SANworks by Compaq

Data Replication Manager
HSG80 ACS Version 8.6-1P
Scripting User Guide

Part Number: EK-DRMSC-OA. C01

Third Edition (January 2002)

Product Version: ACS Version 8.6-1P
DRM Scripting Kit Version 2.0A

This user guide provides installation, configuration, and operating procedures for running scripts with *SANworks* ™ Data Replication Manager by Compaq. The scripts run on Compaq *OpenVMS* ™, Compaq *Tru64* ™, IBM AIX, Microsoft Windows NT/2000, and Sun Solaris hosts and handle eight specific failover, failback, and resumption of operation situations.

COMPAQ

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Data Replication Manager HSG80 ACS Version 8.6-1P Scripting User Guide
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About this Guide

This user guide provides information to help you:

- Acquire and install software required for using Data Replication Manager (DRM) scripts.
- Configure and customize files required for the scripts.
- Run failover, failback, and resumption of operation scripts.
- Contact technical support for additional assistance.

Intended Audience

This book is intended for use by DRM customers who are experienced with the following:

- Configuring a DRM environment to include zoning, write history logs, association sets, and remote copy sets.
- Running failover, failback, and resumption of operations with command line interpreter (CLI) commands.

Related Documentation

In addition to this guide, Compaq provides corresponding information:

Table 1: Related Documentation

Document Title	Part Number
Compaq SANworks Command Scripter Version 1.0A Release Notes	AA-RN6HB-TE
Compaq SANworks Command Scripter Version 1.0A Installation Card	AE-RN6FB-TE

Table 1: Related Documentation (Continued)

Document Title	Part Number
Compaq SANworks Command Scripter Version 1.0A User Guide	AA-RN6EB-TE
Compaq SANworks Data Replication Manager HSG80 ACS Version 8.6-1P Configuration Guide	AA-RPHZB-TE
Compaq SANworks Data Replication Manager HSG80 ACS Version 8.6-1P Failover/Failback Procedures Guide	AA-RPJ0B-TE
Compaq StorageWorks HSG80 Array Controller ACS Version 8.6 CLI Reference Guide	EK-G80CL-RA. A01
Compaq StorageWorks HSG80 Array Controller ACS Version 8.6 Troubleshooting Reference Guide	EK-G80TR-SA. A01

Prerequisites

Before you run the DRM scripts, make sure you consider the items below.

- This manual assumes a DRM configuration is in place before scripts are used. Refer to the platform, hardware, and software requirements discussed in Chapter 1 that support scripting.
- Compaq strongly recommends that detailed functional testing be performed on all scripts before they are used operationally.

Document Conventions

The conventions included in Table 2 apply in most cases.

Table 2: Document Conventions

Element	Convention
Key names, menu items, buttons, and dialog box titles	**Bold**
File names and application names	*Italics*
User input, command names, system responses (output and messages)	`Monospace font` `COMMAND NAMES` are uppercase unless they are case sensitive
Variables	*`Monospace, italic font`*
Website addresses	Sans serif font (http://www.compaq.com)

Symbols in Text

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

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

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

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

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

Identifies a procedural step to be performed at the initiator site.

Identifies a procedural step to be performed at the target site.

Symbols on Equipment

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

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

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

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

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

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

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

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

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

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

Rack Stability

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

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

Getting Help

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

Compaq Technical Support

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

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

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

Be sure to have the following information available before calling:

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

IMPORTANT: To be eligible for technical support, you must be using the DRM scripts provided by Compaq as described in the User Guide in a supported configuration. Scripts that have been modified in any way are not supported.

Compaq Website

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

Compaq Authorized Reseller

For the name of your nearest Compaq Authorized Reseller:

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

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DRM Scripting Overview

Introduction

SANworks ™ Data Replication Manager by Compaq provides a means to prevent data loss through the use of hardware redundancy and software data replication.

A Data Replication Manger (DRM) configuration consists of paired storage sites. The *initiator* site carries out primary data processing. A *target* site is set up for data replication. Data processing occurs at the initiator site and is replicated or copied to the target site. If a significant failure occurs at the initiator site, data processing can be resumed at the target site, where the data is intact.

In a DRM environment, a site *failover* makes the data available at the target site, most likely after some type of failure. *Failback* moves data operations back to the initiator after the initiator site has been brought back online. *Failsafe locked* is an error mode you can set to cease initiator site I/O whenever the target becomes inaccessible or the initiator unit fails. You may want to transition between a failsafe-locked mode and normal mode to continue or resume operations at the initiator site. This transition does not constitute a failover or failback event, but as a *resumption of operations*.

Usually, to perform failover, failback, or a resumption of operations, an operator must manually issue a complex series of Command Line Interpreter (CLI) commands to a controller. The use of *scripts* greatly reduces the need to issue many of these commands manually. This can be especially beneficial with configurations containing many remote copy sets or numerous subsystems that all need to perform actions quickly during a crisis. You only need to run a program file to begin issuing the appropriate CLI commands for an event action (for example, an unplanned failover). For Compaq *OpenVMS* ™ it is a command (com) file, for Compaq *Tru64* ™, IBM AIX, and Sun Solaris it is a shell (sh) file, and for Microsoft Windows platforms it is a batch (bat) file.

Although scripting may make procedures easier to perform, the operator must still be able to perform failover, failback, or failsafe-mode transitions with CLI commands if the scripts encounter an abnormal condition that prevents their satisfactory completion.

This guide explains:

- Failover and failback planning considerations
- How to obtain and install the necessary files needed for using scripts
- How to set up the Command Console LUN (CCL)
- How to customize the following files to your DRM configuration:
  - — Configuration generation batch, shell, and command files
  - — Target controller configuration files
  - — The application action list
- How to run the failover, failback, and resumption of operation program files

Site Failover Basic Description

If the initiator site is no longer available, or if there is anticipated downtime that will prevent operation at the initiator site, you must decide whether to perform a site failover to the target site. Performing a failover enables the target site to assume the role of the initiator and access (write/read) data until the problem is resolved and a failback can be issued. Transferring control of system operation to the target site ensures that there will be minimal interruption in data access after a failure.

IMPORTANT: Verify that all components at the target site are operational before you begin the site failover.

NOTE: If you decide to perform a failover operation, keep in mind that *all* components must be failed over. Therefore, if only one component fails, fixing that single component may be preferable to performing a complete failover.

Table 1–1 outlines example criteria that calls for a failover, as well as criteria that does not call for a failover.

Table 1–1: Possible Failover Situations

Type of Failure	Recommended Action	
	Remote Copy Set Error_Mode = Normal	**Remote Copy Set Error_Mode = Failsafe**
Total initiator site loss	Manual intervention to fail over data and processing to target site	Manual intervention to fail over data and processing to target site
Loss of initiator site fabric	Manual intervention to fail over data and processing to target site	Manual intervention to fail over data and processing to target site
Loss of initiator controller pair	Manual intervention to fail over data to target site, and restart of processing at both sites	Manual intervention to fail over data to target site, and restart of processing at both sites
Loss of all intersite links	Failover not necessary	Decide on which site should continue processing: continue at inititator site or failover to target site
Total target site loss	Failover not necessary	Manually continue processing at initiator site
Loss of target fabric	Failover not necessary	Manually continue processing at initiator site
Loss of target controller pair	Failover not necessary	Manually continue processing at initiator and target sites
Loss of single initiator controller	Failover not necessary	Failover not necessary
Loss of both initiator switches	Manual intervention to fail over data to target site, and restart of processing at both sites	Manual intervention to fail over data to target site, and restart of processing at both sites
Loss of single initiator switch	Failover not necessary	Failover not necessary

Table 1–1: Possible Failover Situations (Continued)

Type of Failure	Recommended Action	
	Remote Copy Set Error_Mode = Normal	**Remote Copy Set Error_Mode = Failsafe**
Extended power outage at initiator site	Manual intervention to fail over data and processing to target site	Manual intervention to fail over data and processing to target site
Loss of both host bus adapters (non-clustered hosts)	Manual intervention to fail over data to target site, and restart of processing at both sites	Manual intervention to fail over data to target site, and restart of processing at both sites
Loss of single disk in redundant storage	Failover not necessary	Failover not necessary
Loss of single storageset	Failover not necessary	Failover not necessary
Loss of single host of cluster	Failover not necessary	Failover not necessary

If one host in a multi-host environment fails, you must decide whether or not a failover is the best course of action.

When you determine that a site failover is necessary, identify which scenario best describes your situation: *planned*, *unplanned*, or *role reversal* failover.

Use the planned failover procedure when failover is a scheduled event. These are situations such as anticipated power disruption, scheduled equipment maintenance at the local site, or the need to transfer operations to another site. Planned failovers are further characterized as *short* or *extended*. A short, planned failover (also referred to as *prefast* in the scripts) assumes the write history log will be able to accommodate the accumulated writes for the duration of the failover. An extended, planned failover (also referred to as *prefull* in the scripts) assumes the write history log will not accommodate the accumulated writes.

An unplanned failover involves situations such as multiple controller failures, multiple host failures, or an unplanned power outage at the local site.

A site role reversal failover transfers the initiator role to another site. The original initiator site then assumes the role of a target site.

Failback Procedure Choices

During failover, the remote copy sets at the target site are in a copy ready state, waiting for the initiator site to become available. When a new initiator site has been established or the original one has been restored, site operation can resume after a failback procedure has been performed. This involves synchronizing data on both the initiator and target subsystems so that operation can be returned to the initiator with minimal downtime.

IMPORTANT: Verify that all components at both sites are operational before performing a failback.

The failback sequence is a scheduled event. The HSG80 Array Controller requires that a viable dual-redundant subsystem be available before a failback can take place.

IMPORTANT: Failback to a single controller configuration is not supported.

Table 1–2 can help you determine which failback procedure to use in different circumstances.

Table 1–2: Types of Failover and Failback

State of the initiator controller pair	Failover type used	Failback type used	Example
Initiator site intact	Short Planned	Fast	Maintenance needs to be performed at the initiator site. The site is brought back up when maintenance is complete with a mini-merge from the write history log.
Initiator site intact	Extended Planned	Full	Maintenance is performed at the initiator site for a length of time that would exceed the space on a write history log. A failback to the initiator after maintenance requires a full disk copy.
Initiator site intact	Unplanned	Full	Power goes off at initiator site. Failover is performed to the target site. Failback to the initiator is performed with a full disk copy once power is restored.

Table 1–2: Types of Failover and Failback (Continued)

State of the initiator controller pair	Failover type used	Failback type used	Example
Initiator site not intact	Unplanned	New Hardware	Lightning strike damages equipment, resulting in a disaster failover. Once new equipment is installed, a failback is performed.
Initiator site intact	Role Reversal	Role Reversal	Another site is given the initiator role for an unspecified time. At a later date, the initiator role reverts back to the original site.

Summary of Failover/Failback Procedure Choices

Scripts are available for most of the failover, failback, and resumption of operation scenarios you are likely to encounter. To perform these procedures with CLI commands, and to find other failover and failback scenarios, refer to the *Compaq SANworks Data Replication Manager HSG80 ACS Version 8.6-1P Failover/Failback Procedures Guide*. Table 1–3 lists the scripting scenarios, explains the conditions for their use, and gives the name of the scripting procedure to follow.

Table 1–3: Failover, Failback, and Resumption of Operations Procedure Choices

Event or Condition	Anticipated Duration of Event	Initiator Mode of Operation	Scripting Procedure to Follow
Unplanned loss of initiator site function. Initiator site hardware will not be replaced.	Unknown	Normal or failsafe	**Chapter 6**: Unplanned Site Failover with Full Failback
Unplanned loss of target site function.	Unknown	Failsafe	**Chapter 7**: Resumption of Operations After Unplanned Loss of Target Site (Failsafe Mode)

Table 1–3: Failover, Failback, and Resumption of Operations Procedure Choices (Continued)

Event or Condition	Anticipated Duration of Event	Initiator Mode of Operation	Scripting Procedure to Follow
Unplanned loss of target site function.	Unknown	Normal	**Chapter 8**: Resumption of Operations After Unplanned Loss of Target Site (Normal Mode)
Planned maintenance outage at initiator site.	Short (up to several hours)	Normal or failsafe	**Chapter 9**: Short Planned Site Failover with Fast Failback
Planned maintenance outage at initiator site.	Extended (several hours or longer)	Normal or failsafe	**Chapter 10**: Extended Planned Site Failover with Full Failback
Planned maintenance at target site.	Extended	Failsafe	**Chapter 11**: Resumption of Replication After Extended Planned Loss of Target (Failsafe Mode)
Unplanned loss of initiator site function. Initiator site hardware will be new.	Unknown	Normal or failsafe	**Chapter 12**: Unplanned Site Failover with Failback to New Hardware
Planned change of operations from initiator site to alternate site. Initiator site remains operational.	Unknown	Normal or failsafe	**Chapter 13**: Planned Site Role Reversal

Benefits of Scripts

The use of scripts in a DRM environment simplifies procedures from the operator's perspective when performing failover, failback, and resumption of operation changes. A program file, consisting of a batch, shell, or command file, can start an entire failover sequence. Down time is shortened by eliminating the delay between command entries. The use of scripts also ensures that the sequence of commands has been predetermined in a calm environment, rather than during a crisis, when mistakes are more common. The result is a failover and failback process that is timely, consistent, and efficient.

Components for Scripting

Scripting requires the following components:

- The Compaq DRM Scripting Kit (Version 2.0A) for your operating system
- A Perl interpreter (part of the AIX, Tru64, and Solaris 8 operating systems, but must be obtained separately for OpenVMS, Solaris 6 and 7, and Windows NT/2000)
- Compaq *SANworks* Command Scripter Version 1.0A

These components are limited to the requirements listed on page 1-14. A brief description of each scripting component follows.

Compaq DRM Scripting Kit

Specific DRM Scripting Kits are available for the following operating systems:

- Compaq OpenVMS
- Compaq Tru64 UNIX, IBM AIX, and Sun Solaris
- Microsoft Windows NT and Microsoft Windows 2000

These virtual "kits" consist only of files and are downloaded from the Compaq website. They contain Perl scripts, Perl support files, example files, and program files necessary for the scripts to perform failover, failback, and resumption of operation procedures. Program files are command files (OpenVMS), shell files (AIX, Tru64, and Solaris), and batch files (Windows NT/2000) specific to an operating system.

Perl Interpreter

Perl is the interpreted programming language in which the scripts are written. The Perl interpreter translates and processes the scripts. Every Perl script must pass through the interpreter in order to execute.

SANworks Command Scripter

The *SANworks* Command Scripter is application software that provides an interface to communicate the CLI commands generated by the Perl scripts to the HSG80 controllers via the Fibre Channel bus.

How the Failover, Failback, and Resumption of Operation Scripts Work

This section describes how the components work together to perform failover, failback, or resumption of operation by the use of scripts.

Perl Scripts

The scripts are written in the Perl programming language and reside on the host's local hard drive. For redundancy, the scripts should reside on a server at both the initiator and target sites.

User-Customized Script Support Files

The failover, failback, and resumption of operation scripts use two user-customized file types to provide variable information: a *configuration file* and an *application action list*.

- The *configuration file* tells the failover/failback scripts which devices are attached to an HSG80 controller, and how the controller is configured with respect to devices and storagesets. An example configuration generation file is provided in the DRM Scripting Kit to allow a configuration file to be created for the subsystem. Once created, customization is needed on the target controller configuration files. One current configuration file for each HSG80 controller subsystem is stored at both the initiator and target sites.

- The *application action list* is used by the *hsg_control.pl* Perl script to perform failover, failback, and resumption of operation actions on the specified DRM initiator-target controller pairs. For example, if you have four initiator controllers that need to failover during a short planned failover action, then you would list the four target controllers in the application action list. All of the controllers will fail over together when that failover action is run.

The configuration files and the application action list are system specific. You must tailor them to reflect your unique configuration and your failover, failback, and resumption of operation preferences. Chapter 4, "File Customization," provides instructions for modifying configuration files and application action lists. These files can then be used by the scripts to perform the necessary steps.

Running a Script

A script is invoked by running a command file (OpenVMS), a shell file (AIX, Solaris, and Tru64), or a batch file (Windows NT/2000) from a command prompt on the system console. Figure 1–1 shows the scripting information flow after you run one of these program files.

1. The Perl interpreter processes the script based on the information in the configuration file and the application action list.
2. The script reads the *control table*, which defines the order of CLI commands to be issued, and sends the appropriate sequence of CLI commands (for the controller configuration specified in the configuration file) to the Command Scripter.
3. The Command Scripter communicates the commands to the HSG80 controller over the Fibre Channel bus and relays `SHOW` command verification back for the scripts.

The area in Figure 1–1 within the dashed lines is further detailed in Figure 1–2 on page 1-12 to show the interaction of specific failover and failback Perl scripts.

IMPORTANT: The names of remote copy sets, stripesets, mirrorsets, RAIDsets, association sets, and connections may not contain a hyphen (-). This is a Perl language restriction. Underscores (_) are allowed.

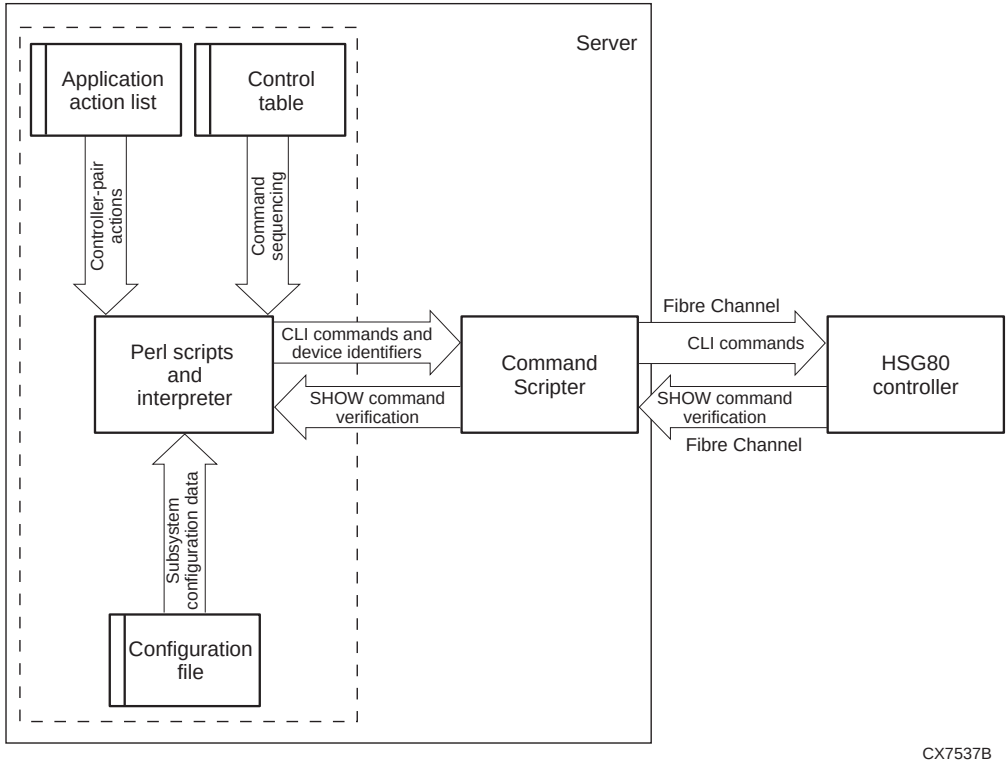


Figure 1–1: Scripting information flow

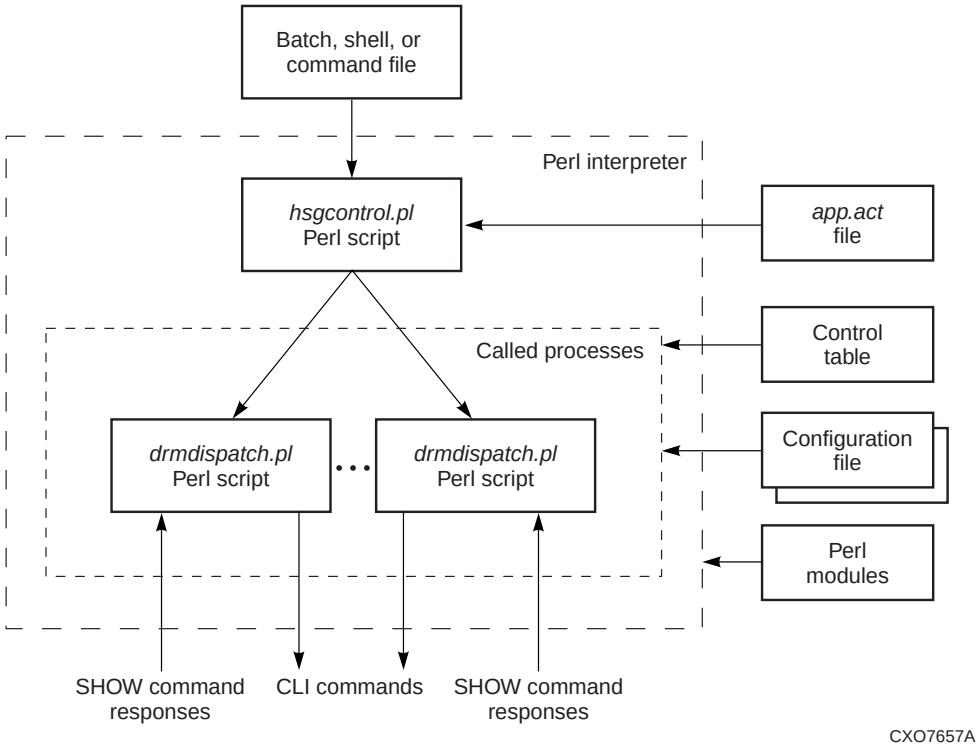


Figure 1–2: Script processing

The Scripting Process Flow

Figure 1–2 shows a high-level view of the process flow for failover, failback, and resumption of operation scripts.

1. The user runs a program file (batch, command, or shell file) to invoke the *hsgcontrol.pl* Perl script.
2. The Perl interpreter processes the scripting instructions. Parameters specified in the failover/failback program file tells the script to read the application action list and what actions to perform. The *hsgcontrol.pl* script then calls the *drmdispatch.pl* script.

3. The *drmdispatch.pl* script performs the work of failover, failback, and resumption of operation. The script is given parameters from the application action list (*app.act* file) that specify how the actions are processed. The controller configuration files and control table are read by the *drmdispatch.pl* script and followed until all actions are performed. Perl modules, containing library routines, can be accessed by the scripts when needed.
4. The *drmdispatch.pl* script then sends commands to the Command Scripter for inband transmission to the controller. `SHOW` command responses are returned from the controllers and used by the scripts to verify that the commands issued to the controllers were successfully executed.

The disaster-tolerant configuration that supports DRM involves two HSG80 Array Controller subsystems—one at an initiator site and one at a target site.

Figure 1–3 depicts a basic DRM configuration.

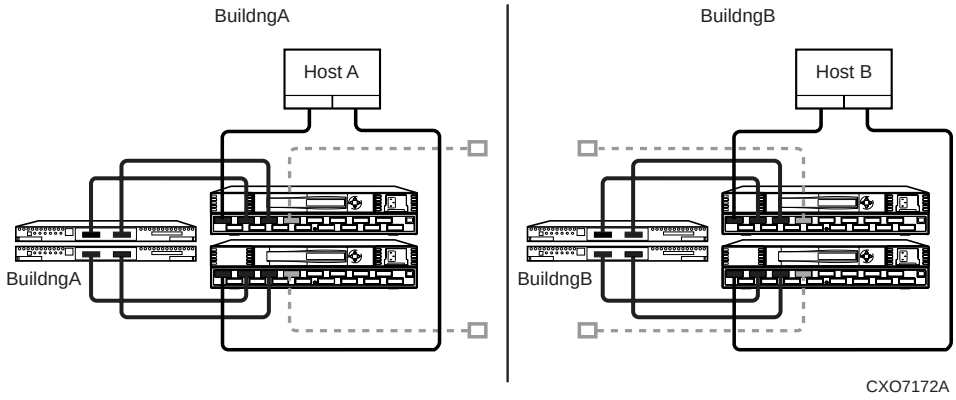


Figure 1–3: Data Replication Manager basic configuration

This figure uses fictional “Buildng A” as the initiator site and “Buildng B” as the target site. The scripts use the following sequence for failover and failback:

- Failover from Buildng A to Buildng B (planned, unplanned, or role reversal)
- Failback step 1 from Buildng B back to Buildng A (fast, full, new hardware, or role reversal)
- Failback step 2 from Buildng B back to Buildng A (fast, full, new hardware, or role reversal)

NOTE: The previous figure refers to Buildng A as the initiator site and Buildng B as the target site. This does not change even after failover has occurred to Buildng B (and before failback has occurred to Buildng A). While in failover mode, the controllers in Buildng B are acting as the *initiator* for all remote copy sets and are referred to as the *target* in this document.

Notice that failback with the scripts is performed in two steps:

- The first step adds the initiator back into the remote copy set. It also performs a normalization if any new data was written to the target controllers while the initiator was inoperable. It is often desirable for the system to operate in this semi-failed-back state while remotely mirroring data, before reverting to the original initiator and target roles.
- The second step reverses the initiator and target roles.

Requirements

This section specifies the hardware and software required for DRM scripting.

Platforms

Supported platforms are:

- Compaq OpenVMS Versions 7.2-1H1, 7.2-2, and 7.3
- Compaq Tru64 UNIX Versions 5.1 and 5.1A
- IBM AIX Version 4.3.3
- Microsoft Windows NT Server Version 4 with Service Pack 6a
- Microsoft Windows 2000 Server with Service Pack 2, Advanced Server with Service Pack 2, and Datacenter Server with Service Pack 2
- Sun Solaris Versions 6, 7, and 8

The scripts work in a heterogeneous DRM environment (with the supported platforms mentioned above) to perform site failovers, failbacks, and other related procedures. However, the servers for a DRM initiator-target pair must be running the same operating system.

The scripts can be run from any one of the scripting supported platforms and can manipulate storage that presents LUNs to other DRM-supported platforms (for example, HP-UX and Novell Netware). A Command Console LUN (CCL) or a non-RCS LUN communicates scripting operations to the controllers. So the host running the scripts may or may not have access to similar types of LUNs on the controller when performing scripting operations.

To manipulate storage on a platform not supported by the scripts, use a controller shared by a host capable of running the scripts. The scripts can manipulate all storage on a controller when communicating through a LUN.

Hardware

DRM supports compatible operating systems sharing the same HSG80 controller. To be compatible, all of the operating systems must support the same level of SCSI command and control: either SCSI-2 with the CCL turned on or off, or SCSI-3 with the CCL turned on. Table 1–4 lists the current DRM-supported operating systems and the SCSI level that each supports:

Table 1–4: DRM Heterogeneous Operating Systems

Operating System	SCSI-2	SCSI-3
Compaq OpenVMS	No	Yes
Compaq Tru64 UNIX	Yes	Yes
HP-UX	Yes	Yes
IBM AIX	Yes	Yes
Microsoft Windows NT/2000	Yes*	Yes
Novell Netware	Yes	No
Sun Solaris	Yes*	Yes*

***IMPORTANT:** Although Windows can be run in SCSI-2 or SCSI-3 mode in a DRM environment, SCSI-2 mode is only supported with no CCL enabled. When sharing a controller in SCSI-2 mode between Windows and another operating system using a CCL, Compaq recommends that scripting be performed with the Windows host.

Sun Solaris running Secure Path Version 2.1D supports SCSI-2 mode with or without a CCL, but not SCSI-3 mode. Sun Solaris running Secure Path Version 3.0 supports SCSI-2 or SCSI-3, but without the use of CCLs.

Switch Zoning

The scripts must reside on hosts in a zone having access to the HSG80 controllers at the initiator and target sites.

The HSG80 controller does not distinguish between commands issued from in-band command tools (Compaq *StorageWorks* ™ Command Console and *SANworks* Management Appliance) and commands issued out-of-band through the serial port. Serial port commands should only be performed when the customer has restricted commanding from other sources. Special care must be taken with the Management Appliance, as it periodically issues polling commands that can interpret serial port communications. All management appliances should be removed from switch zones in which controllers are commanded through a serial port.

Software

The following software is required to use scripts to perform DRM failover, failback, and resumption of operations:

- Compaq DRM Scripting Kit, Version 2.0A
- Perl interpreter
  - — Open VMS: Version 5.6 (system privileges needed)
  - — Tru64 UNIX: Version 5.005 (part of operating system)
  - — IBM AIX: Version 5.5.3.0 (part of operating system)
  - — Windows NT/2000: ActivePerl Version 5.6.1.628, binary kit for Win32
  - — Solaris 6: Version 5.005 (for Intel/Solaris) or Version 5.6.1 (SPARC/Solaris)
  - — Solaris 7: Version 5.005 (for Intel/Solaris) or Version 5.6.1 (SPARC/Solaris)
  - — Solaris 8: Version 5.005 (for Intel/Solaris, part of operating system) or Version 5.6.1 (for SPARC/Solaris, part of operating system)
- Compaq *SANworks* Command Scripter, Version 1.0A
- Compaq *StorageWorks* Array Controller Software (ACS) Version 8.6-1P

2

Installation

Introduction

This chapter discusses acquiring and installing software components necessary for the scripting processes to run. The following software components are required to prepare a server attached to a Storage Area Network (SAN) for script operation:

- The Compaq DRM Scripting Kit
- A Perl interpreter
- The Compaq *SANworks* Command Scripter

These software components must be installed on each host at the initiator and target sites that will use scripting.

Compaq DRM Scripting Kit

This software kit is obtained from the Compaq website:

http://www.compaq.com/products/sanworks/drm/downloads.html

The kit contains program files, Perl scripts, Perl modules, control tables, and example files. Several kits are available for various operating systems, and they provide the scripts to perform failover, failback, and resumption of operation procedures.

Installing the Compaq DRM Scripting Kit Files

The DRM Scripting Kit should be installed on an initiator and target host (at a minimum) to provide redundancy. It can also be installed on any host to manipulate storage through a compatible controller, but this method may not provide disaster tolerance when a site goes offline. Use the following procedures to install the DRM Scripting Kit on your operating systems.

NOTE: When CLONE_HOME is used in a path name in this manual, it refers to the name you assigned to the default directory of the script files. So if you use C:\scripts as the default directory in Windows NT/2000, a path name of %CLONE_HOME%\bin would be the same as C:\scripts\bin.

Compaq OpenVMS

1. Create a directory, for example, SYS$DEVICE:[SCRIPTS], to be the default directory for the scripts.
2. Copy the scripting kit self-extracting file (*drmscript_vms_v2.0a.exe)* into the directory created in step 1.
3. From the command line prompt, enter the command:

   ```
   run drmscript_vms_v2.0a.exe
   ```

   The kit files will self-extract into the default directory you created.
4. Verify that the subdirectories bin, config, log, tmp, and vms were created in the default directory. See Appendix A for a list and description of the installed files.

Compaq Tru64 UNIX, IBM AIX, and Sun Solaris

1. Create a directory (for example, /scripts) to be a default directory for the scripts.
2. Copy the scripting kit tar file (*scripts.tar)* into the directory created in step 1.
3. From the command line, enter the following command:

   ```
   tar -xvfp scripts.tar
   ```

   The kit files will self-extract into the default directory you created.
4. Verify that the subdirectories bin, config, log, sh, and tmp were created in the default directory. See Appendix A for a list and description of the installed files.
5. Set the environmental variable. In the ksh shell, use the following two commands:

   ```
   CLONE_HOME=ScriptDefault
   Example: CLONE_HOME=/scripts
   export CLONE_HOME
   ```

   These lines can also be added to the */.profile* file to make the environmental variable load after rebooting.

Microsoft Windows NT/2000

1. Create a directory (for example, C:\scripts) to be a default directory for the scripts.
2. Copy the scripting kit self-extracting file (*script_win_v2.0a.exe)* into the directory created in step 1.
3. From Windows Explorer or a command line prompt, double-click or execute the *script_win_v2.0a.exe* file. The kit files self-extract into the default directory you created.
4. Verify that the subdirectories bat, bin, config, log, and tmp are created in the default directory. See Appendix A for a list and description of the installed files.
5. Add an environmental variable named %CLONE_HOME% to set the default directory of the scripts.
   a. From the Windows desktop, click **Start**.
   b. Click **Settings**.
   c. Click **Control Panel**.
   d. Double-click **System**.
   e. • For Windows 2000 servers, click **Advanced**, then click **Environment Variables**.
      • For Windows NT Server, click **Environment**.
   f. • For Windows 2000, in the System Variables section, click **New**.
      • For Windows NT, continue with step 5g.
   g. In the dialog box, type CLONE_HOME in the **Variable Name** field. In the Variable Value field, enter the path to the script default directory (for example, C:\scripts).
   h. • For Windows 2000, click **OK**.
      • For Windows NT, click **Set**.
   i. Click **OK** until you reach the Control Panel. Close the Control Panel.

Perl Interpreter

A Perl interpreter is necessary to execute the Perl scripts, and must be installed on each server that runs the scripts. The Tru64 UNIX, AIX, and Solaris Version 8 platforms have a Perl interpreter included with their operating systems. In the OpenVMS, Windows NT/2000, and Solaris Versions 6 and 7 environments, the interpreter is a component that must be separately obtained and installed. For information on how to obtain and install a Perl interpreter for OpenVMS, Windows NT/2000, and Sun Solaris 7, see the following sections.

Compaq OpenVMS

Obtaining the OpenVMS Perl Interpreter

The Perl interpreter for the OpenVMS platform can be downloaded from:

http://www.sidhe.org/vmsperl/prebuilt.html

The interpreter tested with the scripts was Perl Version 5.6.0 and is labeled as OpenVMS Alpha 7.2-1, Dec C Sockets.

Installing the OpenVMS Perl Interpreter

Follow the OpenVMS installation instructions located on the website listed above.

Microsoft Windows NT/2000

Obtaining the Windows Perl Interpreter (ActivePerl)

The Perl interpreter for the Windows platforms can be downloaded from:

http://aspn.activestate.com/ASPN/Downloads/ActivePerl/

Compaq tested the scripts with the ActivePerl 5.6.1.628 MSI package for Windows. Previous versions of the ActivePerl program are also available at the site.

Installing Windows ActivePerl

Follow the Windows installation instructions located on the Activestate website listed above.

Windows NT Server users must have installed or must download Microsoft Windows Installer version 1.1 or later, and must be operating with Service Pack 5 or later. No additional software is needed for Windows 2000 servers.

Sun Solaris Versions 6 and 7

Obtaining the Sun Solaris Versions 6 and 7 Perl Interpreter

The Perl interpreter for the Sun Solaris platforms can be downloaded from:

http://www.sunfreeware.com

At the time this document was prepared there were two versions of the Solaris Perl interpreter. Perl Version 5.6.1 was available for the SPARC/Solaris and Perl Version 5.005 was available for Intel/Solaris.

Installing the Sun Solaris Perl Interpreter

Follow the installation instructions located on the sunfreeware website listed above.

SANworks Command Scripter

The Command Scripter component provides the interface for the Perl scripts to communicate with the HSG80 controller via the Fibre Channel bus.

Obtaining SANworks Command Scripter

To obtain the Command Scripter, contact a reseller or Compaq account representative. Refer to “Compaq Authorized Reseller” in the “About This Guide” section for source information.

For DRM users with a previous version of the Command Scripter, check for updates at the following website:

http://www.comaq.com/products/sanworks/softwaredrivers/commandscripter/index.html

Installing SANworks Command Scripter

This section describes the procedures for installing the Command Scripter on OpenVMS, Tru64, AIX, Windows NT/2000, and Solaris. The Command Scripter must be installed on the initiator and target site servers where the scripts reside.

Compaq OpenVMS

The following procedure installs the Command Scripter on a OpenVMS server:

1. Mount the CD-ROM. Use the command:

   ```
   MOUNT/OVERRIDE=ID DKA400:
   ```

2. Create a directory for the Command Scripter files. The following command creates a directory named CMDSCRPT:

   ```
   CREATE/DIRECTORY SYS$SYSDEVICE:[CMDSCRPT]
   ```

3. Set the directory created in the previous step as the default directory with the following command:

   ```
   SET DEFAULT SYS$SYSDEVICE:[CMDSCRPT]
   ```

4. Copy the self-extracting zip file using the following command:

   ```
   COPY DKA400:[OVMS_V71]SCRPT10V.EXE *.*
   ```

5. Unzip the files with the following command:

   ```
   RUN SCRPT10V.EXE
   ```

   A message displays, showing that the files are unzipped.

6. Enter the following command:

   ```
   DIRECTORY
   ```

   The following message displays:

   ```
   Directory SYS$SYSDEVICE:[CMDSCRIPT]
   COMPAQ-AXPVMS-CPQCMDSCR-V0100-45-1.PCSI;1
   SCRIPT10V.EXE;1
   ```

7. Install Command Scripter using the following command:

   ```
   PRODUCT INSTALL CPQCMDSCR /SOURCE=[]
   ```

   When asked to continue, enter **Yes**. Follow the on screen prompts. A verification message is displayed.

8. When installation is complete, add the following line to the system SYLOGIN.COM file:

   CMDSCRIPT == “$CMDSCRIPT”

To run Command Scripter, you must have certain process privileges. Consult the Command Scripter documentation to determine which privileges are necessary. The Perl scripts must be run from a privileged account.

Installation is complete.

Compaq Tru64 UNIX

The following procedure installs the Command Scripter on a Tru64 UNIX server:

1. Mount the CD-ROM using the following command:

   ```
   mount -r -t cdfs -o rrip /dev/disk/cdrom0c /mnt
   ```

2. Enter the following commands:

   ```
   CD /mnt
   CD unix
   install.sh
   ```

3. The license agreement displays. Enter **Yes** to accept the license agreement terms.
4. The following message displays:

   ```
   Starting the Command Scripter Installation . . . . . .
   Press Enter to continue with the installation.
   ```

   The files are copied.

5. Copy *cmdscript* to CLONE_HOME/bin (the subdirectory under the default directory where the DRM scripting files reside: for example, /scripts/bin).

Installation is complete.

IBM AIX

The following procedure installs the Command Scripter on an IBM AIX server:

1. Mount the CD-ROM using the following command:

   ```
   mount /cdrom
   ```

2. Enter the following commands:

   ```
   CD /cdrom
   ./install.sh
   ```

3. The license agreement displays. Enter **Yes** to accept the license agreement terms.

4. The following message displays:

```
Starting the Command Scripter Installation . . . . . .
Press Enter to continue with the installation.
```

   The files are copied.

5. Copy *cmdscript* to CLONE_HOME/bin (the subdirectory under the default directory where the DRM scripting files reside: for example, /scripts/bin).

Installation is complete.

Microsoft Windows NT/2000

The following procedure installs the Command Scripter on Windows NT or Windows 2000 servers:

1. Insert the Command Scripter CD-ROM. The InstallShield Wizard runs automatically.

NOTE: If the CD-ROM does not automatically run, open Windows Explorer and click the CD-ROM drive. Double-click the Windows folder, then double-click *setup.exe*.

2. From the Welcome screen, click **Next**.
3. The license agreement displays. Click **Yes** to accept the license agreement.
4. Accept the default or choose a destination for the program installation. Click **Next**.
5. Click **Finish**. A *SANworks* Command Scripter program icon is added to the Programs menu.
6. Copy *cmdscript.exe* to %CLONE_HOME%\BIN (the subdirectory under the default directory where the DRM scripting files reside: for example, C:\scripts\bin).
7. The Windows version of Command Scripter requires that a controller be configured on each storage subsystem to direct the inband Fibre Channel data.

   To test the connection, use the following procedure for each controller:

   a. Go to the Windows command prompt.

   b. Switch to the %CLONE_HOME%\bin directory (where %CLONE_HOME% is the name given to the default scripts directory).

c. Enter the following CLI command:

```
cmdscript -f DeviceName "show this_controller"
```

DeviceName is the LUN communicating with the controller. It can be a drive letter (for example, Q:), or a string in the format Scsi3:1:124:0. (Refer to "Communicating Via Command Scripter" on page 5-2.)

You will see the expected SHOW command response from the controller.

8. Take note of what drive letters correspond to each controller name. You will need these for later configuration tasks.

Installation is complete.

Sun Solaris

The following procedure installs Command Scripter on a Sun Solaris server:

1. Insert the CD-ROM.
2. Select the UNIX folder.
3. Select *install.sh*.
4. Enter **OK**. There are no arguments. This returns the license agreement terms.
5. Enter **YES**. Files are copied into directories.
6. When the system installs CPQelm, select **Enter**.
7. Copy *cmdscript* to CLONE_HOME/BIN (the subdirectory under the default directory where the DRM scripting files reside: for example, /usr/scripts/bin).
8. Close the install window and eject the CD-ROM.

Installation is complete.

3

CCL Setup

Introduction

This guide assumes that a Data Replication Manager (DRM) configuration is already in place to allow the scripts to run. However, there are some setup procedures that are important enough that the concepts are reiterated here to ensure a smooth transition to the scripting environment. In particular, if the Command Console LUN (CCL) will be used, then it must be enabled on the controller and configured so the host can make use of it. The CCL is a special pseudo disk device on a RAID storage system that allows the servers to communicate with the RAID array. This chapter discusses how to set up a CCL for each supported operating system. If the CCL is not being used (for example, a non-RCS LUN is used), then this chapter can be skipped.

The scripts reside on hosts in a zone having access to controllers at the initiator and target sites. The following procedure shows you how to set up one CCL for each of the platforms that support scripting. Set up another CCL for the other site controller (initiator or target), to allow communication from either site's host.

Compaq OpenVMS CCL and Job Queue Setup

OpenVMS is only supported in SCSI-3 mode. The following procedures describe OpenVMS CCL setup and job queue setup.

Compaq OpenVMS CCL Setup

1. From the initiator controller, use the following command:

   `SET THIS_CONTROLLER IDENTIFIER=`*`Value`*

   The IDENTIFIER switch creates a CCL identifier that makes the controller and the CCL visible to the host. *Value* is a number between 0–32768.

2. From the target controller, use the following command:

   `SET THIS_CONTROLLER IDENTIFIER=`*`Value`*

   Where the value can be a number between 0–32768 (unique for each CCL).

3. From the initiator and target-site hosts, enter the following command:

   ```
   MCR SYSMAN
   IO AUTOCONFIGURE/LOG
   ```

4. From the host, enter the following command:

   ```
   SHOW DEVICE GG
   ```

   A listing of initiator and target CCLs appears in the format 1GGA*Value*, where *Value* is a number between 0–32768.

5. Verify that Command Scripter is working, by entering the following command from the initiator and target hosts:

   ```
   CMDSCRIPT -f $1$GGAValue "SHOW THIS_CONTROLLER"
   ```

   with *Value* being the ID number of the initiator or target CCLs.

Compaq OpenVMS Job Queue Setup

- If you have an existing batch queue you would like to use for the scripts, then define the logical name CLONE_QUEUE to point to this queue. Use the command:

  ```
  DEFINE/SYSTEM CLONE_QUEUE HostName_BATCH
  ```

- If you do not have a batch queue set up on your system, refer to the VMS System Manager's Manual and define one. After defining a batch queue, point to it using the step above.

Compaq Tru64 UNIX CCL Setup

Tru64 is supported in SCSI-2 and SCSI-3 mode. The following steps enable the CCL and configure it on the Tru64 UNIX platform:

1. To enable the controller CCL in SCSI-2 mode, enter the following commands from each controller subsystem:

   ```
   SET THIS_CONTROLLER SCSI_VERSION=SCSI-2
   SET THIS_CONTROLLER COMMAND_CONSOLE_LUN
   ```

   To enable the CCL in SCSI-3 mode, enter the following command from each controller subsystem:

   ```
   SET THIS_CONTROLLER SCSI_VERSION=SCSI-3
   ```

2. Verify the CCLs can be seen by the host by entering this command (from the host):

   ```
   hwmgr -view device
   ```

   The following is a sample output for this command:

```
HWID: Device Name          Mfg      Model            Location
 -------------------------------------------------------------------------------
    4: /dev/dmapi/dmapi
    5: /dev/scp_scsi
    6: /dev/kevm
   44: /dev/disk/floppy0c             3.5in floppy     fdi0-unit-0
   57: /dev/disk/cdrom0c    COMPAQ    CD-224E          bus-2-targ-0-lun-0
   58: /dev/disk/dsk0c      COMPAQ    BC03662379       bus-6-targ-3-lun-0
   62: /dev/cport/scp1               HSG80CCL         bus-1-targ-3-lun-0
   63: /dev/cport/scp2               HSG80CCL         bus-0-targ-0-lun-0
   70: /dev/disk/dsk9c      DEC       HSG80            IDENTIFIER=1509
   71: /dev/disk/dsk10c     DEC       HSG80            IDENTIFIER=1529
```

   The device names of the CCLs in this example are scp1 and scp2. To verify which controller (remote copy name) uses a CCL, enter the command:

   ```
   cmdscript -f DeviceName "show this_controller"
   ```

   The resulting sample output describes the controller and its remote copy name:

```
Controller:
        HSG80 ZG02103566 Software V86P-3, Hardware  E12
        NODE_ID          = 5000-1FE1-0009-0EC0
        ALLOCATION_CLASS = 0
        SCSI_VERSION     = SCSI-3
        Configured for MULTIBUS_FAILOVER with ZG02103685
            In dual-redundant configuration
        Device Port SCSI address 6
        Time: 23-OCT-2001 10:33:10
        Command Console LUN is lun 0 (IDENTIFIER = 1500)
Host PORT_1:
        Reported PORT_ID = 5000-1FE1-0009-0EC1
        PORT_1_TOPOLOGY  = FABRIC (fabric up)
        Address          = 6F1900
Host PORT_2:
        Reported PORT_ID = 5000-1FE1-0009-0EC2
        PORT_2_TOPOLOGY  = FABRIC (fabric up)
        Address          = 6F1B00
        REMOTE_COPY = HSG015I
Cache:
        256 megabyte write cache, version 0022
        Cache is GOOD
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
Mirrored Cache:
        256 megabyte write cache, version 0022
        Cache is GOOD
        No unflushed data in cache
Battery:
        NOUPS
        FULLY CHARGED
        Expires:             29-AUG-2003
```

IBM AIX CCL Setup

AIX is supported in SCSI-2 and SCSI-3 mode. The following steps enable the CCL and configure it on the IBM AIX platform:

1. To enable the controller CCL in SCSI-2 mode, enter the following command from each controller subsystem:

   ```
   SET THIS_CONTROLLER SCSI_VERSION=SCSI-2
   ```

   ```
   SET THIS_CONTROLLER COMMAND_CONSOLE_LUN
   ```

2. To enable the CCL in SCSI-3 mode, enter the following command from each controller subsystem:

   ```
   SET THIS_CONTROLLER SCSI_VERSION=SCSI-3
   ```

3. Verify that the CCL is enabled by entering the following command from each controller subsystem:

   ```
   SHOW THIS_CONTROLLER
   ```

   The following is a sample output showing that the CCL is enabled:

   ```
   Controller:
           HSG80 ZG05103470 Software V86P-3, Hardware  E12
           NODE_ID          = 5000-1FE1-0009-0A40
           ALLOCATION_CLASS = 0
           SCSI_VERSION     = SCSI-3
           Configured for MULTIBUS_FAILOVER with ZG05103641
               In dual-redundant configuration
           Device Port SCSI address 6
           Time: 13-DEC-2001 08:57:54
           Command Console LUN is lun 0 (IDENTIFIER = 10)
   .
   .
   .
   ```

4. Verify that CCLs can be seen by the host by entering the command (from the host):

   ```
   lsdev -Cc disk
   ```

   The following sample output verifies the host recognizes the CCL:

   ```
   hdisk0 Available 10-60-00-6,0  16 Bit LVD SCSI Disk Drive
   hdisk1 Available 20-58-00-6,0  DEC HSG80 Command Console LUN
   hdisk2 Available 20-58-00-6,1  DEC HSG80 RAID Array
   ```

Microsoft Windows NT/2000 CCL Setup

Windows supports the CCL in SCSI-3 mode only. The following steps enable the CCL and configure it on a Windows platform:

1. To enable the CCL, enter the following command from each controller subsystem:

   ```
   SET THIS_CONTROLLER SCSI_VERSION=SCSI-3
   ```

2. Check which CCLs can be seen by entering the following command from each host used by the scripts.

   ```
   CMDSCRIPT -F SUBSYSDATA
   ```

   The system displays a list of CCLs similar to the following:

   ```
   Available devices:
       Device Name      Vendor      Product ID     Serial Num   FW
          Scsi4:1:0:0  DEC       HSG80CCL          ZG91412410  V86P
          Scsi4:1:2:0  DEC       HSG80CCL          ZG91205687  V86P
          Scsi5:1:1:0  DEC       HSG80CCL          ZG91416136  V86P
          Scsi5:1:3:0  DEC       HSG80CCL          ZG91606296  V86P
   ```

3. To ensure that a host can see the CCL, enter the following command, using a device name like one of those shown in the example display in the previous step:

   ```
   CMDSCRIPT -F DeviceName "SHOW THIS_CONTROLLER"
   ```

   ```
   Example: cmdscript -f Scsi4:1:0:0 "show this_controller"
   ```

   The resulting display should show all the characteristics of the controller, verifying that the host sees the CCL.

Sun Solaris CCL Setup

Sun Solaris supports the CCL when running Secure Path Version 2.1D in SCSI-2 mode and SCSI-3 mode. A CCL is not supported with Secure Path Version 3.0, so non-RCS LUNs must be used to communicate with the controller.

To enable the controller CCL in SCSI-2 mode with Secure Path Version 2.1D, enter the following command from each controller subsystem:

```
SET THIS_CONTROLLER SCSI_VERSION=SCSI-2
```

```
SET THIS_CONTROLLER COMMAND_CONSOLE_LUN
```

To enable the CCL in SCSI-3 mode with Secure Path Version 2.1D, enter the following command from each controller subsystem:

```
SET THIS_CONTROLLER SCSI_VERSION=SCSI-3
```

The following sections describe file changes needed when running Secure Path Version 2.1D with Sun Solaris.

/kernel/drv/sd.conf

All Secure Path devices must have a corresponding *sd* target entry. Secure Path creates its own *sd.conf* entries, one per targN of the *ldLite.conf* file entries. These entries are placed at the head of the *sd.conf* file and allow Secure Path devices to configure prior to other *sd* targets. Placing the *ldLite* entries at the head of the *sd.file* prevents conflicts between Secure Path entries and other SCSI bindings.

Secure Path entries have the format:

```
name="sd" parent="ldLite" target=N lun=0;
```

where N represents the value of targN-dev-Name in *ldLite.conf*.

For example, Secure Path device target 20 would have the following entry:

```
name="sd" parent="ldLite" target=20 lun=0;
```

When you add or remove Secure Path units and LUNs, you must also add or remove the entries for them in *sd.conf*.

Entries to *mda.conf* and *LdLite.conf*

Entries to the CCL in the *mda.conf*, *ldLite.conf*, and *sd.conf* files are similar to other LUNs with the following differences:

- *mda.conf*

  The LUN ID assigned to the CCL can be determined by issuing the following CLI command:

  ```
  show this_controller
  ```

  The LUN ID assigned to the CCL is displayed in the controller data and is usually LUN 0. Similar to any storage LUN on the RAID storage system, there must be two entries for each CCL in *mda.conf*—one for each path.

  An example of an entry in *mda.conf* containing an initiator CCL is:

  ```
  name="mda" parent="/pci@1f,4000/fibre-channel@2" target=33 lun=0 qdepth=32;
  name="mda" parent="/pci@1f,4000/fibre-channel@4" target=32 lun=0 qdepth=32;
  ```

  An example of an entry in *mda.conf* containing a target CCL is:

  ```
  name="mda" parent="/pci@1f,4000/fibre-channel@2" target=35 lun=0 qdepth=32;
  name="mda" parent="/pci@1f,4000/fibre-channel@4" target=34 lun=0 qdepth=32;
  ```

- *ldLite.conf*

  The World Wide LUN ID that is needed in *ldLite.conf* is created by appending the Node ID of the RAID storage system with the hexadecimal equivalent of the SCSI ID of the CCL device (HSG80CCL).

  You can determine the Node ID by issuing the CLI command:

  ```
  show this_controller
  ```

  The Node ID is a 16-character hexadecimal value displayed as the NODE_ID in the controller data. The SCSI ID of the CCL must also be converted to a hexadecimal value. The hexadecimal value for HSG80CCL is 4853-4738-3043-434C.

  For example, to assign the CCL to target 20 of a *StorageWorks* HSG80 Storage System with a Node ID of 5000-1FE1-0001-ED10, *ldLite.conf* must have the following entry:

  ```
  targ20-devName="5000-1FE1-0001-ED10-4853-4738-3043-434C"
  ```

  Reboot the servers with the command `reboot -- -r`. You should now be able to see the CCLs using the `format` command.

4

File Customization

Introduction

This chapter takes you through the customizations required for the configuration generation files, target controller configuration files, and the application action list. These customizations must be made to files on both the initiator and target hosts so the scripts may be run from either site for redundancy.

File Customization Steps

The following list summarizes the file configuration process explained in this chapter.

- Create executable files to simplify the configuration generation task (see "Configuration Generation File Creation" on page 4-3). One executable configuration generation file is created for each controller subsystem on each host. The executable files are run on each host to create initiator and target controller configuration files.
- Execute the configuration generation file for each controller subsystem. See "Running Configuration Generation Files" on page 4-17.
- Use pertinent information from the initiator configuration files to copy into, or otherwise modify, the respective target configuration files. See "Target Controller Configuration File Customization" on page 4-19. Customizations to the target configuration files are:
  - — Copy association set information from initiator configuration files to the target configuration files.
  - — Copy remote copy set information from the initiator configuration files to the target configuration files.
  - — Identify and add target-site hosts that are granted access to remote copy set units following a failover.
  - — Modify the read and write cache values in the target configuration files to maintain consistent values with the initiator configuration files.

- Modify the application action list (*app_ex.act* file) to specify all DRM initiator-target controller pairs that you want to execute concurrently in the SAN. See "Application Action List Customization" on page 4-23.

IMPORTANT: The names of remote copy sets, stripesets, mirrorsets, RAIDsets, association sets, and connection names may not contain a hyphen (-). This is a Perl restriction. Underscores (_) are allowed.

Table 4–1 lists the files created or customized on the initiator and target hosts while performing the procedures in this chapter. A configuration generation file for each controller subsystem is created on both hosts and saved in the BAT, SH, or VMS subdirectory of CLONE_HOME (the name of the directory where the scripts reside), depending on your operating system. The *.xxx* file extension denotes a filename ending with *.com* (OpenVMS), *.sh* (Tru64 UNIX, AIX, and Solaris), or *.bat* (Windows).

Table 4–1: Created or Customized Host Files

Initiator Host		Target Host	
Subdirectory	File	Subdirectory	File
bat, sh, or vms	*InitiatorName_gen.xxx* Example: *tulsa_gen.bat*	bat, sh, or vms	*InitiatorName_gen.xxx* Example: *tulsa_gen.bat*
bat, sh, or vms	*TargetName_gen.xxx* Example: *fargo_gen.bat*	bat, sh, or vms	*TargetName_gen.xxx* Example: *fargo_gen.bat*
config	*InitiatorName.cfg* Example: *tulsa.cfg*	config	*InitiatorName.cfg* Example: *tulsa.cfg*
config	*TargetName.cfg* Example: *fargo.cfg*	config	*TargetName.cfg* Example: *fargo.cfg*
config	*app.act*	config	*app.act*

The generation files you create are run on each host to create initiator and target controller configuration files. These will have a *.cfg* extension and will be saved in the config subdirectory.

On each host, customization occurs on two types of files: the target controller configuration files (*TargetName.cfg*) on the initiator and target hosts, and the application action list (*app.act*). When you are finished, the files on the initiator host and target host are nearly identical.

Configuration Generation File Creation

During installation of the DRM Scripting Kit for a specific operating system, one of three types of example configuration generation files were extracted and placed in a CLONE_HOME subdirectory (where CLONE_HOME is the default directory where the scripts reside).

- OpenVMS files reside in the vms subdirectory.
- Tru64 UNIX, AIX, and Solaris files reside in the sh subdirectory
- Windows files reside in the bat subdirectory

The example configuration generation file (*gen_ex.xxx*, where *.xxx* is the *bat*, *sh*, or *com* file extension) is provided as a template file. It must be modified to create one customized configuration generation file for each HSG80 controller subsystem at both the initiator and target sites. The syntax of the configuration generation file differs, depending on the operating system and whether a CCL or non-RCS LUN is used. The modified template file is saved as an executable program file and then run at the initiator site, and again at the target site, to create individual controller configuration files on all hosts that will use the scripts.

Before creating configuration files for your scripts, ensure that your DRM configuration is correctly set up. For example, check that you have an association set with a log disk for the initiator site, that all remote copy sets belong to an association set, a log disk is available for the target site, or any other desired setup properties are enabled. Also check that each unit has a preferred path at both the initiator and target sites.

IMPORTANT: Any time your controller configuration changes, the controller configuration generation program files you create will have to be run again to create new controller configuration files.

Compaq OpenVMS

The following procedure describes how to create initiator and target configuration generation files in SCSI-3 mode when using a CCL.

1. Modify the *gen_ex.com* file to create an initiator configuration generation file for the initiator site. Use a text editor and make the necessary modifications using the following syntax:

   perl -I CLONE_HOME [.BIN]generate_cfg.pl com=cs *RemoteCopyName idnum*

   where,

RemoteCopyName identifies the initiator DRM controller (remote copy) name of the subsystem (for example, *tulsa*). The remote copy name can be obtained from running a `SHOW THIS` command from the controller.

idnum specifies the device identification number for the operating system that Command Scripter uses to communicate with initiator controller *tulsa*. As shown in Figure 4–1, this is the identification number of the CCL for the local controller (Controller A) communicating with the initiator host (Host A).

In OpenVMS, the device identification number can be obtained by entering the command:

```
SHOW DEVICE GG
```

A listing of CCLs appears in the format 1GGA*Value*, where Value is a number between 1-9999. An example of a valid device identification number would be 1GGA3001.

2. Save the edited generation file into the CLONE_HOME/vms subdirectory with a meaningful name like *tulsa_gen.com*.

3. Modify the *gen_ex.com* file again to create a target configuration generation file for the initiator site. The device identification number used in this file specifies the device identification number for the CCL of the controller at the target site (Controller B) communicating with the initiator host (Host A). Use the syntax:

   perl -I CLONE_HOME [.BIN]generate_cfg.pl com=cs *RemoteCopyName idnum*

   RemoteCopyName identifies the target DRM controller (remote copy) name of the subsystem (for example, *fargo*).

   idnum specifies the device identification number for the operating system that Command Scripter uses to communicate with target controller *fargo*. As shown in Figure 4–1, this is the identification number of the CCL for the remote controller (Controller B) communicating with the initiator host (Host A).

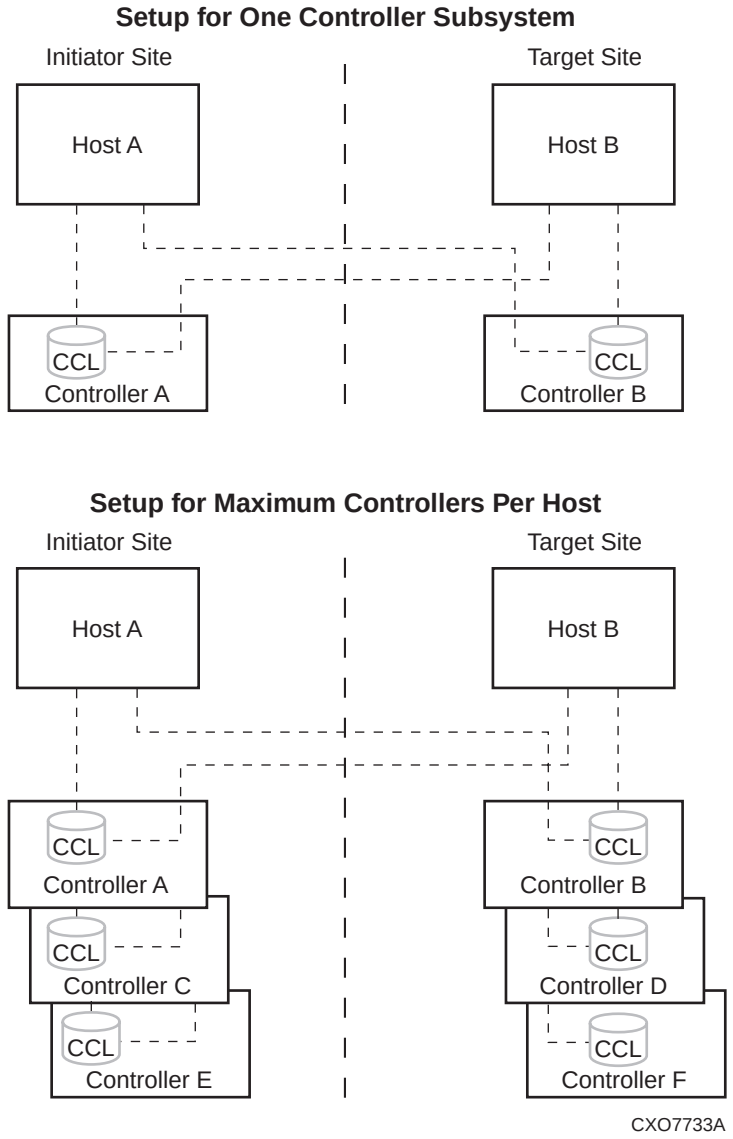


Figure 4–1: Generation file setup using a CCL

4. Save this program file in the vms subdirectory with a meaningful name like *fargo_gen.com*.
5. Repeat the above steps to create initiator and target configuration generation files for the target site. Use the correct device identification numbers of the CCLs communicating with the controllers. Save these files in the vms subdirectory on the target host using the same naming convention as used previously.

Compaq Tru64 UNIX

The following procedure describes how to create initiator and target configuration generation files when using a CCL in SCSI-2 or SCSI-3 mode.

1. Modify the *gen_ex.sh* file to create an initiator configuration generation file for the initiator site. Use a text editor and make the necessary modifications using the following syntax:

   ```
   perl -I $CLONE_HOME $CLONE_HOME/bin/generate_cfg.pl com=cs
   RemoteCopyName idnum
   ```

   where,

   RemoteCopyName identifies the DRM controller (remote copy) name of the initiator subsystem (for example, *tulsa*). This name is case sensitive in Tru64 UNIX and must match the case of the name used later when configuring the application action list.

   idnum specifies the device identification number for the operating system that Command Scripter uses to communicate with controller *tulsa*. As shown in Figure 4–1, this is the identification number of the CCL for the local controller (Controller A) communicating with the initiator host (Host A).

   In Tru64 UNIX, the device identification number can be obtained by entering the command:

   ```
   hwmgr -view device
   ```

   The resulting output shows the CCLs (see “Compaq Tru64 UNIX CCL Setup” on page 3-2. The device identification number or “idnum” in that example is scp1.). To find the controller remote copy name for a particular CCL, enter the following command from the bin subdirectory of CLONE_HOME:

   ```
   cmdscript -f DeviceName “show this_controller”
   ```

2. Save the edited shell file into the $CLONE_HOME/sh subdirectory with a meaningful name like *tulsa_gen.sh*.

3. Modify the *gen_ex.sh* file again to create a target configuration generation file for the initiator site. The device identification number used in this file specifies the device identification number for the CCL of the controller at the target site (Controller B) with access to the initiator host (Host A). Use the syntax:

   ```
   perl -I $CLONE_HOME $CLONE_HOME/bin/generate_cfg.pl com=cs
   RemoteCopyName idnum
   ```

   where,

   RemoteCopyName identifies the DRM controller (remote copy) name of the target subsystem (for example, *fargo*). This name is case sensitive in Tru64 UNIX and must match the case of the name used later when configuring the application action list.

   idnum specifies the device identification number for the operating system that Command Scripter uses to communicate with controller *fargo*. As shown in Figure 4–1, this is the identification number of the CCL for the remote controller (Controller B) communicating with the initiator host (Host A).

4. Save this program file in the sh subdirectory with a meaningful name like *fargo_gen.sh*.

5. Repeat the above steps to create initiator and target configuration generation program files for the target site. Use the correct device identification numbers of the CCLs communicating with the controllers. Save these generation files in the sh subdirectory on the target host using the same naming conventions used previously.

IBM AIX

The following procedure describes how to create initiator and target configuration generation files when using a CCL in either SCSI-2 or SCSI-3 mode.

1. Modify the *gen_ex.sh* file to create an initiator configuration generation file for the initiator site. Use a text editor and make the necessary modifications using the following syntax:

   ```
   perl -I $CLONE_HOME $CLONE_HOME/bin/generate_cfg.pl com=cs
   RemoteCopyName idnum
   ```

   where,

RemoteCopyName identifies the DRM controller (remote copy) name of the initiator subsystem (for example, *tulsa*). This name is case sensitive in IBM AIX and must match the case of the name used later when configuring the application action list.

idnum specifies the device number for the operating system that Command Scripter uses to communicate with controller *tulsa*. As shown in Figure 4–1, this is the device number of the CCL for the local controller (Controller A) communicating with the initiator host (Host A).

To find the *idnum*, use the `lsdev -Cc disk` command to find the device assigned to the CCL. A listing of all available hdisks appears with those that are CCLs identified as such. So for this example, the idnum for an hdisk CCL might be:

/dev/hdisk1

To verify that this is the correct controller subsystem to which this device communicates, enter the following command:

```
cmdscript -f /dev/hdisk1 “show this”
```

The resulting display shows the characteristics of the controller beginning with the controller (remote copy) name. If a typical `show this_controller` response is not received, then an incorrect *idnum* was used for that controller.

2. Save the edited generation file into the $CLONE_HOME/sh subdirectory with a meaningful name like *tulsa_gen.sh.*

3. Modify the *gen_ex.sh* file again to create a target configuration generation file for the initiator site. The device identification number used in this file specifies the device identification number for the CCL of the controller at the target site (Controller B) communicating with the initiator host (Host A). Use the syntax:

   ```
   perl -I $CLONE_HOME $CLONE_HOME/bin/generate_cfg.pl com=cs
   RemoteCopyName idnum
   ```

   where,

   RemoteCopyName identifies the target DRM controller (remote copy) name of the target subsystem (for example, *fargo*). This name is case sensitive in IBM AIX and must match the case of the name used later when configuring the application action list.

   idnum specifies the device number for the operating system that Command Scripter uses to communicate with controller *fargo*. As shown in Figure 4–1, this is the device number of the CCL for the remote controller (Controller B) communicating with the initiator host (Host A).

4. Save this program file in the sh subdirectory with a meaningful name like *fargo_gen.sh*.
5. Repeat the above steps to create initiator and target configuration generation program files for the target site. Use the correct device identification numbers of the CCLs communicating with the controllers. Save these program files in the sh subdirectory on the target host using the same naming conventions used previously.

Microsoft Windows NT/2000

Windows NT/2000 can be run in SCSI-2 mode with no CCLs or in SCSI-3 mode with CCLs. The following procedures show how to use either method.

SCSI-2 Mode with No CCL Enabled

In SCSI-2 mode (with no CCL enabled), the scripting hosts communicate with controllers through LUNs. These must be non-RCS LUNs with "sticky" drive letters, meaning that they are persistent during restarts of the host. Hosts at the initiator and target sites must see these LUNs as the same drive letter. For example, if Host A (initiator) sees this LUN as Q:, then Host B (target) must see the same LUN as Q: also (refer to Figure 4–2.). There is a maximum limit of three controllers per host. Follow these steps to create SCSI-2 initiator and target controller generation batch files:

1. Ensure you have one non-RCS LUN enabled on each initiator and target controller subsystem that each host running the scripts can access (see Figure 4–2). This means that the initiator host must have access to LUNs at the initiator and target sites, and the target host has access to LUNs at the initiator and target sites. If zoning is enabled, make sure the initiator and target hosts reside in the same zone.
2. Modify the *gen_ex.bat* file to create an initiator configuration generation file for each initiator site controller. Use a text editor and make the necessary modifications using the following syntax:

   ```
   Perl -I %CLONE_HOME% %CLONE_HOME%\bin\generate_cfg.pl com=cs
   RemoteCopyName Device:
   ```

   where,

   RemoteCopyName identifies the DRM controller (remote copy) name of the initiator subsystem (for example, *tulsa*). The remote copy name can be obtained by running a `SHOW THIS` command from the controller.

   Device: specifies the non-RCS LUN that Command Scripter uses to communicate with the initiator controller from the initiator host (for example, Q: in Figure 4–2).

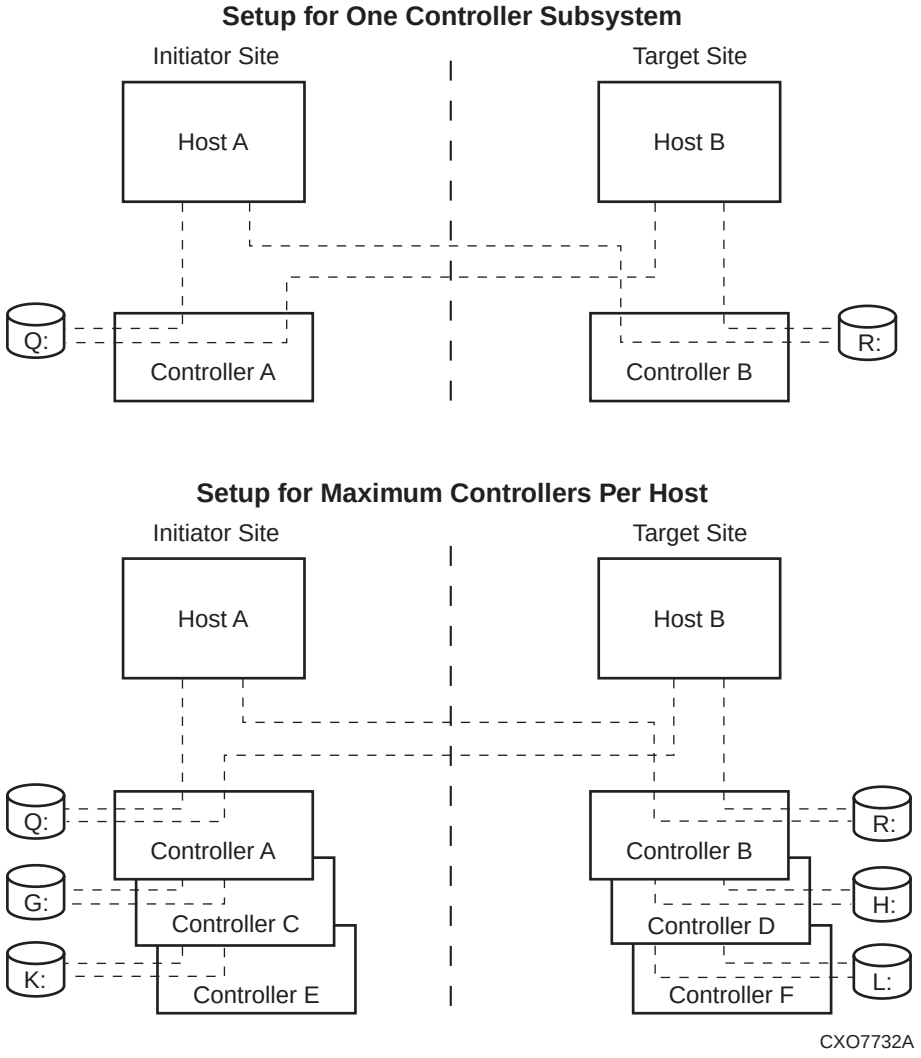


Figure 4–2: Generation file setup with a non-RCS LUN

3. Save the edited initiator configuration generation batch file into the %CLONE_HOME%\bat subdirectory with a meaningful name like *tulsa_gen.bat.*

4. Modify the *gen_ex.bat* file again to create a target configuration generation file for the initiator site. The syntax is:

   ```
   Perl -I %CLONE_HOME% %CLONE_HOME%\bin\generate_cfg.pl com=cs
   RemoteCopyName Device:
   ```

   where,

   RemoteCopyName identifies the DRM controller (remote copy) name of the target subsystem (for example, *fargo*).

   Device: specifies the non-RCS LUN that Command Scripter uses to communicate with the target controller from the initiator host (for example, R: in Figure 4–2).

5. Save this batch file in the BAT subdirectory with a meaningful name like *fargo_gen.bat*.

6. Repeat the above steps to create initiator and target configuration generation batch files for all hosts running scripts at the target site. Use the correct non-RCS LUN device letters that provide communications to the controllers. Save these batch files in the BAT subdirectory on the target host using the same naming convention used previously.

SCSI-3 Mode with CCLs

In SCSI-3 mode, the Windows scripting hosts communicate with controllers through CCLs. Chapter 3 describes how to set up CCLs and identify their serial numbers. Follow these steps to create initiator and target controller generation batch files:

1. Modify the *gen_ex.bat* file to create an initiator controller configuration generation file for each host running scripts at the initiator site. Use a text editor and make the necessary modifications using the following syntax:

   ```
   Perl -I %CLONE_HOME% %CLONE_HOME%\bin\generate_cfg.pl com=cs
   RemoteCopyName SerNum
   ```

   where,

   RemoteCopyName identifies the DRM controller (remote copy) name of the initiator subsystem (for example, *tulsa*). The remote copy name can be obtained by running a `SHOW THIS` command from the controller.

SerNum specifies the device serial number that Command Scripter uses to communicate with initiator controller *tulsa*. As shown in Figure 4–1, this is the serial number of the CCL for Controller A (*tulsa*) that is communicating with Host A. The maximum limit is three controllers per host.

One way to find the serial number of a controller CCL would be by using the following steps:

a. Enter the command:

```
CMDSCRIPT -F SUBSYSDATA
```

A listing of available controller devices will display, similar to the following:

```
Available devices:
   Device Name      Vendor      Product ID     Serial Num   FW
      Scsi4:1:0:0  DEC       HSG80CCL          ZG91412410  V86P
      Scsi4:1:2:0  DEC       HSG80CCL          ZG91205687  V86P
      Scsi5:1:1:0  DEC       HSG80CCL          ZG91416136  V86P
      Scsi5:1:3:0  DEC       HSG80CCL          ZG91606296  V86P
```

This output display shows CCLs that may be within the same controller subsystem pair. For example, the first and third device listed above may be *tulsa_top* and *tulsa_bot*.

b. Cross-reference the device serial number to the controller name using the following command:

```
CMDSCRIPT -F DeviceName "SHOW THIS"

Example: cmdscript -f Scsi4:1:0:0 "show this"
```

The resulting display shows the characteristics of the controller, beginning with the controller name. For example,

```
tulsa_bot>
```

As shown in the first line of the listing in step 1a, you now know that the serial number for the bottom controller of tulsa is ZG91412410 by cross-referencing the device name, controller name, and serial number.

NOTE: Scripts may be run from either the top or bottom controller of a controller subsystem pair. So the scripts for controller *tulsa* can be run from the top or bottom controller of *tulsa*.

2. Save the edited initiator configuration generation batch file into the %CLONE_HOME%\bat subdirectory with a meaningful name like *tulsa_gen.bat.*

3. Modify the *gen_ex.bat* file again to create a target configuration generation file for the initiator site. The syntax is:

```
Perl -I %CLONE_HOME% %CLONE_HOME%\bin\generate_cfg.pl com=cs
RemoteCopyName SerNum
```

where,

RemoteCopyName identifies the DRM controller (remote copy) name of the target subsystem (for example, *fargo*). The remote copy name can be obtained by running a `SHOW THIS` command from the controller.

SerNum specifies the device serial number that Command Scripter uses to communicate with target controller *fargo* from the initiator host. As shown in Figure 4–1, this is the serial number of the CCL for Controller B (*fargo*) that is communicating with Host A.

4. Save this batch file in the BAT subdirectory with a meaningful name like *fargo_gen.bat*.
5. Repeat the above steps to create initiator and target configuration generation batch files for each host running the scripts at the target site. Save these batch files in the BAT subdirectory on the target host using the same naming convention used previously.

Sun Solaris

Solaris can run using the CCL in SCSI-2 or SCSI-3 mode with Secure Path Version 2.1D. Solaris cannot use the CCL with Secure Path Version 3.0, so it must use a non-RCS LUN. The following procedures show how to use either method.

Using the CCL

1. Modify the *gen_ex.sh* file to create an initiator controller configuration generation file for each host running the scripts at the initiator site. Use a text editor and make the necessary modifications using the following syntax:

```
perl -I $CLONE_HOME $CLONE_HOME/bin/generate_cfg.pl com=cs
RemoteCopyName idnum
```

where,

RemoteCopyName identifies the DRM controller (remote copy) name of the subsystem (for example, *tulsa*). This name is case sensitive in Sun Solaris and must match the case of the name used later when configuring the application action list.

idnum specifies the device number for the operating system that Command Scripter uses to communicate with controller *tulsa*. As shown in Figure 4–1, this is the device number of the CCL for the local controller (Controller A) communicating with the initiator host (Host A).

To find the *idnum*, use the `format` command to find the device assigned to the CCL. For example, the format entry displayed would look like the following:

```
c1t100d0 <drive type unknown>
```

So for this example, the entry for idnum would be:

/dev/rdsk/c1t100d0s2

where s2 is the slice number of the drive.

2. Save the edited generation file into the $CLONE_HOME/sh subdirectory with a meaningful name like *tulsa_gen.sh.*

3. Modify the *gen_ex.sh* file again to create a target configuration generation file for the initiator site. The device identification number used in this file specifies the device identification number for the CCL of the controller on the target site (Controller B) communicating with the initiator host (Host A). Use the syntax:

   ```
   perl -I $CLONE_HOME $CLONE_HOME/bin/generate_cfg.pl com=cs
   RemoteCopyName idnum
   ```

   where,

   RemoteCopyName identifies the target DRM controller (remote copy) name of the subsystem (for example, *fargo*). This name is case sensitive in Sun Solaris and must match the case of the name used later when configuring the application action list.

   idnum specifies the device number for the operating system that Command Scripter uses to communicate with controller *fargo*. As shown in Figure 4–1, this is the device number of the CCL for the remote controller (Controller B) communicating with the initiator host (Host A).

4. Save this program file in the sh subdirectory with a meaningful name like *fargo_gen.sh*.

5. Repeat the above steps to create initiator and target configuration generation program files for all hosts running the scripts at the target site. Use the correct device identification numbers of the CCLs communicating with the controllers. Save these program files in the sh subdirectory on the target host using the same naming conventions used previously.

Using the Non-RCS LUN (No CCL)

1. Modify the *gen_ex.sh* file to create an initiator configuration generation file for each host running the scripts at the initiator site. Use a text editor and make the necessary modifications using the following syntax:

   ```
   perl -I $CLONE_HOME $CLONE_HOME/bin/generate_cfg.pl com=cs
   RemoteCopyName DeviceID
   ```

   where,

   RemoteCopyName identifies the DRM controller (remote copy) name of the subsystem (for example, *tulsa*). This name is case sensitive in Solaris and must match the case of the name used later when configuring the application action list.

   DeviceID specifies the identifier for the non-RCS LUN you created to allow Command Scripter to communicate with the initiator controller *tulsa*. The setup is similar to that shown in Figure 4–2, where instead of a drive letter, this is the device identifier of the LUN for the local controller (Controller A) communicating with the initiator host (Host A). The device identifier can be found using the following method.

   Run a SHOW CLI command on the non-RCS LUN you created and note the LUN ID (or WWLUN_ID) number. See the following example:

   ```
   TULSA TOP ->show d34
       LUN                                          Uses             Used by
   ------------------------------------------------------------------------------
   D34                                           DISK50100    (partition)
           LUN ID:      6000-1FE1-0009-0A30-0001-0280-4798-00B3
           NOIDENTIFIER
           Switches:
             RUN                    NOWRITE_PROTECT        READ_CACHE
             READAHEAD_CACHE          WRITEBACK_CACHE
             MAX_READ_CACHED_TRANSFER_SIZE = 128
             MAX_WRITE_CACHED_TRANSFER_SIZE = 128
           Access:
             TgtHost1_HBA, TgtHost2_HBA, InitHost1_HBA, InitHost2_HBA
          State:
             ONLINE to this controller
             Not reserved
             NOPREFERRED_PATH
           Size:             4442290 blocks
           Geometry (C/H/S): ( 1315 / 20 / 169 )
   ```

   Next, run the following commands to get a listing of all recognized devices:

   ```
   cd /opt/CPQswsp/bin
   ./spmgr display
   ```

A listing of all devices similar to the following displays:

```
Server:  SUN002    Report Created: Thu, Dec 13 16:14:03 2001
  Command: ./spmgr display
  = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
  Storage:  5000-1FE1-0009-0D90
  Load Balance: Off  Auto-restore: Off
  Path Verify: On    Verify Interval: 30
  HBAs: fca-pci-0  fca-pci-1  fca-pci-4  fca-pci-5
  Controller:  ZG05103924, Operational
               ZG02103935, Operational
  Devices:  c6t0d0 c6t0d1 c6t0d2 c6t0d6 c6t0d3 c6t0d4 c6t0d5
.
.
.
TGT/LUN   Device           WWLUN_ID           Parent               #_Paths
    0/  0   c7t0d0           6000-1FE1-0009-0A30-0001-0280-4798-00B3   4
.
.
.
```

Locate your device by matching the WWLUN_ID of this display with the LUN ID obtained from the previous SHOW command. The device indentifier is listed for the non-RCS LUN (for example, c7t0d0) and is used to create the necessary DeviceID syntax for the configuration generation file as follows:

/dev/rdsk/c7t0d0s2

where s2 is the slice number of the drive.

To verify that this is the correct controller subsystem to which this device communicates, enter the following command:

```
cmdscript -f /dev/rdsk/c7t0d0s2 “show this”
```

The resulting display shows the characteristics of the controller beginning with the controller (remote copy) name. If a typical `show this_controller` response is not received, then an incorrect device ID was used for the controller.

2. Save the edited generation file into the $CLONE_HOME/sh subdirectory with a meaningful name like *tulsa_gen.sh.*

3. Modify the *gen_ex.sh* file again to create a target configuration generation file for the initiator site. Use the syntax:

   ```
   perl -I $CLONE_HOME $CLONE_HOME/bin/generate_cfg.pl com=cs
   RemoteCopyName DeviceID
   ```

   where,

   RemoteCopyName identifies the target DRM controller (remote copy) name of the subsystem (for example, *fargo*). This name is case sensitive in Solaris and must match the case of the name used later when configuring the application action list.

DeviceID specifies the identifier for the non-RCS LUN you created to allow Command Scripter to communicate with the initiator controller *tulsa*. The setup is similar to that shown in Figure 4–2, where instead of a drive letter, this is the device identifier of the LUN for the target controller (Controller B) communicating with the initiator host (Host A).

4. Save this edited configuration generation file in the sh subdirectory with a meaningful name like *fargo_gen.sh*.
5. Repeat the above steps to create initiator and target controller configuration generation program files for each host running the scripts at the target site. Use the correct device identification for the non-RCS LUNs communicating with the controllers. Save these edited files in the sh subdirectory on the target host using the same naming conventions used previously.

Running Configuration Generation Files

After creating initiator and target configuration generation files for each controller subsystem at each site, execute each file on the initiator and target hosts running the scripts. For example, the initiator configuration generation file for controller *tulsa* is run from the initiator site hosts, and a configuration generation file for controller *tulsa* is run from the target hosts. Remember that any time your controller configuration changes, these generation files must be run again to create new controller configuration files.

The configuration generation files run a Perl script called *generate_cfg.pl*. When this script runs:

- Many `SHOW` commands are sent to the applicable HSG80 controller. The script creates a controller configuration file based on the received responses.
- This resulting configuration file framework is named by the script in the format *ControllerName.cfg*.

In the examples above, the *tulsa_gen.xxx* program file creates a configuration file called *tulsa.cfg* (provided that *tulsa* is the controller name used in the configuration generation bat, sh, or com file) and places it in the config subdirectory of the platform's CLONE_HOME directory.

The following steps outline how the configuration generation files run on each platform.

Compaq OpenVMS

1. Locate the configuration generation files in the CLONE_HOME/vms directory.
2. Run the command file for the first controller. These files must be run from a privileged account.
3. Continue to run the configuration generation files for each initiator and target controller on the initiator and target hosts.

Compaq Tru64 UNIX, IBM AIX, and Sun Solaris

1. Locate the configuration generation files in the $CLONE_HOME/sh directory.
2. Run the shell file for the first controller.

NOTE: It may be necessary to change the file permissions to make them executable.

3. Continue to run the configuration generation files for each initiator and target controller on the initiator and target hosts.

Microsoft Windows NT/2000

1. In Windows Explorer, locate the configuration generation batch files in the %CLONE_HOME%\bat directory.
2. Double-click or run the batch file for the first controller.
3. Continue to run the configuration generation batch file for each initiator and target controller on the initiator and target hosts.

Controller Configuration File Customization

The configuration files that are created after running the generation files, and placed in the config subdirectory, represent a picture in time of the controller configuration. The information in these files enables the Perl scripts to issue the correct commands to the necessary devices. The sections in these files have names like ASSOCIATIONSET, CONNECTIONS, CONTROLLER, and so on. Appendix B shows an example of a controller configuration file.

After the configuration files have been generated, you will have files for both the initiator and target controllers residing on each host. Please note that:

- The configuration files for the initiator controllers are complete and do not have to be modified.
- The configuration files for the target controllers must be modified each time they are created. This is done to put them into a state that should exist after failover.
- The configuration file for any controller must be recreated by rerunning the configuration generation executable file every time there are changes made to the configuration of that controller.

Target Controller Configuration File Customization

The target controller configuration files are built by running configuration generation program files that execute the *generate_cfg.pl* script. However, these files require additional information to allow the target site to assume the initiator role after failover. You can copy some of this information directly from similar sections of the corresponding initiator controller configuration file. You will need to edit other sections manually.

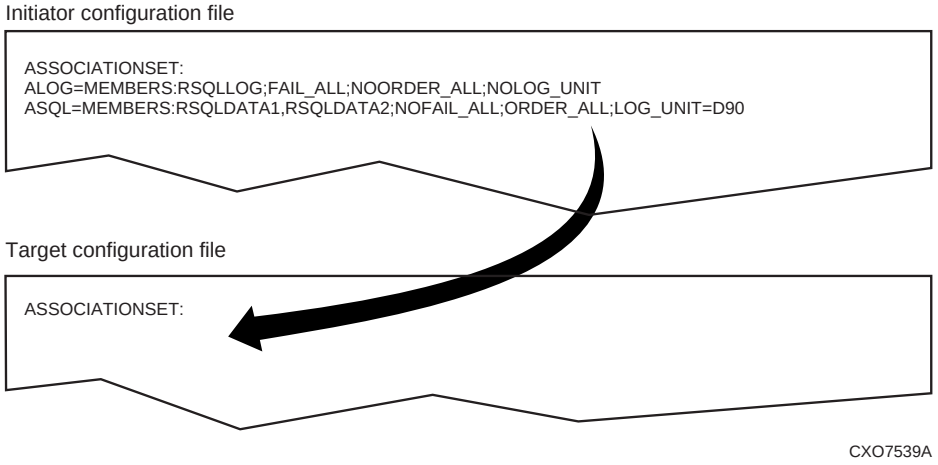
Association Set Section

This section exists in the initiator configuration file, but not in the target configuration file, because association sets do not exist on the target site when the script is executed.

To make the necessary changes:

- Using a text editor, copy the association set information from the initiator configuration file into the target configuration file, as shown in Figure 4–3.
- Set up a target log unit for each association set. Refer to the procedure described in the *Compaq SANworks Data Replication Manager HSG80 ACS Version 8.6-1P Configuration Guide* if you are not sure how to do this.

NOTE: Compaq recommends that the log unit on the initiator match a designated log unit on the target, and that it be set up as a write history log unit.

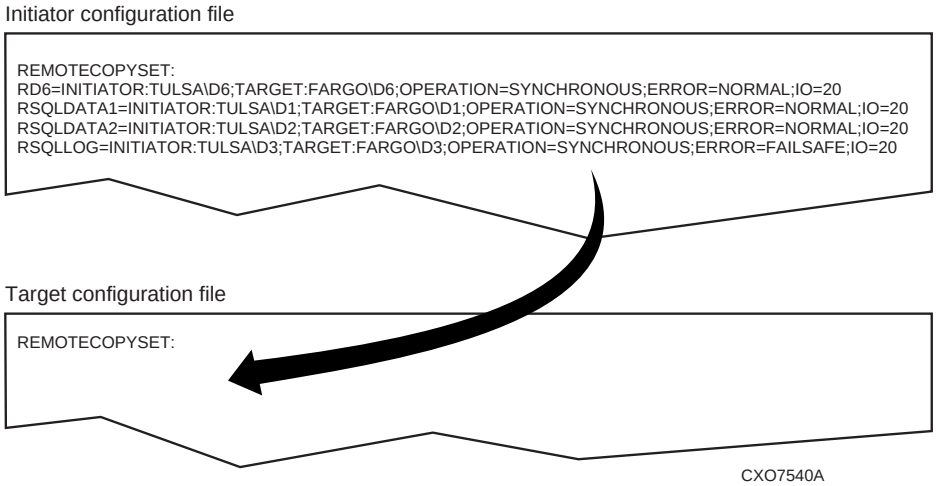


NOTE: Ensure an exact copy of the data is made with no extra lines, returns, and so on.

Figure 4–3: Copying association set information

Remote Copy Set Section

Because the information is not available when the script runs, this is another section does not exist in the target configuration file. Using a text editor, copy the remote copy set information from the corresponding initiator controller configuration file into the target file, as shown in Figure 4–4.



NOTE: Ensure an exact copy of the data is made with no extra lines, returns, and so on.

Figure 4–4: Copying remote copy set information

Connections Section

This section in the configuration file specifies which host has access to the LUNs. In a newly created target configuration file, the information may look like the following:

```
CONNECTIONS:
D1=TULSAC,TULSAD
D2=TULSAC,TULSAD
```

Only the DRM initiator controller connections will have been inserted in this section by the remote copy set LUNs. You must modify this section to enable the target-site hosts access to these LUNs following a site failover. To do this, modify the target configuration file with the names of the desired host connections. Spaces between the connection names are not allowed.

For example, assume that SERVA_T and SERVA_B are target-site host connections to be given access to the LUNs. After you modify the file with a text editor, the resulting section would look like the following:

```
CONNECTIONS:
D1=TULSAC,TULSAD,SERVA_T,SERVA_B
D2=TULSAC,TULSAD,SERVA_T,SERVA_B
```

Maximum Read/Write Cached Transfer Size Section

When the target configuration file is created, maximum read and write cached transfer size default values are inserted that do not correspond to the values in the initiator configuration file. Change these values to match those of the initiator configuration file. Ensure that the units being modified are mapped to the correct remote copy sets.

For example, the newly created initiator and target configuration files may show the following:

Initiator Configuration File	Target Configuration File
MAX_READ_CACHED_TRANSFER_SIZE:	MAX_READ_CACHED_TRANSFER_SIZE:
D1=32	D1=1
D2=128	D2=1
MAX_WRITE_CACHED_TRANSFER_SIZE:	MAX_WRITE_CACHED_TRANSFER_SIZE:
D1=32	D1=1
D2=128	D2=1

With a text editor, modify the values in the target configuration file to match the values of the initiator as shown below:

```
MAX_READ_CACHED_TRANSFER_SIZE:
D1=32
D2=128
MAX_WRITE_CACHED_TRANSFER_SIZE:
D1=32
D2=128
```

Application Action List Customization

During installation, the default application action list (*app_ex.act*) was extracted from the DRM Scripting Kit and placed in the config subdirectory of CLONE_HOME. It provides a basic structure that you must customize using the procedure below. The customized file is saved as *app.act*, and becomes the application action list used by all hosts running the scripts. For a discussion of the structure of the application action list and details of the Perl scripts that use this file, refer to Appendix C.

Customizing the Application Action List

The following steps are provided as guidelines to prepare your application action list:

1. Rename the *app_ex.act* file to *app.act* in the CONFIG directory.
2. With a text editor, open the *app.act* file.
3. Identify the number of DRM initiator-target controller subsystems in your DRM configuration and populate the number of actions to correspond with the number of DRM subsystems. The number of initiator-target subsystems will match the number of entries for each action. For example, two DRM subsystems will comprise two entries under the action SHORT_PLANNED_FAILOVER_STEP1.
4. For each entry within a failover or failback action section, modify the controller name to that of the *target* controller name for each DRM initiator-target pair.
5. For each entry containing failsafe-lock actions (SET_ERROR_NORMAL_OPERATION and SET_ERROR_CONFIGURED_OPERATION), modify the controller name to that of the *initiator* controller name for each DRM initiator-target pair.
6. Save the *app.act* file and copy it to the other site.

Example Customization of an Application Action List

Assume that you have three DRM initiator-target controller pairs in your system, called sun-moon, mars-venus, and jupiter-saturn.

1. Rename the *app_ex.act* file to *app.act* at the initiator site.
2. At the initiator site, open the *app.act* file with a text editor and start with the action called SHORT_PLANNED_FAILOVER_STEP1. What you see is:

```
SHORT_PLANNED_FAILOVER_STEP1
Background fargo drmdispatch PLANNED failover_step1 ALL NOTFORCED
Background denver drmdispatch PLANNED failover_step1 ALL NOTFORCED
END_SHORT_PLANNED_FAILOVER_STEP1
```

NOTE: This is what is seen in the actual *app_ex.act* file. The names *fargo* and *denver* are names of the target controllers that must be substituted with your target controller names.

3. Three initiator-target controller pairs are identified in our example, but the *app.act* file shows only two. To add a third action, copy and paste an existing action line with a text editor. After copying another action line you would have:

```
SHORT_PLANNED_FAILOVER_STEP1
Background fargo drmdispatch PLANNED failover_step1 ALL NOTFORCED
Background denver drmdispatch PLANNED failover_step1 ALL NOTFORCED
Background denver drmdispatch PLANNED failover_step1 ALL NOTFORCED
END_SHORT_PLANNED_FAILOVER_STEP1
```

4. For failover or failback actions, change the sample DRM controller names to the actual target controller (remote copy) names (*moon*, *venus*, and *saturn*). An example would be:

```
SHORT_PLANNED_FAILOVER_STEP1
Background moon drmdispatch PLANNED failover_step1 ALL NOTFORCED
Background venus drmdispatch PLANNED failover_step1 ALL NOTFORCED
Background saturn drmdispatch PLANNED failover_step1 ALL NOTFORCED
END_SORT_PLANNED_FAILOVER_STEP1
```

5. For the failsafe actions (SET_ERROR_NORMAL_OPERATION, SET_ERROR_CONFIGURED_OPERATION_STEP1, and SET_ERROR_CONFIGURED_OPERATION_STEP2) change the sample DRM controller names to the actual initiator controller names (*sun*, *mars*, and *jupiter*). An example would be:

```
SET_ERROR_NORMAL_OPERATION
Background sun drmdispatch PLANNED failsafe_op ALL NOTFORCED
Background mars drmdispatch PLANNED failsafe_op ALL NOTFORCED
Background jupiter drmdispatch PLANNED failsafe_op ALL NOTFORCED
END_SET_ERROR_NORMAL_OPERATION
```

NOTE: The initiator controller names in the actual *app_ex.act* file that would be replaced are *tulsa* and *greenbay*.

6. Save the file. The same *app.act* file you just created is also used at the target site. Copy this file from your initiator host to your target host.

The file customization is now complete for both sites.

5

Scripting File Descriptions and Behaviors

This chapter describes the function of the program files used for failover, failback, and resumption of operations. The chapter also explains how to verify that the scripts can communicate with the controllers via Command Scripter, and how to work with some of the scripting features.

Program File Descriptions

The program files that start the failover, failback, and resumption of operation scripts are provided in the DRM Scripting Kit and are placed in the bat, sh, or vms subdirectory of the CLONE_HOME directory during installation (where CLONE_HOME is a variable indicating the default directory where the scripts reside). Each batch, shell, or command file contains explicit Perl commands and parameters that perform specific actions based on customizations made to the controller configuration files and application action list (discussed in Chapter 4).

You should run the program file for the desired failover, failback, or resumption of operation scenario from a command prompt window to see the status results when the script finishes. The program files, listed here with a *.xxx* extension denoting *.bat, .sh*, or *.com*, perform the following functions:

- *hsg_fo.xxx* performs a site failover on controllers identified in the application action list. You are prompted to run a planned, unplanned, or role reversal failover.
- *hsg_fb1.xxx* performs a site failback (step 1) on controllers identified in the application action list. You are prompted to run a fast, full, role reversal, or new hardware failback.
- *hsg_fb2.xxx* performs a site failback (step 2) on controllers identified in the application action list. You are prompted to run a fast, full, role reversal, or new hardware failback.
- *hsg_op.xxx* allows a resumption of operations by toggling the error mode of the remote copy sets between failsafe-locked and normal mode.

IMPORTANT: Do not perform other processing tasks while the scripts are running. This includes running more than one instance of the scripts, issuing commands through Command Scripter, and issuing commands directly on the controller through a terminal server or serial port. This may cause the controller to hang.

Communicating Via Command Scripter

Command Scripter accesses storage subsystems through device drivers on the local host system when given the a supplied device name, controller serial number, or worldwide unique identifier. Command Scripter will use the supplied device name to attempt to locate a Command Console LUN (CCL) on the same controller. If a CCL is found, access to the controller will be through the CCL. Otherwise, access will be through the specified device.

The general syntax for checking whether Command Scripter can communicate through the specified device is:

```
cmdscript -f DeviceName "show this_controller"
```

DeviceName in OpenVMS is the device identification number described in Chapter 4 when setting up the OpenVMS configuration generation files, and obtained by entering the `SHOW DEVICE GG` command.

DeviceName in Tru64 UNIX Version 5.x systems is the name of the device special file name. This is the CCLName described in Chapter 4 when setting up the Tru64 configuration generation files, and obtained by using the `hwmgr -view device` command.

DeviceName in AIX and Solaris is the idnum described in Chapter 4 when setting up the AIX or Solaris configuration generation files. It includes the complete directory path to the device name. Refer to Chapter 4 on how to obtain the complete device name.

DeviceName in Windows can either be the drive letter of the non-RCS LUN when not using the CCL (for example, Q:) or the controller CCL name in the format "Scsi3:1:124:0". Windows systems do not assign device names to the CCL. A pseudo name for the CCL is created in the format Adapter:Bus:Target:LUN. Chapter 4 describes how this format can be converted to a serial number when creating a configuration generation file.

The general syntax for checking whether Command Scripter can communicate through a device when knowing its serial number (as in Windows systems that use the CCL) is:

```
cmdscript -n SerialNumber "show this"
```

The general syntax for checking whether Command Scripter can communicate through a device when knowing its worldwide unique identifier is:

```
cmdscript -w WorldwideID "show this"
```

Whenever you want to obtain a list of available controllers seen by Command Scripter, use the command:

```
cmdscript -f subsysdata
```

Verbose and Condensed Displays

The first time a program file is run to launch a script, you are prompted to select either a verbose or condensed reporting display. A verbose display lists the status of the controller and all remote copy sets while the script runs (see Figure 5–1). A condensed display lists only the controller name and its status (see Figure 5–2).

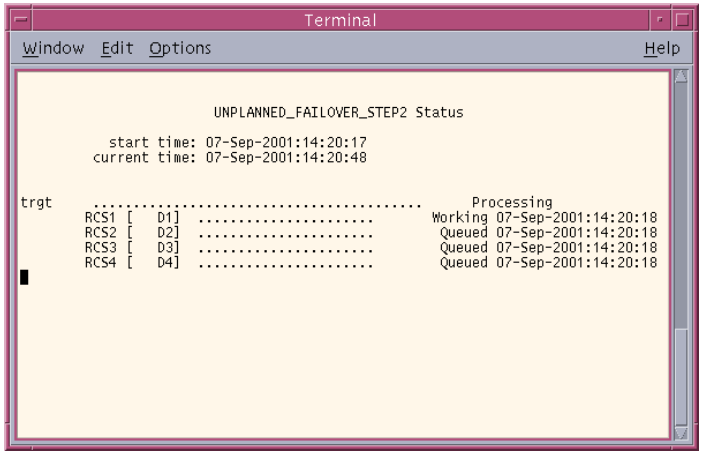


Figure 5–1: Verbose status display

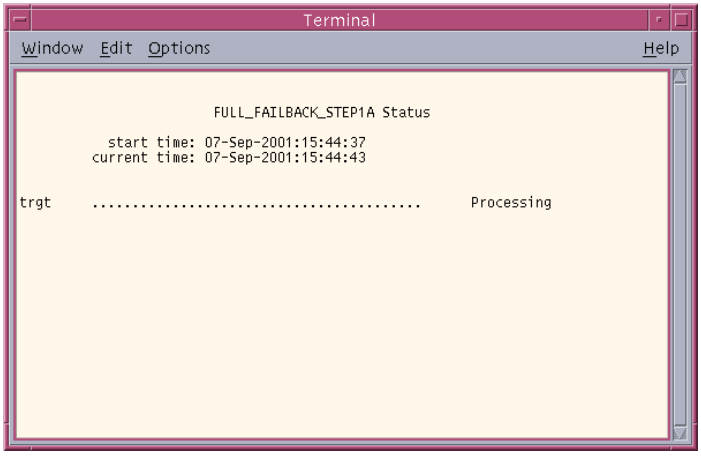


Figure 5–2: Condensed status display

The verbose or condensed option is set in a .RC file. That option remains in effect until you change it. To change the display option, you must delete the associated .RC file. Table 5–1 lists the specific .RC files created from a particular failover, failback, or resumption of operation program file. Delete the .RC file in the config subdirectory of the CLONE_HOME directory for the type of failover or failback you plan to run. You are then prompted again for the verbose or condensed output format the next time the program file is run. Your choice of display output causes that program file to create another .RC file to store that preference.

NOTE: The verbose status display is not currently supported with Compaq OpenVMS.

Table 5–1: RC File Location

Script program file	RC file created
hsg_fo.xxx	app_fo.rc
hsg_fb1.xxx	app_fb1.rc
hsg_fb2.xxx	app_fb2.rc
hsg_op.xxx	app_op.rc

Terminating a Script

IMPORTANT: Compaq recommends that you not terminate a script unless absolutely necessary. Terminating a script may leave the system in an unknown state. If this occurs, you are responsible for putting the system in a known state.

The way scripts are terminated after being invoked depends on the operating system on which they are running. Procedures to terminate running scripts are discussed below for each operating system.

Compaq OpenVMS

To terminate scripts while processing, press **Ctrl**+**C**. A message appears that asks whether you want to terminate the batch job. Pressing **y** (yes) ends a script while pressing **n** (no) cancels the request and display the command prompt. Since some scripts are called in the background, there may be other Perl scripts running. To end these scripts:

1. Enter the command:

   ```
   SHOW QUEUE
   ```

   Observe any background scripts running. A resulting example display for a running script will look like the following:

   ```
   Batch queue DRMSCRIPT, available, on VMS019::

     Entry        Jobname                          Username          Status
     -----        -------                           -------          ------
       25     ROLE_REVERSE_FAILOVER_STEP1_FARGO   DOE              Executing
   ```

2. Delete any background jobs by deleting the specific entry. For example, enter the command:

   ```
   delete /entry=25
   ```

   This deletes the script running in the background.

3. Confirm that all background jobs are deleted by entering the `SHOW QUEUE` command again.

4. The resulting display will look like the following:

   ```
   Batch queue DRMSCRIPT, idle, on VMS019::
   ```

Compaq Tru64 UNIX, IBM AIX, and Sun Solaris

Use the following procedure to terminate a script and background processes in Tru64 UNIX, AIX, or Solaris:

1. Press the **Ctrl**+**C** keys to terminate the script.
2. Type the following commands to find scripting processes still running:

```
ps -ef |grep cmdscript
ps -ef |grep perl
```

3. Terminate these processes using the *kill* command.

Microsoft Windows NT/2000

To terminate scripts while processing, press the **Ctrl**+**C** keys. A message appears that asks whether you want to terminate the batch job. Pressing **y** (yes) ends a script while pressing **n** (no) cancels the request and displays the command prompt. Since some scripts are called in the background, there may be other Perl scripts running. To end these scripts:

1. Open the Windows Task Manager by pressing **Ctrl**+**Alt**+**Delete** and clicking **Task Manager**.
2. Click **Processes** tab.
3. Search for all appearances of *Perl.exe* in the list. Highlight each occurrence and click **End Process**.
4. Close the Windows Task Manager.

6

Unplanned Site Failover with Full Failback Procedure

This chapter provides the procedure for performing an unplanned loss of the initiator site with a full failback to the existing hardware.

This procedure is used after experiencing an unplanned loss of the initiator site. The loss could have been caused by a power failure or other event that did not damage initiator site hardware. The duration of the outage at the initiator site is unknown. After a failover to the target site a full failback is performed to the initiator site.

The sequence of steps are:

- Running the Unplanned Failover Program File Procedure
- Target Host Setup Procedure
- Running the Full Failback Program Files Procedure
- Initiator Site Cleanup Procedure

NOTE: In this chapter, the ▷ symbol is used to identify a procedural step performed at the initiator site, and the ⊙ symbol is used to identify a target-site procedural step.

Running the Unplanned Failover Program File Procedure

⊙ 1. Open a command prompt window on the target host.

⊙ 2. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section “Communicating Via Command Scripter” on page 5-2.

⊙ 3. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.

4. Run the *hsg_fo.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.

5. You will see a message asking what type of failover to run. Enter **u** for an unplanned failover.

6. You will see a confirmation message that asks you to confirm that an unplanned failover is desired. Enter **y** for yes.

7. If this is the first time the program file is run, or you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fo.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

8. When an operation completion status result is displayed (similar to Figure 6–1), continue the failover procedure at the target site with the "Target Host Setup Procedure."

IMPORTANT: If a script encounters an abnormal condition and exits with a warning or error, abort the scripting activities and perform the remaining steps manually. These procedures are located in the *Data Replication Manager HSG80 ACS Version 8.6-1P Failover/Failback Procedures Guide*.

Target Host Setup Procedure

1. To verify that failover completed successfully, issue this CLI command:

```
SHOW REMOTE_COPY_SETS FULL
```

   The output shows the status of remote copy sets. Be sure the units listed under Initiator State are at the target site.

2. To verify that the target hosts can connect to the LUNs, use this command:

```
SHOW UNITS FULL
```

   In the Access field of the display, all units that are used by remote copy sets should show that the target hosts connections are enabled. This should also show the initiator controller connections.

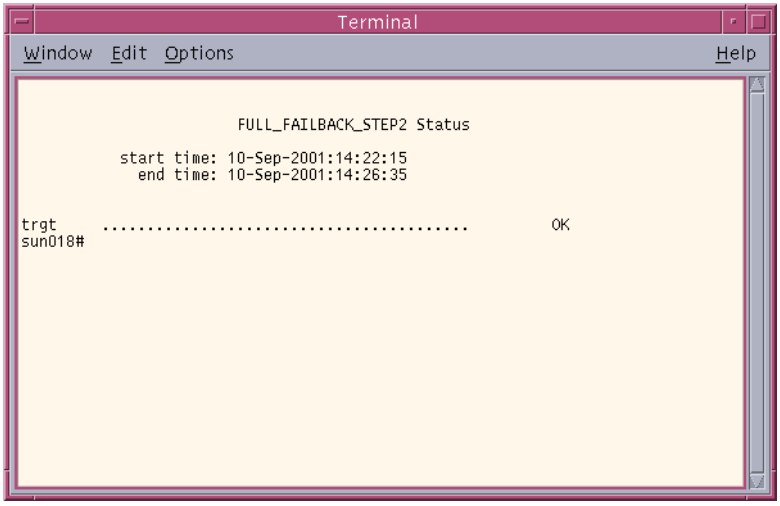


Figure 6–1: Operation completion status result display

3. The following step requires actions relative to each operating system in your configuration.

   a. **Compaq OpenVMS**: Allow hosts to recognize new units:

      1) If the target site hosts are shut down, boot them now. Booting the hosts enables OpenVMS to recognize the drives.

      2) If the target site hosts are not shut down, use the following command from a privileged account to enable OpenVMS to recognize the drives:

      ```
      MCR SYSMAN IO AUTOCONFIGURE/LOG
      ```

   b. **Compaq Tru64 UNIX**: Allow the hosts to recognize new units.

      1) If the target site hosts are shut down, boot them now. Booting the hosts enables Tru64 UNIX to recognize the drives.

      2) If the target hosts are not shut down, use the following command to recognize the drives:

      ```
      hwmgr -scan scsi
      ```

This may take awhile for large configurations. If this is the case, scan only the SCSI bus where one of the DRM host adapters is located with the following command:

```
hwmgr -scan scsi -bus x
```

(where x is the SCSI bus number)

c. **IBM AIX**: Allow the hosts to recognize new units.

1) If the target site hosts are shut down, boot them now. Booting the hosts enables AIX to recognize the drives.

2) If the target hosts are not shut down, use the following commands to recognize the drives and verify that they are present:

```
cfgmgr -v
lsdev -Cc disk
```

Use the following commands to access file systems on the failed-over LUNs:

```
importvg -y volumegroupname hdiskx
mount all
```

NOTE: *volumegroupname* is the name of the volume group originally created at the initiator site, and x is the number of the hdisk assigned to the failed-over LUN. If the -y *volumegroupname* parameter is omitted, AIX will create a default volume group name, for example, vg00.

d. **Microsoft Windows NT**: Allow the host to recognize new units.

Reboot the servers at the target site and log in using an account that has administrative privileges. You should be able to see all of the units in My Computer. If Secure Path is not installed correctly, you will see each drive twice.

e. **Microsoft Windows 2000**: Allow hosts to recognize new units.

1) If you *have not* changed the UNIT_OFFSET of any host connections since the hosts have been booted, you do not need to reboot the target site hosts.

a) On each host, log in using an account that has administrative privileges.

b) Open **Computer Management** and click **Disk Management**.

c) After Disk Management has initialized, go to the Action Menu and click **Rescan Disks**. All of the failed over units should appear in the right-hand pane. If Secure Path is not installed correctly, you will see each unit twice.

2) If you *have* changed the UNIT_OFFSET of any host connections, you must reboot that host. After the server has rebooted, log in using an account that has administrative privileges. You should be able to see all of the units in Disk Management. If Secure Path is not installed correctly, you will see each drive twice.

f. **Sun Solaris**: Allow the hosts to recognize new units.

1) Reboot the servers using the command `reboot -- -r` at the target site and log in using an account that has administrative privileges. You should be able to see all of the units by using the `format` command.

2) If Secure Path was not configured for these units, you will not see the drives. You need to edit the WWIDs in the */kernal/drv/IdLite.conf* file. To find the new WWIDs of the units, use the `SHOW` *UnitName* command on the controller. You may also need to adjust the */kernal/drv/mda.conf* and */kernal/drv/sd.conf* files to accommodate for extra LUNs. After editing the *IdLite.conf*, *mda.conf*, and *sd.conf* files, reboot the server using the `reboot -- -r` command. You should now be able to see the drives using the `format` command. Refer to the *Compaq SANworks Secure Path for Sun Solaris Installation and Reference Guide* for assistance.

4. Once the problem that disabled the initiator site is remedied, continue the full failback procedure at the initiator site with the "Running the Full Failback Program Files Procedure."

Running the Full Failback Program Files Procedure

1. Before performing the failback procedure, locate your record of `SHOW` command output that details the initiator configuration. Verify that your initiator controller configuration is the same as your target controller configuration. Compare the status of the controllers, association sets, remote copy sets, units, and connections. Refer to the *Data Replication Manager HSG80 ACS 8.6-1P Failover/Failback Procedures Guide* for the full status comparison procedure.

2. Open a command prompt window on the initiator host.

3. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section "Communicating Via Command Scripter" on page 5-2.

4. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.
5. Run the *hsg_fb1.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.
6. You will see a message asking what type of failback to run. Enter **f** for a full failback.
7. You will see a confirmation message that asks you to confirm that a full failback is desired. Enter **y** for yes.
8. If this is the first time the program file is run or if you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fb1.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.
9. The display indicates when mirroring is complete. At this time, you are disaster tolerant and can operate in this mode until you choose to complete the failback process.

IMPORTANT: If a script encounters an abnormal condition and exits with a warning or error, abort the scripting activities and perform the remaining steps manually. These procedures are located in the *Data Replication Manager HSG80 ACS Version 8.6-1P Failover/Failback Procedures Guide*.

10. When you are ready to complete the failback to the original initiator site, run the *hsg_fb2.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.
11. You will see a message asking what type of failback to run. Enter **f** for a full failback.
12. You will see a confirmation message that asks you to confirm that a full failback is desired. Enter **y** for yes.
13. If this is the first time the program file is run or if you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fb2.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

14. Boot all of the target hosts now, to be ready for a future failover.
15. Continue with the full failback procedure at the initiator site with "Initiator Site Cleanup Procedure."

Initiator Site Cleanup Procedure

The following steps require actions relative to each operating system in your configuration.

1. **Compaq OpenVMS**: Allow the hosts to recognize new units.
   a. If the initiator site hosts are shut down, boot them now. Booting the hosts enables OpenVMS to recognize the drives.
   b. If the initiator site hosts are not shut down, use the following command from a privileged account to enable OpenVMS to recognize the drives:

      ```
      MCR SYSMAN IO AUTOCONFIGURE/LOG
      ```

2. **Compaq Tru64 UNIX**: Allow the hosts to recognize new units.
   a. If the initiator site hosts are shut down, boot them now. Booting the hosts enables Tru64 UNIX to recognize the drives.
   b. If the initiator hosts are not shut down, use the following command to recognize the drives:

      ```
      hwmgr -scan scsi
      ```

      This may take awhile for large configurations. If this is the case, scan only the SCSI bus where one of the DRM host adapters are located with the following command:

      ```
      hwmgr -scan scsi -bus x
      ```

      (where x is the SCSI bus number)

3. **IBM AIX**: Allow the hosts to recognize new units.
   a. If the initiator site hosts are shut down, boot them now. Booting the hosts enables AIX to recognize the drives.

b. If the initiator site hosts are not shut down, use the following commands to recognize the drives and mount the file systems:

```
cfgmgr -v
mount all
```

4. **Microsoft Windows NT**: Allow the host to recognize new units.

   Reboot the servers at the initiator site and log in using an account that has administrative privileges. You should be able to see all of the units in My Computer. If Secure Path is not installed correctly, you will see each drive twice.

5. **Microsoft Windows 2000**: Allow hosts to recognize new units.

   a. If you *have not* changed the UNIT_OFFSET of any host connections since the hosts have been booted, you do not need to reboot the initiator site hosts.

      1) On each host, log in using an account that has administrative privileges.

      2) Open Computer Management and click **Disk Management**.

      3) After Disk Management has initialized, go to the Action Menu and click **Rescan Disks**. All of the failed over units should appear in the right-hand pane. If Secure Path is not installed correctly, you will see each unit twice.

   b. If you *have* changed the UNIT_OFFSET of any host connections, you must reboot that host. After the server has rebooted, log in using an account that has administrative privileges. You see all of the units in Disk Management. If Secure Path is not installed correctly, you will see each drive twice.

This completes the procedure for performing an unplanned site failover with a full failback.

7

Resumption of Operations After Unplanned Loss of Target Site Procedure (Failsafe Mode)

This chapter provides the procedure for performing a resumption of operations after an unplanned loss of the target site while running in failsafe error mode.

When the error mode of the remote copy set is in failsafe, and the connection to the target site is lost, host I/O is paused. This occurs because the initiator state of the remote copy set becomes inoperative while being failsafe locked. These procedures are used to resume host I/O until the connection to the target site is re-established. The sequence of steps are:

- Verification of Lost Connections Procedure
- Running the Resumption of Operations Program File Procedure
- Initiator Site Cleanup Procedures
- Running the Resumption of Operations Program File Procedure

NOTE: In this chapter, the ▷ symbol is used to identify a procedural step performed at the initiator site, and the ⊙ symbol is used to identify a target-site procedural step.

Verification of Lost Connections Procedure

▷ 1. Verify that the connection to the target site is lost and host I/O is paused. If you are connected to the initiator site controllers when connection to the target site is lost, you will see a confirmation message on your terminal, similar to that shown in Example Display 1. Refer to Appendix D for the meaning of the instance codes.

Example Display 1

```
BuildngATop>

%EVL--BuildngATop> --06-JUN-2001 12:57:13-- Instance Code: 0E098901
Template: 144.(90)
 Occurred on 06-JUN-2001 at 12:57:13
 Power On Time: 2. Years, 72. Days, 5. Hours, 31. Minutes, 56. Seconds
 Controller Model: HSG80
 Serial Number: ZG84906303 Hardware Version:  E03(2B)
 Software Version: V86-1P
 Target Controller Board Serial Number: "      ZG94115654"
Initiator WWLID: 6000-1FE1-0000-4250-0009-9411-5654-003E
 Initiator Node Name: "BUILDNGA"
 Initiator Unit Number: 1.(00000001)
 Target WWLID: 6000-1FE1-0000-4250-0009-9411-5654-003E
 Target Node Name: "BUILDNGB"
 Target Unit Number: 1.(00000001)
 Number of Targets: 1.(00000001)
 Remote Copy Set Name: "RCS1"
 Association Set Name: "AS_D1"
 Log Unit Number: Not Available
 Instance Code: 0E098901
%EVL--BuildngATop> --06-JUN-2001 12:57:14-- Instance Code: 02908901
Template: 81.(51)
 Occurred on 06-JUN-2001 at 12:57:13
 Power On Time: 2. Years, 72. Days, 5. Hours, 31. Minutes, 56. Seconds
 Controller Model: HSG80
 Serial Number: ZG84906303 Hardware Version:  E03(2B)
 Software Version: V86-1P
 Unit Number: 1.(0001)
 Unit Software Version: 1.(01) Unit Hardware Version: 53.(35)
 Retry Level: 1. Retries: 1.
 Port: 1. Target: 0. LUN: 0.
 SCSI Device Type: 0.(00)
 Device ID: "BB00911CA0" Device Serial Number: "V00907W1"
 Device Software Revision Level: "3B05"
 SCSI Command Opcode: 42.(2A)
 Sense Data Qualifiers: 64.(40)
SCSI Sense Data:
  Error Code: 112.(70) {current command execution}
  Information field is valid
  Segment: 0.(00)
  Sense Key: 2.(02) NOT READY
  ILI: 0 EOM: 0 FM: 0
  Information: 6AB80A00
  Additional Sense Length: 10.(0A)
  Command-Specific Information: 00000000
  ASC: 4.(04) ASCQ: 128.(80)
  FRU: 0.(00) Sense-Key Specific: 000000
 Instance Code: 02908901
```

2. Host I/O to the remote copy sets will be paused. Verify that the initiator state of the remote copy set is inoperative, with unit failsafe locked, with the following command:

   ```
   SHOW REMOTE_COPY_SETS FULL
   ```

   You will see a display similar to that in Example Display 2.

Example Display 2

```
BuildngATop> show remote_copy_sets full
Name                                          Uses             Used by
------------------------------------------------------------------------------
RCS1          remote copy                     D1               AS_D1
        Reported LUN ID: 6000-1FE1-0000-4250-0009-9411-5654-003E
        Switches:
          OPERATION_MODE  = SYNCHRONOUS
          ERROR_MODE      = FAILSAFE
          FAILOVER_MODE   = MANUAL
          OUTSTANDING_IOS = 20
        Initiator (BUILDNGA\D1) state:
          INOPERATIVE
          Unit failsafe locked
        Target state:
          BUILDNGB\D1      is COPYING                0% complete
```

3. Continue the restore process with “Running the Resumption of Operations Program File Procedure.”

Running the Resumption of Operations Program File Procedure

1. Open a command prompt window on the initiator host.
2. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section “Communicating Via Command Scripter” on page 5-2.
3. Check the error mode, initiator state, and target status of all remote copy sets with the CLI command:

   ```
   SHOW REMOTE_COPY_SETS FULL
   ```

   Example Display 3 provides a sample output.

Example Display 3

```
BuildngATop> show remote_copy_sets full
Name                                          Uses             Used by
------------------------------------------------------------------------------
RCS1          remote copy                     D1               AS_D1
        Reported LUN ID: 6000-1FE1-0000-4250-0009-9411-5654-003E
        Switches:
          OPERATION_MODE  = SYNCHRONOUS
          ERROR_MODE      = FAILSAFE
          FAILOVER_MODE   = MANUAL
          OUTSTANDING_IOS = 20
        Initiator (BUILDNGA\D1) state:
          INOPERATIVE
          Unit failsafe locked
        Target state:
          BUILDNGB\D1      is COPYING                 0% complete
```

a. If all remote copy sets are in failsafe error mode, and:

   1) Every initiator state is failsafe locked, proceed to step 5.

   2) Every initiator state is not failsafe locked, proceed to step 5.

   3) Initiator states are a mixture of failsafe locked or not being in failsafe locked, proceed to step 4.

b. If all remote copy sets are in normal mode, proceed to step 5.

c. If the remote copy sets are mixed between failsafe and normal error modes, and:

   1) Every remote copy set in failsafe error mode is failsafe locked, and every remote copy set in normal error mode has no targets, proceed to step 5.

   2) Every remote copy set in failsafe error mode is not in a failsafe locked state, proceed to step 5.

   3) Any remote copy sets in failsafe error mode are failsafe locked, and remote copy sets in normal error mode have targets, proceed to step 4.

4. For remote copy sets in failsafe error mode with mixed initiator states, or a mixture of error modes with failsafe error modes that are failsafe locked and normal error mode with targets, change all the remote copy sets in failsafe mode to normal mode. Use the CLI command:

   `SET` *`RemoteCopySetName`* `ERROR_MODE=NORMAL`

   `Example: SET RCS1 ERROR_MODE=NORMAL`

   When the remote copy sets are in normal mode, proceed to the next step.

5. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.

6. Run the *hsg_op.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.

7. You will see a message that you are performing a DRM operation to modify error mode, and asks whether normal or configured error mode is desired. Enter **n** for normal mode.

8. You will see a confirmation message that asks you to confirm that a normal error mode is desired. Enter **y** for yes.

9. If this is the first time the program file is run, or you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_op.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

10. When an operation completion status result is displayed (similar to Figure 6–1), verify that the script removed the targets by entering the following command:

    ```
    SHOW REMOTE_COPY_SETS FULL
    ```

    You will see a display similar to that in Example Display 4.

Example Display 4

```
BuildngATop> show remote_copy_sets full
Name                                              Uses             Used by
------------------------------------------------------------------------------
RCS1          remote copy                         D1
        Reported LUN ID: 6000-1FE1-0000-01F0-0009-8490-6303-0134
        Switches:
          OPERATION_MODE  = SYNCHRONOUS
          ERROR_MODE      = NORMAL
          FAILOVER_MODE   = MANUAL
          OUTSTANDING_IOS = 20
        Initiator (BUILDNGA\D1) state:
          ONLINE to the other controller
        No targets
```

11. Continue with the “Initiator Site Cleanup Procedure.”

Initiator Site Cleanup Procedure

1. The following steps requires actions relative to each operating system in your configuration.

   a. **Compaq OpenVMS**: Allow hosts to recognize new units.

      1) If the initiator site hosts are shut down, boot them now. Booting the hosts enables OpenVMS to recognize the drives.

      2) If the initiator site hosts are not shut down, use the following command from a privileged account to enable OpenVMS to recognize the drives:

      ```
      MCR SYSMAN IO AUTOCONFIGURE/LOG
      ```

   b. **Compaq Tru64 UNIX**: Allow the hosts to recognize new units.

      1) If the initiator site hosts are shut down, boot them now. Booting the hosts enables Tru64 UNIX to recognize the drives.

      2) If the initiator hosts are not shut down, use the following command to recognize the drives:

      ```
      hwmgr -scan scsi
      ```

      This may take awhile for large configurations. If this is the case, scan only the SCSI bus where one of the DRM host adapters are located with the following command:

      ```
      hwmgr -scan scsi -bus x
      ```

      (where x is the SCSI bus number)

   c. **IBM AIX**: Allow the hosts to recognize new units.

      1) If the initiator site hosts are shut down, boot them now. Booting the hosts enables AIX to recognize the drives.

      2) If the initiator site hosts are not shut down, use the following commands to recognize the drives and mount the file systems:

      ```
      cfgmgr -v
      mount all
      ```

d. **Microsoft Windows NT**: Allow the host to recognize new units.

Reboot the servers at the initiator site and log in using an account that has administrative privileges. You should be able to see all of the units in My Computer. If Secure Path is not installed correctly, you will see each drive twice.

e. **Microsoft Windows 2000**: Allow hosts to recognize new units.

1) If you *have not* changed the UNIT_OFFSET of any host connections since the hosts have been booted, you do not need to reboot the initiator site hosts.

a) On each host, log in using an account that has administrative privileges.

b) Open **Computer Management** and click **Disk Management**.

c) After Disk Management has initialized, go to the Action Menu and click **Rescan Disks**. All of the failed over units should appear in the right-hand pane. If Secure Path is not installed correctly, you will see each unit twice.

2) If you *have* changed the UNIT_OFFSET of any host connections, you must reboot that host. After the server has rebooted, log in using an account that has administrative privileges. You see all of the units in Disk Management. If Secure Path is not installed correctly, you will see each drive twice.

f. **Sun Solaris**: Allow the hosts to recognize new units.

1) Reboot the servers using the command `reboot -- -r` at the target site and log in using an account that has administrative privileges.

2) If Secure Path was not configured for these units, you will not see the drives. You need to edit the WWIDs in the */kernal/drv/IdLite.conf* file. To find the new WWIDs of the units, use the `SHOW` *UnitName* command on the controller. You may also need to adjust the */kernal/drv/mda.conf* and */kernal/drv/sd.conf* files to accommodate for extra LUNs. After editing the *IdLite.conf*, *mda.conf*, and *sd.conf* files, reboot the server using the `reboot -- -r` command. You should now be able to see the drives using the `format` command. Refer to the *Compaq SANworks Secure Path for Sun Solaris Installation and Reference Guide* for assistance.

2. Continue the resumption of operations process by "Running the Resumption of Operations Program File Procedure."

Running the Resumption of Operations Program File Procedure

This procedure is used when a connection is re-established to the target site. The remote copy sets are changed back to failsafe mode and host I/O resumes with the target site.

1. Open a command prompt window on the initiator host.
2. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section "Communicating Via Command Scripter" on page 5-2.
3. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.
4. Run the *hsg_op.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.
5. You will see a message that you are performing a DRM operation to modify error mode, and asks whether normal or configured error mode is desired. Enter **c** for configured error mode.
6. You will see a confirmation message that asks you to confirm that a configured error mode is desired. Enter **y** for yes.
7. If this is the first time the program file is run, or you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_op.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.
8. A normalization occurs. When the operation completion status result is displayed (similar to Figure 6–1), verify that the error mode is failsafe, that the initiator state is online, and the target state is normal by entering the following command:

   ```
   SHOW REMOTE_COPY_SETS FULL
   ```

   You will see a display similar to that in Example Display 5.

Example Display 5

```
BuildngATop> show remote_copy_sets full
Name                                          Uses             Used by
------------------------------------------------------------------------------
RCS1          remote copy                     D1               AS_D1
        Reported LUN ID: 6000-1FE1-0000-4250-0009-9411-5654-003E
        Switches:
          OPERATION_MODE  = SYNCHRONOUS
          ERROR_MODE      = FAILSAFE
          FAILOVER_MODE   = MANUAL
          OUTSTANDING_IOS = 20
        Initiator (BUILDNGA\D1) state:
          ONLINE to this controller
          Not reserved
        Target state:
          BUILDNGB\D1      is NORMAL
```

IMPORTANT: If the operation completion status indicates a failure, check the remote copy sets to see if they are in a failsafe mode and their target state is normal. Sometimes the screen refresh may cause a failure indication, even though the scripts performed successfully.

This completes the procedure for resuming initiator site processing after an unplanned communication loss while in failsafe mode.

8

Resumption of Operations After Unplanned Loss of Target Site Procedure (Normal Mode)

This chapter provides the procedure for performing a resumption of operations after an unplanned loss of the target site while running in normal error mode.

This procedure is used when the initiator remote copy sets are in normal error mode and an unplanned loss of the target occurs. Remote copy sets to the target site are removed. All of the steps in this procedure are performed from the initiator site.

The sequence of steps are:

- Verification of Lost Connections Procedure
- Running the Resumption of Operations Program File Procedure

NOTE: In this chapter, the ▷ symbol is used to identify a procedural step performed at the initiator site, and the ⊙ symbol is used to identify a target-site procedural step.

Verification of Lost Connections Procedure

▷ 1. Verify that the connection to the target site is lost. If you are connected to the initiator site controllers when connection to the target site is lost, you will see a confirmation message on your terminal, as shown in Example Display 1. Refer to Appendix D for the meaning of the instance code.

Example Display 1

```
BuildngATop>

%EVL--BuildngATop> --06-JUN-2001 12:57:13-- Instance Code: 0E0F8B01
Template: 144.(90)
 Occurred on 06-JUN-2001 at 12:57:13
 Power On Time: 2. Years, 72. Days, 5. Hours, 31. Minutes, 56. Seconds
 Controller Model: HSG80
 Serial Number: ZG84906303 Hardware Version:  E03(2B)
 Software Version: V86-1P
 Target Controller Board Serial Number: "      ZG94115654"
Initiator WWLID: 6000-1FE1-0000-4250-0009-9411-5654-003E
```

```
Initiator Node Name: "BUILDNGA"
Initiator Unit Number: 1.(00000001)
Target WWLID: 6000-1FE1-0000-4250-0009-9411-5654-003E
Target Node Name: "BUILDNGB"
Target Unit Number: 1.(00000001)
Number of Targets: 1.(00000001)
Remote Copy Set Name: "RCS1"
Association Set Name: "AS_D1"
Log Unit Number: Not Available
Instance Code: 0E098901
```

2. Continue the restore process with "Running the Resumption of Operations Program Files Procedure."

Running the Resumption of Operations Program Files Procedure

1. Open a command prompt window on the initiator host.
2. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section "Communicating Via Command Scripter" on page 5-2.
3. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.
4. Run the *hsg_op.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.
5. You will see a message that you are performing a DRM operation to modify error mode, and asks whether normal or configured error mode is desired. Enter **n** for normal mode.
6. You will see a confirmation message that asks you to confirm that a normal error mode is desired. Enter **y** for yes.
7. If this is the first time the program file is run, or you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_op.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

8. When an operation completion status result is displayed (similar to Figure 6–1), verify that the script removed the targets by entering the following command:

   ```
   SHOW REMOTE_COPY_SETS FULL
   ```

   You will see a display similar to that in Example Display 2.

Example Display 2

```
BuildngATop> show remote_copy_sets full
Name                                            Uses             Used by
------------------------------------------------------------------------------
RCS1          remote copy                       D1
        Reported LUN ID: 6000-1FE1-0000-01F0-0009-8490-6303-0134
        Switches:
          OPERATION_MODE  = SYNCHRONOUS
          ERROR_MODE      = NORMAL
          FAILOVER_MODE   = MANUAL
          OUTSTANDING_IOS = 20
        Initiator (BUILDNGA\D1) state:
          ONLINE to the other controller
        No targets
```

9. Once the connection to the target site is re-established, the remote copy sets need to be added back in. Run the *hsg_op.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.

10. You will see a message that you are performing a DRM operation to modify error mode, and asks whether normal or configured error mode is desired. Enter **c** for configured error mode.

11. You will see a confirmation message that asks you to confirm that a configured error mode is desired. Enter **y** for yes.

12. When an operation completion status result is displayed (similar to Figure 6–1), verify that the error mode is normal, that the initiator state is online, and the target state is normal by entering the following command:

    ```
    SHOW REMOTE_COPY_SETS FULL
    ```

    You will see a display similar to that in Example Display 3.

Example Display 3

```
BuildngATop> show remote_copy_sets full
Name                                              Uses             Used by
------------------------------------------------------------------------------
RCS1          remote copy                         D1               AS_D1
        Reported LUN ID: 6000-1FE1-0000-4250-0009-9411-5654-003E
        Switches:
          OPERATION_MODE  = SYNCHRONOUS
          ERROR_MODE      = NORMAL
          FAILOVER_MODE   = MANUAL
          OUTSTANDING_IOS = 20
        Initiator (BUILDNGA\D1) state:
          ONLINE to this controller
          Not reserved
        Target state:
          BUILDNGB\D1      is NORMAL
```

IMPORTANT: If the operation completion status indicates a failure, check the remote copy sets to see if they are in a normal mode and their target state is normal. Sometimes the screen refresh may cause a failure indication, even though the scripts performed successfully.

This completes the procedure for resuming initiator site processing after an unplanned communication loss while in normal mode.

9

Short Planned Site Failover with Fast Failback Procedure

This chapter provides the procedure for performing a short planned site failover with a fast failback.

This procedure ensures the proper functioning of a failover and subsequent failback during short duration maintenance activities. When a planned site failover is used with a fast failback, each remote copy set must be in an association set with a write history log enabled. Because of the short duration of the planned outage, the write history log will be able to accommodate the accumulated writes. These are the sequence steps:

- Initiator Site Preparation Procedure
- Running the Short Planned Failover Program File Procedure
- Target Host Setup Procedure
- Running the Fast Failback Program Files Procedure
- Initiator Site Cleanup Procedure

NOTE: In this chapter, the ▷ symbol is used to identify a procedural step performed at the initiator site, and the ⊙ symbol is used to identify a target-site procedural step.

Initiator Site Preparation Procedure

▷ 1. Before performing the failover procedure, locate your record of `SHOW` command output that details the current initiator configuration. Verify that your target controller configuration is the same as your initiator controller configuration.

2. Follow the step listed below for each operating system in your heterogeneous configuration. Refer to Appendix E for DRM system power up or power down procedures.

    a. **Compaq OpenVMS**: If the operating system is running and is used exclusively for DRM operations, shut down the operating system and power off the hosts. If the operating system is used for other applications, remove all I/O to the LUNs with remote copy sets that will be failed over, then dismount the volumes associated with these LUNs.

    b. **Compaq Tru64 UNIX**: If the operating system is running and is used exclusively for DRM operations, shut down the operating system and power off the hosts. If the operating system is used for other applications, remove all I/O and unmount all file system LUNs that have remote copy sets that will be failed over.

    c. **IBM AIX**: If the operating system is running, remove all I/O to the remote copy set LUNs that will be failed over, then unmount the file systems associated with these LUNs.

    d. **Microsoft Windows NT-X86**: If the operating system is running, shut it down and power off the hosts.

    e. **Microsoft Windows 2000**: If the operating system is running, shut it down and power off the hosts.

    f. **Sun Solaris**: If the operating system is running, shut it down and power off the hosts.

3. Continue the planned failover process with the “Running the Short Planned Failover Program File Procedure.”

Running the Short Planned Failover Program File Procedure

1. Open a command prompt window on the target host.

2. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section “Communicating Via Command Scripter” on page 5-2.

3. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.
4. Run the *hsg_fo.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.
5. You will see a message asking what type of failover to run. Enter **p** for a planned failover.
6. You will see a confirmation message that asks you to confirm that a planned failover is desired. Enter **y** for yes.
7. You will see a message asking what type of planned failover to run. Enter **s** for a short planned failover.
8. If this is the first time the program file is run, or you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fo.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.
9. When an operation completion status result is displayed (similar to Figure 6–1), continue the failover procedure at the target site with the "Target Host Setup Procedure."

IMPORTANT: If a script encounters an abnormal condition and exits with a warning or error, abort the scripting activities and perform the remaining steps manually. These procedures are located in the *Data Replication Manager HSG80 ACS Version 8.6-1P Failover/Failback Procedures Guide*.

Target Host Setup Procedure

1. To verify that failover completed successfully, issue this CLI command:

   ```
   SHOW REMOTE_COPY_SETS FULL
   ```

   The output shows the status of remote copy sets. Be sure that the units you see (listed under *Initiator State*) are at the target site.
2. To verify that the target hosts can connect to the LUNs, use this command:

   ```
   SHOW UNITS FULL
   ```

In the Access field of the display, all units that are used by remote copy sets should show that the target host connections are enabled. This should also show the initiator controller connections.

3. The following step requires actions relative to each operating system in your configuration.

   a. **Compaq OpenVMS**: Allow hosts to recognize new units.

      1) If the target site hosts are shut down, boot them now. Booting the hosts enables OpenVMS to recognize the drives.

      2) If the target site hosts are not shut down, use the following command from a privileged account to enable OpenVMS to recognize the drives:

      ```
      MCR SYSMAN IO AUTOCONFIGURE/LOG
      ```

   b. **Compaq Tru64 UNIX**: Allow the hosts to recognize new units.

      1) If the target site hosts are shut down, boot them now. Booting the hosts enables Tru64 UNIX to recognize the drives.

      2) If the target hosts are not shut down, use the following command to recognize the drives:

      ```
      hwmgr -scan scsi
      ```

      This may take awhile for large configurations. If this is the case, scan only the SCSI bus where one of the DRM host adapters is located with the following command:

      ```
      hwmgr -scan scsi -bus x
      ```

      (where x is the SCSI bus number)

   c. **IBM AIX**: Allow the hosts to recognize new units.

      1) If the target site hosts are shut down, boot them now. Booting the hosts enables AIX to recognize the drives.

      2) If the target hosts are not shut down, use the following commands to recognize the drives and verify that they are present:

      ```
      cfgmgr -v
      lsdev -Cc disk
      ```

Use the following commands to access file systems on the failed-over LUNs:

```
importvg -y volumegroupname hdiskx
mount all
```

NOTE: *volumegroupname* is the name of the volume group originally created at the initiator site, and x is the number of the hdisk assigned to the failed-over LUN. If the -y *volumegroupname* parameter is omitted, AIX will create a default volume group name, for example, vg00.

d. **Microsoft Windows NT**: Allow the host to recognize new units.

Reboot the servers at the target site and log in using an account that has administrative privileges. You should be able to see all of the units in My Computer. If Secure Path is not installed correctly, you will see each drive twice.

e. **Microsoft Windows 2000**: Allow hosts to recognize new units.

1) If you *have not* changed the UNIT_OFFSET of any host connections since the hosts have been booted, you do not need to reboot the target site hosts.

a) On each host, log in using an account that has administrative privileges.

b) Open **Computer Management** and click **Disk Management**.

c) After Disk Management has initialized, go to the Action Menu and click **Rescan Disks**. All of the failed over units should appear in the right-hand pane. If Secure Path is not installed correctly, you will see each unit twice.

2) If you *have* changed the UNIT_OFFSET of any host connections, you must reboot that host. After the server has rebooted, log in using an account that has administrative privileges. You should be able to see all of the units in Disk Management. If Secure Path is not installed correctly, you will see each drive twice.

f. **Sun Solaris**: Allow the hosts to recognize new units.

1) Reboot the servers using the command `reboot -- -r` at the target site and log in using an account that has administrative privileges.

2) If Secure Path was not configured for these units, you will not see the drives. You need to edit the WWIDs in the */kernal/drv/IdLite.conf* file. To find the new WWIDs of the units, use the `SHOW` *UnitName* command on the controller. You may also need to adjust the */kernal/drv/mda.conf* and */kernal/drv/sd.conf* files to accommodate for extra LUNs. After editing the *IdLite.conf*, *mda.conf*, and *sd.conf* files, reboot the server using the `reboot -- -r` command. You should now be able to see the drives using the `format` command. Refer to the *Compaq SANworks Secure Path for Sun Solaris Installation and Reference Guide* for assistance.

⊙ 4. Continue the planned failback procedure at the target site with the "Running the Fast Failback Program Files Procedure."

Running the Fast Failback Program Files Procedure

⊙ 1. Before performing the failback procedure, locate your record of `SHOW` command output that details the initiator configuration. Verify that your initiator controller configuration is the same as your target controller configuration. Compare the status of the controllers, association sets, remote copy sets, units, and connections. Refer to the *Data Replication Manager HSG80 ACS 8.6-1P Failover/Failback Procedures Guide* for the full status comparison procedure.

⊙ 2. Open a command prompt window on the target host.

⊙ 3. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section "Communicating Via Command Scripter" on page 5-2.

⊙ 4. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.

⊙ 5. Run the *hsg_fb1.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.

⊙ 6. You will see a message asking what type of failback to run. Enter **s** for a fast failback.

⊙ 7. You will see a confirmation message that asks you to confirm that a fast failback is desired. Enter **y** for yes.

8. If this is the first time the program file is run or if you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fb1.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

9. The failback script performs a mini-merge to copy data from the write history log to the initiator site. If space on the write history log is exceeded, a full copy of the disk is performed. The display indicates when copying is complete. At this time, you are disaster tolerant and can operate in this mode until you choose to complete the failback process.

   IMPORTANT: If a script encounters an abnormal condition and exits with a warning or error, abort the scripting activities and perform the remaining steps manually. These procedures are located in the *Data Replication Manager HSG80 ACS Version 8.6-1P Failover/Failback Procedures Guide*.

10. When you are ready to complete the failback to the original initiator site, run the *hsg_fb2.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.

11. You will see a message asking what type of failback to run. Enter **s** for a fast failback.

12. You will see a confirmation message that asks you to confirm that a fast failback is desired. Enter **y** for yes.

13. If this is the first time the program file is run or if you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fb2.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

14. After normalization occurs, check that the target state of all LUNs is normal. Use the command:

    ```
    SHOW REMOTE_COPY_SETS FULL
    ```

15. Continue with the fast failback procedure at the initiator site with “Initiator Site Cleanup Procedure.”

Initiator Site Cleanup Procedure

The following steps requires actions relative to each operating system in your configuration.

1. **Compaq OpenVMS**: Allow the hosts to recognize new units.
   a. If the initiator site hosts are shut down, boot them now. Booting the hosts enables OpenVMS to recognize the drives.
   b. If the target site hosts are not shut down, use the following command from a privileged account to enable OpenVMS to recognize the drives:

      ```
      MCR SYSMAN IO AUTOCONFIGURE/LOG
      ```

2. **Compaq Tru64 UNIX**: Allow the hosts to recognize new units.
   a. If the initiator site hosts are shut down, boot them now. Booting the hosts enables Tru64 UNIX to recognize the drives.
   b. If the initiator hosts are not shut down, use the following command to recognize the drives:

      ```
      hwmgr -scan scsi
      ```

      This may take awhile for large configurations. If this is the case, scan only the SCSI bus where one of the DRM host adapters are located with the following command:

      ```
      hwmgr -scan scsi -bus x
      ```

      (where x is the SCSI bus number)

3. **IBM AIX**: Allow the hosts to recognize new units.
   a. If the initiator site hosts are shut down, boot them now. Booting the hosts enables AIX to recognize the drives.
   b. If the initiator site hosts are not shut down, use the following commands to recognize the drives and mount the file systems:

      ```
      cfgmgr -v
      mount all
      ```

4. **Microsoft Windows NT**: Allow the host to recognize new units.

   Reboot the servers at the initiator site and log in using an account that has administrative privileges. You should be able to see all of the units in My Computer. If Secure Path is not installed correctly, you will see each drive twice.

5. **Microsoft Windows 2000**: Allow hosts to recognize new units.

   a. If you *have not* changed the UNIT_OFFSET of any host connections since the hosts have been booted, you do not need to reboot the initiator site hosts.

      1) On each host, log in using an account that has administrative privileges.

      2) Open **Computer Management** and click **Disk Management**.

      3) After Disk Management has initialized, go to the Action Menu and click **Rescan Disks**. All of the failed over units should appear in the right-hand pane. If Secure Path is not installed correctly, you will see each unit twice.

   b. If you *have* changed the UNIT_OFFSET of any host connections, you must reboot that host. After the server has rebooted, log in using an account that has administrative privileges. You see all of the units in Disk Management. If Secure Path is not installed correctly, you will see each drive twice.

This completes the procedure for running a short planned site failover with a fast failback.

10

Extended Planned Site Failover with Full Failback Procedure

This chapter provides the procedure for performing an extended planned site failover with a full failback to existing hardware.

This procedure is used to ensure the proper functioning of a planned failover and subsequent full failback for extended initiator site maintenance activities. It is expected that the duration of the event exceeds the ability of the write history log to capture all of the host I/O. Therefore, a full normalization of the remote copy sets is needed after failback. The sequence of steps are:

- Initiator Site Preparation Procedure
- Running the Extended Planned Failover Program File Procedure
- Target Host Setup Procedure
- Running the Full Failback Program Files Procedure
- Initiator Site Cleanup Procedure

NOTE: In this chapter, the ▷ symbol is used to identify a procedural step performed at the initiator site, and the ⊙ symbol is used to identify a target-site procedural step.

Initiator Site Preparation Procedure

▷ 1. Before performing the failover procedure, locate your record of `SHOW` command output that details the current initiator configuration. Verify that your target controller configuration is the same as your initiator controller configuration.

2. Follow the step listed below for each operating system in your configuration. Refer to Appendix E for DRM system power up or power down procedures.

   a. **Compaq OpenVMS**: If the operating system is running and is used exclusively for DRM operations, shut down the operating system and power off the hosts. If the operating system is used for other applications, remove all I/O to the LUNs with remote copy sets that will be failed over, then dismount the volumes associated with these LUNs.

   b. **Compaq Tru64 UNIX**: If the operating system is running and is used exclusively for DRM operations, shut down the operating system and power off the hosts. If the operating system is used for other applications, remove all I/O and unmount all file system LUNs that have remote copy sets that will be failed over.

   c. **IBM AIX**: If the operating system is running, remove all I/O to the remote copy set LUNs that will be failed over, then unmount the file systems associated with these LUNs.

   d. **Microsoft Windows NT-X86**: If the operating system is running, shut it down and power off the hosts.

   e. **Microsoft Windows 2000**: If the operating system is running, shut it down and power off the hosts.

   f. **Sun Solaris**: If the operating system is running and is being used exclusively for DRM operations, shut down the operating system and power off the hosts. If the operating system is being used for other applications, remove all I/O and unmount all volumes that have remote copy sets that will be failed over.

3. Check the error mode, initiator state, and target status of all remote copy sets with the CLI command:

   ```
   SHOW REMOTE_COPY_SETS FULL
   ```

   Example Display 1 provides a sample output.

Example Display 1

```
BuildngATop> show remote_copy_sets full
Name                                          Uses             Used by
-------------------------------------------------------------------------------
RCS1          remote copy                     D1               AS_D1
        Reported LUN ID: 6000-1FE1-0000-4250-0009-9411-5654-003E
        Switches:
          OPERATION_MODE  = SYNCHRONOUS
          ERROR_MODE      = FAILSAFE
          FAILOVER_MODE   = MANUAL
          OUTSTANDING_IOS = 20
        Initiator (BUILDNGA\D1) state:
          INOPERATIVE
          Unit failsafe locked
        Target state:
          BUILDNGB\D1      is COPYING                 0% complete
```

a. If all remote copy sets are in failsafe error mode, and:

   1) Every initiator state is failsafe locked, proceed to step 5.

   2) Every initiator state is not failsafe locked, proceed to step 5.

   3) Initiator states are a mixture of failsafe locked or not being in failsafe locked, proceed to step 4.

b. If all remote copy sets are in normal mode, proceed to step 5.

c. If the remote copy sets are mixed between failsafe and normal error modes, and:

   1) Every remote copy set in failsafe error mode is failsafe locked, and every remote copy set in normal error mode has no targets, proceed to step 5.

   2) Every remote copy set in failsafe error mode is not in a failsafe locked state, proceed to step 5.

   3) Any remote copy sets in failsafe error mode are failsafe locked, and remote copy sets in normal error mode have targets, proceed to step 4.

4. For remote copy sets in failsafe error mode with mixed initiator states, or a mixture of error modes with failsafe error modes that are failsafe locked and normal error mode with targets, change all the remote copy sets in failsafe mode to normal mode. Use the CLI command:

   `SET` *`RemoteCopySetName`* `ERROR_MODE=NORMAL`

   `Example: SET RCS1 ERROR_MODE=NORMAL`

   When the remote copy sets are in normal mode, proceed to the next step.

5. Continue the planned failover process with the "Running the Extended Planned Failover Program File Procedure."

Running the Extended Planned Failover Program File Procedure

1. Open a command prompt window on the target host.
2. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section "Communicating Via Command Scripter" on page 5-2.
3. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.
4. Run the *hsg_fo.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.
5. You will see a message asking what type of failover to run. Enter **p** for a planned failover.
6. You will see a confirmation message that asks you to confirm that a planned failover is desired. Enter **y** for yes.
7. You will see a message asking what type of planned failover to run. Enter **e** for an extended planned failover.
8. If this is the first time the program file is run, or you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Press **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fo.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

   IMPORTANT: If a script encounters an abnormal condition and exits with a warning or error, abort the scripting activities and perform the remaining steps manually. These procedures are located in the *Data Replication Manager HSG80 ACS Version 8.6-1P Failover/Failback Procedures Guide* listed in Table 1-1.

9. Continue with the planned failover at the target site with "Target Host Setup Procedure."

Target Host Setup Procedure

1. To verify that the target site host can connect to the LUNs, use this command:

   ```
   SHOW UNITS FULL
   ```

   In the Access field of the display, all units that are used by remote copy sets should show that both the target host and the initiator controller connections are enabled.

2. The following step requires actions relative to each operating system in your configuration.

   a. **Compaq OpenVMS**: Allow the hosts to recognize new units.

      1) If you have shut down the host, boot it now. Booting the host enables OpenVMS to recognize the drive.

      2) If you did not shut down the host, use the following command from a privileged account to enable OpenVMS to recognize the drives:

         ```
         MCR SYSMAN IO AUTOCONFIGURE/LOG
         ```

   b. **Compaq Tru64 UNIX**: Allow the hosts to recognize new units.

      1) If the target site hosts are shut down, boot them now. Booting the hosts enables Tru64 UNIX to recognize the drives.

      2) If the target hosts are not shut down, use the following command to recognize the drives:

         ```
         hwmgr -scan scsi
         ```

      This may take awhile for large configurations. If this is the case, scan only the SCSI bus where one of the DRM host adapters are located with the following command:

      ```
      hwmgr -scan scsi -bus x
      ```

      (where x is the SCSI bus number)

   c. **IBM AIX**: Allow the hosts to recognize new units.

      1) If the target site hosts are shut down, boot them now. Booting the hosts enables AIX to recognize the drives.

2) If the target hosts are not shut down, use the following commands to recognize the drives and verify that they are present:

```
cfgmgr -v
lsdev -Cc disk
```

Use the following commands to access file systems on the failed-over LUNs:

```
importvg -y volumegroupname hdiskx
mount all
```

NOTE: *volumegroupname* is the name of the volume group originally created at the initiator site, and x is the number of the hdisk assigned to the failed-over LUN. If the -y *volumegroupname* parameter is omitted, AIX will create a default volume group name, for example, vg00.

d. **Microsoft Windows NT**: Allow the host to recognize new units.

Reboot the servers at the target site and log in using an account that has administrative privileges. You should be able to see all of the units in My Computer. If Secure Path is not installed correctly, you will see each drive twice.

e. **Microsoft Windows 2000**:

1) If you *have not* changed the UNIT_OFFSET of any host connections since the hosts have been booted, you do not need to reboot the target site hosts.

a) On each host, log in using an account that has administrative privileges.

b) Open **Computer Management** and click **Disk Management**.

c) After Disk Management has initialized, go to the Action Menu and click **Rescan Disks**. All of the failed over units should appear in the right-hand pane. If Secure Path is not installed correctly, you will see each unit twice.

2) If you *have* changed the UNIT_OFFSET of any host connections, you must reboot that host. After the host has rebooted, log in using an account that has administrative privileges. You should be able to see all of the units in My Computer. If Secure Path is not installed correctly, you will see each drive twice.

f. **Sun Solaris**: Allow hosts to recognize new units.

1) Reboot the servers using the command `reboot -- -r` at the target site and log in using an account that has administrative privileges.

2) If Secure Path was not configured for these units, you will not see the drives. You need to edit the WWIDs in the */kernal/drv/IdLite.conf* file. To find the new WWIDs of the units, use the `SHOW` *UnitName* command on the controller. You may also need to adjust the */kernal/drv/mda.conf* and */kernal/drv/sd.conf* files to accommodate for extra LUNs. After editing the *IdLite.conf*, *mda.conf*, and *sd.conf* files, reboot the server using the `reboot -- -r` command. You should now be able to see the drives using the `format` command. Refer to the *Compaq SANworks Secure Path for Sun Solaris Installation and Reference Guide* for assistance.

3. After the completion of maintenance work at the initiator site, continue with the "Running the Full Failback Program Files Procedure."

Running the Full Failback Program Files Procedure

1. Before performing the failback procedure, locate your record of `SHOW` command output that details the initiator configuration. Verify that your initiator controller configuration is the same as your target controller configuration. Compare the status of the controllers, association sets, remote copy sets, units, and connections. Refer to the *Data Replication Manager HSG80 ACS 8.6-1P Failover/Failback Procedures Guide* for the full status comparison procedure.
2. Open a command prompt window on the target host.
3. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section "Communicating Via Command Scripter" on page 5-2.
4. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.
5. Run the *hsg_fb1.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.
6. You will see a message asking what type of failback to run. Enter **f** for a full failback.
7. You will see a confirmation message that asks you to confirm that a full failback is desired. Enter **y** for yes.

8. If this is the first time the program file is run or if you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fb1.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

9. When an operation completion status result is displayed (similar to Figure 6–1), shut down all target site hosts.

   IMPORTANT: If a script encounters an abnormal condition and exits with a warning or error, abort the scripting activities and perform the remaining steps manually. These procedures are located in the *Data Replication Manager HSG80 ACS Version 8.6-1P Failover/Failback Procedures Guide*.

10. When you are ready to complete the failback to the original initiator site, run the *hsg_fb2.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.

11. You will see a message asking what type of failback to run. Enter **f** for a full failback.

12. You will see a confirmation message that asks you to confirm that a full failback is desired. Enter **y** for yes.

13. If this is the first time the program file is run or if you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fb2.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

14. Continue with the full failback procedure at the initiator site with “Initiator Site Cleanup Procedure.”

Initiator Site Cleanup Procedure

1. Verify that the initiator host can connect to the remote copy set units with this command:

   ```
   SHOW UNITS FULL
   ```

   In the Access field of the display, all units that are used by remote copy sets should show that the initiator hosts are enabled.

2. The following steps require actions relative to each operating system in your configuration.

   a. **Compaq OpenVMS**: Allow hosts to recognize new units:

      1) If the initiator site hosts are shut down, boot them now. Booting the hosts enables OpenVMS to recognize the drives.

      2) If the initiator site hosts are not shut down, use the following command from a privileged account to enable OpenVMS to recognize the drives:

         ```
         MCR SYSMAN IO AUTOCONFIGURE/LOG
         ```

   b. **Compaq Tru64 UNIX**: Allow the hosts to recognize new units.

      1) If the initiator site hosts are shut down, boot them now. Booting the hosts enables Tru64 UNIX to recognize the drives.

      2) If the initiator hosts are not shut down, use the following command to recognize the drives:

         ```
         hwmgr -scan scsi
         ```

         This may take awhile for large configurations. If this is the case, scan only the SCSI bus where one of the DRM host adapters is located with the following command:

         ```
         hwmgr -scan scsi -bus x
         ```

         (where x is the SCSI bus number)

   c. **IBM AIX**: Allow the hosts to recognize new units.

      1) If the initiator site hosts are shut down, boot them now. Booting the hosts enables AIX to recognize the drives.

2) If the initiator site hosts are not shut down, use the following commands to recognize the drives and mount the file systems:

```
cfgmgr -v
mount all
```

d. **Microsoft Windows NT**: Allow the host to recognize new units.

Reboot the servers at the initiator site and log in using an account that has administrative privileges. You should be able to see all of the units in My Computer. If Secure Path is not installed correctly, you will see each drive twice.

e. **Microsoft Windows 2000**: Allow hosts to recognize new units.

1) If you *have not* changed the UNIT_OFFSET of any host connections since the hosts have been booted, you do not need to reboot the initiator site hosts.

a) On each host, log in using an account that has administrative privileges.

b) Open **Computer Management** and click **Disk Management**.

c) After Disk Management has initialized, go to the Action Menu and click **Rescan Disks**. All of the failed over units should appear in the right-hand pane. If Secure Path is not installed correctly, you will see each unit twice.

2) If you *have* changed the UNIT_OFFSET of any host connections, you must reboot that host. After the server has rebooted, log in using an account that has administrative privileges. You should be able to see all of the units in Disk Management. If Secure Path is not installed correctly, you will see each drive twice.

f. **Sun Solaris**: Allow the hosts to recognize new units.

1) Reboot the servers using the command `reboot -- -r` at the initiator site and log in using an account that has administrative privileges.

2) If Secure Path was not configured for these units, you will not see the drives. You need to edit the WWIDs in the */kernal/drv/IdLite.conf* file. To find the new WWIDs of the units, use the `SHOW` *UnitName* command on the controller. You may also need to adjust the */kernal/drv/mda.conf* and */kernal/drv/sd.conf* files to accommodate for extra LUNs. After editing the *IdLite.conf*, *mda.conf*, and *sd.conf* files, reboot the server using the `reboot -- -r` command. You should now be able to see the drives using the `format` command. Refer to the *Compaq SANworks Secure Path for Sun Solaris Installation and Reference Guide* for assistance.

This completes the procedure for running an extended planned site failover with a full failback.

11

Resumption of Replication After Extended Planned Loss of Target Procedure (Failsafe Mode)

This chapter provides the procedure for performing a resumption of replication after an extended planned loss of the target site while running in failsafe error mode.

This procedure is used when the error mode of the remote copy set is set for failsafe and when the target site will be shut down for an extended length of time. Setting the error mode of the remote copy set to normal will allow host I/O to continue while the target site is offline. Because there is no log unit configured, a full copy will be performed once the target is back online. The sequence of steps are:

- Running the Resumption of Replication Program File Procedure
- Continuing the Resumption of Replication Program File Procedure

NOTE: In this chapter, the ▷ symbol is used to identify a procedural step performed at the initiator site, and the ⊙ symbol is used to identify a target-site procedural step.

Running the Resumption of Replication Program File Procedure

▷ 1. Use the following CLI command to verify that the error mode of the remote copy sets is set to failsafe and to make note of the initiator states:

```
SHOW REMOTE_COPY_SETS FULL
```

You will see a display similar to that in Example Display 1.

Example Display 1

```
BuildngATop> show remote_copy_sets full
Name                                            Uses             Used by
------------------------------------------------------------------------------

RCS1          remote copy                       D1               AS_D1
        Reported LUN ID: 6000-1FE1-0000-4250-0009-9411-5654-003E
        Switches:
          OPERATION_MODE  = SYNCHRONOUS
          ERROR_MODE      = FAILSAFE
          FAILOVER_MODE   = MANUAL
          OUTSTANDING_IOS = 20
        Initiator (BUILDNGA\D1) state:
          ONLINE to this controller
          Not reserved
        Target state:
          BUILDNGB\D1      is NORMAL
```

2. Open a command prompt window on the initiator host.

3. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section "Communicating Via Command Scripter" on page 5-2.

4. Perform the following steps based on the initiator state of your remote copy sets that are in the failsafe error mode.

   a. If every initiator states is failsafe locked, proceed to step 6.

   b. If every initiator states is not failsafe locked, proceed to step 6.

   c. If the initiator states are a mixture of failsafe locked or not being in failsafe locked, proceed to step 5.

5. For remote copy sets in failsafe error mode with mixed initiator states, change all the remote copy sets in failsafe mode to normal mode. Use the CLI command:

   `SET` *`RemoteCopySetName`* `ERROR_MODE=NORMAL`

   `Example: SET RCS1 ERROR_MODE=NORMAL`

   When the remote copy sets are in normal mode, proceed to the next step.

6. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.

7. Run the *hsg_op.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.

8. You will see a message that you are performing a DRM operation to modify error mode, and asks whether normal or configured error mode is desired. Enter **n** for normal mode.

9. You will see a confirmation message that asks you to confirm that a normal error mode is desired. Enter **y** for yes.

10. If this is the first time the program file is run, or you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_op.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

11. When an operation completion status result is displayed (similar to Figure 6–1), verify that the script removed the targets by entering the following command:

    ```
    SHOW REMOTE_COPY_SETS FULL
    ```

    You will see a display similar to that in Example Display 2.

Example Display 2

```
BuildngATop> show remote_copy_sets full
Name                                              Uses             Used by
------------------------------------------------------------------------------
RCS1          remote copy                         D1
        Reported LUN ID: 6000-1FE1-0000-01F0-0009-8490-6303-0134
        Switches:
          OPERATION_MODE  = SYNCHRONOUS
          ERROR_MODE      = NORMAL
          FAILOVER_MODE   = MANUAL
          OUTSTANDING_IOS = 20
        Initiator (BUILDNGA\D1) state:
          ONLINE to the other controller
        No targets
```

12. The target site is now available for desired actions. Continue with the "Continuing the Resumption of Replication Program File Procedure."

Continuing the Resumption of Replication Program File Procedure

When the target site is operational and back on line, continue resumption of operations with the following procedure for resuming remote copy set operation.

1. If you are connected to the initiator site controllers when the target site comes online, you will see the following confirmation messages on your terminal, as shown in Example Display 3. Refer to Appendix D for the meaning of the instance codes.

Example Display 3

```
BuildngATop>

%EVL--BuildngATop> --07-JUN-2001 14:16:15-- Instance Code: 07050064
 Template: 5.(05)
 Power On Time: 2. Years, 73. Days, 6. Hours, 50. Minutes, 57. Seconds
 Event reported by Peer to Peer Remote Copy target controller
 Controller Model: HSG80
 Serial Number: ZG94115654 Hardware Version:  E10(28)
 Software Version: V86-1P
 Instance Code: 07050064
 Last Failure Code: 08090010 (No Last Failure Parameters)

%EVL--BuildngATop> --07-JUN-2001 14:16:15-- Instance Code: 43010064
 Template: 4.(04)
 Power On Time: 2. Years, 73. Days, 6. Hours, 50. Minutes, 57. Seconds
 Event reported by Peer to Peer Remote Copy target controller
 Controller Model: HSG80
 Serial Number: ZG94115654 Hardware Version:  E10(28)
 Software Version: V86-1P
 Other Controller Serial Number: ZG94319198
 Failed Controller Target Number: 0.(00)
 LUNs Taken By This Controller:
  00000003
  00000000
  00000000
  00000000
  00000000
  00000000
  00000000
  00000000
 Instance Code: 43010064
```

2. Open a command prompt window on the initiator host.

3. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section “Communicating Via Command Scripter” on page 5-2.

4. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.

5. Run the *hsg_op.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.

6. You will see a message that you are performing a DRM operation to modify error mode, and asks whether normal or configured error mode is desired. Enter **c** for configured error mode.

7. You will see a confirmation message that asks you to confirm that a configured error mode is desired. Enter **y** for yes.

8. If this is the first time the program file is run, or you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_op.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

9. When an operation completion status result is displayed (similar to Figure 6–1), verify that the error mode of the remote copy set is failsafe by entering the following command:

   ```
   SHOW REMOTE_COPY_SETS FULL
   ```

   You will see a display similar to that in Example Display 4.

Example Display 4

```
BuildngATop> show remote_copy_sets full
Name                                          Uses             Used by
------------------------------------------------------------------------------
RCS1          remote copy                     D1               AS_D1
        Reported LUN ID: 6000-1FE1-0000-4250-0009-9411-5654-003E
        Switches:
          OPERATION_MODE  = SYNCHRONOUS
          ERROR_MODE      = FAILSAFE
          FAILOVER_MODE   = MANUAL
          OUTSTANDING_IOS = 20
        Initiator (BUILDNGA\D1) state:
          ONLINE to this controller
          Not reserved
        Target state:
          BUILDNGB\D1      is NORMAL
```

IMPORTANT: If the operation completion status indicates a failure, check the remote copy sets to see if they are in a failsafe mode and their target state is normal. Sometimes the screen refresh may cause a failure indication, even though the scripts performed successfully.

This completes the procedure for resuming initiator site processing after an extended planned loss of the target.

12

Unplanned Site Failover with Failback to New Hardware Procedure

This chapter provides the procedure for performing an unplanned site failover of the initiator site with a full failback to new hardware.

This procedure is used when some type of disaster (lightning, flood, fire, or the like) forces a failover to the target site. When the damaged components at the initiator site (hosts, controllers, switches, for example) have been repaired, and the site is operational and back online, then a failback is performed. The sequence of steps are:

- Running the Unplanned Failover Program File Procedure
- Target Host Setup Procedure
- Initiator Site Preparation Procedure
- Running the New Hardware Failback Program Files Procedure
- Initiator Site Cleanup Procedure

NOTE: In this chapter, the ▷ symbol is used to identify a procedural step performed at the initiator site, and the ⊙ symbol is used to identify a target-site procedural step.

Running the Unplanned Failover Program File Procedure

⊙ 1. Verify that the intersite connections are severed with the following CLI command:

```
SHOW THIS_CONTROLLER
SHOW OTHER_CONTROLLER
```

You will see a display similar to that in Example Display 1.

Example Display 1

```
BuildngBTop> show this_controller
Controller:
        HSG80 ZG94115654 Software V86-1P, Hardware  E10
        NODE_ID          = 5000-1FE1-0000-4250
        ALLOCATION_CLASS = 0
        SCSI_VERSION     = SCSI-3
        Configured for MULTIBUS_FAILOVER with ZG94319198
            In dual-redundant configuration
        Device Port SCSI address 7
        Time: 10-MAY-2001 16:41:11
        Command Console LUN is lun 0 (NOIDENTIFIER)
Host PORT_1:
        Reported PORT_ID = 5000-1FE1-0000-4253
        PORT_1_TOPOLOGY  = FABRIC (fabric up)
        Address          = 260213
Host PORT_2:
        Reported PORT_ID = 5000-1FE1-0000-4254
        PORT_2_TOPOLOGY  = FABRIC (offline)
        Address          = 260413
        REMOTE_COPY = BUILDNGB
Cache:
        256 megabyte write cache, version 0012
        Cache is GOOD
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
Mirrored Cache:
        256 megabyte write cache, version 0012
        Cache is GOOD
        No unflushed data in cache
Battery:
        NOUPS
        FULLY CHARGED
        Expires:             01-MAY-2003
BuildngBTop> show other_controller
Controller:
        HSG80 ZG94319198 Software V86-1P, Hardware  E10
        NODE_ID          = 5000-1FE1-0000-4250
        ALLOCATION_CLASS = 0
        SCSI_VERSION     = SCSI-3
        Configured for MULTIBUS_FAILOVER with ZG94115654
            In dual-redundant configuration
        Device Port SCSI address 6
        Time: 10-MAY-2001 16:43:12
        Command Console LUN is lun 0 (NOIDENTIFIER)
Host PORT_1:
        Reported PORT_ID = 5000-1FE1-0000-4251
        PORT_1_TOPOLOGY  = FABRIC (fabric up)
        Address          = 200213
Host PORT_2:
        Reported PORT_ID = 5000-1FE1-0000-4252
        PORT_2_TOPOLOGY  = FABRIC (offline)
        REMOTE_COPY = BUILDNGB
Cache:
        256 megabyte write cache, version 0012
        Cache is GOOD
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
```

```
Mirrored Cache:
        256 megabyte write cache, version 0012
        Cache is GOOD
        No unflushed data in cache
Battery:
        NOUPS
        FULLY CHARGED
        Expires:            01-MAY-2003
```

2. Open a command prompt window on the target host.
3. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section "Communicating Via Command Scripter" on page 5-2.
4. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.
5. Run the *hsg_fo.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.
6. You will see a message asking what type of failover to run. Enter **u** for an unplanned failover.
7. You will see a confirmation message that asks you to confirm that an unplanned failover is desired. Enter **y** for yes.
8. If this is the first time the program file is run, or you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fo.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

   IMPORTANT: If a script encounters an abnormal condition and exits with a warning or error, abort the scripting activities and perform the remaining steps manually. These procedures are located in the *Data Replication Manager HSG80 ACS Version 8.6-1P Failover/Failback Procedures Guide*.

9. When an operation completion status result is displayed (similar to Figure 6–1), continue the failover procedure at the target site with the "Target Host Setup Procedure."

Target Host Setup Procedure

1. To verify that failover completed successfully, issue this CLI command:

   ```
   SHOW REMOTE_COPY_SETS FULL
   ```

   The output shows the status of remote copy sets.

   NOTE: Be sure that the units you see (listed under *Initiator State*) are at the target site.

2. To verify that the target hosts can connect to the LUNs, use this command:

   ```
   SHOW UNITS FULL
   ```

   In the Access field of the display, all units that are used by remote copy sets should show that the target hosts connections are enabled. This should also show the initiator controller connections.

3. The following step requires actions relative to each operating system in your configuration.

   a. **Compaq OpenVMS**: Allow hosts to recognize new units:

      1) If the target site hosts are shut down, boot them now. Booting the hosts enables OpenVMS to recognize the drives.

      2) If the target site hosts are not shut down, use the following command from a privileged account to enable OpenVMS to recognize the drives:

      ```
      MCR SYSMAN IO AUTOCONFIGURE/LOG
      ```

   b. **Compaq Tru64 UNIX**: Allow the hosts to recognize new units.

      1) If the target site hosts are shut down, boot them now. Booting the hosts enables Tru64 UNIX to recognize the drives.

      2) If the target hosts are not shut down, use the following command to recognize the drives:

      ```
      hwmgr -scan scsi
      ```

      This may take awhile for large configurations. If this is the case, scan only the SCSI bus where one of the DRM host adapters is located with the following command:

      ```
      hwmgr -scan scsi -bus x
      ```

      (where x is the SCSI bus number)

c. **IBM AIX**: Allow the hosts to recognize new units.

1) If the target site hosts are shut down, boot them now. Booting the hosts enables AIX to recognize the drives.

2) If the target hosts are not shut down, use the following commands to recognize the drives and verify that they are present:

```
cfgmgr -v
lsdev -Cc disk
```

Use the following commands to access file systems on the failed-over LUNs:

```
importvg -y volumegroupname hdiskx
mount all
```

NOTE: *volumegroupname* is the name of the volume group originally created at the initiator site, and x is the number of the hdisk assigned to the failed-over LUN. If the -y *volumegroupname* parameter is omitted, AIX will create a default volume group name, for example, vg00.

d. **Microsoft Windows NT**: Allow the host to recognize new units.

Reboot the servers at the target site and log in using an account that has administrative privileges. You should be able to see all of the units in My Computer. If Secure Path is not installed correctly, you will see each drive twice.

e. **Microsoft Windows 2000**: Allow hosts to recognize new units.

1) If you *have not* changed the UNIT_OFFSET of any host connections since the hosts have been booted, you do not need to reboot the target site hosts.

a) On each host, log in using an account that has administrative privileges.

b) Open **Computer Management** and click **Disk Management**.

c) After Disk Management has initialized, go to the Action Menu and click **Rescan Disks**. All of the failed over units should appear in the right-hand pane. If Secure Path is not installed correctly, you will see each unit twice.

2) If you *have* changed the UNIT_OFFSET of any host connections, you must reboot that host. After the server has rebooted, log in using an account that has administrative privileges. You should be able to see all of the units in Disk Management. If Secure Path is not installed correctly, you will see each drive twice.

f. **Sun Solaris**: Allow the hosts to recognize new units.

1) Reboot the servers using the command `reboot -- -r` at the target site and log in using an account that has administrative privileges. You should be able to see all of the units by using the `format` command.

2) If Secure Path was not configured for these units, you will not see the drives. You need to edit the WWIDs in the */kernal/drv/IdLite.conf* file. To find the new WWIDs of the units, use the `SHOW` *UnitName* command on the controller. You may also need to adjust the */kernal/drv/mda.conf* and */kernal/drv/sd.conf* files to accommodate for extra LUNs. After editing the *IdLite.conf*, *mda.conf*, and *sd.conf* files, reboot the server using the `reboot -- -r` command. You should now be able to see the drives using the `format` command. Refer to the *Compaq SANworks Secure Path for Sun Solaris Installation and Reference Guide* for assistance.

4. Once the problem that disabled the initiator site is remedied, continue the full failback procedure to new hardware at the initiator site with the "Initiator Site Preparation Procedure."

Initiator Site Preparation Procedure

1. Follow the step listed below for the operating system in your configuration. Refer to Appendix E for DRM system power up or power down procedures.

a. **Compaq OpenVMS**: If the operating system is running and is used exclusively for DRM operations, shut down the operating system and power off the hosts. If the operating system is used for other applications, remove all I/O to the LUNs with remote copy sets that will be failed over, then dismount the volumes associated with these LUNs.

b. **Compaq Tru64 UNIX**: If the operating system is running and is used exclusively for DRM operations, shut down the operating system and power off the hosts. If the operating system is used for other applications, remove all I/O and unmount all file system LUNs that have remote copy sets that will be failed over.

c. **IBM AIX**: If the operating system is running, remove all I/O to the remote copy set LUNs that will be failed over, then unmount the file systems associated with these LUNs.

d. **Microsoft Windows NT-X86**: If the operating system is running, shut it down and power off the hosts.

e. **Microsoft Windows 2000**: If the operating system is running, shut it down and power off the hosts.

f. **Sun Solaris**: If the operating system is running and is being used exclusively for DRM operations, shut down the operating system and power off the hosts. If the operating system is being used for other applications, remove all I/O and unmount all volumes that have remote copy sets that will be failed over.

2. Manually reconfigure the controllers, but do not re-create the original remote copy sets. This procedure includes the following steps:

NOTE: Steps c, f, and g will cause the controller pair to restart.

a. Set node ID and checksum for THIS controller (this information can be found on top of the controller). See the *Compaq SANworks Data Replication Manager HSG80 ACS Version 8.6-1P Configuration Guide* for information on the node ID and World Wide Name. This node ID for the OTHER controller will be set automatically by the command in step c.

b. **Compaq Tru64 UNIX, IBM AIX, Microsoft Windows, and Sun Solaris**: Go to Step 2c.

Compaq OpenVMS only: Set the identifier to its previous value with the following command:

```
SET THIS IDENTIFIER=Value
```

```
Example: set this identifier=98
```

Verify the identifier setting with the following command:

```
SHOW THIS_CONTROLLER
```

You will see a display similar to that in Example Display 2.

Example Display 2

```
HSG> show this_controller
Controller:
        HSG80 ZG84906303 Software V86-1P, Hardware  E03
        NODE_ID          = 5000-1FE1-0000-01F0
        ALLOCATION_CLASS = 0
        SCSI_VERSION     = SCSI-2
        Not configured for dual-redundancy
        Device Port SCSI address 7
        Time: 11-MAY-2001 11:41:36
        Command Console LUN is lun 0 (IDENTIFIER = 98)
Host PORT_1:
        Reported PORT_ID = 5000-1FE1-0000-01F1
        PORT_1_TOPOLOGY  = OFFLINE (offline)
Host PORT_2:
        Reported PORT_ID = 5000-1FE1-0000-01F2
        PORT_2_TOPOLOGY  = OFFLINE (offline)
        NOREMOTE_COPY
Cache:
        512 megabyte write cache, version 0012
        Cache is GOOD
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
Mirrored Cache:
        Not enabled
Battery:
        NOUPS
        FULLY CHARGED
        Expires:             11-MAY-2003
```

c. Configure the controllers for multiple bus failover by issuing the following command:

```
SET MULTIBUS_FAILOVER COPY = THIS_CONTROLLER
```

This command will automatically restart the OTHER controller.

d. (Optional) Set the controller to the preferred SCSI mode with the following CLI command:

```
SET THIS_CONTROLLER SCSI_VERSION = SCSI-x
```

NOTE: *x* = 2 or 3. SCSI-2 is the default setting. Do not restart the controller.

e. Designate a controller prompt with the following CLI commands:

```
SET THIS_CONTROLLER PROMPT= "InitiatorControllerNameTop> "
Example: set this_controller prompt = "buildngA Top> "
SET OTHER_CONTROLLER PROMPT="InitiatorControllerNameBottom> "
Example: set other_controller prompt = "buildngA Bottom> "
```

f. Set mirrored cache using the following CLI command:

```
SET THIS_CONTROLLER MIRRORED_CACHE
```

NOTE: This CLI command may fail because internal cache diagnostics are running. These diagnostics can take up to 5 minutes to complete, so you may need to retry this command.

g. Enter the following command:

```
SET THIS_CONTROLLER REMOTE_COPY = InitiatorRemoteCopyName
```

Example: set this_controller remote_copy = buildngA

h. Run the Configuration utility to assign a disk name to physical disks with the following CLI command:

```
RUN CONFIG
```

You will see a display similar to that in Example Display 3.

Example Display 3

```
BuildngATop> run config

Config Local Program Invoked

Config is building its tables and determining what devices exist
on the subsystem. Please be patient.

add disk DISK10000   1 0 0
add disk DISK10100   1 1 0
add disk DISK10200   1 2 0
add disk DISK10300   1 3 0
add disk DISK20000   2 0 0
add disk DISK20100   2 1 0
add disk DISK20200   2 2 0
add disk DISK20300   2 3 0
add disk DISK30000   3 0 0
add disk DISK30100   3 1 0
add disk DISK30200   3 2 0
add disk DISK30300   3 3 0
add disk DISK40000   4 0 0
add disk DISK40300   4 3 0
add disk DISK50000   5 0 0
add disk DISK50300   5 3 0
add disk DISK60000   6 0 0
add disk DISK60300   6 3 0

Config - Normal Termination
```

i. Create and initialize all storagesets and units. This includes all that had existed at the initiator site as well as those that were created at the target site since failover. The units that will be part of remote copy sets must be identical to the corresponding units at the target site. Wait to create any units that will be used for log disks until later in this procedure. See the *Compaq StorageWorks HSG80 ACS Version 8.6 Configuration Reference Guide* for information on creating storagesets and units.

j. Verify the creation of the storagesets and units with the following CLI command:

```
SHOW UNITS FULL
```

You will see a display similar to that in Example Display 4.

Example Display 4

```
BuildngATop> show units full
    LUN                                        Uses             Used by
------------------------------------------------------------------------
 D1                                          DISK10000
        LUN ID:      6000-1FE1-0000-01F0-0009-8490-6303-0134
        NOIDENTIFIER
        Switches:
          RUN                   NOWRITE_PROTECT        READ_CACHE
          READAHEAD_CACHE         WRITEBACK_CACHE
          MAX_READ_CACHED_TRANSFER_SIZE = 32
          MAX_WRITE_CACHED_TRANSFER_SIZE = 32
        Access:
              All
        State:
          ONLINE to this controller
          Not reserved
          NOPREFERRED_PATH
        Size:             17769177 blocks
        Geometry (C/H/S): ( 5258 / 20 / 169 )
 D2                                          DISK20000
        LUN ID:      6000-1FE1-0000-01F0-0009-8490-6303-0135
        NOIDENTIFIER
        Switches:
          RUN                   NOWRITE_PROTECT        READ_CACHE
          READAHEAD_CACHE         WRITEBACK_CACHE
          MAX_READ_CACHED_TRANSFER_SIZE = 32
          MAX_WRITE_CACHED_TRANSFER_SIZE = 32
        Access:
              All
        State:
          ONLINE to this controller
          Not reserved
          NOPREFERRED_PATH
        Size:             17769177 blocks
        Geometry (C/H/S): ( 5258 / 20 / 169 )
```

k. **Compaq Tru64 UNIX, IBM AIX, Microsoft Windows, and Sun Solaris:** Go to Step 3.

Compaq OpenVMS only: Use the following command to set each unit's device identifier to the value it was prior to hardware replacement:

```
SET UnitName IDENTIFIER = Value
```

```
Example: set d1 identifier = 1
```

This becomes the VMS device identifier for DGx1.

3. Disable all access to the units with the following CLI command:

   ```
   SET UnitName DISABLE = ALL
   ```

   ```
   Example: set d1 disable = all
   ```

   Repeat this step for each unit.

4. Verify the disabled access with the following CLI command:

   ```
   SHOW UNITS FULL
   ```

   You will see a display similar to that in Example Display 5.

Example Display 5

```
BuildngATop> show units full
LUN                                        Uses             Used by
------------------------------------------------------------------------
  D1                                                DISK10000
        LUN ID:      6000-1FE1-0000-01F0-0009-8490-6303-0134
        IDENTIFIER = 1
        Switches:
          RUN                   NOWRITE_PROTECT        READ_CACHE
          READAHEAD_CACHE         WRITEBACK_CACHE
          MAX_READ_CACHED_TRANSFER_SIZE = 32
          MAX_WRITE_CACHED_TRANSFER_SIZE = 32
        Access:
               None
        State:
          ONLINE to this controller
          Not reserved
          NOPREFERRED_PATH
        Size:             17769177 blocks
        Geometry (C/H/S): ( 5258 / 20 / 169 )
 D2                                             DISK20000
        LUN ID:      6000-1FE1-0000-4250-0009-9411-5654-003F
        NOIDENTIFIER
        Switches:
          RUN                   NOWRITE_PROTECT        READ_CACHE
          READAHEAD_CACHE         WRITEBACK_CACHE
          MAX_READ_CACHED_TRANSFER_SIZE = 32
          MAX_WRITE_CACHED_TRANSFER_SIZE = 32
        Access:
               None
        State:
          ONLINE to this controller
          Not reserved
          NO PREFERRED_PATH
        Size:             17769177 blocks
        Geometry (C/H/S): ( 5258 / 20 / 169 )
```

5. Set up new units for any additional remote copy sets that were added at the target site while failed over, by using the following CLI command:

   ```
   ADD UNIT UnitName ContainerName DISABLE_ACCESS_PATH=ALL
   ```

   ```
   Example: add unit d1 disk10000 disable_access_path=all
   ```

6. At the initiator site, the units must be preferred to one controller or the other. Check for preference with the following CLI command:

   ```
   SHOW UNITS FULL
   ```

   You will see a display similar to that in Example Display 6.

Example Display 6

```
BuildngATop> show units full
D1                                          DISK10000
        LUN ID:      6000-1FE1-0000-01F0-0009-8490-6303-0134
        IDENTIFIER = 1
        Switches:
          RUN                   NOWRITE_PROTECT       READ_CACHE
           READAHEAD_CACHE        WRITEBACK_CACHE
           MAX_READ_CACHED_TRANSFER_SIZE = 32
           MAX_WRITE_CACHED_TRANSFER_SIZE = 32
        Access:
              None
        State:
          ONLINE to this controller
          Not reserved
          PREFERRED_PATH = THIS_CONTROLLER
        Size:             17769177 blocks
        Geometry (C/H/S): ( 5258 / 20 / 169 )
 D2                                          DISK20000
        LUN ID:      6000-1FE1-0000-01F0-0009-8490-6303-0135
        NOIDENTIFIER
        Switches:
          RUN                   NOWRITE_PROTECT       READ_CACHE
           READAHEAD_CACHE        WRITEBACK_CACHE
           MAX_READ_CACHED_TRANSFER_SIZE = 32
           MAX_WRITE_CACHED_TRANSFER_SIZE = 32
        Access:
              None
        State:
          ONLINE to this controller
          Not reserved
          PREFERRED_PATH = OTHER_CONTROLLER
        Size:             17769177 blocks
        Geometry (C/H/S): ( 5258 / 20 / 169 )
```

If the units need to be preferred, use the following command:

```
SET UnitName PREFERRED_PATH = THIS_CONTROLLER
Example: set d1 preferred_path = this_controller
```

or

```
SET UnitName PREFERRED_PATH = OTHER_CONTROLLER
Example: set d2 preferred_path = other_controller
```

7. Set the maximum cached transfer size to 128 with the following CLI command:

   ```
   SET UnitName MAXIMUM_CACHED_TRANSFER_SIZE = 128
   Example: set d1 maximum_cached_transfer_size = 128
   ```

   NOTE: This command sets both the read and write maximum cached transfer size.

   Repeat this step for each remote copy set unit.

8. Enable Port 1 and Port 2 connections to the fabric with the following CLI commands:

   ```
   SET THIS_CONTROLLER PORT_1_TOPOLOGY = FABRIC
   SET OTHER_CONTROLLER PORT_1_TOPOLOGY = FABRIC
   SET THIS_CONTROLLER PORT_2_TOPOLOGY = FABRIC
   SET OTHER_CONTROLLER PORT_2_TOPOLOGY = FABRIC
   ```

9. Create connections to the remote target controllers. Use the CLI commands:

   ```
   ADD REMOTE_COPY_SETS RCS199 D199 InitiatorControllerName\D199
   Example: add remote_copy_sets rcs199 d199 buildnga\d199
   ```

   NOTE: This command will fail with the error message "initiator unit specified not found." However, it will create and name the connections appropriately.

10. Set target access to all remote copy units by issuing the following CLI command:

    ```
    SET UnitNumber ENABLE_ACCESS_PATH=HostIDs
    Example: set d1 enable_access_path=BUILDNGBa,BUILDNGBb,
    BUILDNGBc,BUILDNGBd
    ```

11. Compare the status of the controllers, association sets, remote copy sets, units, and connections. Refer to the *Data Replication Manager HSG80 ACS 8.6-1P Failover/Failback Procedures Guide* for the full status comparison procedure. Make sure that any status change is reflected on the target. To make a status comparison, bring up a terminal emulator session and enter a `SHOW THIS` command.

12. Continue the new hardware failback phase at the target site with "Running the New Hardware Failback Program Files Procedure."

Running the New Hardware Failback Program Files Procedure

1. Open a command prompt window on the target host.
2. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section "Communicating Via Command Scripter" on page 5-2.
3. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.
4. Run the *hsg_fb1.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.
5. You will see a message asking what type of failback to run. Enter **n** for a new hardware failback.
6. You will see a confirmation message that asks you to confirm that a new hardware failback is desired. Enter **y** for yes.
7. If this is the first time the program file is run or if you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fb1.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.
8. Monitor the display for the indication that mirroring is complete. At this time, you are disaster tolerant and can operate in this mode until you choose to complete the failback process.

   IMPORTANT: If a script encounters an abnormal condition and exits with a warning or error, abort the scripting activities and perform the remaining steps manually. These procedures are located in the *Data Replication Manager HSG80 ACS Version 8.6-1P Failover/Failback Procedures Guide*.

9. When you are ready to complete the failback to the original initiator site, run the *hsg_fb2.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.
10. You will see a message asking what type of failback to run. Enter **n** for a new hardware failback.

11. You will see a confirmation message that asks you to confirm that a new hardware failback is desired. Enter **y** for yes.

12. If this is the first time the program file is run or if you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fb2.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

13. Continue with the new hardware failback procedure at the initiator site with "Initiator Site Cleanup Procedure."

Initiator Site Cleanup Procedure

1. After you have completed this action, verify the connections with the following CLI command:

   ```
   SHOW CONNECTIONS
   ```

   You will see a display similar to that in Example Display 7.

Example Display 7

```
BuildngATop> show connections
Connection                                                          Unit
   Name      Operating system    Controller  Port    Address    Status
Offset

BUILDNGBA      PPRC_TARGET      THIS        2      260413   OL this         0
          HOST_ID=5000-1FE1-0000-4250 ADAPTER_ID=5000-1FE1-0000-4254

BUILDNGBB      PPRC_TARGET      OTHER       2      200413   OL other        0
          HOST_ID=5000-1FE1-0000-4250 ADAPTER_ID=5000-1FE1-0000-4252

BUILDNGBC    PPRC_INITIATOR     THIS        2               offline        0
          HOST_ID=5000-1FE1-0000-4250 ADAPTER_ID=5000-1FE1-0000-4254

BUILDNGBD    PPRC_INITIATOR     OTHER       2               offline        0
          HOST_ID=5000-1FE1-0000-4250 ADAPTER_ID=5000-1FE1-0000-4252
HOSTA1           WINNT          THIS        1      260013   OL this         0
          HOST_ID=1000-0000-C920-A7B9 ADAPTER_ID=1000-0000-C920-A7B9

HOSTA2           WINNT          OTHER       1      200013   OL other        0
          HOST_ID=1000-0000-C921-3F4E ADAPTER_ID=1000-0000-C921-3F4E

HOSTB1           WINNT          THIS        1      220013   OL this         0
          HOST_ID=1000-0000-C921-3E98 ADAPTER_ID=1000-0000-C921-3E98

HOSTB2           WINNT          OTHER       1      250013   OL other        0
          HOST_ID=1000-0000-C921-3EFC ADAPTER_ID=1000-0000-C921-3EFC
```

2. Set all connections that were renamed back to their appropriate operating system with the following CLI command.

   SET *InitiatorHostConnectionName* OPERATING_SYSTEM = (*IBM,SUN,Compaq Tru64_UNIX,VMS,or WINNT)*

   Example: set hostA1 operating_system = vms

3. After you have completed this action, verify the connections with the following CLI command:

   SHOW CONNECTIONS

   You will see a display similar to that in Example Display 8.

Example Display 8

```
BuildngATop> show connections
Connection                                                          Unit
   Name      Operating system    Controller  Port    Address    Status
Offset

BUILDNGBA      PPRC_TARGET      THIS        2      260413   OL this        0
           HOST_ID=5000-1FE1-0000-4250 ADAPTER_ID=5000-1FE1-0000-4254

BUILDNGBB      PPRC_TARGET      OTHER       2      200413   OL other       0
           HOST_ID=5000-1FE1-0000-4250 ADAPTER_ID=5000-1FE1-0000-4252

BUILDNGBC    PPRC_INITIATOR     THIS        2               offline        0
           HOST_ID=5000-1FE1-0000-4250 ADAPTER_ID=5000-1FE1-0000-4254

BUILDNGBD    PPRC_INITIATOR     OTHER       2               offline        0
           HOST_ID=5000-1FE1-0000-4250 ADAPTER_ID=5000-1FE1-0000-4252
HOSTA1             VMS          THIS        1      260013   OL this        0
           HOST_ID=1000-0000-C920-A7B9 ADAPTER_ID=1000-0000-C920-A7B9

HOSTA2             VMS          OTHER       1      200013   OL other       0
           HOST_ID=1000-0000-C921-3F4E ADAPTER_ID=1000-0000-C921-3F4E

HOSTB1             VMS          THIS        1      220013   OL this        0
           HOST_ID=1000-0000-C921-3E98 ADAPTER_ID=1000-0000-C921-3E98

HOSTB2             VMS          OTHER       1      250013   OL other       0
           HOST_ID=1000-0000-C921-3EFC ADAPTER_ID=1000-0000-C921-3EFC
```

4. You can enhance host I/O performance by resetting the maximum cached transfer size to the value used on the original initiator. Obtain your record of SHOW command output that details the original initiator configuration. Using the output as a reference, set the maximum cached transfer size to the original initiator value using the following CLI command:

```
SET UnitName MAXIMUM_CACHED_TRANSFER_SIZE = InitiatorValue
Example: set d1 maximum_cache_transfer_size = 32
```

NOTE: The default maximum cache transfer size is 32

Repeat this step for all remote copy set units.

5. After you have completed this action, verify host access with the following CLI command:

```
SHOW UNITS FULL
```

You will see a display similar to that in Example Display 9.

Repeat this step for all units.

Example Display 9

```
BuildngATop> show units full
    LUN                                          Uses             Used by
------------------------------------------------------------------------------
  D1                                           DISK10000          BUILDNGA\RCS1
        LUN ID:      6000-1FE1-0000-01F0-0009-8490-6303-0134
        IDENTIFIER = 1
        Switches:
          RUN                    NOWRITE_PROTECT        READ_CACHE
          READAHEAD_CACHE          WRITEBACK_CACHE
          MAX_READ_CACHED_TRANSFER_SIZE = 32
          MAX_WRITE_CACHED_TRANSFER_SIZE = 32
        Access:
          BUILDNGBA, BUILDNGBB, BUILDNGBC, BUILDNGBD,    HOSTA1,    HOSTA2
        State:
          ONLINE to this controller
          Not reserved
          PREFERRED_PATH = THIS_CONTROLLER
        Size:              17769177 blocks
        Geometry (C/H/S): ( 5258 / 20 / 169 )

 D2                                           DISK20000
        LUN ID:      6000-1FE1-0000-01F0-0009-8490-6303-0135
        NOIDENTIFIER
        Switches:
          RUN                    NOWRITE_PROTECT        READ_CACHE
          READAHEAD_CACHE          WRITEBACK_CACHE
          MAX_READ_CACHED_TRANSFER_SIZE = 32
          MAX_WRITE_CACHED_TRANSFER_SIZE = 32
        Access:
          BUILDNGBA, BUILDNGBB, BUILDNGBC, BUILDNGBD,    HOSTA1,    HOSTA2
        State:
          ONLINE to this controller
          Not reserved
          PREFERRED_PATH = OTHER_CONTROLLER
        Size:              17769177 blocks
        Geometry (C/H/S): ( 5258 / 20 / 169 )
```

6. The following steps requires actions relative to each operating system in your configuration.

   a. **Compaq OpenVMS**: Allow the hosts to recognize new units:

      1) If the initiator site hosts are shut down, boot them now. Booting the hosts enables OpenVMS to recognize the drives.

      2) If the initiator site hosts are not shut down, use the following command from a privileged account to enable OpenVMS to recognize the drives:

      ```
      MCR SYSMAN IO AUTOCONFIGURE/LOG
      ```

   b. **Compaq Tru64 UNIX**: Allow the hosts to recognize new units.

      1) If the target site hosts are shut down, boot them now. Booting the hosts enables Tru64 UNIX to recognize the drives.

      2) If the target hosts are not shut down, use the following command to recognize the drives:

      ```
      hwmgr -scan scsi
      ```

      This may take awhile for large configurations. If this is the case, scan only the SCSI bus where one of the DRM host adapters are located with the following command:

      ```
      hwmgr -scan scsi -bus x
      ```

      (where x is the SCSI bus number)

   c. **IBM AIX**: Allow the hosts to recognize new units.

      1) If the initiator site hosts are shut down, boot them now. Booting the hosts enables AIX to recognize the drives.

      2) If the initiator site hosts are not shut down, use the following commands to recognize the drives and mount the file systems:

      ```
      cfgmgr -v
      mount all
      ```

   d. **Microsoft Windows NT**: Allow the host to recognize new units.

      Reboot the servers at the initiator site and log in using an account that has administrative privileges. You should be able to see all of the units in My Computer. If Secure Path is not installed correctly, you will see each drive twice.

e. **Microsoft Windows 2000**: Allow hosts to recognize new units:

1) If you *have not* changed the UNIT_OFFSET of any host connections since the hosts have been booted, you do not need to reboot the initiator site hosts.

a) On each host, log in using an account that has administrative privileges.

b) Open **Computer Management** and click **Disk Management**.

c) After Disk Management has initialized, go to the Action Menu and click **Rescan Disks**. All of the failed over units should appear in the right-hand pane. If Secure Path is not installed correctly, you will see each unit twice.

2) If you *have* changed the UNIT_OFFSET of any host connections, you must reboot that host. After the server has rebooted, log in using an account that has administrative privileges. You see all of the units in Disk Management. If Secure Path is not installed correctly, you will see each drive twice.

f. **Sun Solaris**: Allow the hosts to recognize new units.

1) Reboot the servers using the command `reboot -- -r` at the target site and log in using an account that has administrative privileges.

2) If Secure Path was not configured for these units, you will not see the drives. You need to edit the WWIDs in the */kernal/drv/IdLite.conf* file. To find the new WWIDs of the units, use the `SHOW` *UnitName* command on the controller. You may also need to adjust the */kernal/drv/mda.conf* and */kernal/drv/sd.conf* files to accommodate for extra LUNs. After editing the *IdLite.conf*, *mda.conf*, and *sd.conf* files, reboot the server using the `reboot -- -r` command. You should now be able to see the drives using the `format` command. Refer to the *Compaq SANworks Secure Path for Sun Solaris Installation and Reference Guide* for assistance.

This completes the procedure for running an unplanned site failover with failback to new hardware.

13

Planned Site Role Reversal Procedure

This chapter provides the procedure for performing a site role reversal.

This procedure is used to implement a planned failover of an initiator site with subsequent simple failback to an alternate (target) site. The sequence of steps are:

- Initiator Site Preparation Procedure
- Running the Role Reversal Failover Program File Procedure
- Target Host Setup Procedure
- Running the Role Reversal Failback Program File Procedure
- Initiator Site Cleanup Procedure

NOTE: In this chapter, the ▷ symbol is used to identify a procedural step performed at the initiator site, and the ⊙ symbol is used to identify a target-site procedural step.

Initiator Site Preparation Procedure

▷ 1. Before performing the failover procedure, locate your record of `SHOW` command output that details the current initiator configuration. Verify that your target controller configuration is the same as your initiator controller configuration.

▷ 2. Follow the step listed below for each operating system in your configuration. Refer to Appendix E for DRM system power up or power down procedures.

   a. **Compaq OpenVMS**: If the operating system is running and is used exclusively for DRM operations, shut down the operating system and power off the hosts. If the operating system is used for other applications, remove all I/O to the LUNs with remote copy sets that will be failed over, then dismount the volumes associated with these LUNs.

b. **Compaq Tru64 UNIX**: If the operating system is running and is used exclusively for DRM operations, shut down the operating system and power off the hosts. If the operating system is used for other applications, remove all I/O and unmount all file system LUNs that have remote copy sets that will be failed over.

c. **IBM AIX**: If the operating system is running, remove all I/O to the remote copy set LUNs that will be failed over, then unmount the file systems associated with these LUNs.

d. **Microsoft Windows NT-X86**: If the operating system is running, shut it down and power off the hosts.

e. **Microsoft Windows 2000**: If the operating system is running, shut it down and power off the hosts.

f. **Sun Solaris**: If the operating system is running, shut it down and power off the hosts.

3. Check the error mode, initiator state, and target status of all remote copy sets with the CLI command:

```
SHOW REMOTE_COPY_SETS FULL
```

Example Display 1 provides a sample output.

Example Display 1

```
BuildngATop> show remote_copy_sets full
Name                                          Uses             Used by
------------------------------------------------------------------------
RCS1          remote copy                     D1               AS_D1
        Reported LUN ID: 6000-1FE1-0000-4250-0009-9411-5654-003E
        Switches:
          OPERATION_MODE  = SYNCHRONOUS
          ERROR_MODE      = FAILSAFE
          FAILOVER_MODE   = MANUAL
          OUTSTANDING_IOS = 20
        Initiator (BUILDNGA\D1) state:
          INOPERATIVE
          Unit failsafe locked
        Target state:
          BUILDNGB\D1      is COPYING                 0% complete
```

a. If all remote copy sets are in failsafe error mode, and:

1) Every initiator state is failsafe locked, proceed to step 5.

2) Every initiator state is not failsafe locked, proceed to step 5.

3) Initiator states are a mixture of failsafe locked or not being in failsafe locked, proceed to step 4.

b. If all remote copy sets are in normal mode, proceed to step 5.

c. If the remote copy sets are mixed between failsafe and normal error modes, and:

1) Every remote copy set in failsafe error mode is failsafe locked, and every remote copy set in normal error mode has no targets, proceed to step 5.

2) Every remote copy set in failsafe error mode is not in a failsafe locked state, proceed to step 5.

3) Any remote copy sets in failsafe error mode are failsafe locked, and remote copy sets in normal error mode have targets, proceed to step 4.

4. For remote copy sets in failsafe error mode with mixed initiator states, or a mixture of error modes with failsafe error modes that are failsafe locked and normal error mode with targets, change all the remote copy sets in failsafe mode to normal mode. Use the CLI command:

```
SET RemoteCopySetName ERROR_MODE=NORMAL
Example: SET RCS1 ERROR_MODE=NORMAL
```

When the remote copy sets are in normal mode, proceed to the next step.

5. Continue the planned failover process with the "Running the Role Reversal Failover Program File Procedure."

Running the Role Reversal Failover Program File Procedure

1. Open a command prompt window on the target host.
2. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section "Communicating Via Command Scripter" on page 5-2.
3. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.

4. Run the *hsg_fo.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.

5. You will see a message asking what type of failover to run. Enter **r** for a role reversal failover.

6. You will see a confirmation message that asks you to confirm that a role reversal failover is desired. Enter **y** for yes.

7. If this is the first time the program file is run, or you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Press **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fo.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

   IMPORTANT: If a script encounters an abnormal condition and exits with a warning or error, abort the scripting activities and perform the remaining steps manually. These procedures are located in the *Data Replication Manager HSG80 ACS Version 8.6-1P Failover/Failback Procedures Guide*.

8. Continue with the planned failover at the target site with "Target Host Setup Procedure."

Target Host Setup Procedure

1. To verify that the target site host can connect to the LUNs, use this command:

   ```
   SHOW UNITS FULL
   ```

   In the Access field of the display, all units that are used by remote copy sets should show that the target host connections are enabled. The display should also show the initiator controller connections.

2. The following step requires actions relative to each operating system in your configuration.

   a. **Compaq OpenVMS**: Allow the hosts to recognize new units.

      1) If you have shut down the host, boot it now. Booting the host enables OpenVMS to recognize the drive.

2) If you did not shut down the host, use the following command from a privileged account to enable OpenVMS to recognize the drives:

```
MCR SYSMAN IO AUTOCONFIGURE/LOG
```

b. **Compaq Tru64 UNIX**: Allow the hosts to recognize new units.

1) If the target site hosts are shut down, boot them now. Booting the hosts enables Tru64 UNIX to recognize the drives.

2) If the target hosts are not shut down, use the following command to recognize the drives:

```
hwmgr -scan scsi
```

This may take awhile for large configurations. If this is the case, scan only the SCSI bus where one of the DRM host adapters are located with the following command:

```
hwmgr -scan scsi -bus x
```

(where x is the SCSI bus number)

c. **IBM AIX**: Allow the hosts to recognize new units.

1) If the target site hosts are shut down, boot them now. Booting the hosts enables AIX to recognize the drives.

2) If the target hosts are not shut down, use the following commands to recognize the drives and verify that they are present:

```
cfgmgr -v
lsdev -Cc disk
```

Use the following commands to access file systems on the failed-over LUNs:

```
importvg -y volumegroupname hdiskx
mount all
```

NOTE: *volumegroupname* is the name of the volume group originally created at the initiator site, and x is the number of the hdisk assigned to the failed-over LUN. If the -y *volumegroupname* parameter is omitted, AIX will create a default volume group name, for example, vg00.

d. **Microsoft Windows NT**: Allow the host to recognize new units.

Reboot the servers at the target site and log in using an account that has administrative privileges. You should be able to see all of the units in My Computer. If Secure Path is not installed correctly, you will see each drive twice.

e. **Microsoft Windows 2000**: Allow the hosts to recognize new units.

1) If you *have not* changed the UNIT_OFFSET of any host connections since the hosts have been booted, you do not need to reboot the target site hosts.

a) On each host, log in using an account that has administrative privileges.

b) Open **Computer Management** and click **Disk Management**.

c) After Disk Management has initialized, go to the Action Menu and click **Rescan Disks**. All of the failed over units should appear in the right-hand pane. If Secure Path is not installed correctly, you will see each unit twice.

2) If you *have* changed the UNIT_OFFSET of any host connections, you must reboot that host. After the host has rebooted, log in using an account that has administrative privileges. You should be able to see all of the units in My Computer. If Secure Path is not installed correctly, you will see each drive twice.

f. **Sun Solaris**: Allow hosts to recognize new units.

1) Reboot the servers using the command `reboot -- -r` at the target site and log in using an account that has administrative privileges.

2) If Secure Path was not configured for these units, you will not see the drives. You need to edit the WWIDs in the */kernal/drv/IdLite.conf* file. To find the new WWIDs of the units, use the `SHOW` *UnitName* command on the controller. You may also need to adjust the */kernal/drv/mda.conf* and */kernal/drv/sd.conf* files to accommodate for extra LUNs. After editing the *IdLite.conf*, *mda.conf*, and *sd.conf* files, reboot the server using the `reboot -- -r` command. You should now be able to see the drives using the `format` command. Refer to the *Compaq SANworks Secure Path for Sun Solaris Installation and Reference Guide* for assistance.

3. After the completion of maintenance work at the initiator site, or whenever you are ready to failback to the initiator site, continue with the “Running the Role Reversal Failback Program File Procedure.”

Running the Role Reversal Failback Program File Procedure

1. Before performing the failback procedure, locate your record of `SHOW` command output that details the initiator configuration. Verify that your initiator controller configuration is the same as your target controller configuration. Compare the status of the controllers, association sets, remote copy sets, units, and connections. Refer to the *Data Replication Manager HSG80 ACS 8.6-1P Failover/Failback Procedures Guide* for the full status comparison procedure.
2. Open a command prompt window on the target host.
3. Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section "Communicating Via Command Scripter" on page 5-2.
4. Change to the bat, sh, or vms subdirectory in the CLONE_HOME directory.
5. Run the *hsg_fb1.xxx* program file (where *.xxx* denotes .com (OpenVMS), .sh (Tru64, AIX, and Solaris), or .bat (Windows NT/2000), depending on your operating system.
6. You will see a message asking what type of failback to run. Enter **r** for a role reversal failback.
7. You will see a confirmation message that asks you to confirm that a role reversal failback is desired. Enter **y** for yes.
8. If this is the first time the program file is run or if you have deleted the .RC file, you are prompted to select a verbose or condensed reporting display. Enter **v** for verbose or **c** for condensed. To change the type of display, you must delete the *app_fb1.rc* file from the config subdirectory of the CLONE_HOME directory and run the program file.

   IMPORTANT: If a script encounters an abnormal condition and exits with a warning or error, abort the scripting activities and perform the remaining steps manually. These procedures are located in the *Data Replication Manager HSG80 ACS Version 8.6-1P Failover/Failback Procedures Guide*.
9. Continue the role reversal failback procedure at the initiator site with "Initiator Site Cleanup Procedure."

Initiator Site Cleanup Procedure

The following steps requires actions relative to each operating system in your configuration.

1. **Compaq OpenVMS**: Allow the hosts to recognize new units.

   a. If the initiator site hosts are shut down, boot them now. Booting the hosts enables OpenVMS to recognize the drives.

   b. If the initiator site hosts are not shut down, use the following command from a privileged account to enable OpenVMS to recognize the drives:

   ```
   MCR SYSMAN IO AUTOCONFIGURE/LOG
   ```

2. **Compaq Tru64 UNIX**: Allow the hosts to recognize new units.

   a. If the initiator site hosts are shut down, boot them now. Booting the hosts enables Tru64 UNIX to recognize the drives.

   b. If the initiator hosts are not shut down, use the following command to recognize the drives:

   ```
   hwmgr -scan scsi
   ```

   This may take awhile for large configurations. If this is the case, scan only the SCSI bus where one of the DRM host adapters are located with the following command:

   ```
   hwmgr -scan scsi -bus x
   ```

   (where x is the SCSI bus number)

3. **IBM AIX**: Allow the hosts to recognize new units.

   a. If the initiator site hosts are shut down, boot them now. Booting the hosts enables AIX to recognize the drives.

   b. If the initiator site hosts are not shut down, use the following commands to recognize the drives and mount the file systems:

   ```
   cfgmgr -v
   mount all
   ```

4. **Microsoft Windows NT**: Allow the host to recognize new units.

   Reboot the servers at the initiator site and log in using an account that has administrative privileges. You should be able to see all of the units in My Computer. If Secure Path is not installed correctly, you will see each drive twice.

5. **Microsoft Windows 2000**: Allow hosts to recognize new units.

   a. If you *have not* changed the UNIT_OFFSET of any host connections since the hosts have been booted, you do not need to reboot the initiator site hosts.

      1) On each host, log in using an account that has administrative privileges.

      2) Open **Computer Management** and click **Disk Management**.

      3) After Disk Management has initialized, go to the Action Menu and click **Rescan Disks**. All of the failed over units should appear in the right-hand pane. If Secure Path is not installed correctly, you will see each unit twice.

   b. If you *have* changed the UNIT_OFFSET of any host connections, you must reboot that host. After the server has rebooted, log in using an account that has administrative privileges. You see all of the units in Disk Management. If Secure Path is not installed correctly, you will see each drive twice.

6. **Sun Solaris**: Allow the hosts to recognize new units.

   a. Power on or reboot the servers using the command `reboot -- -r` at the target site and log in using an account that has administrative privileges.

   b. If Secure Path was not configured for these units, you will not see the drives. You need to edit the WWIDs in the */kernal/drv/IdLite.conf* file. To find the new WWIDs of the units, use the `SHOW` *UnitName* command on the controller. You may also need to adjust the */kernal/drv/mda.conf* and */kernal/drv/sd.conf* files to accommodate for extra LUNs. After editing the *IdLite.conf*, *mda.conf*, and *sd.conf* files, reboot the server using the `reboot -- -r` command. You should now be able to see the drives using the `format` command. Refer to the *Compaq SANworks Secure Path for Sun Solaris Installation and Reference Guide* for assistance.

This completes the role reversal failback procedure.

A

DRM Scripting Kit Files

This appendix provides a list of files that are extracted from the DRM Scripting Kit. The table below lists the kit files provided, their location in the CLONE_HOME subdirectory, and gives a brief description.

Table A–1: Installed DRM Scripting Kit Files

Directory	Filename	Description
Default	Hsgcs.pm Hsgcustom.pm Hsgdrm.pm Hsggen.pm	Perl modules containing library files used by Perl scripts. These should not be modified.
BIN	drmdispatch.pl	Generates Command Line Interpreter (CLI) commands to perform failover or failback. This file should not be modified.
BIN	generate_cfg.pl	Creates a controller configuration file and saves it with a *ControllerName.cfg* file name. This file should not be modified.
BIN	hsgcontrol.pl	Reads actions from the application action list and calls the *drmdispatch.pl* Perl script to perform these named actions. This file should not be modified.
BIN	pchoice.pl	Handles user input for prompts that require a logical response. This file should not be modified.
CONFIG	app_ex.act	Example file used to create an application action list.
CONFIG	failback_step1a.tbl	Contains step 1 failback instructions read by the *drmdispatch.pl* Perl script and performed on the initiator. This file should not be modified.
CONFIG	failback_step1b.tbl	Contains step 1 failback instructions read by the *drmdispatch.pl* Perl script and performed on the target. This file should not be modified.

Table A–1: Installed DRM Scripting Kit Files (Continued)

Directory	Filename	Description
CONFIG	failback_step1c.tbl	Contains step 1 failback instructions read by the *drmdispatch.pl* Perl script and performed on the target. This file should not be modified.
CONFIG	failback_step2.tbl	Contains step 2 failback instructions read by the *drmdispatch.pl* Perl script. This file should not be modified.
CONFIG	failover_step1.tbl	Contains step 1 failover instructions read by the *drmdispatch.pl* Perl script. This file should not be modified.
CONFIG	failover_step2.tbl	Contains step 2 failover instructions read by the *drmdispatch.pl* Perl script. This file should not be modified.
CONFIG	fast_failback_ step1.tbl	Contains step 1 fast failback instructions read by the *drmdispatch.pl* Perl script. This file should not be modified.
CONFIG	failsafe_op.tbl	Contains instructions that modify the error mode of the remote copy sets to normal mode in order to resume operations at the initiator site due to a planned or unplanned loss of the target site while in failsafe error mode. This file should not be modified.
CONFIG	failsafe_revop1.tbl	Contains step 1 of instructions that reverts the remote copy set to a former error mode. This file should not be modified.
CONFIG	failsafe_revop2.tbl	Contains step 2 of instructions that reverts the remote copy set to a former error mode. This file should not be modified.
CONFIG	hsg80class.msg	Contains a translation between error codes and text messages that are displayed in the .CHK files generated by the scripts.
CONFIG	prefast_failover_ step2.tbl	Contains step 2 pre-fast failover instructions read by the *drmdispatch.pl* Perl script. This file should not be modified.
CONFIG	prefast_failover_ step3.tbl	Contains step 3 pre-fast failover instructions read by the *drmdispatch.pl* Perl script. This file should not be modified.

Table A–1: Installed DRM Scripting Kit Files (Continued)

Directory	Filename	Description
CONFIG	prefull_failover_ step2.tbl	Contains step 2 pre-full failover instructions read by the *drmdispatch.pl* Perl script. This file should not be modified.
LOG	None	Installed as an empty directory, but used as a repository for .LOG and .CHK files generated by scripts. The .LOG files trace all commands and responses sent to and from the controllers. The .CHK files contain error messages.
TMP	None	Installed as an empty directory, but used as a repository for temporary files.
OpenVMS only files		
Default	Hsgvms.pm	Perl module containing library files used by Perl scripts. This file should not be modified.
VMS	gen_ex.com	Example file to create a configuration generation file for each controller pair.
VMS	hsg_fb1.com	Initiates a Perl script that performs step 1 of a planned site failback on controllers identified in the application action list. This file should not be modified.
VMS	hsg_fb2.com	Initiates a Perl script that performs step 2 of a planned site failback on controllers identified in the application action list. This file should not be modified.
VMS	hsg_fo.com	Initiates a Perl script that performs a two-step planned site failover on controllers identified in the application action list. This file should not be modified.
VMS	hsg_op.com	Runs a Perl script to change the remote copy set error mode on the initiator controller. This file should not be modified.
VMS	start_perl_job.com	Launches *drmdispatch.pl* from *hsgcontrol.pm.* This file should not be modified.

Table A–1: Installed DRM Scripting Kit Files (Continued)

Directory	Filename	Description
Tru64 UNIX, IBM AIX, and Sun Solaris files		
Default	Hsgtru64.pm	Perl module containing library files used by Perl scripts. This file should not be modified.
Default	Hsgibm.pm	Perl module containing library files used by Perl scripts. This file should not be modified.
Default	Hsgsun.pm	Perl module containing library files used by Perl scripts. This file should not be modified.
SH	gen_ex.sh	Example file to create a configuration generation file for each controller pair.
SH	hsg_fb1.sh	Initiates a Perl script that performs step 1 of a planned site failback on controllers identified in the application action list. This file should not be modified.
SH	hsg_fb2.sh	Initiates a Perl script that performs step 2 of a planned site failback on controllers identified in the application action list. This file should not be modified.
SH	hsg_fo.sh	Initiates a Perl script that performs a two-step planned site failover on controllers identified in the application action list. This file should not be modified.
SH	hsg_op.sh	Runs a Perl script to change the remote copy set error mode on the initiator controller. This file should not be modified.
Windows only files		
Default	Hsgwindows.pm	Perl module containing library files used by Perl scripts. This file should not be modified.
BAT	gen_ex.bat	Example file to create a configuration generation file for each controller pair.
BAT	hsg_fb1.bat	Initiates a Perl script that performs step 1 of a planned site failback on controllers identified in the application action list. This file should not be modified.
BAT	hsg_fb2.bat	Initiates a Perl script that performs step 2 of a planned site failback on controllers identified in the application action list. This file should not be modified.

Table A–1: Installed DRM Scripting Kit Files (Continued)

Directory	Filename	Description
BAT	hsg_fo.bat	Initiates a Perl script that performs a two-step planned site failover on controllers identified in the application action list. This file should not be modified.
BAT	hsg_op.bat	Runs a Perl script to change the remote copy set error mode on the initiator controller. This file should not be modified.
BAT	start_perl_job.bat	Launches *drmdispatch.pl* from *hsgcontrol.pl.* This file should not be modified.

B

Sample Controller Configuration File

This appendix provides an example of an initiator controller configuration file for a DRM initiator-target pair of *tulsa* (initiator) and *fargo* (target).

Example of Controller Configuration File

```
ASSOCIATIONSET:
ASS_1=MEMBERS:RCS_M1,RCS_M2;NOFAIL_ALL;NOORDER_ALL;LOG_UNIT=D50

CLONES:

CLONESTORAGESETCONFIG:

CONNECTIONS:
D1=FARGOC,FARGOD,HORN_B,HORN_T
D11=SUN018_B,SUN018_T
D2=FARGOC,FARGOD,HORN_B,HORN_T
D3=FARGOC,FARGOD,HORN_B,HORN_T
D50=None
D6=TRU050_B,TRU050_T

CONTROLLER:
CCLLUN=0
CCLid=2
Failover=MULTIBUS_FAILOVER
Firmware=V86P
SANName=TULSA
SCSI=SCSI-3
SerialNumbers=ZG91606296,ZG91205687
WWid=5000-1FE1-0000-1520
commmode=cs
device=zg91606296
name=tulsa
```

Example of Controller Configuration File (Continued)

```
MAX_READ_CACHED_TRANSFER_SIZE:
D1=32
D11=32
D2=32
D3=32
D50=32
D6=256

MAX_WRITE_CACHED_TRANSFER_SIZE:
D1=32
D11=32
D2=32
D3=32
D50=32
D6=256

MIRRORSET:
HISTLOG=DISK10000,DISK20000
M1=

PREFERRED_PATH:
D1=THIS_CONTROLLER
D11=THIS_CONTROLLER
D2=THIS_CONTROLLER
D3=THIS_CONTROLLER
D50=
D6=OTHER_CONTROLLER

RAID5SET:

REMOTECOPYSET:
RCS_M1=INITIATOR:TULSA\D1;TARGET:FARGO\D1;OPERATION=SYNCHRONOUS;ERROR=NORMAL;IO=200
RCS_M2=INITIATOR:TULSA\D2;TARGET:FARGO\D2;OPERATION=SYNCHRONOUS;ERROR=NORMAL;IO=200
RCS_M3=INITIATOR:TULSA\D3;TARGET:FARGO\D3;OPERATION=SYNCHRONOUS;ERROR=NORMAL;IO=200

SNAPSHOTS:

STRIPESET:
```

Example of Controller Configuration File (Continued)

```
TERMINALSERVER:
backup=
password=
primary=

UNIT:
D1=DISK30200
D11=DISK60300
D2=DISK50100
D3=DISK60100
D50=HISTLOG
D6=DISK40300

UNIT_IDENTIFIERS:
D1=
D11=
D2=
D3=
D50=
D6=
```

C

Structure of the Application Action List

Default Application Action List

The default application action list (*app_ex.act*) is provided in the DRM Scripting Kit and installed in the CONFIG subdirectory of the CLONE_HOME directory (the default directory where the scripts reside). It contains groupings of various failover, failback, and resumption of operation actions, and lists the DRM initiator or target controllers to be included in each action.

The scripts need the target controller name in a failover or failback action and the initiator controller name in a resumption of operation action. Only one controller name is needed for an initiator-target controller pair because the script can determine and perform its role based on the pairing information contained in the controller configuration file.

The default application action list is shown below. It contains actions for two separate DRM controller pairs. The two target controllers are named *fargo* and *denver*. The two initiator controllers are *tulsa* and *greenbay.*

Default Application Action List

```
#
# This file specifies the actions that need to be performed on the
# HSG controllers
#
# This configuration file is used by the CLONE_HOME/bin/hsgcontrol.pl
#
# The structure of the file is as follows:
# "#"    : comment sign. Only comment signs on the 1st position of the line
#          are allowed
# ACTION : Start of the Action specification for this application
# END_ACTION : End of Action definition for this application
```

Default Application Action List (Continued)

```
#
# An action line is constructed as follows:
# Foreground|Background <ControllerName> <PerlScriptName> <Parameter1>
# <Parameter2> <Parameter3> <Parameter4>
#

#
SHORT_PLANNED_FAILOVER_STEP1
Background fargo drmdispatch PLANNED failover_step1 ALL NOTFORCED
Background denver drmdispatch PLANNED failover_step1 ALL NOTFORCED
END_SHORT_PLANNED_FAILOVER_STEP1

#
SHORT_PLANNED_FAILOVER_STEP2
Background fargo drmdispatch PLANNED prefast_failover_step2 ALL NOTFORCED
Background denver drmdispatch PLANNED prefast_failover_step2 ALL NOTFORCED
END_SHORT_PLANNED_FAILOVER_STEP2

#
SHORT_PLANNED_FAILOVER_STEP3
Background fargo drmdispatch PLANNED prefast_failover_step3 ALL NOTFORCED
Background denver drmdispatch PLANNED prefast_failover_step3 ALL NOTFORCED
END_SHORT_PLANNED_FAILOVER_STEP3

#
EXTENDED_PLANNED_FAILOVER_STEP1
Background fargo drmdispatch PLANNED failover_step1 ALL NOTFORCED
Background denver drmdispatch PLANNED failover_step1 ALL NOTFORCED
END_EXTENDED_PLANNED_FAILOVER_STEP1

#
EXTENDED_PLANNED_FAILOVER_STEP2
Background fargo drmdispatch PLANNED prefull_failover_step2 ALL NOTFORCED
Background denver drmdispatch PLANNED prefull_failover_step2 ALL NOTFORCED
END_EXTENDED_PLANNED_FAILOVER_STEP2

#
UNPLANNED_FAILOVER_STEP1
Background fargo drmdispatch DISASTER failover_step1 ALL NOTFORCED
Background denver drmdispatch DISASTER failover_step1 ALL NOTFORCED
END_UNPLANNED_FAILOVER_STEP1

#
UNPLANNED_FAILOVER_STEP2
Background fargo drmdispatch DISASTER failover_step2 ALL NOTFORCED
Background denver drmdispatch DISASTER failover_step2 ALL NOTFORCED
END_UNPLANNED_FAILOVER_STEP2
```

Default Application Action List (Continued)

```
#
FAST_FAILBACK_STEP1
Background fargo drmdispatch PLANNED  fast_failback_step1 ALL NOTFORCED
Background denver drmdispatch PLANNED  fast_failback_step1 ALL NOTFORCED
END_FAST_FAILBACK_STEP1
#
FAST_FAILBACK_STEP2
Background fargo drmdispatch PLANNED failback_step2 ALL NOTFORCED
Background denver drmdispatch PLANNED failback_step2 ALL NOTFORCED
END_FAST_FAILBACK_STEP2
#
FULL_FAILBACK_STEP1A
Background fargo drmdispatch DISASTER failback_step1a ALL NOTFORCED
Background denver drmdispatch DISASTER failback_step1a ALL NOTFORCED
END_FULL_FAILBACK_STEP1A
#
FULL_FAILBACK_STEP1B
Background fargo drmdispatch DISASTER failback_step1b ALL NOTFORCED
Background denver drmdispatch DISASTER failback_step1b ALL NOTFORCED
END_FULL_FAILBACK_STEP1B
#
FULL_FAILBACK_STEP1C
Background fargo drmdispatch DISASTER failback_step1c ALL NOTFORCED
Background denver drmdispatch DISASTER failback_step1c ALL NOTFORCED
END_FULL_FAILBACK_STEP1C
#
FULL_FAILBACK_STEP2
Background fargo drmdispatch DISASTER failback_step2 ALL NOTFORCED
Background denver drmdispatch DISASTER failback_step2 ALL NOTFORCED
END_FULL_FAILBACK_STEP2
#
ROLE_REVERSE_FAILOVER_STEP1
Background fargo drmdispatch PLANNED failover_step1 ALL NOTFORCED
Background denver drmdispatch PLANNED failover_step1 ALL NOTFORCED
END_ROLE_REVERSE_FAILOVER_STEP1
```

Default Application Action List (Continued)

```
#
ROLE_REVERSE_FAILOVER_STEP2
Background fargo drmdispatch PLANNED failover_step2 ALL NOTFORCED
Background denver drmdispatch PLANNED failover_step2 ALL NOTFORCED
END_ROLE_REVERSE_FAILOVER_STEP2

#
ROLE_REVERSE_FAILOVER_STEP3
Background fargo drmdispatch PLANNED failback_step1a ALL NOTFORCED
Background denver drmdispatch PLANNED failback_step1a ALL NOTFORCED
END_ROLE_REVERSE_FAILOVER_STEP3

#
ROLE_REVERSE_FAILOVER_STEP4
Background fargo drmdispatch PLANNED failback_step1b ALL NOTFORCED
Background denver drmdispatch PLANNED failback_step1b ALL NOTFORCED
END_ROLE_REVERSE_FAILOVER_STEP4

#
ROLE_REVERSE_FAILBACK_STEP1
Background fargo drmdispatch PLANNED failback_step2 ALL NOTFORCED
Background denver drmdispatch PLANNED failback_step2 ALL NOTFORCED
END_ROLE_REVERSE_FAILBACK_STEP1

#
SET_ERROR_NORMAL_OPERATION
Background tulsa drmdispatch PLANNED failsafe_op ALL NOTFORCED
Background greenbay drmdispatch PLANNED failsafe_op ALL NOTFORCED
END_SET_ERROR_NORMAL_OPERATION

#
SET_ERROR_CONFIGURED_OPERATION_STEP1
Background tulsa drmdispatch PLANNED failsafe_revop1 ALL NOTFORCED
Background greenbay drmdispatch PLANNED failsafe_revop1 ALL NOTFORCED
END_SET_ERROR_CONFIGURED_OPERATION_STEP1

#
SET_ERROR_CONFIGURED_OPERATION_STEP2
Background tulsa drmdispatch PLANNED failsafe_revop2 ALL NOTFORCED
Background greenbay drmdispatch PLANNED failsafe_revop2 ALL NOTFORCED
END_SET_ERROR_CONFIGURED_OPERATION_STEP2
```

Action Commands

Each action in the application action list begins with an action name on the first line and ends on a line with the action name preceded by the string "END_." These names must be in capital letters. For example:

```
SHORT_PLANNED_FAILOVER_STEP1
(individual action lines go here)
END_SHORT_PLANNED_FAILOVER_STEP1
```

The # character as the first character on a line indicates that the rest of that line is a comment. Comment symbols placed anywhere other than the first character on a line are not allowed. Empty lines are also not allowed.

An action line is constructed as follows:

```
Foreground | Background ControllerName PerlScriptName Param1 Param2
Param3 Param4
```

Refer to Table C–1 for a description of this structure.

Table C–1: Structure of an Action Command

Variable	Description
Foreground | Background	Indicates whether the action line must be executed in the foreground or background. If in the foreground, the *hsgcontrol.pl* script executes that action line and waits until the Perl script is finished before continuing with the next line. If in the background, the *hsgcontrol.pl* script starts a background process for the action line and continues processing the next action line.
ControllerName	The name of the storage subsystem on which the action is performed. This parameter is passed, without any checking or case conversion, to the Perl script.
PerlScriptName	The name of the Perl script.
Parameters 1, 2, 3, and 4	These four parameters are used by the Perl script without any parsing or case conversion. In an action, they appear in the following order: parameter 1 = failure type parameter 2 = control table parameter 3 = remote copy sets processed parameter 4 = condition clearing

How the Perl Scripts Use the Application Action List

Two important Perl scripts are responsible for invoking failover, failback, and resumption of operations:

- The *hsgcontrol.pl* script reads the application action list (*app.act*) and passes parameters to the *drmdispatch.pl* script.
- The *drmdispatch.pl* script reads the control tables and executes the steps for failover, failback, and resumption of operations.

The following sections discuss these two Perl scripts.

hsgcontrol.pl

The *hsgcontrol.pl* script runs from a batch file. The script processes actions that are read from the application action list.

The following command line shows the script syntax for the Windows platform (where CLONE_HOME is the environmental variable that represents the directory where the scripts reside). Its structure is shown in Table C–2.

```
%CLONE_HOME%\BIN\hsgcontrol.pl FileName ActionLabel RCFile
```

Table C–2: Structure of the hsgcontrol.pl Script Command

Variable	Description
CLONE_HOME\BIN	The variable pointing to the default directory of the script files and the BIN subdirectory. This is the path to the *hsgcontrol.pl* script.
hsgcontol.pl	The Perl script name.
FileName	The name of the application action list that contains the actions to be performed.
ActionLabel	The named action to be performed from the application action list. For example, PLANNED_FAILOVER_STEP1
RCFile	This file sets the user's preference to receive status reporting in either "verbose" or "condensed" mode. For more information about these preferences, see Chapter 5.

An example of the *hsgcontrol.pl* Perl script command executed by a Windows batch file is:

```
Perl -I %CLONE_HOME% %CLONE_HOME%\bin\hsgcontrol.pl app
PLANNED_SHORT_ FAILOVER_STEP1 app_fo1.rc
```

The script searches for a section named PLANNED_SHORT_FAILOVER_ STEP1 in the *app.act* file and performs all action entries between PLANNED_SHORT_FAILOVER_STEP1 and END_PLANNED_SHORT_FAILOVER_STEP1.

drmdispatch.pl

As *hsgcontrol.pl* performs the actions in the application list, it calls the *drmdispatch.pl* script and passes the parameters specified in the application action list. The following is the syntax for the script. Its structure (for the Windows format) is shown in Table C–3.

```
%CLONE_HOME%\BIN\drmdispatchl.pl ControllerName FailoverType
ControlTable RCSProcessed Forced_NotForced ErrorLog
```

Table C–3: Structure of the drmdispatch.pl Script Command

Variable	Description
CLONE_HOME\BIN	The variable pointing to the default directory of the script files and the BIN subdirectory. This is the path to the *drmdispatch.pl* script.
drmdispatch.pl	The Perl script name.
ControllerName	The name of the controller receiving the action.
FailoverType	Specifies either a PLANNED or DISASTER failover.
ControlTable	Identifies the control table interpreted by the script. These control tables have a *.tbl* extension and should not be modified.
RCSProcessed	A list of the remote copy sets to process. This should be set to ALL.
Forced_NotForced	Indicates whether the script must clear conditions before deleting a unit. This should be set to NOTFORCED, which requires manually clearing conditions via the storage system.

Table C–3: Structure of the drmdispatch.pl Script Command (Continued)

Variable	Description
ErrorLog	An optional parameter that specifies the error log file when the script is run.

An example of the *drmdispatch.pl* Perl script command called by the *hsgcontrol.pl* script with parameters passed by the app.act files is:

```
Perl %CLONE_HOME%\bin\drmdispatch.pl fargo PLANNED failover_step1
ALL NOTFORCED Er
```

This script starts a planned failover using the steps defined in the failover_step_1 control table. All remote copy sets are processed. Error conditions for a controller are not cleared by the script. Error messages are placed in a log file called *Er* in the CLONE_HOME\LOG directory, where CLONE_HOME is the default directory of the scripts.

D

Troubleshooting

This appendix provides several troubleshooting aids. Recommendations are listed for troubleshooting common problems when using scripts. A listing of error codes provides help in interpreting error messages. A listing of confirmation message instance codes are also provided for examples used in this book that display these codes.

Troubleshooting Recommendations

If errors are encountered while running the scripts, consider the recommendations given below:

- Verify that the script server can communicate with the target controller via Command Scripter. Use the `cmdscript` command as described in the section "Communicating Via Command Scripter" on page 5-2.
- Verify that all configuration files are current for each controller pair.
- Ensure that commands and controller names used in case sensitive platforms like Compaq Tru64, IBM AIX, and Sun Solaris are consistent. For example, a configuration generation file may list a controller as *tulsa*, so the *app.act* file must list it with the same lower case. Otherwise the script will not execute.
- Ensure that all target configuration files with manually updated sections are correctly updated with matching fields from the corresponding initiator configuration file. Also ensure that no spaces, line feeds, returns, and so on, were manually added to the updated sections. These may cause the script to hang.
- Ensure that application action files follow correct formatting and that they use correct DRM controller (remote copy) names. Failover and failback actions use the target controller name in the action statement. Resumption of operation actions use the initiator controller name in the action statement. Remember that Tru64 UNIX, IBM AIX, and Sun Solaris are case sensitive, and it is generally helpful to use lower case to be consistent.

- Inspect script-generated log files located in the LOG subdirectory of the CLONE_HOME directory. A .LOG file is created for each step in the failover/failback process, and traces the commands and responses that were sent and received from the controllers. To see error messages, look at the .CHK files that are written to this subdirectory. Refer to Table D–1 for a list of all error codes, their meanings, and what actions should be taken.
- Be sure to look at the most recent .LOG and .CHK files. These files are marked with a numeric revision number with the controller name passed to *drmdispatch.pl* from the application action list.

  For example, running the DISASTER_FAILOVER_STEP1 action for a controller named *tulsa* may result in the following files in the LOG subdirectory:

  tulsa_disaster_failover_step1.chk.1

  tulsa_disaster_failover_step1.log.1

Scripting Error Codes

This appendix describes error codes that you may encounter when you use the Perl scripts. Table D–1 lists the error codes, meanings, and what actions you should take.

Table D–1: Scripting Error Codes

Error Code	Meaning	Action
1120	%new - cannot read controller configuration file	Check presence, and file access to, specified configuration file.
1180	%delete_unit - cannot read unit, or unit does not exist	Check unit and underlying storage for possible problems. Correct any error conditions detected on the controller. Verify connectivity with the controller, and repair error conditions as necessary.
1181	%delete_unit - cli command error	Check unit and underlying storage for possible problems. Correct any error conditions detected on the controller.

Table D–1: Scripting Error Codes (Continued)

Error Code	Meaning	Action
1240	%get_subclone_list - source unit does not exist	A mismatch exists between configuration file and the actual controller configuration. Check unit section or clone section for discrepancies, and repair.
1241	%get_subclone_list - cannot read source unit	Verify connectivity with the controller and repair error conditions, as necessary. Check unit specified in the error message and verify that it is a valid unit on the controller.
1242	%get_subclone_list - cannot match storage type on source unit	Configuration problem on unit specified. Update configuration file.
1320	%reconstructing - cannot read mirror properties	Verify specified mirror set on controller and correct as necessary.
1422	%cli - cannot send command	Communications error. Identify communications problem and correct.
1500	%get - cannot match show output to storage type	Communications error. Identify communications problem and correct.
1520	%parse_mirror_info - unknown header information	Communications error. Identify communications problem and correct.
1521	%parse_mirror_info - cannot parse mirror name	Communications error. Identify communications problem and correct.
1522	%parse_mirror_info - cannot parse mirror membership info	Communications error. Identify communications problem and correct.
1524	%parse_mirror_info - cannot parse mirror size	Communications error. Identify communications problem and correct.
1540	%parse_unit_info - unknown header information	Communications error. Identify communications problem and correct.
1541	%parse_unit_info - cannot parse unit name	Communications error. Identify communications problem and correct.
1542	%parse_unit_info - cannot parse unit size	Communications error. Identify communications problem and correct.

Table D–1: Scripting Error Codes (Continued)

Error Code	Meaning	Action
1560	%parse_storage_type - unknown header information	Communications error. Identify communications problem and correct.
1561	%parse_storage_type - unknown storage information	Communications error. Identify communications problem and correct.
1580	%get_size - cannot read size of the disk	Communications error. Identify communications problem and correct.
1644	%connect - no controller prompt	Communications error. Identify communications problem and correct.
2000	%drm_site_failover - cannot read configuration entry for remote copy set	Configuration file problem. Verify correctness of the remote copy set section to the remote copy set specified.
2003	%drm_site_failover - cannot failover unit. SITE_FAILOVER command failed.	A site failover was attempted five times. Controller problem with site failover of remote copy set. Identify and correct problem.
2010	%drm_move_initiator - cannot read configuration entry for remote copy set	Possible mismatch between configuration file and controller. Verify that the configuration file accurately reflects configuration on controller. Possible communication error. Verify communication with controller and correct problem as needed.
2011	%drm_move_initiator - cannot move initiator role to target in remote copy set	Possible communications or controller problem. Identify and correct problem.
2012	%drm_move_initiator - initiator role for remote copy set is already specified to another controller and/or unit. Mixed up initiator and target.	Possible mismatch between configuration file and controller. Verify that the configuration file accurately reflects configuration on controller.
2021	%add-rcs_to_assocset - configuration file not up to date	Mismatch between configuration file and controller configuration. Update configuration file.

Table D–1: Scripting Error Codes (Continued)

Error Code	Meaning	Action
2022	%add_rcs_to_assocset - cannot add association set	Attempted adding association set five times. There is a controller problem with adding the association set. Identify and correct controller problem.
2023	%add_whl_to_assocset - cannot add WHL to association set	Possible mismatch between configuration file and controller. Verify that the configuration file accurately reflects configuration of controller.
2030	%remove_rcs_from_assocset - the association set does not exist	Association set does not exist on controller but does exist in configuration file. Update configuration file.
2040	%drm_create_remotecopyset - a storageset, remote copy set, or association set already exists	Name conflict exists. Verify and correct the configuration filename.
2041	%drm_create_remotecopyset - cannot read configuration entry for remote copy set	Cannot find entry of remote copy set in configuration file. Update the configuration file.
2042	%drm_create_remotecopyset - cannot create the remote copy set	Cannot run add remote command. Check for possible communications errors and repair.
2050	%drm_delete_remotecopyset - the remote copy set does not exist	The remote copy set does not exist on the controller. Update the configuration file.
2051	%drm_delete_remotecopyset - the remote copy set is still part of an association set	Mismatch between the configuration file and controller configuration. Configuration file indicates remote copy set should be part of the association set, but controller indicates it is not part of the association set. Update configuration file.

Table D–1: Scripting Error Codes (Continued)

Error Code	Meaning	Action
2052	%drm_delete_remotecopyset - remote copy set still exists after removal	Cannot delete remote copy set. Check for communication error and repair as needed. Also possible issue with error mode on controller. If in failsafe, set the error mode to normal.
2060	%drm_add_target_unit - the remote copy set does not exist	Remote copy set does not exist on the controller. Update the configuration file.
2061	%drm_add_target_unit - the remote copy set already has a target. Delete that first.	Remote copy set is present but already has a target configured. There is a mismatch between the configuration file and controller configuration. Update the configuration file.
2062	%drm_add_target_unit - cannot add target to existing remote copy set. Check connection to remote site.	Check target unit status for access problems and verify the path to remote site is functional.
2070	%drm_remove_target_unit - the remote copy set does not exist	The remote copy set does not exist on the controller. Update the configuration file.
2071	%drm_remove_target_unit - mismatch between configuration file and current controller setup	The controller and its configuration file specify a target unit, but conflict with each other. Update the configuration file.
2072	%drm_remove_target_unit - target unit still there after removal	Communication error. Identify communication problem and correct.
2080	%drm_grant_server_access - connection configured for unit does not exist in controller	Mismatch between configuration file and controller. Connection no longer exists on controller. Update configuration file.

Table D–1: Scripting Error Codes (Continued)

Error Code	Meaning	Action
2090	%drm_deny_server_access - connection configured for unit does not exist in controller	Mismatch between configuration file and controller. Connection no longer exists on controller. Update configuration file.
2100	%parse_associationset_info - unknown header information	Communication error. Identify communication problem and correct.
2101	%parse_associationset_info - cannot parse association set name	Communication error. Identify communication problem and correct.
2110	%parse_remotecopyset_info - unknown header information	Communication error. Identify communication problem and correct.
2111	%parse_remotecopyset_info - cannot parse remote copy set name	Communication error. Identify communication problem and correct.
2120	%drm_read_associationset_ config - association set configuration information missing	No association set defined in configuration file. Update configuration file.
2130	%drm_read_remotecopyset_ config- remote copy set configuration information missing	No remote copy set defined in configuration file. Update configuration file.
2140	%drm_change_hostport_ topology - invalid port number	Failover or failback control file problem. File is possibly corrupt. Restore control file.
2141	%drm_change_hostport_ topology - invalid topology	Failover or failback control file problem. File is possibly corrupt. Restore control file.
2160	%drm_change_unit_ characteristic - cannot change characteristic for unit	Controller problem. Check the unit status and repair as needed.
2161	%drm_change_unit_ characteristic - incorrect value for characteristic. Action continues, but using defaults.	Possible controller problem. Check unit status and repair as needed. Possible configuration problem. Repair file as needed.

Table D–1: Scripting Error Codes (Continued)

Error Code	Meaning	Action
2180	%drm_upload_saved_config	Communications error. Identify communication problem and correct.
2200	%drm_deny_remote_hsg_ access - cannot remove access	Communications error. Identify communication problem and correct.
2201	%drm_deny_remote_hsg_ access - cannot read configuration entry for remote copy set	Configuration file problem. Update configuration file.
2202	%drm_deny_remote_hsg_ access - remote copy set does not contain this controller	Configuration file problem. Node specified is not an initiator or target. Update configuration file.
2210	%drm_grant_remote_hsg_ access - cannot grant access	Communication error. Identify communication problem and correct.
2211	%drm_grant_remote_hsg_ access - cannot read configuration entry for remote copy set	Configuration file problem. Update configuration file.
2212	%drm_grant_remote_hsg_ access - remote copy set does not contain this controller	Configuration file problem. Node specified is not an initiator or target. Update configuration file.
2220	%parse_connection_info - unknown header information	Communication error. Identify communication problem and correct.
2221	%parse_connection_info - cannot parse connection information	Communication error. Identify communication problem and correct.
2231	%change_rcs_characteristic - cannot change characteristic due to incorrect value	Control table problem. Table has been possibly corrupted. Restore control table.
2232	%change_rcs_characteristic - cannot change characteristic for remote copy set on HSG controller	Problem is with remote copy set on controller. Correct error on controller as needed.

Confirmation Message Instance Codes

In the examples provided in the scripting failover, failback, and resumption of operation procedures, some controller displays show confirmation messages with the event log symbol (%EVL) and an instance code. Information about instance codes and their meanings can be found in the *Compaq StorageWorks HSG80 Array Controller Version 8.6 Troubleshooting Reference Guide*, part number EK-G80TR-SA. A01. The few instance codes that appear in the examples are described in Table D–2.

Table D–2: Instance Code Legend

Instance Code	What It Means
0E0F8B01	The copy was terminated due to a write failure on the target unit. The write failure was due to the links being down (target inaccessible). The copy will restart when at least one link is restored. The initiator unit is specified by the Initiator WWLID field.
0E098901	The remote copy set specified by the Remote Copy Set Name field has gone inoperative due to a disaster tolerance failsafe locked condition.
02908901	The host command failed because the remote copy set went failsafe locked prior to command completion. The remote copy set is specified by the Remote Copy Name field. The Information field of the Device Sense Data contains the block number of the first block error.
07050064	Failover Control received a Last Gasp message from the other controller. The other controller is expected to restart within a given time period. If the other controller does not, the other controller will be held reset with the “Kill” line.
43010064	Host Port Protocol component has detected that the other controller has failed and that this controller has taken over the units specified in the extended sense data.

E

DRM Power Up and Power Down

This appendix describes the procedure for powering up and powering down your DRM systems.

Power Up Data Replication Manager Systems

The procedures below describe how to power on and power off the storage subsystem after it has been configured.

CAUTION: Compaq recommends that you power up the controllers and switches at the target site before applying power to the initiator site. Powering up in the wrong sequence may cause incorrect configurations.

Power on the DRM systems in the sequence described in the following procedures.

NOTE: In this chapter, procedures performed at the initiator or target sites show symbols at each step for reference. The ▷ symbol is used to identify a step performed at the initiator site, and a ⊙ symbol is used to identify a target-site step.

Target Site Power Up Procedure

⊙ 1. Ensure that all enclosures, switches, and rack power distribution units (PDUs) have their power switches in the OFF position.

⊙ 2. Apply power to all PDUs.

⊙ 3. Turn on the power switches for the racks from the target site.

⊙ 4. Ensure that all controllers are on and functional.

⊙ 5. Apply power to all Fibre Channel switches.

When completed, go to the Initiator Site Power Up Procedures.

Initiator Site Power Up Procedure

1. Ensure that all enclosures, switches, and rack PDUs have their power switches in the OFF position.
2. Apply power to all PDUs.
3. Turn on the power switches for the racks from the initiator site.
4. Make sure that all controllers are on and functional.
5. Apply power to all Fibre Channel switches.

Power Down Data Replication Manager Systems

Power down the DRM systems in the sequence described in the following procedures. If the initiator site will be powered down for a long period of time, you may need to disable cache batteries.

Initiator Site Power Down Procedure

1. Issue the following CLI commands (in the order shown):

```
SHUTDOWN OTHER_CONTROLLER
SHUTDOWN THIS_CONTROLLER
```

2. Turn off the Fibre Channel switches.
3. Turn off the power to the enclosures.
4. Turn off the PDUs.

When completed, go to the Target Site Power Down Procedures.

Target Site Power Down Procedure

1. Issue the following CLI commands (in this order):

```
SHUTDOWN OTHER_CONTROLLER
SHUTDOWN THIS_CONTROLLER
```

2. Turn off the Fibre Channel switches.
3. Turn off the power to the enclosures.
4. Turn off the PDUs.

Glossary

This glossary defines terms associated with the use of scripts to perform failover, failback, and resumption of operations in a Data Replication Manager (DRM) environment. It is not a comprehensive glossary of computer terms.

ACS
See array controller software.

ActivePerl
The Perl interpreter used by the DRM Perl scripts in the Windows platform.

application action list
A file that controls multiple instances of an action across DRM pairs (initiator-target pairs). An application action list is specific for one failover/failback application and specifies the actions that are to be performed on an initiator-target pair.

array controller
See controller.

array controller software (ACS)
Software that is contained on a removable PCMCIA program card that provides the operating environment for the array controller. Also known by the acronym *ACS*.

association set
A group of remote copy sets that share common attributes. Members of an association set can be configured to transition to the same state at the same time. An association set:

- Shares the same log unit
- Has its host access removed from all members when one member fails
- Keeps I/O order across all members

asynchronous mode
A mode of operation of the remote copy set whereby the write operation provides command completion to the host after the data is safe on the initiating controller, and prior to the completion of the target command.

Asynchronous mode can provide greater performance and faster response time, but the data on all members at any one point in time cannot be assumed to be identical. *See also* synchronous mode.

batch file
A text file containing Windows operating system commands that are used to invoke Perl scripts. The batch file *hsg_fo.bat*, for example, invokes a Perl script that performs a site failover on controllers identified in the application action list.

CCL
See command console LUN.

CLI
See command line interpreter.

CLI command
CLI commands allow users to manage their subsystems by viewing and modifying the controller and its attached devices. A primary function of CLI commands is to control the failover mode of a controller pair.

CLI SHOW command
See SHOW commands.

clone
A utility that physically duplicates data on any unpartitioned single-disk unit, stripeset, mirrorset, or striped mirrorset.

command console LUN (CCL)
A special pseudo disk device on the RAID storage system that allows the server to communicate with the RAID array.

command line interpreter (CLI)
The configuration interface that operates the controller software. Also known as *command line interface*.

Command Scripter
Application software that provides an interface to communicate the CLI commands generated by the Perl scripts to the HSG80 controllers via the Fibre Channel bus. With Command Scripter, users can edit and run script files that contain CLI commands.

condensed display
A screen output displayed while the failover and failback scripts run. The display shows only the status of the controller. A user preference for this type of display is set in a resource (.RC) file created by the failover and failback batch files. *See also* verbose display.

configuration file
A file that tells the failover/failback scripts what devices are attached to a controller and how the controller is configured with respect to devices and storagesets. There is a configuration file for each controller subsystem on the initiator and target hosts. *See also* initiator configuration file *and* target configuration file.

container
1. Any entity that is capable of storing data, whether it is a physical device or a group of physical devices. 2. A virtual internal controller structure representing either a single disk or a group of disk drives linked as a storageset. Stripesets and mirrorsets are examples of storageset containers that the controller uses to create units.

controller
A hardware device that uses software to facilitate communications between a host and one or more storage devices organized in an array. The HS-series *StorageWorks* family of controllers are all array controllers.

control table
A file that controls the order of CLI commands to be issued and sends the appropriate sequence of CLI commands (for the configuration specified in the configuration file) to the Command Scripter. The Command Scripter runs the script file and issues the commands to the HSG80 controller over the Fibre Channel bus.

copying member
In a mirrorset, a copying member is a container introduced to the mirrorset after the mirrorset has already been in use. None of the blocks can be guaranteed to be the same as other members of the mirrorset. Therefore, the *copying* member is made the same by copying all the data from a *normal* member. This is in contrast to *normalizing*, where all blocks written since creation are known to be the same.

When all blocks on the copying member are the same as those on the normal member, the copying member becomes a normal member. Until it becomes a normal member, the copying member contains undefined data and is not useful. *See also* normalizing member.

Data Replication Manager
Data Replication Manager provides controller-based mirroring across a Fibre Channel link. The HSG80 Array Controller storage system is used on a host port-to-host port basis, which allows data to be synchronously migrated from one storage system or physical site to another, even if they are located at different physical sites. Using the required multiple-bus failover configuration, the controller is not only able to distribute an input/output request to both the initiator and target sites, but it can also transfer the initiator's role to the target site as needed. Thus, Data Replication Manager is a distributed computing model that supports full disaster-tolerant storage.

device identifier
A unique 16-digit hexadecimal identifier of a Fibre Channel device.

disaster tolerance (DT)
As applied to DRM, disaster tolerance provides the ability for rapid recovery of user data from a remote location when a significant event or a disaster occurs at the primary computing site.

disk mirroring
The recording of redundant data for fault-tolerant operation. Data is written on two partitions of the same disk or on two separate disks within the same system. Disk mirroring uses the same controller. RAID 1 provides for mirroring, which is usually accomplished with SCSI drives. *See also* RAID.

disk striping
The spreading of data over multiple disk drives to improve performance. Data is interleaved by bytes or by sectors across the drives. For example, with four drives and a controller designed to overlap reads and writes, four sectors could be read in the same time it normally takes to read one. Disk striping does not inherently provide fault tolerance or error checking. It is used in conjunction with various other methods. *See also* RAID.

DRM controller name
The identification of a controller in a DRM environment.

drmdispatch.pl
See script.

DRM Scripting Kit
A self-extracting kit that contains batch files, Perl scripts, Perl modules, control tables, and example files used to configure a DRM environment and perform failover and failback.

DT
See disaster tolerance.

dual-redundant configuration
A storage subsystem configuration consisting of two active controllers operating as a single controller. If one controller fails, the other controller assumes control of the failing controller's devices. *See also* failover, failback.

environmental variable
Environmental information, such as drive, path, or filename, associated with a symbolic name. With the DRM scripts, the environmental variable CLONE_HOME defines the path to the default directory where the scripts reside.

fabric
A network of Fibre Channel switches or hubs and other devices. *See also* switch fabric.

failback
In a DRM environment, after failover occurs, failback moves data operations back to the initiator after the initiator site has been brought back online. *See also* failover.

failover
The process that takes place when one controller in a dual-redundant configuration assumes the workload of a failed companion controller. Failover continues until the failed controller is repaired or replaced. *See also* failback, dual-redundant configuration, planned failover.

failsafe locked
A condition a remote copy set assumes under certain potentially catastrophic error conditions. The failsafe locked condition prevents further write operations from the host to the remote copy set members. The failsafe error mode is enabled by the user to fail any I/O whenever the target is inaccessible or the initiator unit fails. When either of these conditions occurs, the remote copy set goes into the inoperative (offline) state.

fast-failback
The synchronization of the initiator site with the target site during a planned failover of the initiator subsystem.

The write operations are logged to the target site write history log, and during the fast-failback, the initiator site is updated from the write history log. *See also* mini-merge, disaster tolerance (DT), planned failover, write history logging.

fiber
An optical strand used in fiber optic cable. Spelled *Fibre* when used in *Fibre Channel* protocol. *See also* fiber optic cable, Fibre Channel.

fiber optic cable
A transmission medium that transmits digital signals in the form of pulses of light. Fiber optic cable is noted for its properties of electrical isolation and resistance to electrostatic contamination.

Fibre Channel
A high-speed transmission technology that can be used as a front-end communications network, a back-end storage network, or both at the same time. Fibre Channel is a driving force in the storage area network (SAN) arena for connecting multiple hosts to dedicated storage systems. With Fibre Channel, the hosts can talk not only to the storage system via SCSI, but also to each other via IP over the same network. Fibre Channel supports existing peripheral interfaces and communications protocols, including SCSI and IP. Its name is somewhat misleading, as Fibre Channel not only supports single-mode and multi-mode fiber connections, but coaxial cable, and twisted pair as well.

heterogeneous SAN
A storage area network configured to support more than one host server operating system.

homogeneous SAN
A storage area network in which all host servers run the same operating system.

HSG80 Array Controller
An intelligent mass storage controller that interfaces between host computer systems using a Fibre Channel bus and Ultra Wide attached mass storage devices, using Ultra Wide Single Ended SCSI buses.

hsgcontrol.pl
See script.

initiator
The site that carries out primary data processing. If a significant failure occurs at the initiator site, data processing can be resumed at the target site, where the data is intact. *See also* target.

initiator configuration file
A configuration file at the initiator site. *See also* configuration file, initiator.

IP address
An acronym for Internet Protocol address. The IP address is a number that is used as the address specifying a particular computer or other device connected to the Internet.

local terminal
A terminal plugged into the EIA-423 maintenance port on the front bezel of the HS series array controllers. Also called a maintenance terminal.

Logical Unit Number (LUN)
A value that identifies a specific logical unit belonging to a SCSI target ID number. A number associated with a physical device during a task's I/O operations. Each task in the system must establish its own correspondence between logical unit numbers and physical devices.

LOG_UNIT
A CLI command switch that, when enabled, assigns a single, dedicated log unit for a particular association set. The association set members must all be in the normal error mode (not failsafe). *See also* write history logging.

LUN
See Logical Unit Number.

maintenance terminal
See local terminal.

mini-merge
As applied to the Data Replication Manager, the data transfers to be made whenever a target becomes inaccessible. This happens when both links or both target controllers have gone down. The transfers that would have been made are instead logged into the association set's assigned log unit to wait until the remote copy set subsystem comes back online. *See also* fast-failback, write history logging.

mirroring
Duplicating data onto another computer at another location. Mirroring is performed for backup purposes or to be in closer proximity to the user.

mirrorset
1. A group of storage devices organized as duplicate copies of each other. Mirrorsets provide the highest level of data availability at the highest cost. Another name for *RAID 1*. Also called *mirrored units* or *mirrored virtual disks*. 2. Two or more physical disks configured to present one highly reliable virtual unit to the host. 3. A virtual disk drive consisting of multiple physical disk drives, each of which contains a complete and independent copy of the entire virtual disk's data.

multiple intersite links
Each intersite link (ISL) is a fiber link between two switches. As applied to Data Replication Manager, increasing bandwidth between switches is handled by adding additional connections between the switches, with a maximum of two connections.

normalization
A state in which, block for block, data written by the host to a mirrorset member is consistent with the data on other normal and normalizing members. The normalizing state exists only after a mirrorset is initialized.

normalizing member
A mirrorset member whose contents are the same as all other normal and normalizing members for data that has been written since the mirrorset was created, or since lost cache data was cleared. A normalizing member is created by a normal member when either all of the normal members fail, or all of the normal members are removed from the mirrorset. *See also* copying member.

normal member
A mirrorset member that, block for block, contains exactly the same data as that on the other members within the mirrorset. Read requests from the host are always satisfied by normal members.

other controller
The controller in a dual-redundant pair that is not connected to the controller serving the current CLI session with a local terminal. *See also* this controller, local terminal.

peripheral device
Any unit, distinct from the CPU and physical memory, that can provide the system with input or can accept output from it. Terminals, printers, tape drives, and disks are peripheral devices.

Perl
Practical Extraction Report Language. A programming language that combines syntax from several UNIX utilities and languages. Perl is widely used to write Web server programs for such tasks as automatically updating user accounts and news group postings, processing removal requests, synchronizing databases, and generating reports.

Perl interpreter
A program through which Perl programs are passed at run time for execution. The Perl interpreter translates the program internally and then executes it immediately.

Perl module
Code written in the Perl language to perform a specific task.

planned failover
As applied to the Data Replication Manager, an orderly shutdown of the controllers for installation of new hardware, updating the software, and so on. The host applications are quiesced and all write operations are permitted to complete before the shutdown. The controllers must be in synchronous operation mode before starting a planned failover. *See also* disaster tolerance (DT), synchronous mode.

port
In general terms, a port is:

- A logical channel in a communications system.
- The hardware and software that connect a host controller to a communications bus, such as a SCSI bus or serial bus.

With respect to a controller, a port is the logical route for data in and out of a controller that can contain one or more channels, all of which contain the same type of data.

With respect to a SCSI system, a port is the hardware and software that connect a controller to a SCSI device.

RAID
Redundant Array of Independent Disks. A disk subsystem that increases performance and provides fault tolerance. RAID is a set of two or more hard disks and a specialized disk controller that contains the RAID functionality.

RAID improves performance by disk striping, which interleaves bytes or groups of bytes across multiple drives, so more than one disk is reading and writing simultaneously. Fault tolerance is achieved by mirroring or parity.

RAID 0
Provides disk striping only, which interleaves data across multiple disks for better performance. It does not provide safeguards against failure.

RAID 1
Uses disk mirroring, which provides 100% duplication of data. Offers highest reliability, but doubles storage cost.

RAID 2
Bits (rather than bytes or groups of bytes) are interleaved across multiple disks.

RAID 3
Data is striped across three or more drives. Used to achieve the highest data transfer rate, because all drives operate in parallel. Parity bits are stored on separate, dedicated drives.

RAID 4
Similar to RAID 3, but manages disks independently rather than in unison. Not often used.

RAID 5
Most widely used. Data is striped across three or more drives for performance; parity bits are used for fault tolerance. The parity bits from two drives are stored on a third drive.

RAID 6
Highest reliability, but not widely used. Similar to RAID 5, but does two different parity computations or the same computation on overlapping subsets of the data.

RAID 10
Also designated *RAID 1,0*. It is a combination of RAID 1 and 0 (mirroring and striping).

RCS
See remote copy set.

redundancy
The provision of multiple interchangeable components to perform a single function to cope with failures and errors. A RAIDset is considered to be redundant when user data is recorded directly to one member, and all of the other members and associated parity also are recorded. If a member is missing from the RAIDset, its data can be regenerated as needed, but the RAIDset is no longer redundant until the missing member is replaced and reconstructed.

remote copy set (RCS)
A feature that allows data to be copied (mirrored) from the originating (initiator) site to a remote (target) site. The result is an exact copy of the data (remote copy set) at the target site. Used in disaster tolerance (DT) applications such as the Data Replication Manager. *See also* disaster tolerance (DT).

SAN
See Storage Area Network.

script
A program written in an interpreted programming language that specifies a set of actions to perform a specific task. For DRM scripting, the *hsgcontrol.pl* script reads actions from the application action list and then calls the *drmdispatch.pl* script. The *drmdispatch.pl* script interprets and executes instructions from the failover and failback control tables and initiates CLI commands to accomplish failover and failback. *See also* failover, failback.

scripting language
A high-level programming or command language that is interpreted (translated on the fly) rather than compiled ahead of time. A scripting, or script, language may be a general-purpose programming language or it may be limited to specific functions to augment the running of an application or system program. Spreadsheet macros and communications scripts are examples of limited-purpose scripting languages.

SHOW commands
A set of CLI commands that display information about controllers, storagesets, devices, partitions, and units.

Storage Area Network (SAN)
A back-end network connecting storage devices via peripheral channels such as SCSI and Fibre Channel. There are two ways of implementing SANs: centralized and decentralized. A centralized SAN ties multiple hosts into a single storage system, which is a RAID device with large amounts of cache and redundant power supplies. The cabling distances allow for local as well as campus-wide and metropolitan-wide hookups over peripheral channels, rather than over an overburdened network. SCSI distances have also been extended. This centralized storage topology is commonly employed to tie a server cluster together for failover.

Fibre Channel is a driving force in the SAN arena because it supports existing peripheral interfaces, as well as network interfaces. Fibre Channel can be configured point to point, in an arbitrated loop (FC-AL), or via a switch. With Fibre Channel, the hosts can talk not only to the storage system via SCSI, but they can also communicate with each other via IP over the same topology. If a centralized storage system is not feasible, a SAN can connect multiple hosts with multiple storage systems.

storage array
An integrated set of storage devices. Storage arrays can be manipulated as one unit, with a single command.

storageset
1. A group of devices configured with RAID techniques to operate as a single container. 2. Any collection of containers, such as stripesets, mirrorsets, striped mirrorsets, JBODs, and RAIDsets.

storage unit
The general term that refers to storagesets, single-disk units, and all other storage devices that are installed in a subsystem and accessed by the host. A storage unit can be any entity that is capable of storing data, whether it is a physical device or a group of physical devices.

StorageWorks Command Console (SWCC)
A graphical user interface (GUI) that provides local and remote management of *StorageWorks* controllers. It is a tool for monitoring, configuring, and troubleshooting storage subsystems. SWCC issues commands and interprets the responses sent by the controller. The user interface displays the logical and physical layout and status of a selected subsystem in graphical form.

surviving controller
The controller in a dual-redundant configuration pair that serves its companion's devices when the companion controller fails.

SWCC
See StorageWorks Command Console.

switch fabric
1. The internal interconnect architecture, used by a switching device, that redirects the data coming in on one of its ports out to another of its ports. 2. The combination of interconnected switches used throughout a campus or large geographic area, which collectively provide a routing infrastructure.

synchronous mode
A mode of operation of the remote copy set whereby the data is written simultaneously to the cache of the initiator subsystem and the cache of the target subsystem. The I/O completion status is not sent until all members of the remote copy set are updated. *See also* asynchronous mode.

target
The site that is set up for data replication. Data processing occurs at the initiator site and data is replicated or copied to the target site. If a significant failure occurs at the initiator site, data processing can be resumed at the target site, where the data is intact. *See also* initiator.

target configuration file
A configuration file at the target site. *See also* configuration file, target.

TCP/IP
Transmission Control Protocol/Internet Protocol. A communications protocol that is the protocol of the Internet and has become the global standard for communications. TCP provides transport functions, which ensure that all bytes sent are received correctly at the other end.

TCP/IP is a routable protocol, and the IP part of TCP/IP provides the routing capability. In a routable protocol, all messages contain not only the address of the destination station, but the address of a destination network. This allows TCP/IP messages to be sent to multiple networks within an organization or around the world, hence its use in the worldwide Internet. Every client and server in a TCP/IP network requires an IP address. *See also* IP address.

this controller
The controller that is serving the current CLI session through a local or remote terminal. *See also* other controller.

unit
A container made accessible to a host. A unit may be created from a single disk drive or tape drive. A unit may also be created from a more complex container, such as a RAIDset. The controller supports a maximum of eight units on each target.

unplanned failover
As applied to the Data Replication Manager, an unplanned outage of the controllers. This may occur when the site communication is lost, or due to some other failure whereby remote copy sets cannot be implemented. The controllers do not perform an orderly shutdown. *See also* planned failover.

verbose display
A screen output displayed while the failover and failback scripts run. The display shows the status of the controller and remote copy sets. A user preference for this type of display is set in a resource (.RC) file created by the failover and failback batch files. *See also* condensed display.

write history logging
As applied to the Data Replication Manager, the use of a log unit to record a history of write commands and data from the host. Write history logging is used for mini-merge and fast-failback. *See also* mini-merge, fast-failback.

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