COMPAQ

Software Product Description

PRODUCT NAME: **HSG80 Data Replication Manager Software Version 8.6-1P** **SPD: 70.90.03**

Description

The HSG80 Data Replication Manager (DRM) Software provides storage controller software capability for the StorageWorks HSG80 Array Controller in Fibre Channel switched fabric environments using remote data replication. Remote replication is defined as data replication from one storage system to another storage system. The distances between the storage systems are determined by the customer's requirements and the chosen topology and infrastructure.

The HSG80 is configured into product offerings which include the RAID Array 8000, the Enterprise Storage Array 12000 storage subsystems and the Modular Array 8000 and Enterprise Modular Array 12000 subsystems and supports topologies using long distance fibre channel and fibre channel over ATM links.

HSG80 Data Replication Manager Software is designed to be common across multiple operating system platforms. However, there may be operational differences between platforms, and there may also be features that are not supported on every platform. Platform dependencies, feature restrictions, and requirements for host software and hardware are shown in the DRM Operations Guide. This guide is free of charge for DRM customers and can be downloaded from the DRM website at:

http://www.compaq.com/products/storageworks/Storage-Management-Software/DataRepindex.html

These kits must be purchased separately, one per operating system type and location.

Data Replication Manager Software (DRM) for HSG80

Description of Data Replication Manager Software

The HSG80 Data Replication Manager Software is the software component of the HSG80 Array Controller when used in switched fabric environments with remote data replication. The HSG80 Array Controller is an intelligent mass storage controller that interfaces between host computer systems using a Fibre Channel bus and attached mass storage devices, using Ultra Wide Single Ended SCSI buses. The software executes in the HSG80 Array Controller; it processes I/O requests from hosts, performing the device-level operations required to satisfy the requests.

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Software Functions

Data Replication Manager software (DRM) includes the following capabilities:

- Data Replication from one Storage System to another
- Synchronous and Asynchronous Copy Operation
- Write History Logging (WHL)
- Fast Failback, for planned failover and failback activity
- Normal or Failsafe modes of operation
- Cluster Support
- Multiple Bus Failover Support
- Host Interconnect and Protocol Services
- Support for up to 84 devices per storage system
- Dual Redundant Controller Operation
- Local program support
- Array Controller Software Storage System Management Services
- Mirrored Write-Back Cache support
- Read Ahead Cache capability
- Disk Mirroring capability (RAID 1)
- Disk Striping capability (RAID 0, 0+1)
- RAID capability (RAID 3/5)
- StorageSet Expansion
- Selective Storage presentation
- Disk Partitioning capability
- Support for 14 drives per SCSI bus
- Support for 96 host connections
- SCSI Device Control
- Asynchronous Disk Swap (Hot Swap)
- Testing and Diagnosis of the HSG80 Array Controller

The following sections describe these capabilities:

Data Replication from One Storage System to Another

Data Replication Manager Software provides a storage-based disaster tolerance and workload migration solution that provides the ability to copy data, in real time, to a remote location, up to 100km away, using direct fibre or further using fibre channel over ATM links. This is done without any host involvement.

The HSG80 dual host port design, when used in DRM configurations, allows for the use of the switched fibre channel topology to accomplish long distance mirroring. This is done through the use of an initiator and target sharing a fibre channel switch connected by a switched Fibre Channel fabric. Data is copied from a local controller directly to another controller at a remote location. This capability provides customers with the ability to maintain the same data at a remote location providing Disaster Tolerance protection.

Synchronous and Asynchronous Copy Operation

In synchronous operation mode, data is simultaneously written to the cache of the initiator subsystem and the cache of the target subsystems. The I/O completion status is not sent to the host until all members of the remote copy set are updated.

In asynchronous operation mode, the write operation is reported to the host as complete before the data is written to the remote unit of the remote copy set. Asynchronous mode can provide improved response time, but the data on all members of the remote copy set will not be an exact copy of the latest data at the local side.

Write History Logging (WHL)

Write History Logging provides a mechanism to log writes to a target controller while there is a link failure. Once configured for WHL, if the links go down, the incoming "writes", are written to the log disk. Once the links are restored, write commands are issued from the log (referred to as "mini-merged") to the target to resynchronize the data. While this process is occurring, any new write operations are appended to the log until the log is emptied. The write operations are issued in the same order in which they were acknowledged to the host.

The Write History Log size is customer settable. Once the log container size is exceeded the customer would need to re-merge to synchronize the data at the target site. By utilizing Write History Logging the customer can substantially reduce resynchronization times by reducing/eliminating the need for a full merge copy of data to the target once the links are restored.

Fast Failback

Fast Failback provides support for manual site failover and failback activities.

Fast Failback utilizes Write History Logging to provide mini-merge of the target "write" data logged during the failover period:

- Mini-merge functionality allows the controller to update only the data that has changed on a re-joined Remote Copy Set (RCS). This may greatly reduce controller overhead and the time required to re-merge RCS during or preparing for a fast failback.
- Fast Failback is supported in Synchronous controller operation.
- The log unit must be configured to support this feature

See the user documentation for configuration support and restrictions.

Normal or Failsafe Modes of Operation

Normal mode can be enabled by the user to process additional I/Os by the host at the initiator site even if the target site has become inaccessible (normal mode enables continuous initiator host processing).

Failsafe mode can be enabled by the user to stall any I/O, whenever the target is inaccessible. The remote copy set is considered Failsafe Locked under this condition, and goes into the inoperative (offline) state. Failsafe mode provides the ability to keep the initiator and target consistent.

Cluster Support

Hosts per site can be configured in a clustered environment using HSG80 Controllers with V8.6-1P. This enables the hosts to share the storage subsystem utilizing the fibre channel bus. Should a failure occur on one host, the storage I/O can be accessed to another functioning host within the cluster.
Refer to the user documentation for configuration support and restrictions.

DRM Multiple Bus Controller Failover

In multiple bus failover, the controller presents units to the host on Host Port "A". Software on the host is responsible for switching to the redundant controller if it cannot access the units.

Host Interconnect and Protocol Services

A single HSG80 Array Controller with DRM software supports multiple hosts at each site, with 2 adapters each, using an optical switch. The HSG80 has two fibre channel host ports per controller; one port is used for host I/O and the other port for communication between the initiator and the target. Check the operating system requirements when configuring the controllers.

See the user documentation for configuration support and restrictions.

Storage System Device Support

HSG80 controllers using Data Replication Manager V8.6-1P provide support for up to 84 devices per storage system.

Dual Redundant Controller Operation

HSG80 controllers using V8.6-1P software must operate as a redundant pair of controllers, configured identically and running identical software versions, including patches, and connected in the same backplane. The array controllers must be in multiple bus failover mode for use in Data Replication Manager configurations.

Local Program Support

The array controller software supports the following local utilities and commands:

CLONE utility for obtaining physical copies of data in concert with Disk Mirroring software. The CLONE Utility cannot be used with partitioned units.

Code Load/Code Patch (CLCP) for controller software changes.

CONFIG for automatically adding new devices to the configuration.

DILX disk inline exerciser (support for local units only).

FMU for displaying controller last failure and memory system failure information as well as control of spontaneous event logging and last failure logging displays.

The array controller software Dynamic Status Display - The array controller software VTDPY utility allows a system manager to view the HSG80-based subsystem state dynamically (terminal port connections are supported at 9600, and 19200bps).

HSUTIL - The HSUTIL utility provides two functions: device format and device code load.

- Device format enables the system manager to perform a basic format operation on a single or multiple disk device(s).
- Device code load provides the functionality to download device firmware onto supported drives via the controller.

Array Controller Storage System Management Services

The controller software provides the following storage system management services:

Alteration of Storage System Parameters

- The array controller software includes a Command Line Interface (CLI) that allows a system manager to display and manipulate controller parameters and device configuration information as required.
- The CLI utility provides type ahead, recall and editing features. Any of the last four commands entered may be recalled and edited.

Environmental Monitor Unit (EMU)

- The array controller software monitors data on the state of the HSG80 controller and subsystem. This data can be reported via CLI and is reported in Environmental Monitor Unit (EMU) LEDs and in some cases activate an audible alarm.

Mirrored Write-Back Cache Capability

The battery or UPS backed write-back cache capability provides the following functions:

Stores data to be written temporarily in the controller non-volatile write-back cache, and, if the mirrored cache option is set, the write-back data is mirrored in the redundant controller cache for fault tolerance. The controller then informs the host that the write request is complete. This feature allows the host to continue working without waiting for data to be written to disk media

Writes the data stored in cache to the disk media based on a least-recently-used cache flushing policy or when a device port has been inactive for a defined period of time

Consolidates contiguously located data blocks from multiple host write requests into a single device request to reduce average latency

On recovery from a single cache failure or power outage, the controller detects that unwritten data still exists in cache and writes it to disk media before enabling normal controller operations.

Read Ahead Cache Capability

If sequential read requests are received from the host, Read Ahead Cache allows the controller to anticipate subsequent read requests and prefetch the next data blocks. This provides read performance optimization.

Disk Mirroring Capability (RAID 1)

The disk mirroring capability provides the following functions:

- Real-time maintenance of up to six identical copies of data on mirrorsets of separate disks attached to a single HSG80 Array Controller
- Protects data against disk failure by replicating all data on each member of the mirrorset. Disk mirroring offers extremely high data reliability
- Captures a designated spare (if one exists) in the event of a mirrorset member disk failure and reconstructs the data of the failed member disk onto it
- The ability to increase or decrease the number of members in a mirrorset as requirements change
- Flexible policy options for determining both how read requests are satisfied and the speed of copying when a new member is being added
- Array controller software disk mirroring can utilize the UNMIRROR command to change MIRRORSETS back to single-disk units

Disk Striping (RAID 0, 0+1)

The array controller software treats sets of disk drives or mirrorsets as stripesets (2 to 24 members up to a maximum stripeset size of 1.024TB) for improved I/O performance through load distribution. A stripeset appears to the operating system as a single virtual disk drive.

Striping of mirrorsets can be used for high-performance access to large amounts of highly available data.

RAID Capability (RAID 3/5)

The RAID capability provides the following functions:

- Manages up to 20 sets of between 3 and 14 disks as RAIDsets (up to a maximum RAIDset size of 1.024 TB). The host views a RAIDset as a single virtual disk. RAIDsets can tolerate the failure of a single member disk without loss of capability to deliver data to hosts.
- Dynamically adjusts between RAID Level 5 and RAID Level 3-like data protection algorithms depending on instantaneous workload.
- Maintains consistency of data and parity across all member disks in a RAIDset. This includes recovery from media errors.
- Detects failure of a single RAIDset member disk and invokes data regeneration algorithms to provide continued data availability to hosts.
- Captures a designated spare (if one exists) in the event of a member disk failure and reconstructs the data and parity of the failed member disk onto it.

Settable chunksize to match RAIDset performance attributes to host I/O profile. For RCS the minimum chunksize is 64 blocks.

For information regarding default chunksize, refer to the HSG80 Array Controller ACS V8.6-1 Installation and Configuration Guide and the HSG80 Array Controller ACS V8.6-1 CLI Reference Guide.

StorageSet Expansion

StorageSet Expansion allows for the joining of two of the same kind of storage container. StorageSet Expansion can be utilized to easily expand a storage container by concatenating RAIDsets, Stripesets or individual disks thereby forming a larger virtual disk, which is presented as a single unit.

The joining of RAIDsets provides the user with the same redundancy and reliability as the individual sets without having to back-up and restore the data. StorageSet Expansion of RAID 3/5 sets provides the same functional capabilities as the original RAID 3/5 sets. In addition to the easy creation of a larger RAIDset, expanded RAIDsets can tolerate the failure of two member disks (a single member out of each original RAIDset) without loss of ability to deliver data to hosts. See the solution documentation for configuration information and restrictions.

Selective Storage Presentation

Selective Storage presentation is a feature of the HSG80 controller that enables the user to control the allocation of storage space and shared access to storage across multiple hosts. This is also known as "Restricting Host Access". In a subsystem that is attached to more than one host or if the hosts have more than one adapter, it is possible to reserve certain units for the exclusive use of certain host connections.

SCSI Bus Drive Support

ACS supports 14 devices per SCSI bus. In a maximum 6-bus configuration, the total drives supported is 84.

Host Connection Support

ACS supports 96 host connections to a single array controller allowing the user to build and manage larger SANs by attaching to up to 24 single servers or 12 clustered pairs.

SCSI Device Control

The controller software converts host I/O requests into device-specific SCSI commands. The software supports concurrent commands and data transfers on multiple SCSI device buses for supported disks.

Array controller software device control functions include the following:

Error Detection and Recovery

The controller software recovers from device errors, including bad block replacement for supported disk drives that do not perform this function for themselves.

For errors on the Fibre Channel host interface, HSG80 Array Controller hardware and the array controller software cooperate to provide the following:

- Automatic retransmission of data, if errors are detected in the original transmission
- Automatic detection of internal data path errors
- Automatic failover of attached devices between HSG80 controllers operating as dual redundant controllers.

Device Integrity Testing
The array controller software executes Device Integrity Test programs upon system manager command. These tests perform the following functions:

- Verify correct operation of individual disk devices and units.
- Place the HSG80 Array Controller under load to verify correct subsystem operation

Error Logging
The array controller software uses SCSI protocol messages to report faulty or failing devices and controller faults to connected hosts that have error logging enabled. In Data Replication Manager configurations, events from remote controllers are communicated to local controllers and then to the host.

Save Configuration on Disk
The array controller software can save device configuration information, HSG80 controller configuration information and controller software patches on to a disk. The stored information can be restored for use by a HSG80 replacement controller. This function is used for HSG80-to-HSG80 controller replacements in non-redundant configurations and certain array controller product upgrades. For additional information refer to the HSG80 Array Controller ACS V8.6-1 Installation and Configuration Guide and to the HSG80 Array Controller ACS V8.6-1 CLI Reference Guide.

Asynchronous Disk Swap (Hot Swap)

ACS supports asynchronous disk swap (also known as Disk Hot Swap). This is defined as disk removal and insertion without regard to a quiescent device bus. Disks can be removed or inserted at any time with some restrictions. Restrictions are noted in the user documentation.

Testing and Diagnosis of the HSG80 Array Controller

Array controller software internal diagnostics execute automatically whenever controller power is turned on, whenever the array controller is reset and periodically during use.

LEDs on the front bezel of the controller provide diagnostic information upon controller failure.

A local serial connection asynchronous I/O port is provided for configuration and diagnosis.

Data Replication Manager Software Hardware Requirements

The Data Replication Manager Software requires an HSG80 Array Controller with 512MB of cache (1.02GB per pair) on which to execute. The HSG80 Array Controller includes six ultra wide single-ended device ports. Up to 84 devices can be supported. Ultra SCSI wide single-ended disks may be attached to the HSG80 Array Controller. The specific devices supported are listed in the *Supported Operating Systems, Adapters, and Devices* section.

Configuration Restrictions

The following configuration restrictions apply:

Data Replication Manager requires a pair (two) identically configured controllers at each site. HSG80 controllers require a minimum Data Replication Manager Software revision level of V8.6-1P for features in this document.

With ACS 8.6-1P, a cache module configured with 512 MB of cache memory is required.

Two controllers in the same controller backplane must be configured as a dual-redundant configuration in multiple bus mode.

A maximum of 84 devices may be configured on a pair of HSG80 with an expansion cabinet.

Switched Fabric configurations only

Supported Operating Systems, Adapters, and Devices

A valid operating system configuration with a supported Fibre Channel interface, as referenced in the following section, is required to operate an HSG80 controller with the array controller software.

Table 1 lists the Windows 2000 and Windows NT on ProLiant and other x86 Systems information.
Table 2 lists the Compaq Tru64 UNIX Hardware, Software, and host platform kit information.
Table 3 lists the Compaq OpenVMS Hardware, Software, and host platform kit information.
Table 4 lists the Sun Solaris Hardware, Software, and host platform kit information.
Table 5 lists the Novell NetWare Hardware, Software, and host platform kit information.
Table 6 lists the Ultra SCSI Wide Disks support information.

Table 1 Windows 2000 and Windows NT on ProLiant and other x86 Systems

Compaq Adapter	Operating System	Adapter Description	Operating System Platform Kit
380574-001	Windows 2000 SP1 or Windows NT 4.0 SP6a	(KGPSA-BC) PCI to Fibre Host Bus Adapter	222322-B21
176479-B21	Windows 2000 SP1 or Windows NT 4.0 SP6a	(KGPSA-CB) PCI to Fibre Host Bus Adapter	222322-B21

Table 2 Compaq Tru64 UNIX

Compaq Adapter	Operating System	Adapter Description	Operating System Platform Kit
168794-B21	5.1	64-bit PCI to Fibre Channel Host Bus Adapter for Tru64 and OVMS	222320-B21
380574-001	5.1	(KGPSA-CA) PCI to Fibre Host Bus Adapter	222320-B21

Table 3 Compaq OpenVMS

Compaq Adapter	Operating System	Adapter Description	Operating System Platform Kit
168794-B21	V7.2-1H1	64-bit PCI to Fibre Channel Host Bus Adapter for Tru64 and OVMS	222321-B21
380574-001	V7.2-1H1	(KGPSA-CA) PCI to Fibre Host Bus Adapter	222321-B21

Table 4 Sun Solaris

Compaq Adapter	Operating System	Adapter Description	Operating System Platform Kit
380576-001	V2.6 (32 bit), V7 & 8 (32bit)	PCI 32-bit to Fibre Host Bus Adapter	222324-B21
123503-001	V7.0 & V8.0 (64bit)	SBUS 64-bit to Fibre Host Bus Adapter	222324-B21

Table 5 Novell NetWare

Compaq Adapter	Operating System	Adapter Description	Operating System Platform Kit
120186-B21	5.1	PCI to Fibre Channel LC Host Bus Adapter (FC-AL and Switch)	222323-B21
223180-B21	5.1	Fibre Host Bus Adapter (FC-AL)	222323-B21

Table 6 Supported Ultra SCSI Wide Disks

Part Number	Device/Model	Capacity GB	Microcode[1]	H/W Rev[2]
176494-B21	BC072638A2	72.8	BDC4	A01
176496-B22	BD03663622	36.4	BDC4	A01
	BD0366349C		3B02/3B06	A01
	BD036635C5		B020	A05
127968-001	DS-RZ1FC-VW	36.4	3B00/2B07/B020/BDC4	A01
147599-001	DS-RZ1FB-VW	36.4	N1H1/0372/1614/3B05	A01
188122-B22	BF01863644	18.2	3B01	A01
188120-B22	BF00963643	9.1	3B01	A01
147598-001	DS-RZ1EA-VW	18.2	3B05	A01
380589-B21	DS-RZ1ED-VW	18.2	0306/1614/3B07/B020/BDC4	A01
380694-B21	DS-RZ1EF-VW	18.2	N1H1/0372	A01
388144-B22	N/A	18.2	3B05	A01
128418-B22	N/A	18.2	B016	A01
142673-B22	BD01862376 BD01862A67	18.2	BCJE B007	A01 A01
147597-001	DS-RZ1DA-VW	9.1	3B05/B020	A01
380588-B21	DS-RZ1DD-VW	9.1	0306/1614/3B07/B020/BDC4	A01

Table 6 (continued)

Part Number	Device/Model	Capacity GB	Microcode[1]	H/W Rev[2]
380595-B21	DS-RZ1DF-VW	9.1	N1H1/0372/1614	A01
123065-B22	N/A	9.1	3B05	A01
328939-B22	N/A	9.1	3B07	A01
142671-B22	BD00962373 BD00962A66	9.1	BCJE B007	A01 A01

[1]Minimum Microcode Version
[2]Minimum Hardware Revision Level

Devices qualified for Compaq support are identified in the Disk Table. Compaq will not assure correct operation of any unqualified device nor assure that such devices when used will not have impact on other supported devices, on the operation of the controller, or on the operation of the system configuration.

ORDERING INFORMATION

HSG80 Data Replication Manager Software kit is available for the HSG80 Controller when utilized in a configuration supporting fibre channel switches with remote data replication. The kit provides the software media containing Data Replication Manager Software, V8.6-1P. A separate kit is required for each HSG80 Array Controller. The DRM kit part number is listed in Table 7 and the solution software kit part numbers are listed in Table 8.

Table 7 HSG80 Data Replication Manager Software Kit Part Number

Part Number	Product Identifier	Description
222316-B21	QB-6CAAA-SA	HSG80 Data Replication Manager Software, V8.6-1P Media, and license package

A co-requisite software kit is an 8.6 operating system platform kit, containing SWCC, and the appropriate installation scripts and drivers for each operating system. One kit is required per location for each operating system supported.

Table 8 HSG80 Solution Software Platform Kit Part Numbers

Part Number	Description
222322-B21	HSG80 Solution Software for Windows NT/Windows 2000 ProLiant and other x86 systems, Media, and License package
222320-B21	HSG80 Solution Software for Tru64 UNIX, Media, and License package
222321-B21	HSG80 Solution Software for OpenVMS, Media, and License package
222324-B21	HSG80 Solution Software for Sun Solaris, Media, and License package
222323-B21	HSG80 Solution Software for Novell NetWare, Media, and License package

The required Data Replication Manager Solution kit is available on the web at: http://www.compaq.com/products/storageworks/Storage-Management-Software/DataRepindex.html. This website allows DRM customers to, free of charge, download:

Data Replication Manager Operating Guide

Failover/Failback Procedures

Data Replication Manager Release Notes

Data Replication Manager Application Notes

SOFTWARE PRODUCT SERVICES

A variety of service options are available from Compaq. For more information, contact your local Compaq office.

Software services for HSG80 Data Replication Manager Solution Software and HSG80 Data Replication Manager Software are covered under the terms and conditions of the Integrated Hardware and Software Customer Service contracts.

Multivendor Customer Services for the HSG80 controller and HSG80 Software are covered under the terms and conditions of the following:

Hardware Customer Service contract

Software Customer Service contract

Software Subscription Service contract

SOFTWARE WARRANTY

HSG80 Data Replication Manager Software is provided with 90-day Telephone Support and 90 days conformance to SPD.

NOTICE