COMPAQ

RA8000/ESA12000 HSG80 Solution Software V8.5 for Linux 6.1

Installation Reference Guide

Part Number AA-RKJQA-TE / 170473-001

First Edition (January 2000)
Compaq Computer Corporation

Notice

The information in this publication is subject to change without notice.

COMPAQ COMPUTER CORPORATION SHALL NOT BE LIABLE FOR TECHNICAL OR EDITORIAL ERRORS OR OMISSIONS CONTAINED HEREIN, NOR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM THE FURNISHING, PERFORMANCE, OR USE OF THIS MATERIAL. THIS INFORMATION IS PROVIDED "AS IS" AND COMPAQ COMPUTER CORPORATION DISCLAIMS ANY WARRANTIES, EXPRESS, IMPLIED OR STATUTORY AND EXPRESSLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, GOOD TITLE AND AGAINST INFRINGEMENT.

The software described in this guide is furnished under a license agreement or nondisclosure agreement. The software may be used or copied only in accordance with the terms of the agreement.

RA8000/ESA12000 HSG80 Solution Software V8.5 for Linux 6.1
First Edition (January 2000)
Part Number AA-RKJQA-TE/170473-001

Contents

Chapter 2
Installing the Command Console Client

Chapter 3
Creating Your Storage Configuration with the CLI

Appendix D
Valid ALPA Settings

Appendix E
For Advanced Users

Appendix F
Understanding RAID Manager's Mail Messages

Appendix G
SNMP MIB Information

Index

Index

List of Figures

List of Tables

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.
FILENAMES	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 *type* information, type the information **without** pressing the **Enter** key.
Enter	When you are instructed to *enter* 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-COMPAQ[1]. This service is available 24 hours a day, 7 days a week.

Outside North America, call the nearest Compaq Technical Support Phone Center. Telephone numbers for 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 and Flash ROM images. You can access the Compaq website by logging on to the Internet at http://www.compaq.com.

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.

---

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

Chapter 1

Installing StorageWorks Solution Software V8.5 on your Host System

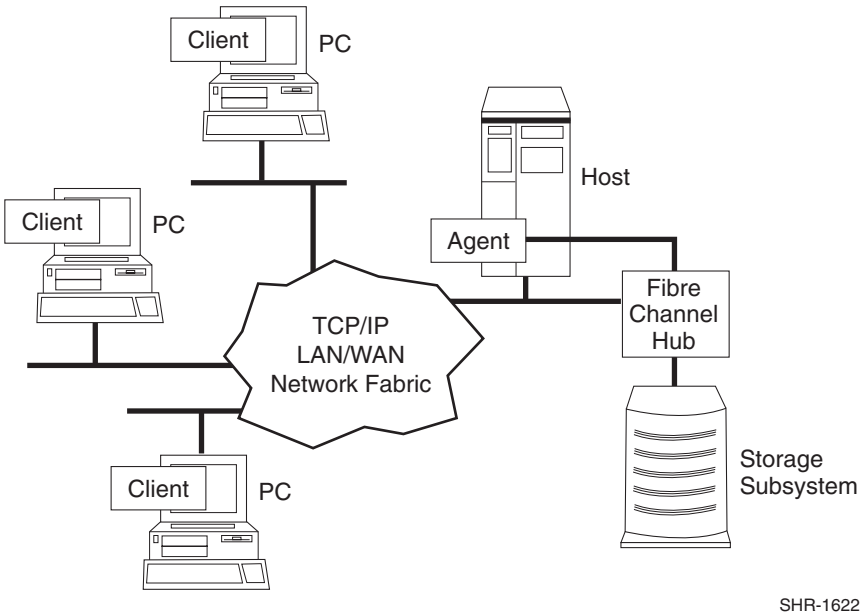
This chapter describes how to install StorageWorks Solution Software V8.5 on your Linux Server, and configure the Command Console Agent.

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 (CPQraidsw) software package.


Client
PC
Client
PC
Client
PC
Host
Agent
Fibre
Channel
Hub
TCP/IP
LAN/WAN
Network Fabric
Storage
Subsystem
SHR-1622

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 Linux Intel or Alpha 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 Linux 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 hub. Refer to *Appendix C* of this guide for basic hub setup instructions.
6. Reboot the Linux 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 Linux system to work with arbitrated loop storage, refer to *Appendix B* of this guide.
8. Reboot your Linux system, create partitions and filesystems on the new units.

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 Linux system with the "cu" command.

See Command Line Interpreter in the *HSG80 RAID Array Controller 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 RA8000/ESA12000 subsystem. 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.

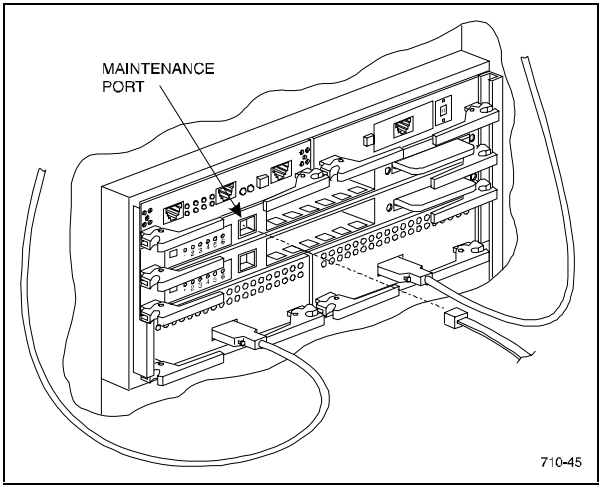


Figure 1-2. Making a serial connection to the HSG80 controller

1.2.3 Establishing Connection with a Linux System

To setup your Linux 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 Linux system to the serial port on the RAID Array controller.
2. Open the file /etc/uucp/ports

   Verify that the following lines exist:

   - port com1
   - type direct
   - device /dev/ttyS0
   - speed 9600

   If these lines are not in the ports file for the appropriate serial port, enter them and save the file.
3. Create /dev/ttyS0

   Enter:

   cd /dev

```
./MAKEDEV ttyS0
```

4. Open a *terminal window* from the Desktop Program menu.
5. Start the Call Up Program (CU), at the prompt type: `cu -p com1` and press the **Enter** key.
6. 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 ZG92004735 Software V85F-0, Hardware E06
     NODE_ID        = 5000-1FE1-0001-6A40
Allocation_Class=0
SCSI_Version=SCSI-3
     Configured for dual-redundancy with ZG9204789
        In dual-redundant configuration
     Device Port SCSI address 7
     Time: NOT SET
     Command Console LUN is lun 0 (NOIDENTIFIER)
Host PORT 1
    Reported PORT_ID = 5000-1FE1-0001-6A41
     PORT_1_TOPOLOGY  = LOOP HARD (loop up)
     PORT_1_AL_PA=71 (71 negotiated)
Host PORT_2:
     Reported PORT_ID = 5000-1FE1-0001-6A42
     PORT_2_TOPOLOGY = LOOP HARD (Standby)
     PORT_2_AL_PA=72 (72 negotiated)
```

```
        NOREMOTE_COPY
    Cache
        32 megabyte write cache, version 0012
        Cache is GOOD
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
    Mirrored Cache:
        32 megabyte write cache, version 0012
        Cache is GOOD
        No unflushed data in cache
    Battery:
        NOUPS
        FULLY CHARGED
        Expires: 27-JUL-2001
    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 the HSG80 User's Guide, the controller configuration chapter for more information.

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

   SET THIS SCSI_VERSION = SCSI-3

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

   SET THIS PORT_1_TOPOLOGY = LOOP_HARD
   SET THIS PORT_2_TOPOLOGY = LOOP_HARD
   SET THIS PORT_1_AL_PA=71
   SET THIS PORT_2_AL_PA=72
   RESTART OTHER
   RESTART THIS

5. To show the connections made by the controller to the server via the switch, type `SHOW CONNECTION` at 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.

The symbol # represents the system prompt.

The StorageWorks Solution Software uses the Red Hat Package Manager (RPM). See the *Package Management with Red Hat Package Manager* chapter in the *Red Hat Linux Reference Guide* for more information.

Installing the Solutions Software on Red Hat Linux 6.1 requires the following major steps:

- Preparing your System for the installation (Section 1.3.1).

- Installing and configuring the RAID Manager packages onto hard disk (Section 1.3.2).

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 */usr/local,* 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 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
CPQraidsw	SWCC Agent software and system updates required for RAID system operation. This package should always be installed

CPQqla2100	The HBA driver for the CPQ/Qlogic DS-SWLA4-PC Fibre Channel 64-bit PCI card.

Installing the RAID Array 8000 Manager packages onto hard disk requires the following steps:

1. Mounting the CD-ROM.
2. Using the Red Hat Package Manager (RPM) to load the packages.
3. Rebooting your computer.
4. Configuring the CPQraidsw package.

1.3.2.1 Mounting the CD-ROM

Take the following steps to mount the CD-ROM:

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

b. Mount the CD-ROM, by typing:

 # mount /dev/cdrom /cd -t iso9660 -o ro

c. Change to the Linux directory by typing:

 # cd /cd/agents/linux

d. Get the name of the package by typing ls. Your output will look like the following:

```
CPQraidsw-2.2-61.rpm
```

e. Refer to Section 1.3.3.2 (Installing the CPQraidsw Package).

1.3.2.2 Installing the CPQraidsw Package

The CPQraidsw package includes both the RAID Manager software (SWCC Agent) and the supported driver for the CPQ/Qlogic Fibre Channel HBA. The default location for this software is in `/usr/local/steam`; this location can be changed by using the `–prefix <path>` option with the `rpm` command. Note that the steam directory and its subdirectories are created during the installation, so that the default prefix is `/usr/local`; therefore, specifying `–prefix /mysoftware` will result in the SWCC Agent being installed in `/mysoftware/steam` and other subdirectories under that root.

The driver for the CPQ/Qlogic Fibre Channel HBA will be installed in `/usr/src/linux/drivers/scsi`. In addition to the installation of the driver, the installation will update the following files in the above directory:

a. `Config.in` – the requisite configuration management information will be put into this file, so that a `make config` (or `make menuconfig` or `make xconfig`) will ask you, if you want to build the driver into the kernel.

b. `Makefile` – the `Makefile` is patched to ensure that the HBA driver will be included in the kernel, if you selected this during the configuration.

c. `hosts.c` – the `hosts.c` file is updated to ensure that the HBA driver is built into the kernel, if selected.

d. `scsi.c` – the `scsi.c` file is patched to enable you to use more than 8 LUNs per SCSI Target ID; this enables you to access the full capacity of the HSG80 RAID controller's range of configurations.

NOTE: All efforts are made to ensure that the correct order of detection is preserved for all your SCSI HBAs during the patching of the hosts.c file. It is recommended that you examine the hosts.c file after completing the RPM installation process to verify that your system's SCSI HBAs are included prior to the QLA2100 entry. This will preserve the order of your sd devices that exist on your system and put the new HSG80's devices after those that already exist in your configuration.

To install the RAID Manager software, follow these steps:

1. Invoke Red Hat Package Manager by typing.

   # rpm -i CPQraidsw-2.2-61.rpm

   or

   # rpm -i –prefix /mysoftware CPQraidsw-2.2-61.rpm

2. Verify that the hosts.c file accurately reflects the order in which you want SCSI HBAs to be detected on your system.

3. Rebuild your kernel to include support for the CPQ/Qlogic Fibre Channel HBA. The driver will be listed under SCSI Low-Level Drivers as 'Compaq/Qlogic QLA2100/QLA2200 Support'. Perform the necessary tasks to ensure that you can boot this new kernel.

4. Make necessary changes to /etc/lilo.conf and run /sbin/lilo

5. Go on to Section 1.3.2.3, (Shutdown and Reboot your computer system), to complete the installation.

1.3.2.3 Shutdown and Reboot Your Computer System

To shutdown and reboot, do the following:

```
# cd /
# shutdown -h now
```

Then boot your system with the newly built kernel.

1.4 Post-Installation Tasks

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

- Create an `sg` device to map to the HSG80 Command Console LUN (CCL)
- Configure the SWCC Agent.
- Label any new LUN(s) with the Linux fdisk command.
- Install and configure the SWCC Client (optional).

1.4.1 Mapping SCSI-generic Devices

In order to prevent any conflicts between the SCSI disk driver, which presents blocked (filesystem-oriented) devices to the system, and the SWCC Agent, which requires the capability to perform raw I/O operations, a SCSI-generic device must be created for communication between the SWCC Agent and the HSG80 RAID Controller.

SCSI-generic devices can be created using the MAKEDEV script in the /dev directory. If you will have fewer than 26 sd devices configured on your system, you can simply execute the following command:

```
# /dev/MAKEDEV sg
```

If you will have more than 26 sd devices configured on your system, you might want to specify the particular sg device that you want to create by using the following command:

```
# /dev/MAKEDEV sgk
```

The MAKEDEV script has been patched to ensure that the above procedure works for up to 256 sg devices.

Note that sg devices follow the same type of nomenclature convention as sd devices with one exception. Under the SCSI-3 configuration that you will use on the HSG80 RAID Controller, the Command Console LUN will be reported as a device type 12 (RAID Controller). Device type 12 cannot be mapped to a sd device, but will be mapped to a sg device; this causes the range of sd devices to skip over the HSG80 CCL. Use the scsi_info command to determine where there is a break in the list of sd devices, so that you can successfully map a sg device.

For example:

The first HSG80 sd device on your system is /dev/sdk, which you determined by using scsi_info on your sd devices. The output for scsi_info /dev/sdk looks as follows:

SCSI_ID="0,0,1"
MODEL="DEC HSG80"
FW_REV="V85F"

Your Command Console LUN for this controller will have a SCSI ID of "0,0,0". After performing a /dev/MAKEDEV sgk, you will get the following output from the command scsi_info /dev/sgk:

SCSI_ID="0,0,0"
MODEL="DEC HSG80CCL"
FW_REV="V85F"

Note that at this point the sd device sdk will map to the sg device sgl.

1.4.2 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 1.4.2.1 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 1.4.2.2 for instructions on running *config.sh*.

1.4.2.1 Configuring the Agent with install.sh

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

```
# cd /usr/local/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.

1.4.2.2 Configuring the Agent with config.sh

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

Type:

```
# cd /usr/local/steam/bin

#./config.sh
```

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

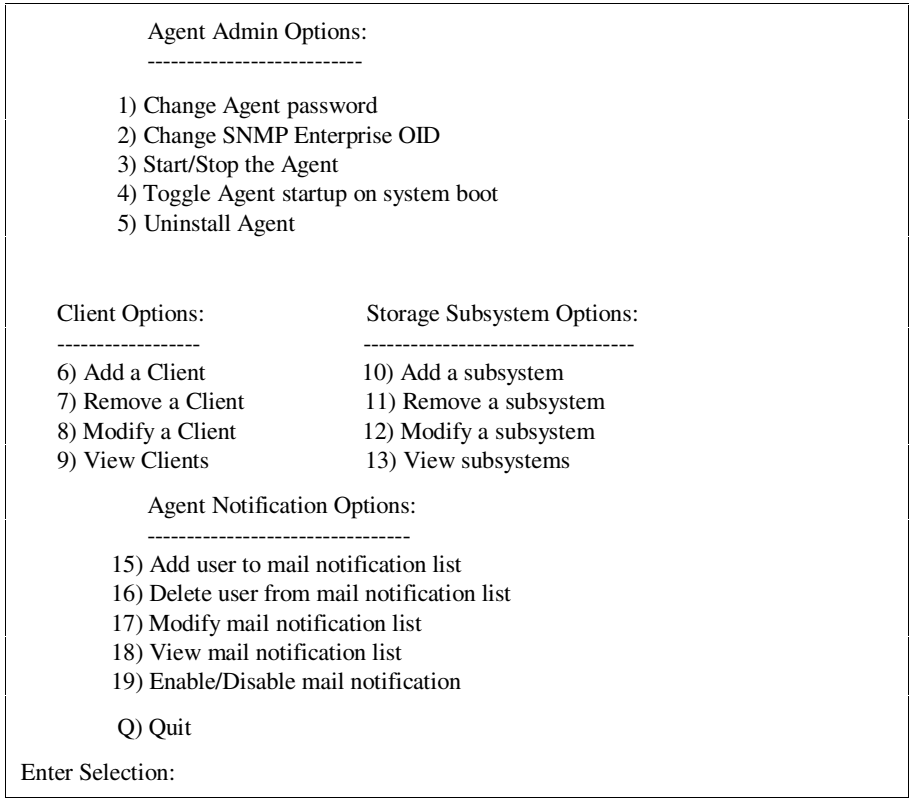


Figure 1-3. Main menu

1.4.2.3 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.

1.4.2.4 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 13, 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 10, 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. The LUN name must be a SCSI-generic (*sg*) device, which maps to the HSG80 Command Console LUN. See section 1.4.1 (Mapping SCSI-generic Devices) for more information on *sg* devices.

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

1.4.2.5 Adding a Client

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

To add a client, select 6, *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).

1.4.2.6 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.

1.4.3 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 *fdisk* 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 Official Red Hat Linux Reference Guide* Manual.

1.4.4 Filesystem Creation

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

To create a new filesystem, use the following command:

```
# mkfs /dev/sdk2
```

1.5 Troubleshooting/Avoiding Problem Situations

1.5.1 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.

Chapter 2

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 NT or Windows 95 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 95 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. NOTE: SWCC for Alpha processors are located in the folder: drive_letter:\swcc\client\alpha
5. Double-click on Setup.
6. 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.

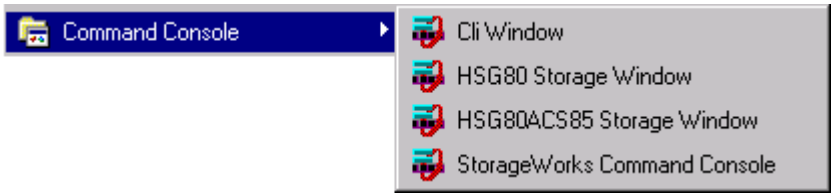


Figure 2-1. Command Console client's start menu

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 storage systems using ACS V8.5 software. Older ACS version (8.3) requires 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).

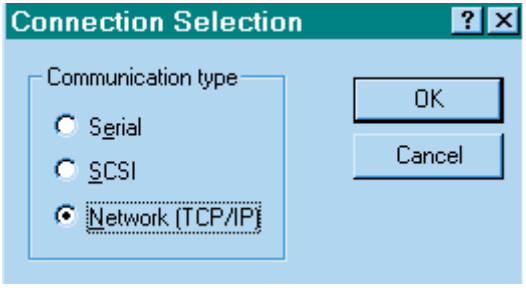


Figure 2-2. Connection selection dialog box

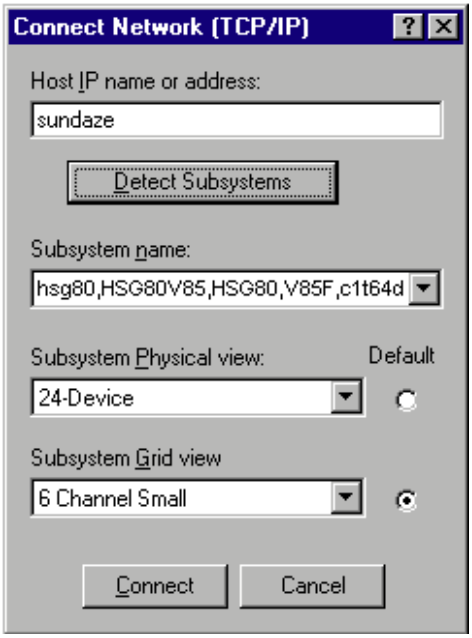


Figure 2-3. Connect network dialog box for storage window

6. 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 Fibre Channel Subsystem. On startup, Command Console finds installed drives and displays then in a grid by channel and SCSI ID number.

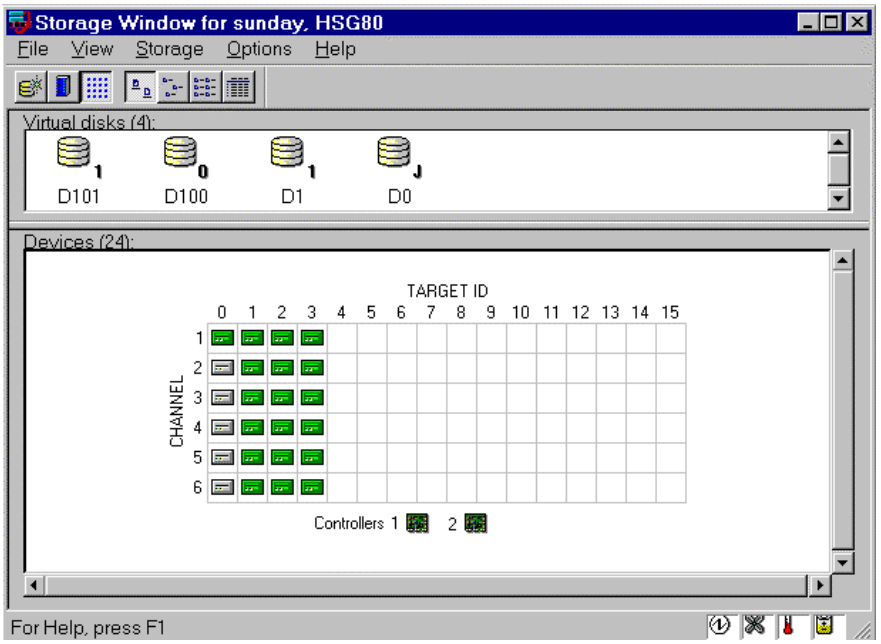


Figure 2-4. Storage window

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 controller's 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-3

(You may also set the time and date.)

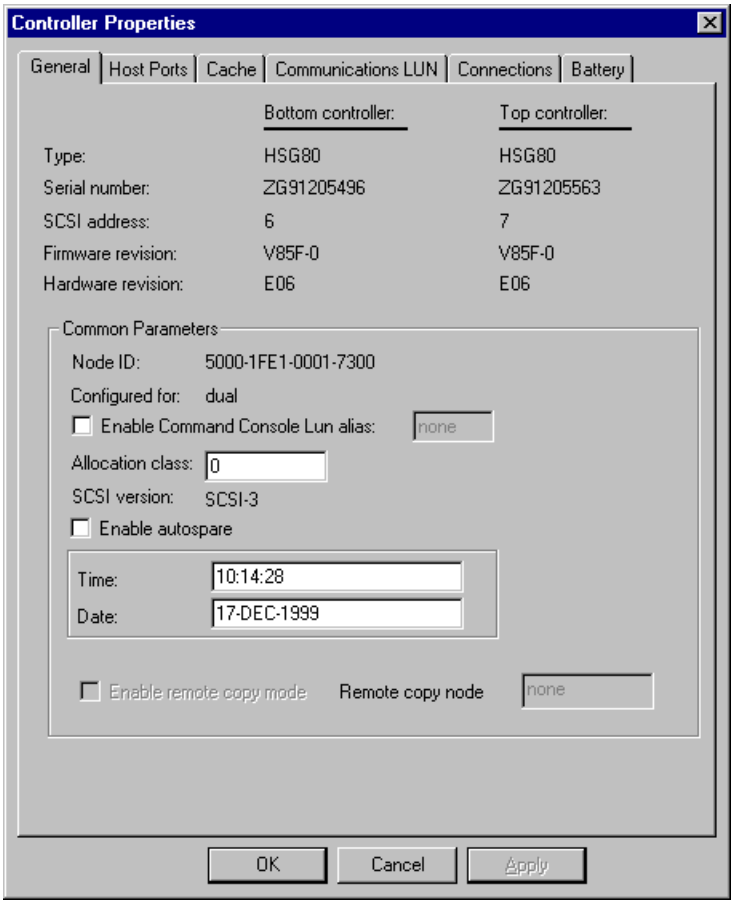


Figure 2-5. General controller properties tab

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.

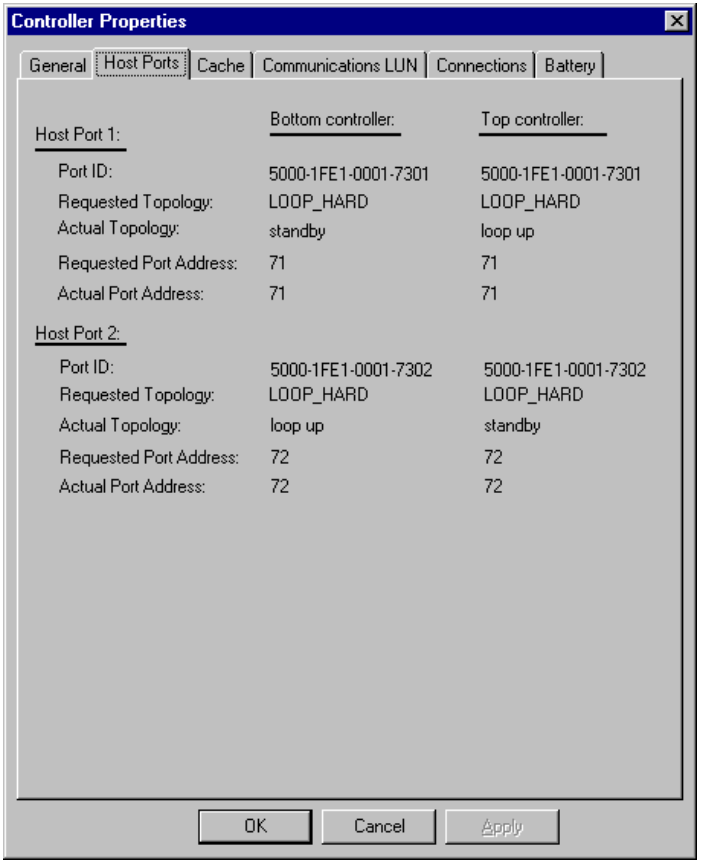


Figure 2-6. Host ports controller properties tab

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

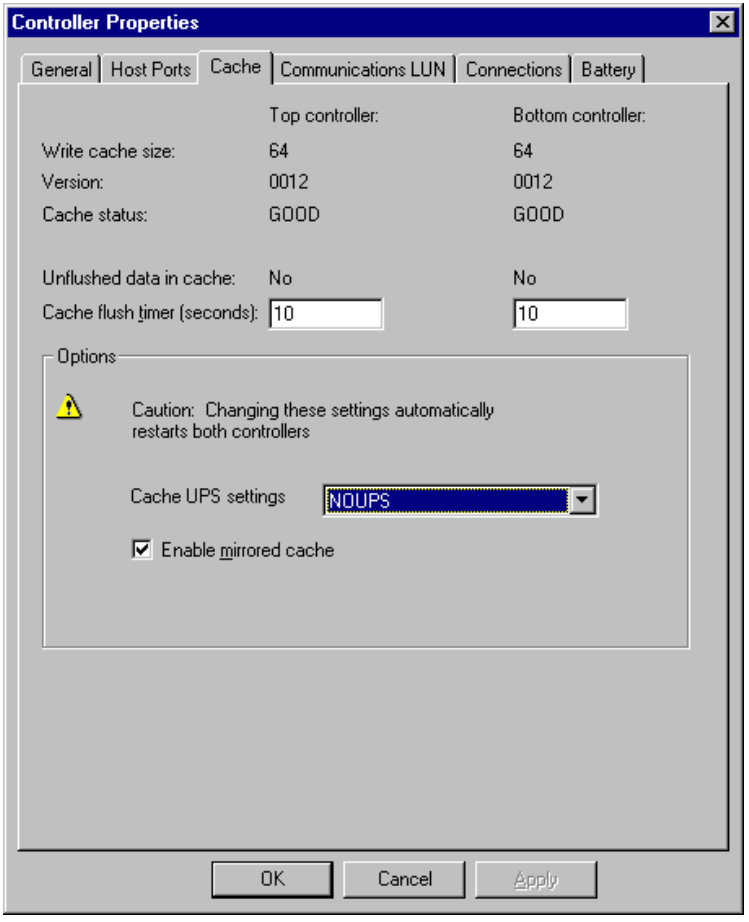


Figure 2-7. Cache controller properties tab

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

NOTE: Ensure that *Fixed* is set if you are using the virtual LUN (CCL).

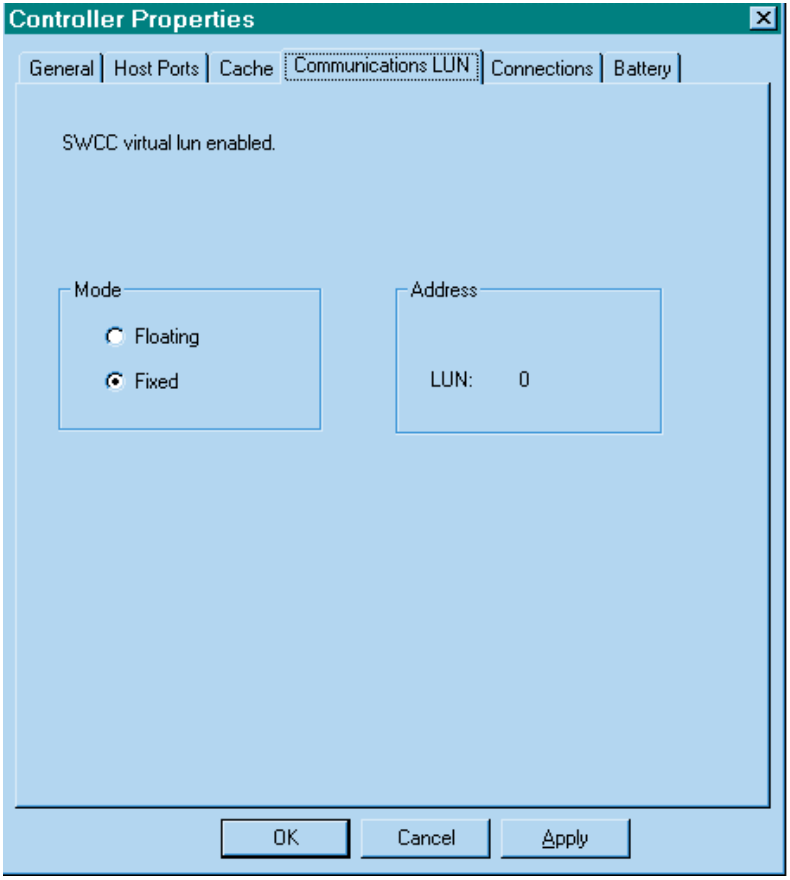


Figure 2-8. Communications LUN controller properties tab

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.

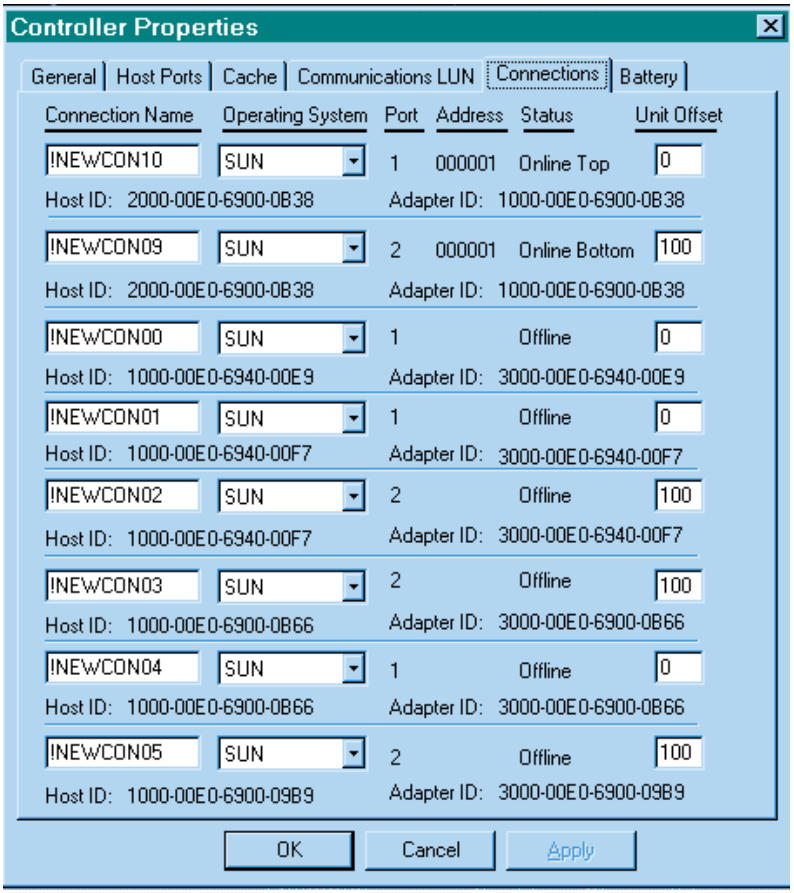


Figure 2-9. Connections controller properties tab

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.

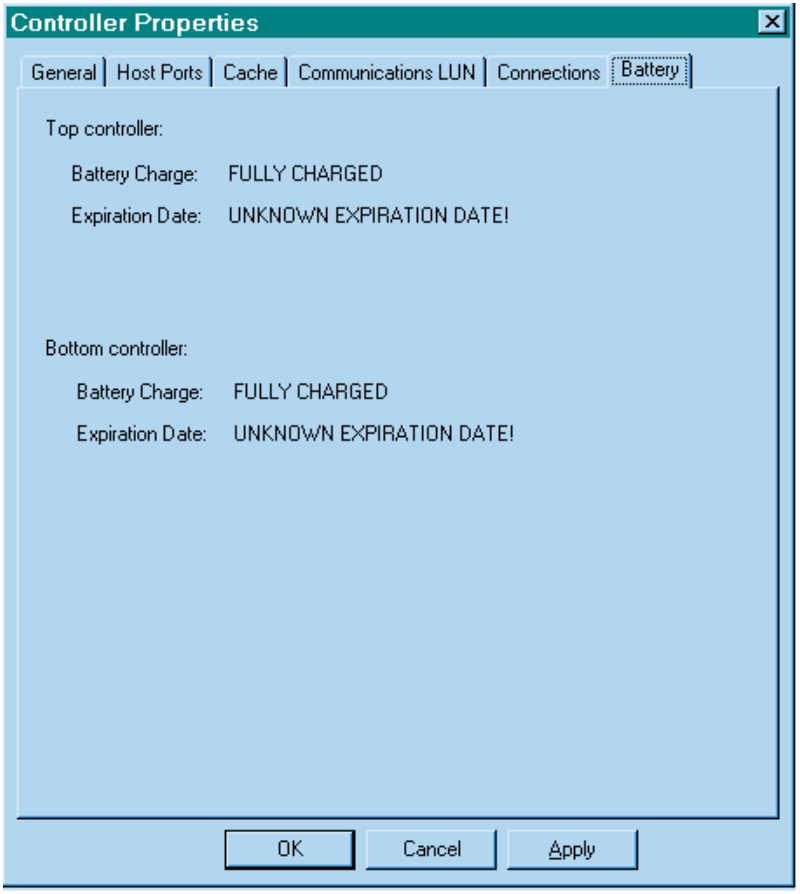


Figure 2-10. Battery controller properties tab

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 StorageWorks Command Console User's 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.

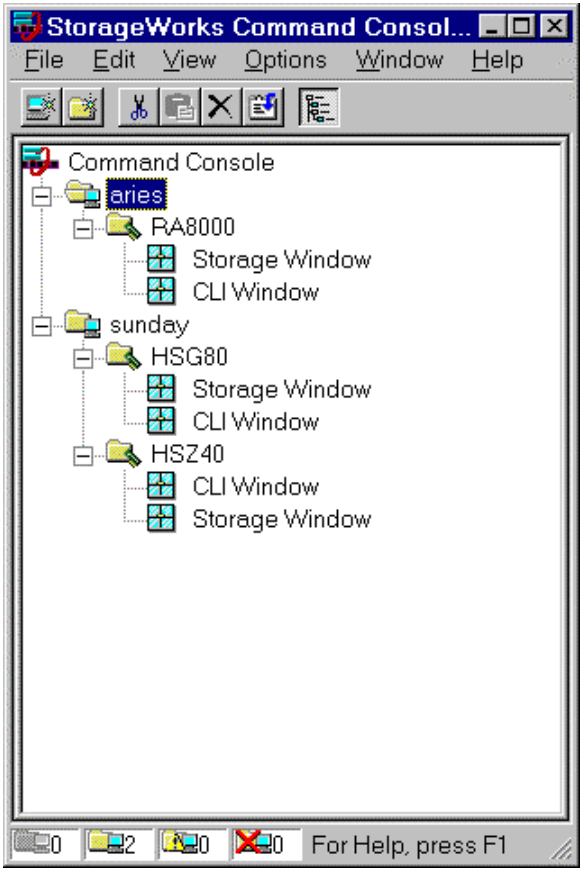


Figure 2-11. Navigation window shows two-host network

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.

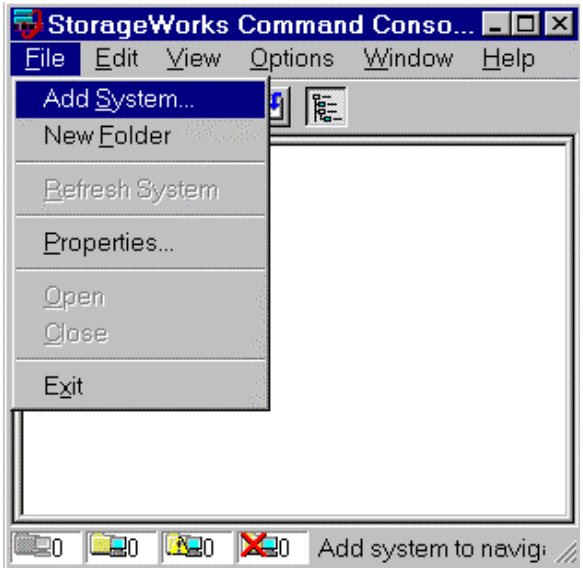


Figure 2-12. Add system from file menu

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.

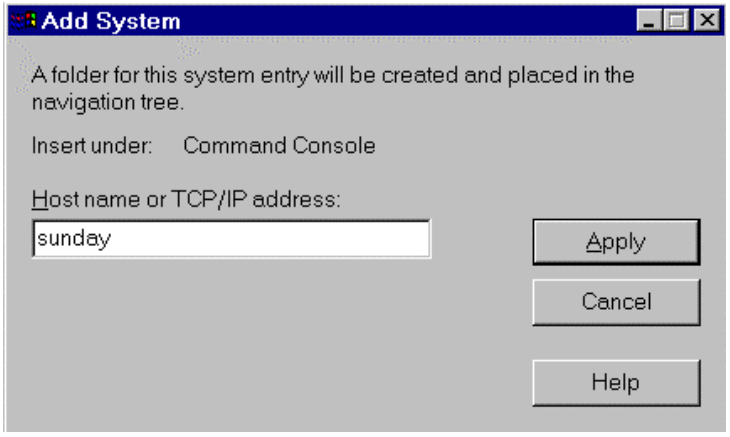


Figure 2-13. Adding a host system

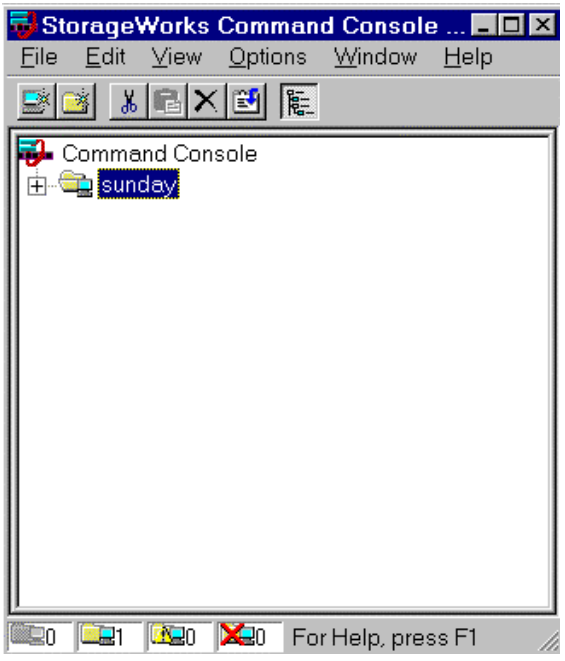


Figure 2-14. "Sunday" added to the navigation window

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 Folde*r.
2. Name the new folder in the Navigation Window by double-clicking its label and entering a new name.

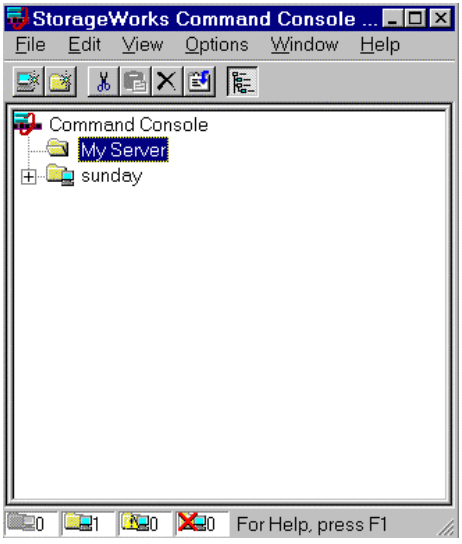


Figure 2-15. Adding a folder

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.

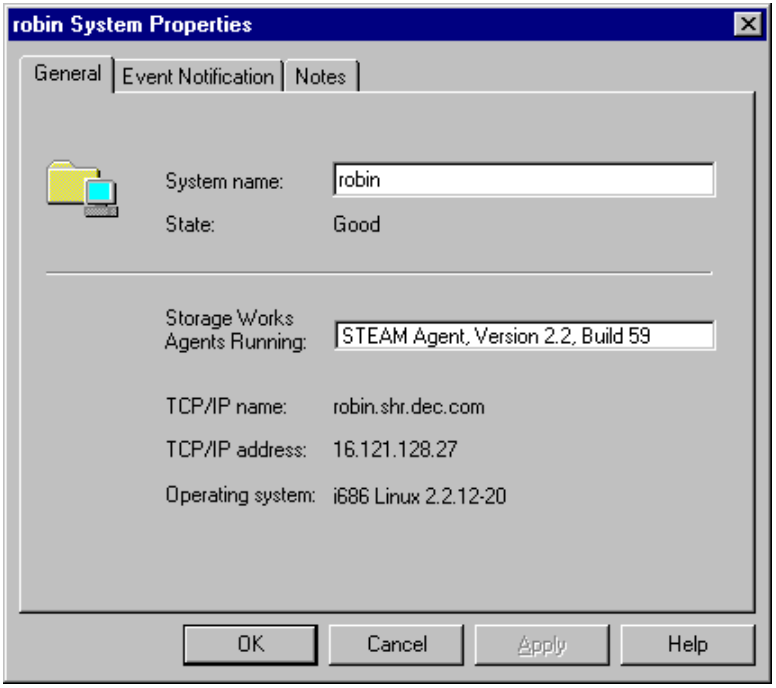


Figure 2-16. System properties

2.5.7 Opening a Storage Window

1. Connect to a storage subsystem.
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 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.

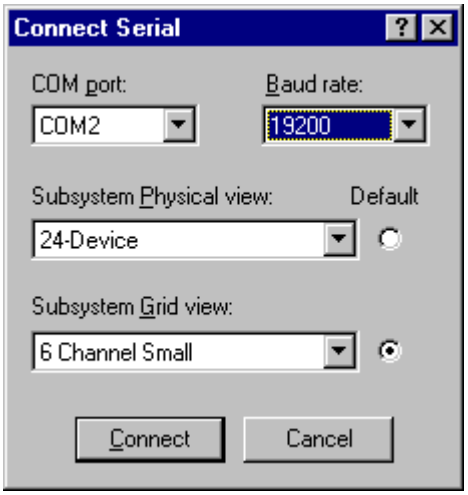


Figure 2-17. Connect serial dialog box

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*.

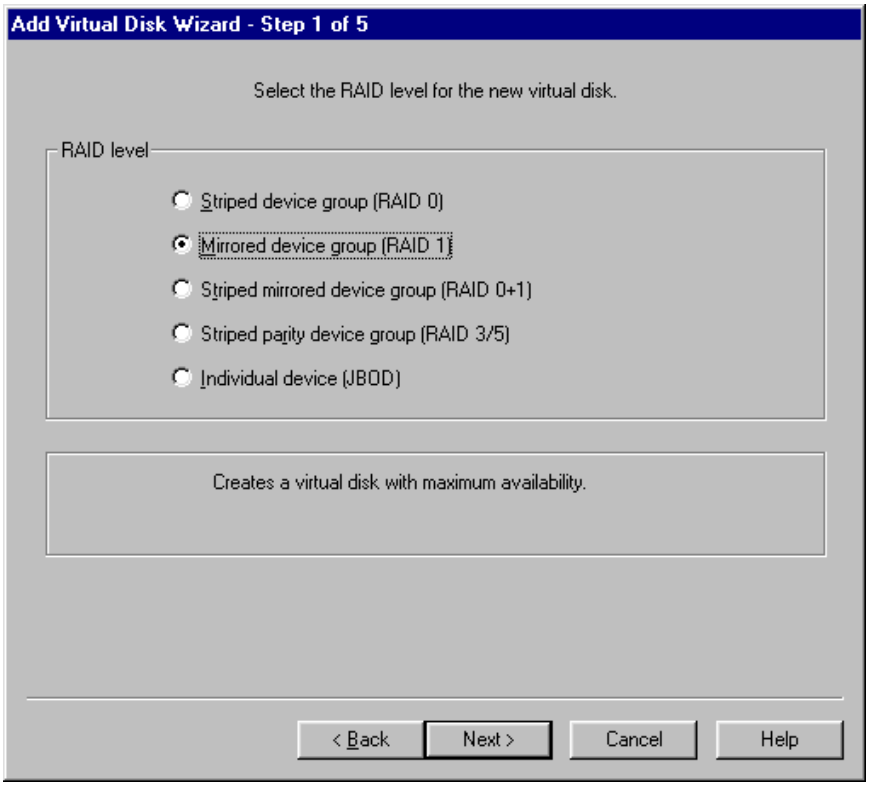


Figure 2-19. Add virtual disk wizard step 1

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.

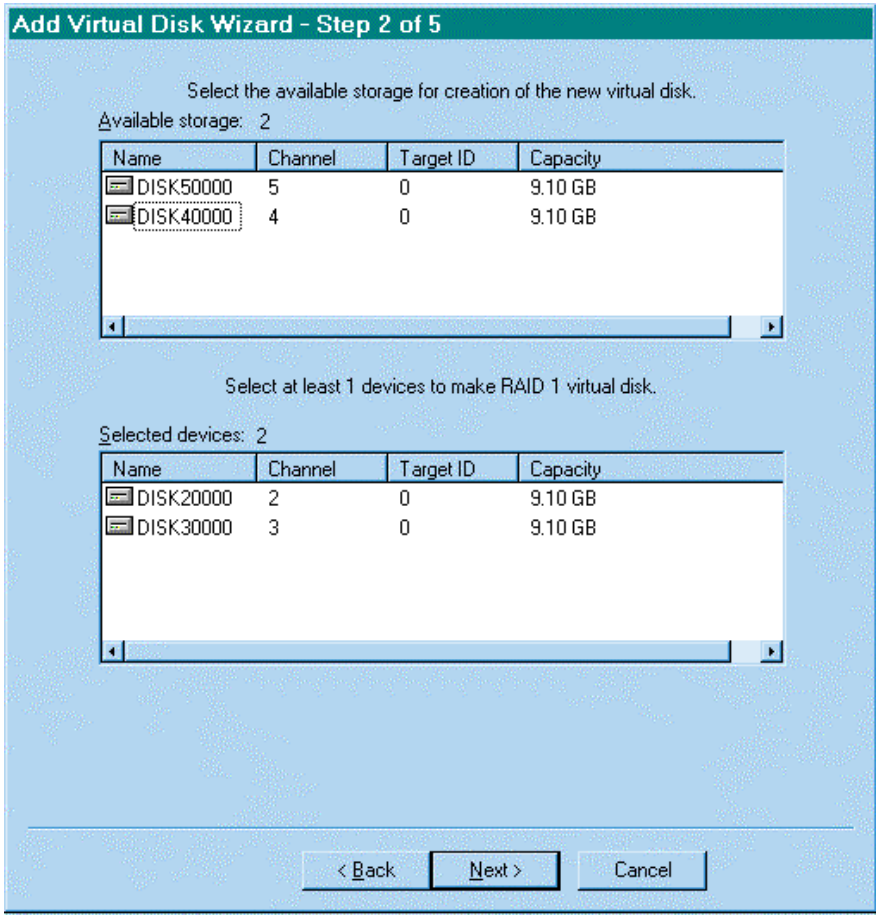


Figure 2-20. Add virtual disk wizard step 2

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.

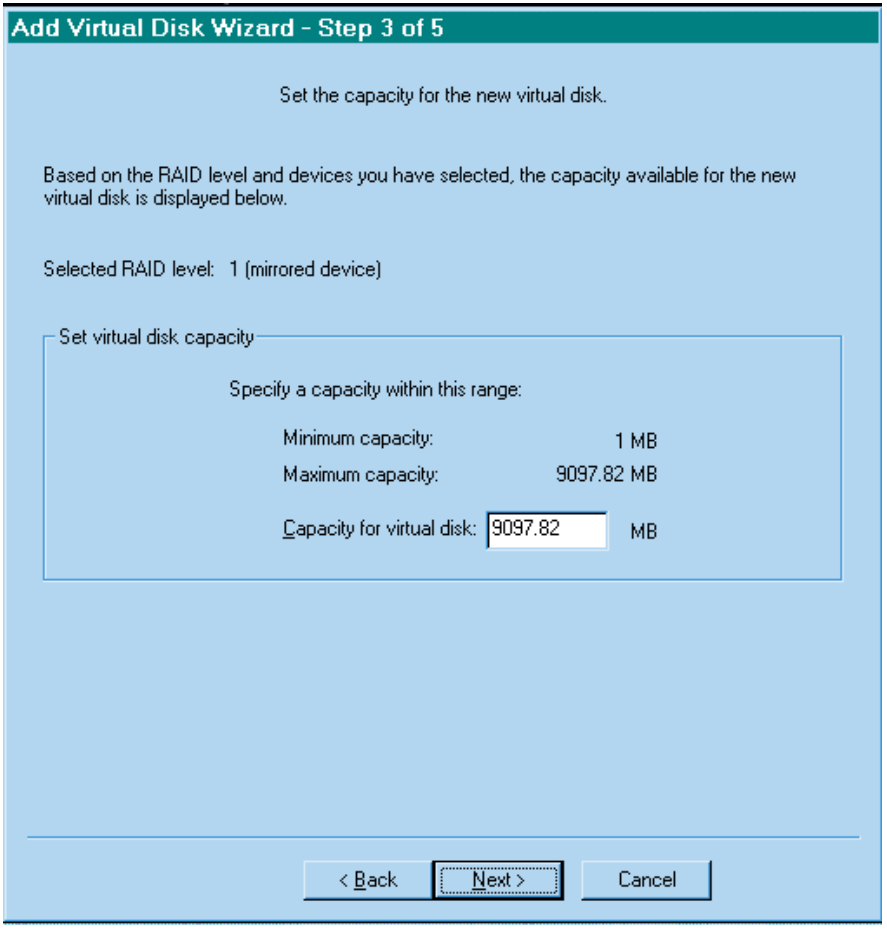


Figure 2-21. Add virtual disk wizard step 3

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

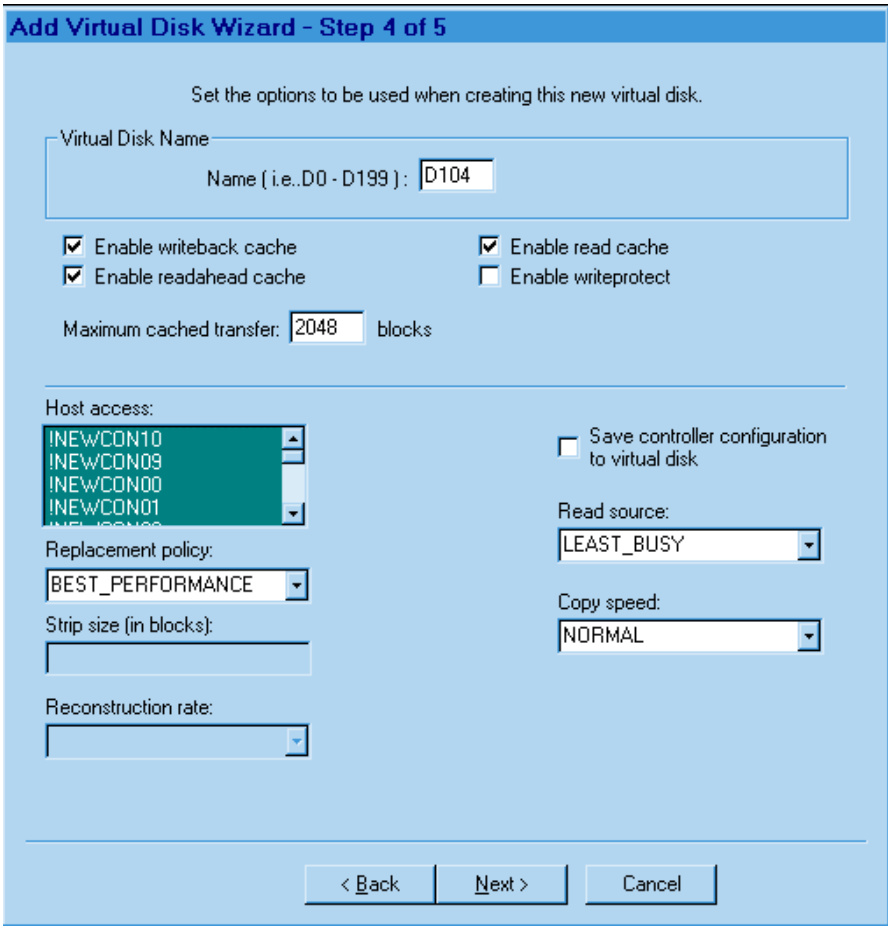


Figure 2-22. Add virtual disk wizard step 4

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.

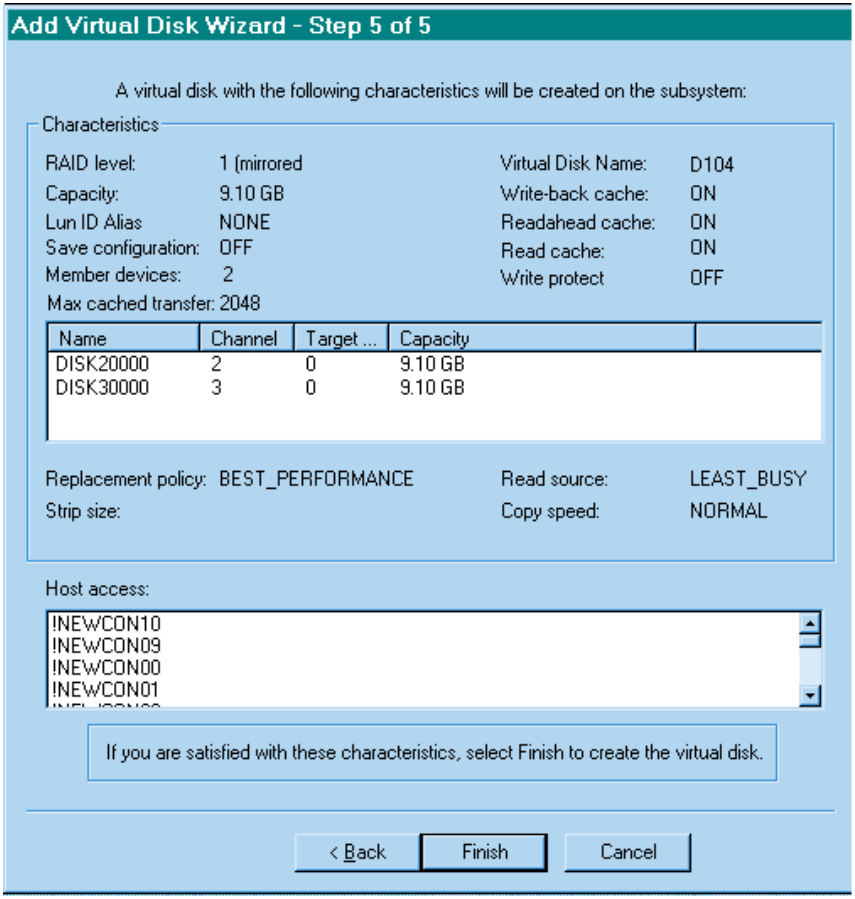


Figure 2-23. Add virtual disk wizard step 5

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 has been 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 the *Command Console User's 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), where Linux will see the unit.

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

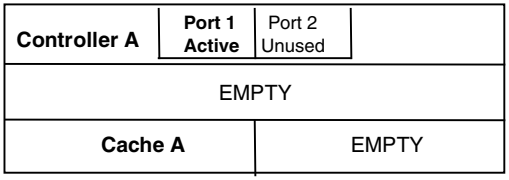


Figure 3-1. Single controller/single host

- 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.

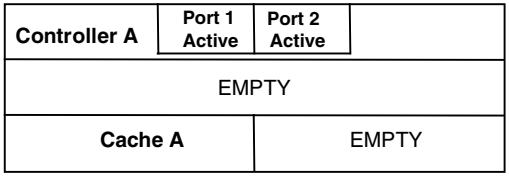


Figure 3-2. Single controller/two hosts

- 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.

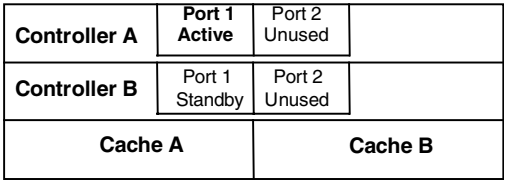


Figure 3-3. Dual controller/single host

- 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.

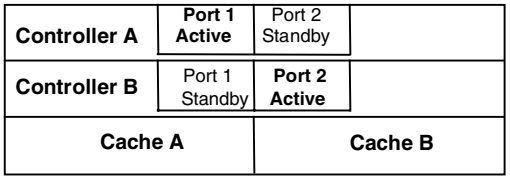


Figure 3-4. Dual controllers/two hosts

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.

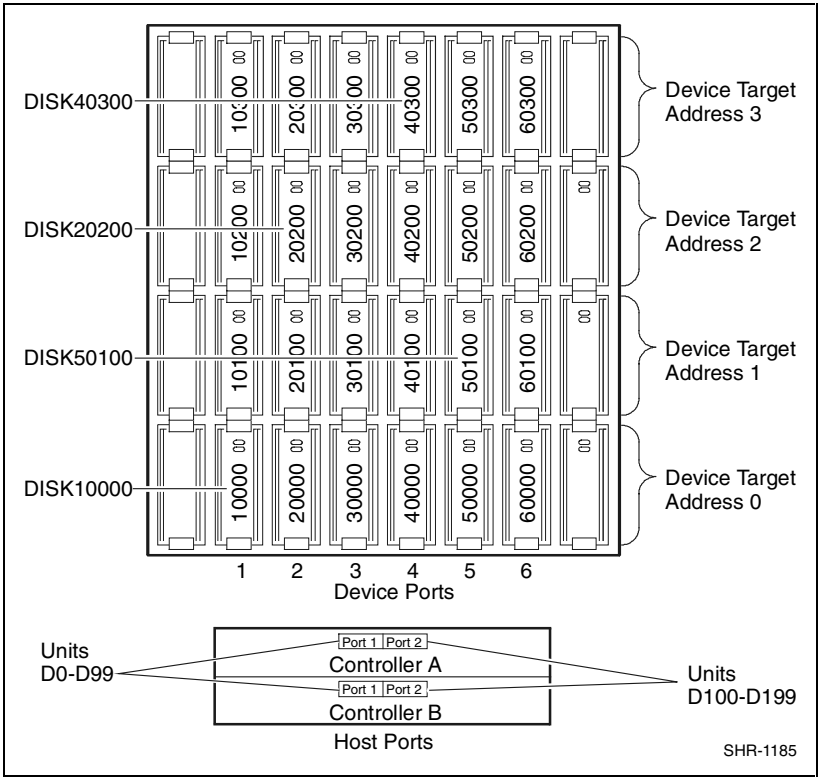


Figure 3-5. Mapping of device ports/targets and host ports

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 User's 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 Linux system with the “cu” 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 RA8000/ESA12000 subsystem. 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.

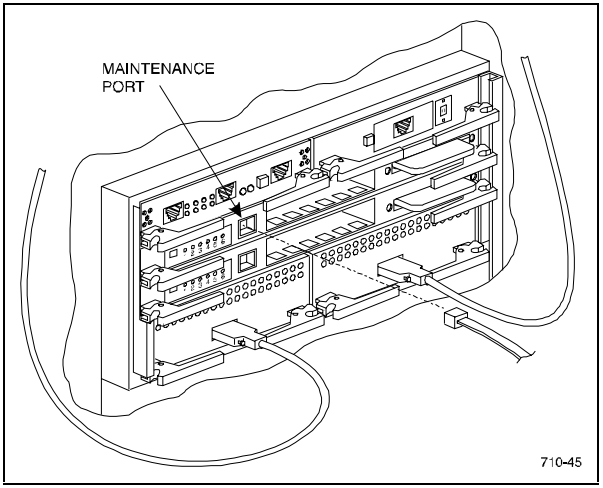


Figure 3-6. Making a serial connection to the HSG80 controller

3.2.2 Establishing Connection with a Linux System

To setup your Linux 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. Open the file /etc/uucp/ports
3. Verify that the following lines exist:
   - port com1
   - type direct
   - device/dev/ttys0
   - speed 9600

   If these lines are not in the ports file for the appropriate serial port, enter them and save the file.
4. Create /dev/ttySO

   Enter:

   ```
   cd /dev
   ```

```
./MAKEDEV ttyS0
```

5. Open a *terminal window* from the Desktop Program menu.
6. Start the Call Up Program (CU), at the prompt type**: cu -p com1** and press the **Enter** key.
7. 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 ZG92004735 Software V85F-0, Hardware E06
     NODE_ID         = 5000-1FE1-0001-6A40
Allocation_Class=0
SCSI_Version=SCSI-3
     Configured for dual-redundancy with ZG9204789
        In dual-redundant configuration
     Device Port SCSI address 7
     Time: NOT SET
     Command Console LUN is lun 0 (NOIDENTIFIER)
Host PORT 1
    Reported PORT_ID = 5000-1FE1-0001-6A41
     PORT_1_TOPOLOGY  = LOOP HARD (loop up)
```

```
PORT_1_AL_PA=71 (71 negotiated)
Host PORT_2:
    Reported PORT_ID = 5000-1FE1-0001-6A42
    PORT_2_TOPOLOGY = LOOP HARD (Standby)
    PORT_2_AL_PA=72 (72 negotiated)
    NOREMOTE_COPY
Cache
    32 megabyte write cache, version 0012
    Cache is GOOD
    No unflushed data in cache
    CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
Mirrored Cache:
    32 megabyte write cache, version 0012
    Cache is GOOD
    No unflushed data in cache
Battery:
    NOUPS
    FULLY CHARGED
    Expires: 27-JUL-2001
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 the HSG80 User's Guide controller configuration chapter 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 DVGRPR0 DISK12000 DISK20000 DISK30000
HSG80 > ADD RAIDSET DVGRPR1 DISK40000 DISK50000 DISK60000
```

In this example, "DVGRPR0" 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 RAIDsets 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 DVGRPR0 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 DVGRPR0
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 Stripeset

Use stripesets to stripe data across multiple disks. Striping data across multiple disks increases I/O performance compared with the performance of a single disk. Stripesets 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 stripeset using the ADD STRIPESET command.

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

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

3.5.1 Initializing a Stripeset

Prior to putting a stripeset 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 stripeset and makes this space inaccessible to the host.

When you initialize a stripeset, 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 Stripeset 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 DVGRPM0**

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 DVGRPM0**

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 DVGRPSM0 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 DVGRPSM0**

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 Fibre Channel system, 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    DVGRPR0
D2    DVGRPR1
D3    DVGRPS0
D4    DISK40100
D5    DISK50100
```

Record the information in the following table:

Date_____	
LUN	Uses

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          D3
               DISK20100
               DISK30100
DVGRPSM0       stripeset  MIRR_0   D5
               MIRR_1
DVGRPM0        mirrorset  DISK10200          D4
               DISK20200
MIRR_0         mirrorset  DISK30200          DVGRPSM0
               DISK40200
MIRR_1         mirrorset  DISK50200          DVGRPSM0
               DISK60200
DVGRPR0        raidset    DISK12000          D1
               DISK20000
               DISK30000
DVGRPR1        raidset    DISK40000          D2
               DISK50000
               DISK60000
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 Fibre Channel subsystem.

Date___________________

Name	**StorageSet**	**Uses**	**Used by**

Appendix **A**

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 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.
RAID 1	Mirrorset	2 - 6 devices per mirrorset, up to 20 mirrorsets per RAID array	2 - 6 devices per mirrorset, up to 20 mirrorsets per RAID array
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.

continued

Table A-1
Storage Configuration Options *continued*

Storage Method	Storageset Type	Number of Devices	Offers
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.

Appendix B

Fibre Channel: Considerations for a Loop and Fabric Environment

This appendix is a general discussion of the elements of a Fibre Channel environment.

In a Fibre Channel loop and Fibre Channel switched access environment, 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 Linux servers and adapters for loop 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 Linux server and the storage (RAID array) components. Given that path with a

loop configuration, the Linux server and storage will be able to communicate successfully.

B.1.1 The Configurable Objects - Servers

Servers are the computing power and have the communication access to the storage that the computing applications require. In this appendix we are focusing the discussion on servers running the Linux 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 1 adapter 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.

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 the entire 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 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 APLAs 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.

Appendix ***C***

Setting Up the Fibre Channel Hubs

C.1 Introduction

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

NOTE: Power to the host computer, hubs, and storage subsystem should be OFF at the start of this procedure. Power on the equipment so that the hubs can automatically configure the loop.

C.2 Cabling

The storage subsystem can contain either one or two controllers. The figures and 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 hubs.
- Table C-2 is the key to Figure C-2 that shows cabling for systems with two controllers and one FC hub.
- Table C-3 is the key to Figure C-3 that shows cabling for systems with one controller and one hub.
- Table C-4 is the key to Figure C-4 that shows cabling for systems with one controller and one hub.

Table C-1
Cabling Two Controllers and Two Hubs

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 hub

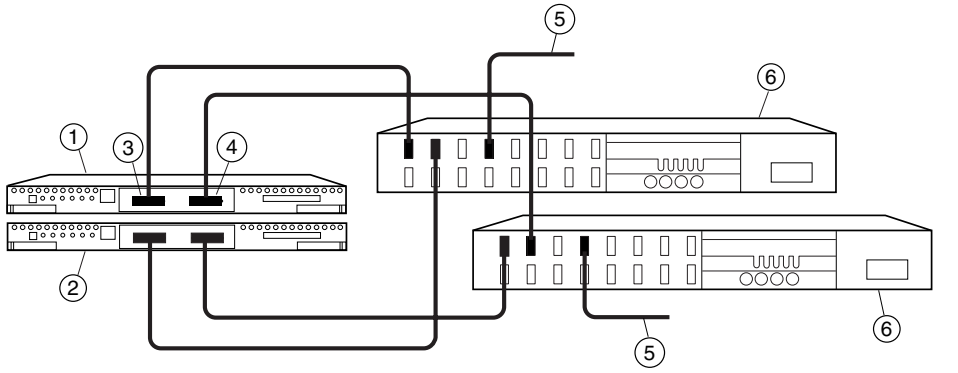


Figure C-1. Cabling two controllers and two hubs

Table C-2
Cabling Two Controllers and One Hub

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 hub

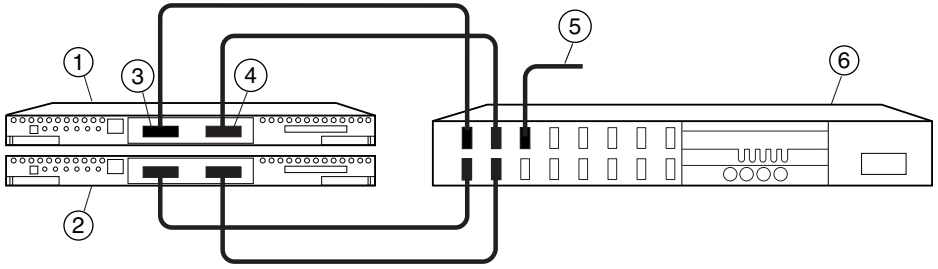
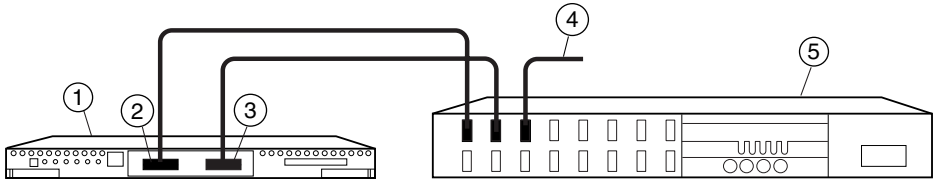


Figure C-2. Cabling two controllers and one hub

Table C-3
Cabling One Controller and One Hub

Figure Legend	Description
❶	Controller
❷	Host port 1
❸	Host port 2
❹	FC cable to host bus adapter
❺	FC hub



CXO6880A

Figure C-3. Cabling one controller and one hub

Table C-4
Cabling One Controller and Two Hubs

Figure Legend	Description
❶	Controller
❷	Host port 1
❸	Host port 2
❹	FC cable to host bus adapter
❺	FC hub

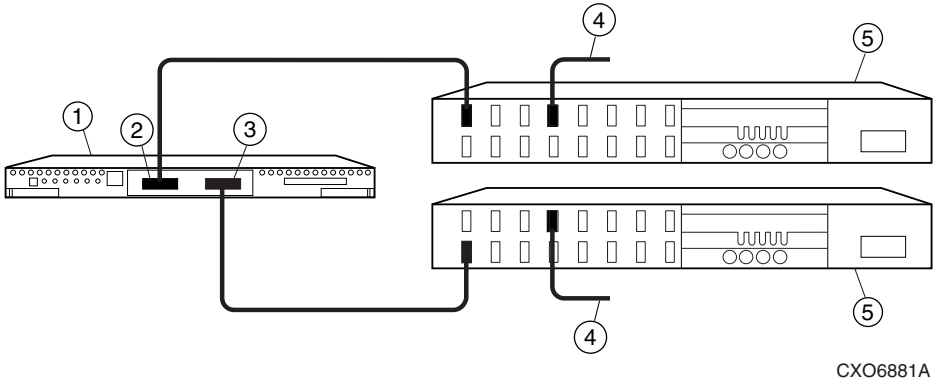


Figure C-4. Cabling one controller and two hubs

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 gPa2100 driver. 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.

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.

Appendix E

For Advanced Users

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

E.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.

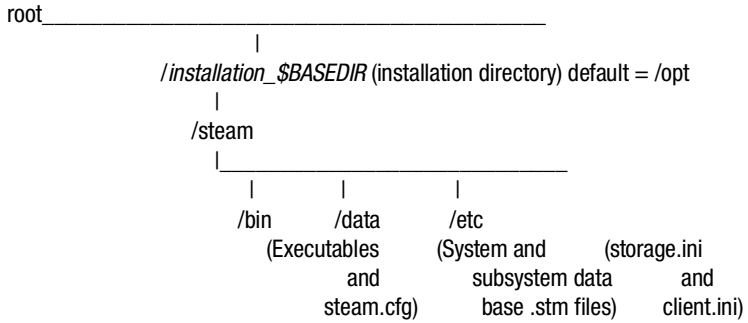
- Services file
- Agent Configuration file
- Client Access file
- Subsystem Identification file
- Mail Notification file

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

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

E.1.1 Locating the Files

The directory structure for Agent is as follows:



When you install Agent, you have the option to change the location of its file structure. If you accept the default installation directory, the setup routine installs Agent's directory structure in the */opt* subdirectory under the root.

Note that the *steam.cfg* file is in the *bin* subdirectory, and that the *storage.ini* and *client.ini* files are both in the *etc* subdirectory.

E.1.2 Editing the Services File

The agent uses sockets (sometimes called "network ports") to communicate with its Clients. The socket numbers at the Client and Agent ends must match for network communication to occur.

In Solaris 2.x-based systems, the socket numbers are assigned in the *services* file in the */etc/inet* subdirectory. In the unlikely event that you experience a conflict with the socket numbers, you may edit the *services* file manually.

The default socket numbers for Command Console are 4998 and 4999. If you are installing the agent and these numbers are already taken by another application, the installation program warns you that you must choose another pair.

To select another pair for Agent, open the *services* file with a text editor. Pick two numbers above 1023 that are not already used in the file, and add the following two lines:

```
spgui       number1/tcp # StorageWorks® Command Console
spagent     number2/tcp # StorageWorks® Command Console
```

NOTEs:

- You must use the same port numbers with any clients with which you want to communicate. (For further details, refer to your Windows 95/98 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.cont file and ensure that the "files" entry comes before the "[NOTFOUND=return]" entry.

E.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 change the name to Compaq Computer Corporation. Manufacturer_name will take 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.
```

E.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_address|notification _method|access_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, select "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|1|2
wanderlust.your.company.com|1|1
```

E.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|f
fw_version|access_device|ccl_device|num_virtual_disks|device_ID1|device_IDn

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 *cxtydzs2* 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|c4t
64d1s2|c4t64d2s2|c4t64d3s2|c4t65d0s2|c4t65d1s2|c4t65d2s2|c4t65d3s2|

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

E.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:

M\notification _level\network_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
M|1|youall@yourcompany.com
```

Appendix **F**

Understanding RAID Manager's Mail Messages

This appendix provides information to help you understand the contents of the automatic mail message(s) RaidManager sends upon the occurrence of an event, if so enabled.

F.1 Mail Message Information

If you have enabled *e-mail notification* via the Agent installation program, (Chapter 1), the Agent sends e-mail notification to the specified network email addresses when a storage subsystem event occurs. The storage subsystem event can be a state change of a physical storage device, logical storage unit or a component of the physical enclosure.

You will always receive this message as being from the RaidManager. The message will specify the name of the Host to which the Raid Array (reporting the event) is connected. The message also tells the severity of the problem, which will be one of three levels:

- Critical
- Warning
- Informational

The mail message appears in the following form:

```
----------------
From RaidManager Tue Jun  8 15:59:59 1999
Date: Tue, 6 Jun 8 1999 15:59:58 -0500 (EST)
From: RaidManager

This is an automatic message from your StorageWorks
RAID Agent, steamd. The following message was just received.
Please check your syslog files and RAID box!
Hostname: Suncity
CRITICAL: Validation failed - Unauthorized client (shr-dhcp-24-188.shr.dec.com, access
level: -1); connection refused  (SP_TCP: ClientConnect)

End Of Automatic Message.
--------------------
```

F.2 Event Information Fields

Often the message is self-explanatory, as shown in the previous example. Other messages reflect the state of the RAID subsystem by displaying event information fields in a line following the problem severity level.

Example:

```
WARNING:-
Suncity Hsg80 12000000000 HSG80 disks(disk21100:2) (SP_MONITOR:
MonitorSubsys)
      \       \           \
       \       \           \
       (1)     (2)         (3)
```

The event information fields can be deciphered as follows:

1. Host Name - to which the RAID experiencing the event is connected.
2. Storage Subsystem - where the problem occurred.
3. State Change - of a particular component of the storage subsystem. This is an eleven digit field that provides the crucial information about the status of your RAID Array.

F.2.1 Mapping State Change Digits to RAID Subsystem Components

Each of the eleven digits in the state change field can be mapped to a RAID subsystem component for deciphering event reports. Table F–1 lists the relationship.

Table F-1
State Change Digit Position and Corresponding Subsystem Component

"State Change" Digit Position	Corresponding RAID Subsystem Component
1	Overall Subsystem
2	Disks
3	Power Supply
4	Fans
5	Battery
6	Temperature
7	This Controller
8	Communications LUN
9	Other Controller
10	External Factors
11	Logical Units

F.2.1.1 The First Digit of the State Change Field (Overall Subsystem)

The **first digit** of the state change field tells about the state change of the **overall subsystem**.

Example:

```
WARNING: -
Suncity Hsg80 12000000000 HSG80 disks(disk21100:2) (SP_MONITOR:MonitorSubsys)
              ⬆
```

This digit can take 2 values:

0 - Everything is fine
1 - Something has changed state

F.2.1.2 The Second Digit of the State Change Field - (Disks)

The **second digit** of the state change field tells about the state change of **disks**.

Example:

```
WARNING: -
Suncity Hsg80 12000000000 HSG80 disks(disk21100:2) (SP_MONITOR:MonitorSubsys)
               ⬆
```

This digit can take three values.

0 - Everything is fine
1 - Drive went from bad to good
2 - Drive went from good to bad

In this example, a value of 2 is displayed in the disk digit position, which indicates that a drive went from good to bad.

The disknames follow in the message line, (in parenthesis), in the format:

disk_name:state

where *disk_name* is the name of the disk and *state* can be either of the following:

1 - disk went from bad to good
2 - disk went from good to bad

In this example, the failed drive is disk21100.

F.2.1.3 The Third Digit of the State Change Field (Power Supply)

The **third digit** of the state change field tells about state change of **power supply**.

Example:

```
WARNING: -
Suncity Hsg80 1022000000000 HSG80 pwr(0:1:2)  (SP_MONITOR: MonitorSubsys)
```

The third digit can take three values:

0 - Everything is fine
1 - Power Supply went from bad to good
2 - Power Supply went from good to bad

The position of the failed power supply usually follows in the message line, in parenthesis, as three numbers that indicate the position in the format:

cabinet_number:power_position:state

where *cabinet_number* is the cabinet ID from 0 to 3, the *power-position* is the power supply location from 1 to 8 and *state* can be any of the following:

1 - Power Supply went from bad to good
2 - Power Supply went from good to bad
3 - Power Supply is not present.

In this example, the Power Supply in position 1of Cabinet 0 (main cabinet) went from good to bad.

F.2.1.4 The Fourth Digit of the State Change Field - (Fans)

The **fourth digit** of the state change field tells about the state change of **fans**.

Example:

```
WARNING: -
Suncity Hsg80 1002000000000 HSG80 fans(0:A:2)  (SP_MONITOR: MonitorSubsys)
```

The fourth digit can take three values:

0 - Everything is fine
1 - Fan state went from bad to good
2 - Fan state went from good to bad

The position of the fan follows in the message line, in parenthesis, in the format:

cabinet_number:fan_position:state

where *cabinet_number* is the cabinet ID from 0 to 3, *fan_position* is the position of the fan and *state* is either of the following:

1 - Fan went from bad to good
2 - Fan went from good to bad

In this example, a fan failure occurred in cabinet 0, the main cabinet.

F.2.1.5 The Fifth Digit of the State Change Field (Battery)

The **fifth digit** tells about the **battery** state change.

Example:

```
WARNING: -
Suncity Hsg80 1000 2000000 HSG80 batt(6:fail)  (SP_MONITOR: MonitorSubsys)
                   ⬆
```

This digit can take three values:

0 - Everything is fine
1 - Battery state went from bad to good
2 - Battery state went from good to bad

The details of the battery failure follow in the message line, in parenthesis, in the format:

controller_id:state

where *controller_id* is the SCSI ID of the **reporting** controller (in other words, the cache battery failed for the other controller), and *state* is any of the following:

good - Battery is good
low - Battery voltage is low
fail - Battery has failed

In this example, the cache battery failed for the controller with SCSI ID 6.

F.2.1.6 The Sixth Digit of the State Change Field (Temperature)

The **sixth digit** of the state change field is about **temperature** state changes.

Example:

```
WARNING: -
Suncity Hsg80 10000200000 HSG80 temp(0:2:2)  (SP_MONITOR: Monitor_Subsys)
                  ⬆
```

The sixth digit can take three values:

0 - Everything is fine
1 - Temperature state went from bad to good
2 - Temperature state went from good to bad

The details regarding the temperature change follows in the message, in parenthesis, in the format:

cabinet_number:sensor_type:state

where *cabinet_number* is the cabinet ID from 0 to 3, *sensor_type* is the EMU sensor, (sensor 1 or sensor 2), and *state* is either of the following:

1 - Temperature went from bad to good
2 - Temperature went from good to bad

In this example, an adverse temperature change is detected by sensor 2 of the main cabinet (0).

F.2.1.7 The Seventh Digit of the State Change Field - (This_Controller)

The **seventh digit** tells about the changes in **This_Controller**.

NOTE: This value is always zero for a dual redundant configuration.

The seventh digit will change to 1 in case of the failure of the controller in a single controller configuration.

F.2.1.8 The Eighth Digit of the State Change Field - (Communications LUN)

The **eighth digit** tells about the state changes of the **Communications LUN**.

Example:

```
CRITICAL: - Suncity Hsg80 1000000 2000 HSG80  (SP_MONITOR: MonitorSubsys)
                                  ⬆
CRITICAL: Unable to open device - hdisk1 (SP_MONITOR: MonitorSubsys)
```

This digit can take three values:

0 - Everything is fine
1 - Communication LUN is available to the host machine
2 - Communication LUN is not available to the host machine

In this example, two mail messages appear. The first message indicates a Communications LUN change of state from available to unavailable. The second message indicates that the Agent is not able to open the Communications LUN for monitoring the subsystem.

F.2.1.9 The Ninth Digit of the State Change Field (Other_Controller)

The **ninth digit** indicates the state change of the **Other_Controller**.

Example:

```
WARNING: -
Suncity Hsg80 10000000 200 HSG80  (SP_MONITOR: MonitorSubsys)
                       ⬆
```

This value will never change for a single controller configuration. It will always change when either of the controllers fail in a dual redundant configuration.

This digit can take three values:

0 - Everything is fine
1 - Both controllers are functioning
2 - One of the two controllers failed

Physically inspect the controllers to verify which one has failed, as indicated by a solid green indicator light (not blinking).

F.2.1.10 The Tenth Digit of the State Change Field - (External Factors)

The **tenth digit** indicates the a state change detected as caused by **external factors**.

Example:

```
WARNING: -
Suncity Hsg80 1000000002 0 HSG80  (SP_MONITOR: MonitorSubsys)
                         ⬆
```

This digit can take three values:

0 - Everything is fine
1 - State changed from bad to good
2 - State changed from good to bad

F.2 1.11 The Eleventh Digit of the State Change Field (Logical Units)

The **eleventh digit** indicates a state change of **Logical Units**.

Example:

```
WARNING: -
Suncity Hsg80 1000000000 2 HSG80  lun(d100:4) (SP_MONITOR: MonitorSubsys)
                         ⬆
```

This digit can take 3 values:

0 - Everything is fine
1 - A LUN state changed from bad to good
2 - A LUN state changed from good to bad

The details about the failure of the LUN follow in the message line, in parenthesis, in the format:

virtual_disk:state

where *virtual_disk* is the unit number of the virtual disk and *state* is any of the following:

0 - good
1 - reduced
2 - reconstructing
4 - failed

In this example, Logical Unit D100 failed.

In most cases, the RaidManager will send at least two consecutive mail messages. The first one is always of the form:

```
---------------
From RaidManager Tue Jun  8 16:09:37 1999
Date: Tue, 8 Jun 1999 16:09:37 -0500 (EST)
From: RaidManager

This is an automatic message from your StorageWorks
RAID Agent, steamd. The following message was just received.
Please check your syslog files and RAID box!

Hostname: Suncity

WARNING:  - A subsystem change has been detected: Suncity HSG80 OVRL=1
(SP_MONITOR: MonitorSubsys)

End Of Automatic Message.
-------------
```

It is the second mail message that deciphering is required by applying the data provided in this appendix. The second message will be similar to the following (depending on the error that is occurring):

```
---------
From RaidManager Tue Jun  8 16:09:37 1999
Date: Tue, 8 Jun 1999 16:09:37 -0500 (EST)
From: RaidManager

This is an automatic message from your StorageWorks
RAID Agent, steamd. The following message was just received.
Please check your syslog files and RAID box!

Hostname: Suncity

WARNING:  - Suncity Hsg80 12000000000 HSG80 disks(disk10200:1 disk60300:2)
(SP_MONITOR: MonitorSubsys)

End Of Automatic Message.
-------------
```

Appendix G

SNMP MIB Information

This appendix provides information about the Simple Network Management Protocols (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 E, *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 20 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.1.11 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.1.12 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.1.13 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.1.14 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.1.15 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.1.16 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.1.17 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.1.18 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.1.19 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.1.20 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>

Index

A

C

N

O

P

R

S

V