



Software Product Description

PRODUCT NAME: HSC High Performance Software, Version 8.6

SPD 42.81.08

DESCRIPTION

HSC software is the software component of a special-purpose hardware/software set that makes up a Hierarchical Storage Controller (HSC) and associated options. The HSC is an intelligent mass-storage server, interfacing one or more host computer systems to a set of mass-storage devices. HSC software is the software executed within the I/O Control Processor and certain other peripheral processors of the HSC. The hardware models using HSC High Performance Software Version 8.6 are the HSC40, HSC60, HSC65, HSC70, HSC90, and HSC95. HSC High Performance Software Version 8.6 does NOT operate on the HSC50. HSC High Performance Software Version 8.6 is required to use the HSC9X-SX/SZ, SCSI Data Channel.

The HSC is an intelligent subsystem. Together with the devices it controls, it is seen by the host computers as a single high-level entity. The host computers send high-level I/O requests to the HSC subsystem and relegate to the subsystem the responsibility for all low-level operations required to implement the high-level requests. Internally, the HSC subsystem uses programmed processors to direct and to perform its detailed I/O operations.

Features

The HSC software is arranged by function. Major portions of the software include: the Disk Server, which services all I/O requests for disk units; the Tape Server, which services all I/O requests for tape units; the Cache Server, which performs cache lookup and update functions; the Command Disk Server, which routes SCSI commands directly to certain SCSI devices such as media loaders; and the DUP (Diagnostics/Utilities Protocol)

Server, which services the host-to-utility connection.

Multiple Host Connections

The HSC attaches to host computer systems through the Computer Interconnect (CI). The HSC supports connection to the maximum number of CI nodes in any valid VMScluster configuration.

The HSC also supports connections within valid VAX System V or ULTRIX configurations.

Supported Device Types

The HSC connects to mass-storage devices from Digital Equipment Corporation's family of Standard Disk Interface (SDI) drives, and tape devices from Digital's family of Standard Tape Interface (STI) drives. The HSC also supports devices from Digital's family of SCSI RZ disks, SW disks, EZ solid state disks and SCSI tapes. If the HSC is dedicated to disk support, and the HSC9X-SF 4 shelf SCSI Array is used, the maximum number of ports for SDI/SCSI disk devices are: HSC40, 12 SDI/21 SCSI; HSC60/65, 20 SDI/21 SCSI; HSC70, 32 SDI/52 SCSI; HSC90/95, 48 SDI/52 SCSI; and the Rackmount HSC95 48 SDI/56 SCSI, respectively. Combinations of SDI/STI and SCSI devices can also be configured as described below.

STI and SCSI tapes connected to HSCs have two software restrictions that must be observed: the maximum number of ports allowable for tape per HSC (24), and the maximum number of drives (masters and slaves) supported by the HSC software (24). The maximum number of ports allowed by the HSC hardware/software for STI/SCSI tape devices are: HSC40/60/65 (dedicated to tape support), 12 STI/12 SCSI; HSC70/90/95 24 STI/24 SCSI; and the rackmount HSC95 24 STI/24 SCSI,

respectively. The TA81, TA8x7, and SA10x tape formatters can connect only one tape unit per port (formatter), while the TA7x, TA9x, and SCSI formatters can connect up to four units per port (formatter).

HSC High Performance Software Version 8.6 operates SCSI disks in both single-path and dual-path modes; SCSI tapes are operated in single-path mode only.

The HSC allows users to attach different mixes of Digital SDI disks, STI tapes, and SCSI disks and tapes given the limitation of the data channel modules (four ports each for HSC5X-BA/CA/DA, eight ports for the HSC9X-FA and seven targets for the HSC9X-SX/SZ), with up to a maximum of eight data channel modules on an HSC70, HSC90, and HSC95, and up to a maximum of three data channel modules on an HSC40, HSC60, and HSC65. The four lowest requester slots on the standalone HSCs may be used for the SCSI Data Channel Module HSC9X-SX/SZ. With the HSC9X-SE Standalone HSC Extension I/O Bulkhead, up to eight SCSI Data Channel Modules may be used in the Standalone HSC. The rackmount HSC95 can use up to eight SCSI Data Channel Modules.

In HSC High Performance Software Version 8.6, the only qualified SCSI disks specified and eligible for software service support are the RZ26, RZ26L, SWXD3-SC RZ26N, SWXD3-SF, RZ28, RZ28B, RZ28D, SWXD3-SG, RZ28M, SWXD3-SH, RZ29B, SWXD3-SE, RZ74, EZ31, EZ32, EZ51R, EZ54R, EZ58R, EZ64, EZ69, RRD42, RRD43, RRD44 and RRD45. In addition, the only qualified SCSI tapes specified and eligible for software service support are TZ86, TZ867, TZ87, TZ87N, TZ875, TZ877, TZ88, TZ887, TLZ06, TLZ6L, TLZ09, TSZ07, TKZ60, TKZ09, TKZ15 and STK4220. V8.6 also provides support for the following tape and optical disk libraries: the TL810, TL820 and the RW524, RW530, RW534 and RW536. Optical media supported by HSC software V8.6 are read-only and write-many; write-once/read-many (WORM) media is not supported.

Note: SW-drives are supported as qualified devices and are identified by HSC High Performance Software as an unknown device type.

Digital supports only devices specifically stated as qualified in this Software Product Description (SPD). DIGITAL DOES NOT WARRANT, EITHER EXPRESS OR IMPLIED, NON-SPECIFIED PRODUCTS WITH RESPECT TO FUNCTIONALITY, OPERATABILITY OR COMPATIBILITY AT THE DEVICE, SUBSYSTEM, SYSTEM OR CLUSTER LEVEL. Any problems arising from non-specified and non-qualified configurations are the customer's responsibility.

The interaction between the HSC and the drive is entirely parameter-driven, the drive specifying its characteristics to the HSC when connected.

Optimized Device Management

HSC software converts host requests into device-specific requests. It manages the physical activity of the drives, supporting parallel transfers on multiple data channels. The HSC also implements deep buffering (the ability to interpret and prepare for transfer) of host commands.

The HSC disk and tape servers ensure systemwide fairness by managing internal resources. These servers overlap CI activity with device activity. The HSC disk server also provides user control of parameters that may be user-workload specific.

For SDI disk units, the HSC disk server performs several optimizations:

- Overlapped Seeks - while one drive is transferring data, other drives on the same requestor may be seeking. Minimizes seek time.
- Seek Ordering - the HSC can reorder commands to optimize the seek profile of a drive, altering the seek algorithm used for a drive depending on the I/O load. Minimizes seek time.
- Rotational Position Sensing - each requestor monitors the rotational position of its drives so that it may initiate I/O to the drive that is closest to the requested position. Minimizes rotational latency.
- Request Fragmentation - a single large request may be fragmented into several smaller requests which may then be reordered to take advantage of the current rotational positioning of the drive. Minimizes rotational latency.

The SCSI Data Channel Card (HSC9X-SX/SZ) maintains a pipeline on a per-disk basis to ensure data prefetching and overlapped seeks. Attached SCSI disks maintain an ordered work queue, obtaining the attention of the HSC9X-SX/SZ only when they are ready to transfer. The disk server generates work fragments that enable the HSC9X-SX/SZ and drive to work efficiently. Attached SCSI drives generally resequence work requests performing seek optimizations internally.

For tape units, the HSC supports overlapped positioning and other non-transfer commands on multiple drives, even when transfers are in progress.

To provide reserve processing power for peaks and bursts in the I/O workload and consistently high performance, the HSC controller should be routinely operated at no more than 80% busy as shown in the "%Idle" metric of the VTDPY display. If an HSC controller's reserve is significantly less than 20 percent, improved performance may be seen by moving some of the busier drives to another HSC controller.

Error Detection and Recovery

The HSC and the devices connected to it (hosts as well as disk and tape units) perform autonomous error recovery actions whenever a device error is detected.

Included for host interface detection are:

- Automatic retransmission of data detected as being in error
- Automatic retransmission on an alternate host path if the primary path fails
- Automatic detection of subsystem internal data path errors
- Thresholding of subsystem internal memory errors

For disk transfers, the HSC automatically:

- Corrects up to 8 errors (of up to 10 bits each) or one 80-bit error in each sector on SDI disks
- Retries erroneous reads
- Replaces bad blocks and redirects subsequent reads and writes to their replacements
- Detects and recovers some mechanical failures (such as mis-seeks)

For tape transfers, the HSC participates in formatter-directed recovery, permitting use of specific retry algorithms that are device dependent.

Cache Features

HSC Cache reduces data retrieval time by eliminating the delays associated with seeking data on electromechanical disk devices. When requested data is found in the HSC Cache—a read "hit" – an access to the disk is not required. The result is a significant reduction in response time from the HSC.

HSC Cache is a volatile high-speed memory. HSC software V8.6 utilizes the full capacity of the installed cache module—the 64MB cache module in all HSC65 and HSC95 controllers and the optional 32MB cache module in the HSC60 and HSC90 controller models. HSC Cache is not supported on the HSC50, HSC40 or HSC70.

The HSC Cache implements a write-through cache policy whereby all disk write operations update data on the disk device before updating cache and being acknowledged to the host as complete. This eliminates the possibility of exposing data to loss due to power failures or other cache failures. In the event of a controller failure, HSC Cache will be flushed.

The user may designate which disks will participate in cache. Tools are provided to assist the user in selecting SDI disks likely to benefit from being cached. The user may also tune cache by adjusting a variety of HSC Cache parameters.

Device Integrity Test Ability

The HSC executes Device Integrity Test programs while continuing to service host requests. This capability is employed in three ways:

- Automatic Device Integrity Tests that are automatically executed when the HSC detects that one of its components (disk, tape, or HSC-internal devices) may be malfunctioning
- Demand Device Integrity Tests that are executed upon the direction of the operator
- Periodic Device Integrity Tests that automatically check certain functions of HSC components at regular intervals

Error Logging

Unrelated to a specific self-test, the HSC provides information describing faulty or failing disk or tape devices. The information is reported via messages to the HSC console device and messages reported over the CI to all hosts that have the device on-line or to the host that issued the failing command depending on the type of error. In addition, the HSC uses the same mechanism to report errors of faulty or failing modules within the HSC.

Errors relating to transfers (host read or write requests) and non-transfer related errors are based on severity. Depending on the error, the severity is either based on a predetermined setting or set during run time. The messages displayed on the HSC console can be limited to specific levels of severity if desired.

Volume Backup and Duplication

The HSC can perform a disk-to-tape volume backup and a tape-to-disk volume restore. This can be completely relegated to the HSC, and need not occupy or consume host CPU and memory resources.

The HSC can also perform disk duplication between disks connected to the same HSC, copying an SDI/SCSI disk device to a like device.

Shadowing

At host request, the HSC can maintain identical data on a set of disk drives (of like model and mode and with identical geometry) during ongoing host I/O operations. For shadowing specifications, refer to the operating system's Software Product Description (SPD).

HSC Software Version 8.6 supports Volume Shadowing Phase II on both SDI and SCSI disks. Volume Shadowing Phase I is supported on SDI disks only.

Alteration of Subsystem Parameters

As part of HSC Software, the SETSHO utility allows the user to alter and display parameters that control internal operation, as well as to display configuration-related information. The SCTSAV utility allows HSC parameters from recent HSC software releases to be saved and used with new software versions.

Dynamic Status Display

The utility VTDPY allows the user to view the status of critical system operation and parameters dynamically. This program can run on VT200, VT300, and VT400 Series video terminals.

HARDWARE REQUIREMENTS

HSC Software is required for models HSC40, HSC60, HSC65, HSC70, HSC90, or HSC95.

To perform I/O operations to a disk or tape unit, an HSC5X-BA Disk Data Channel, HSC5X-CA Tape Data Channel, HSC5X-DA Disk/Tape Data Channel, HSC9X-FA Disk Data Channel, or HSC9X-SX/SZ SCSI Data Channel is also required.

To perform HSC data caching, the HSC6X-BA/BB (32MB cache option for the HSC60) and HSC9X-BA (32MB cache option for the HSC90) or the HSC65 or HSC95 with embedded 64MB cache are required. V8.6 supports the full 64MB of cache memory resident in all HSC65 and HSC95 Controllers.

A SCSI Ready Back Door and three SCSI I/O bulkheads are available to change or increase the maximum number of SCSI Data Channel cards in an HSC.

- HSC9X-SA SCSI-Ready Back Door for Standalone HSC40/60/70/90
- HSC9X-SC Rackmount HSC 100% SCSI I/O Bulkhead
- HSC9X-SD Rackmount HSC 50% SCSI I/O Bulkhead
- HSC9X-SE Standalone HSC 100% SCSI I/O Bulkhead

Two SCSI Array Starter Kits are available for the Standalone HSC controller to allow the installation of Storage-Works BA350-SA shelves in the top of the Standalone HSCs.

- HSC9X-SS Standalone HSC SCSI Array Starter Kit (2 Shelf connections)

- HSC9X-SF Standalone HSC SCSI 4 Shelf Array Starter Kit

The HSC Software supports Disk, Tape, or SCSI Data Channels in any valid module combination (based upon maximum configuration restriction) up to a maximum of three (for HSC40/60/65) or eight modules (for HSC70/90/95) as described in the following table.

Table 1
Maximum Module Configurations for Disks

HSC Type	Max. No. SDI Ports	Max. No. SDI/SCSI	4-Port Modules	8-Port Modules	7-Target SCSI Modules
HSC40	12	21	3	0	3
HSC60	20	21	1	2	3
HSC65	20	21	1	2	3
HSC70	32	52	8	0	8
HSC90	48	52	4	4	8
HSC95	48	52	4	4	8
RM HSC95	48	56	4	4	8

Note: Configuration guidelines for the HSC are provided in the *HSC User's Guide*, Chapter 5.

Host Node Hardware and Software Required

A valid VAX VMS, OpenVMS VAX, OpenVMS AXP, ULTRIX, or VAX System V configuration with CI hardware connection is required. A Digital Customer Service representative can advise which software version and hardware revisions are currently supported for HSC.

HSC Software Version 8.6 does not support HSC50. Support for the HSC50 is provided by a separate software release. (Refer to the Software Product Description for HSC50 Software Version 4.1, SPD 32.96.xx.) In addition, HSC software Version 8.6 does not support 36-bit systems. (Refer to the Software Product Description for HSC Software TOPS-10/20, Version 3.60, SPD 38.05.xx.)

OPTIONAL HARDWARE

Optional hardware for the HSC40/70 consists of the data channel cards HSC5X-BA/CA/DA and HSC9X-SX/SZ.

Optional hardware for the HSC60/65/90/95 consists of HSC5X-BA/CA/DA, HSC9X-FA, and HSC9X-SX/SZ data channel cards, the HSC6X-BA/BB cache option for the HSC60, and the HSC9X-BA cache option for the HSC90.

Optional SCSI Hardware for the HSC40/60/65/70/90/95 consist of three SCSI I/O bulkheads to change or increase the of SCSI Data Channel cards supported in an HSC and two SCSI Array Starter Kits for the standalone HSC to allow the installation of up to four StorageWorks BA350-SA shelves in the top of the standalone HSCs.

- HSC9X-SC Rackmount HSC 100% SCSI I/O Bulk-head
- HSC9X-SD Rackmount HSC 50% SCSI I/O Bulk-head
- HSC9X-SE Standalone HSC 100% SCSI I/O Bulk-head
- HSC9X-SS Standalone HSC SCSI Array Starter Kit (2 Shelf connections)
- HSC9X-SF Standalone HSC SCSI 4 Shelf Array Starter Kit

SOFTWARE REQUIREMENTS

HSC Software Version 8.6 requires the OpenVMS VAX Version 5.5-2 Operating System or higher.

Device	HSC Software	Minimum OpenVMS VAX	Minimum OpenVMS Alpha	ULTRIX
HSC9X-SX/SZ	V8.6	V5.5-2	6.1	-
HSC40/60/65/70/90/95	V8.6	V5.5-2	6.1	-

OPTIONAL SOFTWARE

HSC Cache Need Analysis and HSC Cache Performance Analysis Tools are included on this release media and are covered by the standard HSC High Performance Software License.

HSC SPMformat, Selectable Pattern Multipass Format Utility, may be purchased and used in conjunction with Version 8.6. HSC SPMFormat allows the reformatting of SDI disks to meet Defense Investigative Services requirements for declassifying media. The part number for the HSC SPMFormat Media and Documentation Kit is QA-0WDAA-H7 (SPD 48.23.xx).

DISTRIBUTION MEDIA

This software is distributed on RX33 diskettes.

ORDERING INFORMATION

The purchase of the HSC40, HSC60, HSC65, HSC70, HSC90, or HSC95 includes the license and media for HSC High Performance Software Version 8.6.

HSC High Performance Software may be ordered with the following part numbers:

Software Media and Documentation Kit:

QA-NBKAA-H7

Software Licenses: QL-NBKA9-AA

Software Product Services: QT-NBKA*-*

For additional information on available licenses, services, and media, refer to the appropriate price book or file.

SOFTWARE LICENSING

This software is furnished under the licensing provisions of Digital Equipment Corporation's Standard Terms and Conditions. For more information about Digital's licensing terms and policies, contact your local Digital office.

SOFTWARE PRODUCT SERVICES

Multivendor Customer Service for the HSC Hardware and HSC High Performance Software is covered under the terms and conditions of the following:

Hardware Customer Service contract

Software Customer Service contract

Media and Documentation Distribution Service (MDDS) contract

Software Service is covered under the terms and conditions of the Integrated Hardware and Software Customer Service Contracts. For more information, contact your local Digital office.

SOFTWARE WARRANTY

Warranty for this software product is provided by Digital with the purchase of a license for the product. This product carries a 1 year conformance to SPD warranty.

The above information is valid at time of release. Please contact your local Digital office for the most up-to-date information.

TM The DIGITAL Logo, CI, DEC, Digital, HSC, HSC40, HSC50, HSC60, HSC70, HSC90, OpenVMS, RX33, RZ, SDI, STI, StorageWorks, TA, TOPS-10, TOPS-20, ULTRIX, VAX, VAX System V, VMS, VMScluster, VT300, and the Digital logo, are trademarks of Digital Equipment Corporation.

©1996 Digital Equipment Corporation. All Rights Reserved.