LUN. The format is the same as the *access_device* field.

For all other controller types, this field contains the text string “none”, indicating that there is no communications LUN available. In this case, Agent uses the device specified in the *access_device* field to connect to the

controller. This device is a virtual disk, also listed in the *device_ID1|device_IDn* fields, below.

num_devices

A numeric value indicating the total number of virtual disks configured in the storage subsystem and added to the operating system as devices. Each virtual disk represents one or more physical devices attached to the controller.

This field contains the value 0 if no virtual disks are configured on this system, or if the ones that have been configured have not been added to the operating system as accessible devices. In this case, the controller's communications LUN must be enabled for Agent/controller communication to occur.

device_ID1|device_IDn

A listing of the operating system device names for the virtual disks configured in the storage subsystem. The format is the same as the *access_device* field. Vertical bars (sometimes called the "pipe" character) are used to delimit the virtual disk names. The total number of names listed must equal the value in the *num_devices* field.

Editing the File

Use an ASCII editor to modify the *storage.ini* file you copied during the installation process. Add a separate line in the file for each system that you wish to grant access to this host system. Use vertical bars (sometimes called the "pipe" character) to delimit the fields in each line. You may add comment lines as long as they start in very first position and begin with the pound sign character, "#".

Sample File

Following is a sample *storage.ini* file. This file configures the Agent to communicate with and monitor subsystems g80 and ra410. Subsystem g80 is a dual-redundant HSG80 based system with the CCL enabled. It is connected to device file c4t65d4s2 (the CCL), and it is checked every thirty seconds. Subsystem ra410 is a single-controller HSZ40 based system, connected to device c3t0d0s2.

```
# Storage subsystems for myhost.com

g80|30|0|10|2|ZG80900660|ZG80900624|V83G|c4t65d4s2|c4t65d4s2|8|c4t64d0s2|c4t64d1s2|c4t64d2s2|c4t64d3s2|c4t65d0s2|c4t65d1s2|c4t65d2s2|c4t65d3s2|

ra410|60|0|4|1|ZG60205297|N|A|V32Z|c3t0d0s2|none|2|c3t0d0s2|c3t2d0s2|
```

F.1.6 Editing the Mail Notification File

The mail notification file, *notify.ini*, configures Agent to send messages to specified network email addresses when a storage subsystem event occurs. The file is located in the directory */\$BASEDIR/steam/etc*.

NOTE: Blank lines are not allowed in the *notify.ini* file. A blank line may interfere with Agent execution.

File Format

The line for each e-mail address must be in the following format:

Mnotification_levelnetwork_email_address

where:

M

The ASCII character “M”.

notification_level

The levels of subsystem faults that generate an e-mail message for the e-mail address in this line, where:

1 = notify when fatal events occur

2 = notify when fatal events or events requiring warnings to the user occur

3 = notify when fatal events, events requiring warnings to the user, or events requiring only informational messages to the user occur

network_email_address

The complete network e-mail address you wish the notification message to be sent to.

Editing the File

Use an ASCII editor to modify the *notify.ini* file you copied during the installation process. Add a separate line in the file for each address you wish to notify when a storage subsystem event occurs. Use vertical bars (sometimes called the “pipe” character) to delimit the three fields in each line. You may add comment lines as long as they start in very first position and begin with the pound character, “#”.

Sample File

Following is a sample *notify.ini* file. This file configures Agent to use e-mail notification to you at *youall@yourcompany.com* for fatal events only.

```
# Email notification for HOST123  
M11|youall@yourcompany.com
```


Appendix **G**

SNMP MIB Information

This appendix provides information about the SNMP traps that may be generated by the Agent.

G.1 SNMP Trap Information

When a physical storage device, a logical storage unit, or a physical enclosure component changes state, the Agent sends out an SNMP trap (that is, an asynchronous event notification) to any hosts that are listed in the CLIENT.INI file with this option enabled. (See Appendix D, *For Advanced Users*, for more information on client.ini settings.)

This section describes the format of the SNMP traps that may be generated. There are 21 trap types, one for each FRU type and state.

G.1.1 Disk Device Failure Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 1
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>
Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.28
Value 3 = <disk device name>
Object 4 = 1.3.6.1.4.1.36.2.15.21.3.2.1.33
Value 4 = <cabinet>
Object 5 = 1.3.6.1.4.1.36.2.15.21.3.2.1.35
Value 5 = <channel>
Object 6 = 1.3.6.1.4.1.36.2.15.21.3.2.1.36
Value 6 = <target ID>

G.1.2 Disk Device Recovery Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 2
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>
Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.28
Value 3 = <disk device name>
Object 4 = 1.3.6.1.4.1.36.2.15.21.3.2.1.33
Value 4 = <cabinet>
Object 5 = 1.3.6.1.4.1.36.2.15.21.3.2.1.35
Value 5 = <channel>
Object 6 = 1.3.6.1.4.1.36.2.15.21.3.2.1.36
Value 6 = <target ID>

G.1.3 Power Supply Device Failure Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
 Source address = <ip address>
 Generic = 6
 Specific = 3
 Variable Binding List :
 Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
 Value 1 = <host name>
 Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
 Value 2 = <subsystem name>
 Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.33
 Value 3 = <cabinet>
 Object 4 = 1.3.6.1.4.1.36.2.15.21.3.2.1.29
 Value 4 = <power supply location>

G.1.4 Power Supply Device Recovery Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
 Source address = <ip address>
 Generic = 6
 Specific = 4
 Variable Binding List :
 Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
 Value 1 = <host name>
 Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
 Value 2 = <subsystem name>
 Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.33
 Value 3 = <cabinet>
 Object 4 = 1.3.6.1.4.1.36.2.15.21.3.2.1.29
 Value 4 = <power supply location>

Fan Device Failure Trap
 Enterprise = 1.3.6.1.4.1.36.2.15.21
 Source address = <ip address>
 Generic = 6
 Specific = 5
 Variable Binding List :
 Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
 Value 1 = <host name>
 Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
 Value 2 = <subsystem name>
 Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.33
 Value 3 = <cabinet>
 Object 4 = 1.3.6.1.4.1.36.2.15.21.3.2.1.30
 Value 4 = <fan location>

G.1.5 Fan Device Recovery Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 6
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>
Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.33
Value 3 = <cabinet>
Object 4 = 1.3.6.1.4.1.36.2.15.21.3.2.1.30
Value 4 = <fan location>

G.1.6 Cache Battery Failure Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 7
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>
Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.31
Value 3 = <cache battery location>

G.1.7 Cache Battery Low Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 8
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>
Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.31
Value 3 = <cache battery location>

G.1.8 Cache Battery Recovery Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 9
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>
Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.31
Value 3 = <cache battery location>

G.1.9 Temperature Sensor Over Threshold Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 10
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>
Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.33
Value 3 = <cabinet>
Object 4 = 1.3.6.1.4.1.36.2.15.21.3.2.1.32
Value 4 = <temperature sensor location>

G.1.10 Temperature Sensor Below Threshold Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 11
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>
Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.33
Value 3 = <cabinet>
Object 4 = 1.3.6.1.4.1.36.2.15.21.3.2.1.32
Value 4 = <temperature sensor location>

G.1.12 Communication Failure Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 12
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>

G.1.13 Communication Recovery Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 13
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>

G.1.14 Controller Failure Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 14
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>

G.1.15 Controller Recovery Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 15
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4

Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>

G.1.16 LUN Failure Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 16
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>
Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.34
Value 3 = <lun name>

G.1.17 LUN Reconstructing Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 17
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>
Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.34
Value 3 = <lun name>

G.1.18 LUN Reduced Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 18
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>

Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.34
Value 3 = <lun name>

G.1.19 LUN Recovery Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 19
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>
Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.34
Value 3 = <lun name>

G.1.20 EMU External Input Failure Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 20
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>
Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.33
Value 3 = <cabinet>

G.1.21 EMU External Input Recovery Trap

Enterprise = 1.3.6.1.4.1.36.2.15.21
Source address = <ip address>
Generic = 6
Specific = 21
Variable Binding List :
Object 1 = 1.3.6.1.4.1.36.2.15.21.1.4
Value 1 = <host name>
Object 2 = 1.3.6.1.4.1.36.2.15.21.3.2.1.2
Value 2 = <subsystem name>
Object 3 = 1.3.6.1.4.1.36.2.15.21.3.2.1.33
Value 3 = <cabinet>

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