Software Product Description

PRODUCT NAME: HP OpenVMS Version 8.4 for Integrity and Alpha servers
SPD 82.35.14

Note:

The OpenVMS VAX information is included in the *HP OpenVMS Operating System for Alpha Version 7.3-1 and 7.3-2, and VAX Version 7.3 Software Product Description* (SPD 25.01.xx).

This SPD describes the HP OpenVMS Operating System software for the AlphaServer and Integrity server computer families. Except where explicitly noted, the features described in this SPD apply equally to AlphaServer and Integrity server systems. HP OpenVMS operating system licenses and part numbers for the two platforms are architecture specific. For further details, see the Ordering Information section of this SPD.

DESCRIPTION

OpenVMS is a general-purpose, multiuser operating system that runs in both production and development environments. Starting with OpenVMS Version 8.2, HP introduced support for OpenVMS for Integrity servers. OpenVMS Version 8.4 continues support for all of the Integrity servers and options supported in previous versions of HP OpenVMS for Integrity servers. For Alpha systems, OpenVMS Version 8.4 replaces Version 8.3; for Integrity servers, Version 8.4 replaces Version 8.3-1H1. Standard support for OpenVMS Version 8.3-1H1 on Integrity systems continues when OpenVMS version 8.4 ships.

OpenVMS Alpha supports Hewlett-Packard's AlphaServer series computers. OpenVMS software supports industry standards, facilitating application portability and interoperability. OpenVMS provides symmetric multiprocessing (SMP) support for multiprocessing systems.

The OpenVMS operating system can be tuned to perform well in a wide variety of environments. This includes combinations of compute-intensive, I/O-intensive, client/server, real-time, and other environments. Actual system performance depends on the type of computer, available physical memory, and the number and type of active disk and tape drives.

The OpenVMS operating system has well-integrated networking, distributed computing, client/server, multiprocessing, and windowing capabilities. It contains extensive features that promote ease-of-use, improve the productivity of programmers, and facilitate system management.

For information about the OpenVMS Version 8.4 new features, see the *HP OpenVMS Version 8.4 New Features and Documentation Overview* at:

http://www.hp.com/go/openvms/doc/

USER ENVIRONMENT

Users can access the OpenVMS software by using the English-like DIGITAL Command Language (DCL), the command language for OpenVMS that is supplied with the system. DCL commands provide information about the system and initiate system utilities and user programs. DCL commands take the form of a command name followed by parameters and qualifiers.

Users can enter DCL commands at a terminal or include them in command procedures. These command procedures can be run interactively or submitted to a batch queue for later processing. Information about DCL and OpenVMS utilities is available on line through the OpenVMS Help system.

With OpenVMS Version 8.4, DCL commands and qualifiers have been enhanced to support upto 16 parameters as command line input with command procedures. For more details on DCL enhancements, see the HP OpenVMS Version 8.4 New Features and Documentation Overview guide.

For users who are familiar with the UNIX shell and utilities, an open source port of GNV is available. GNV implements a UNIX environment on OpenVMS and includes an Implementation of the UNIX shell BASH (Bourne Again Shell) and many UNIX-shell utilities.

The following tools and utilities are integrated into the OpenVMS operating system.

Text Processing

The Extensible Versatile Editor (EVE) is the default editor for OpenVMS. EVE allows users to insert, change, and delete text quickly. EVE is a full-screen editor that allows users to scroll through text on a terminal screen. EVE provides an EDT-style keypad, allowing EDT users to move easily to EVE.

Mail Utility

The Mail utility allows users to send messages to any other user on the system. Multinode operation is available if a DECnet or TCP/IP product is installed and licensed on each participating node on the network.

With OpenVMS 8.4 Mail Headers can have upto 998 characters and the mail forwarding entry limit is increased from 31 to 255

Command-Level Programming

Command-level programming allows users to create special files, called command procedures, that contain a series of DCL commands. When users execute a command procedure, the system processes the commands in the command procedure consecutively.

User Environment Tailoring

Users can customize the computing environment with login command procedures, shorthand commands, binding of commands to function keys, and command recall and editing.

PROGRAM DEVELOPMENT ENVIRONMENT

OpenVMS includes a comprehensive set of tools for developing programs, including: run-time libraries (RTLs), a linker, a librarian, and a symbolic debugger.

The following tools are available to the OpenVMS programmer.

Java™ SE Development Kit

The Java Platform, Standard Edition Development Kit (JDK) provides a development and deployment environment for Java applications on OpenVMS Alpha and OpenVMS for Integrity servers, including a set of basic development tools and a rich set of class libraries.

Language and Run-Time Library Support

OpenVMS includes several RTLs that provide:

- String manipulation
- Parallel processing support
- I/O routines
- I/O conversion
- Terminal-independent screen handling
- Date and time formatting routines
- Highly accurate mathematical functions
- Signaling and condition handling
- Other general-purpose functions

With OpenVMS Alpha, these routines can be called from programs written in such languages as MACRO-32, MACRO-64, Ada, BASIC, C, C++, COBOL, Fortran, Pascal, and PL/I.

With OpenVMS for Integrity servers, these routines can be called from programs written in such languages as MACRO-32, BASIC, C, C++, COBOL, Fortran, and Pascal.

Also included in OpenVMS are language-support libraries. While each language is different, all provide support for sequential file I/O, and most support direct and indexed file I/O. Language RTLs also provide support for I/O formatting, error handling, and in Fortran, the ability to read unformatted files that contain data from other vendors.

RTLs are provided to support translated images created from user-mode images built on OpenVMS Alpha Version 6.1 through Version 7.3-2.

Calling Standard

Many HP languages adhere to the common calling standard. This means that routines written in any of these languages can directly call routines written in any other language. Development of applications using multiple languages is simple and straightforward.

All user-accessible routines in the RTLs follow the appropriate platform calling standard and condition-handling conventions, and most are contained within shareable images.

At a lower level, programs can call system services directly for security, event flag, asynchronous system trap, logical name, record and file I/O, process control, timer, time conversion, condition handling, lock management, and memory management. Again, system services use the appropriate platform calling standard and condition-handling conventions.

OpenVMS supports the execution of user-mode images created on earlier versions of OpenVMS. Typically, recompiling and relinking are not required.

MACRO Compiler

With minor modifications, VAX MACRO-32 sources can be compiled for execution on Alpha or Integrity servers.

POSIX Threads Library

OpenVMS includes a user-mode, multithreading capability called POSIX Threads Library. POSIX Threads Library provides a POSIX 1003.1-1996 standard style threads interface. Additionally, POSIX Threads Library provides an interface that is the OpenVMS implementation of Distributed Computing Environment (DCE) threads as defined by The Open Group.

POSIX Threads Library is a library of run-time routines that allows the user to create multiple threads of execution within a single address space. With POSIX Threads Library Kernel Threads features enabled, POSIX Threads Library provides for concurrent processing across all CPUs by allowing a multithreaded application to have a thread executing on every CPU (on both symmetric and asymmetric multiprocessor systems). Multithreading allows computation activity to overlap I/O activity. Synchronization elements, such as mutexes and condition variables, are provided to help ensure that shared resources are accessed correctly. For scheduling and prioritizing threads, POSIX Threads Library provides multiple scheduling policies. For debugging multithreaded applications, POSIX Threads Library is supported by the OpenVMS Debugger. POSIX Threads Library also provides Thread Independent Services (TIS), which assist in the development of thread-safe APIs.

Librarian Utility

The Librarian utility permits storage of object modules, image files, macros, help files, text files, or any general record-oriented information in central, easily accessible files. Object module and image file libraries are searched by the linker when the linker finds a reference it cannot resolve in one of its input files. Macro libraries are searched by MACRO-32 and MACRO-64 when either finds a macro name that is not defined in the input file.

Hypersort

Hypersort is a portable library of user-callable routines that provide a high-performance sorting capability for Alpha and Integrity servers.

Traceback Facility

When an application is compiled and linked with traceback information, the Traceback facility translates stack frame addresses into routine names and line numbers and displays a symbolic traceback whenever a runtime error occurs in that application.

Debugger

The OpenVMS Debugger allows users to trace program execution, as well as display and modify register contents using the same symbols that are present in the source code.

The debugger contains a heap analyzer feature that displays a graphic view of memory allocations and deallocations in real time.

System Code Debugger

The OpenVMS System Code Debugger is a kernel code debugger. It allows a system code developer to trace the execution of nonpageable system code at any interrupt priority level (IPL). Based on the OpenVMS Debugger, the System Code Debugger uses the same interface and most of the same command set.

System Dump Analyzer (SDA) Utility

In the event of a system failure, OpenVMS writes the contents of memory to a preallocated dump file. This dump file can later be analyzed using System Dump Analyzer (SDA). System dumps can either be full memory dumps, where all memory is written, or selective memory dumps, where only portions of memory in use at the time of the system failure is written. The dump file can be located on any locally connected disk. On Alpha and Integrity servers, dump compression allows both full and selective dumps to be written to smaller files than required for uncompressed dumps. Full memory dumps, if not compressed, require a dump file big enough to hold all memory. Selective memory dumps write as much of the memory in use at the time of the system failure that will fit into the dump file.

Spinlock Tracing Utility

The Spinlock Tracing Utility provides a mechanism for characterizing spinlock usage and can collect performance data for a given spinlock on a per-CPU basis.

Process Dumps

When an application fails, a copy of its registers and memory can be written to a data file, which can be examined using the ANALYZE PROCESS utility. This utility uses the same interface and commands as the OpenVMS Debugger to allow registers and memory to be examined. On Alpha or Integrity servers, another process can initiate the writing of the memory dump.

RMS File Utilities

Record Management Services (RMS) file utilities allow users to analyze the internal structure of an RMS file and tune the I/O, memory, space and performance parameters of the file. The RMS file utilities can also be used to create, load, and reclaim space in an RMS file. For more information about RMS, see the Operating System Environment section of this SPD.

File Differences Utility

This utility compares the contents of two files and lists those records that do not match.

Translated Image Environment (TIE) (Alpha)

OpenVMS Alpha provides an array of services that allow the operation of programs which have undergone binary translation from OpenVMS VAX images. These programs perform virtually all user-mode functions on OpenVMS Alpha and operate in combination with other programs (images) that have been translated from OpenVMS VAX or have been built using native compilers on OpenVMS Alpha. Without requiring special source code, the TIE resolves differences between the VAX and Alpha architectures, including floating-point registers, condition codes, exception handling, and ASTs. The TIE included with OpenVMS Alpha can run images that have been translated elsewhere.

For additional information, see the following website: http://h71000.www7.hp.com/commercial/cace.html (under the Tools section)

Translated Image Environment (TIE) (Integrity servers)

OpenVMS for Integrity servers provides an array of services that allow the operation of programs which have undergone binary translation from OpenVMS Alpha images or VESTed OpenVMS VAX images. These programs perform virtually all user-mode functions on OpenVMS for Integrity servers and operate in combination with other programs (images) that have been translated from OpenVMS Alpha or VAX, or have been built using native compilers on OpenVMS for Integrity servers. Without requiring special source code, the TIE resolves differences between the Alpha and Integrity architectures, including floating-point.

For additional information, see the following website: http://h71000.www7.hp.com/commercial/cace.html (under the Tools section)

VIRTUALIZATION ON OPENVMS

OpenVMS for Integrity servers Version 8.4 is supported as a guest operating system on HP Integrity Virtual Machines (Integrity VM). Integrity VM is a soft partitioning and virtualization technology within the HP Virtual Server Environment, which enables you to create multiple virtual servers or machines with shared resourcing within a single HP Integrity server or nPartition.

OpenVMS as a guest operating system supports the following features:

- The OpenVMS guest OS is SMP enabled and supports up to 64 GB physical memory.
- The OpenVMS guests support virtualized disk drives and network interfaces provided by Integrity VM. Integrity VM presents disks and logical volumes as SCSI disks (DK devices on OpenVMS guests) and virtual network interfaces as Intel Gigabit Cards (EI devices on OpenVMS guests) regardless of the physical network card or mass storage connection for the host system.
- Limited support for online migration - supports only the stand-alone guest configurations.
- Supports Accelerated Virtual IO (AVIO) LAN and SCSI drivers.
- Supports management and monitoring of OpenVMS guest operating system using the VSE suite of products.

ID-VSE for OpenVMS

The HP Insight Dynamics - Virtual Server Environment (ID-VSE) is an integrated suite of multiplatform products that helps you to continuously analyze, and optimize physical and virtual server resources. It helps you to reduce the cost associated with capacity and energy planning, provisioning, upgrades, and making changes in your data center. ID-VSE integrates with HP Systems Insight Manager (HP SIM) running on a central management station (CMS), and manages one or more managed nodes in your network. The following suite of ID-VSE products are supported on OpenVMS Version 8.4:

HP Virtualization Manager

The Virtualization Manager software provides a framework for visualizing your virtual server environment (VSE) at different levels of detail.

HP Capacity Advisor

The Capacity Advisor software provides capacity analysis and planning to help optimize the workloads across VSE for the highest utilization of server resources.

HP Global Workload Manager

HP Global Workload Manager (gWLM) is a multisystem, multi-OS workload manager that serves as an intelligent policy engine in the VSE software.

For additional information, see the OpenVMS Version 8.4 New Features and Documentation Overview guide.

SYSTEM MANAGEMENT ENVIRONMENT

OpenVMS provides a set of tools and utilities that aid the system manager in configuring and maintaining an optimal system as follows:

Web-Based Enterprise Management Services for OpenVMS

Web-Based Enterprise Managment (WBEM) Services for OpenVMS is an industry standard for monitoring and controlling resources. It is available and installed automatically with OpenVMS on Integrity server systems. WBEM Services for OpenVMS (WBEMCIM) is required for use of such features as Instant Capacity (iCAP), Temporary Instant Capacity (TiCAP), and for products such as Global Workload Manager (gWLM), and HP Systems Insight Manager (HP SIM). In addition, WBEM Providers for OpenVMS is installed automatically with OpenVMS for Integrity servers.

With Version 8.4, WBEM providers will be supported on BL860c and BL870c blade servers to manage and monitor them by communicating with HP SIM management agents. For server blade support, "Providers" are included that enable the monitoring of hardware and the operating system, including:

- Operating system
- Computer system
- Process and processor statistics
- Indication (monitors events)
- Firmware version
- Fan and power supply
- Management Processor
- CPU instance
- Memory instance
- Enclosure

Provisioning OpenVMS Using HP Systems Insight Manager

Provisioning is the process of installing or upgrading an operating system. With provisioning support, HP SIM installs or upgrades OpenVMS quickly and easily on one or more servers in the network. You can install or upgrade OpenVMS on up to eight servers simultaneously. Provisioning support also facilitates installing or upgrading OpenVMS on Integrity servers and server blades that do not include a CD/DVD drive.

HP Systems Insight Manager (HP SIM) is the foundation for HP's unified server-storage management strategy. It provides simplified, centralized management of multiple servers and platforms through a web-based, unified ("single-pane-of-glass") interface. HP SIM offers the basic tools needed to identify, discover, monitor and deploy systems and other assets on the network. The core HP SIM software uses WBEM to deliver essential capabilities required for managing HP server platforms.

HP SIM running on an HP ProLiant server with Microsoft Windows supports provisioning of OpenVMS on both HP Integrity rx3600 and rx6600 servers, and on HP Integrity BL860c Server Blades.

HP SIM can be activated from a browser on a PC. An OpenVMS plug-in must be installed on the ProLiant server. Once HP SIM initiates the provisioning, the installation or upgrade process occurs automatically in the background. To provide provisioning over the network, use HP SIM in conjunction with the InfoServer software utility (and TCP/IP Services for OpenVMS).

Provisioning can also be accomplished with vMedia. An ISO image of the OpenVMS OE DVD is created and stored on the server where HP SIM is running. HP SIM then connects vMedia to that image. Using vMedia one server can be provisioned at a time. Currently, HP SIM provisioning does not support booting from a shadowed system disk. You can deploy vMedia independently of HP SIM to install or upgrade a server over the network.

For more information about OpenVMS Provisioning see:

http://www.hp.com/go/openvms/provisioning

HP Availability Manager

HP Availability Manager is a system management tool that enables you to monitor one or more OpenVMS nodes on an extended local area network (LAN) from either an OpenVMS Alpha system, or an OpenVMS for Integrity server system, or a PC running Windows®. This tool helps system managers and analysts target a specific node or process for detailed analysis and also can resolve certain performance or resource problems. It is the multiplatform replacement for the DECamds product and includes the DECamds functionality in its capabilities.

For OpenVMS Version 8.4, Availability Manager has a wide-area capability whereby any system on the network supporting Availability Manager can be managed from a central console. Moreover, Availability Manager is enhanced to support Cluster over IP to manage and monitor LAN or IP path data, and IP interface for cluster communication.

The Data Collector, part of the Availability Manager product, collects system and process data on an OpenVMS node and should be installed on each node that you need to monitor (Alpha and Integrity servers).

The Data Analyzer analyzes and displays the data collected by the Data Collector, and can analyze and display data from many OpenVMS nodes simultaneously (OpenVMS Alpha nodes, and PCs running Windows).

Hardware recommendations and related documentation are available on the OpenVMS System Management web page located at:

http://www.hp.com/products/openvms
/availabilitymanager/

DECamds

DECamds is in maintenance mode and is not available on OpenVMS Version 8.2 or higher. Availability Manager replaces DECamds. DECamds installs and runs on VAX from V6.2 through V7.3 and Alpha from V6.2 through V7.3-2.

DECamds is not supported on OpenVMS for Integrity servers and will not install on OpenVMS Alpha Version 8.2 or higher.

HP OpenView Agents on OpenVMS

The following are the OpenView Agents on OpenVMS:

- HP Operations Manager Agents

HP Operations Manager is a comprehensive management solution that monitors, controls, automates corrective actions and reports on the health of all parts of the managed IT infrastructure. HP Operations Manager Agent for OpenVMS allows you to integrate OpenVMS systems into the HP Operations Manager environment, in order to establish a comprehensive end-to-end management solution. HP Operations Manager Agent for OpenVMS, are installed on managed OpenVMS systems and provide remote intelligence for collecting, aggregating, and monitoring information from a variety of information sources.

- HP OpenView Performance Agents

OpenView Performance Agent (OVPA) for OpenVMS collects, summarizes, time stamps, and detects alarm conditions on resource data across your system; this includes both current and historical data. OVPA provides performance, resource, and end-to-end transaction response time measurements and supports network and database measurement information.

Performance Data Collector

Performance data for an AlphaServer or Integrity server system can be gathered using the Performance Data Collector (TDC). By default, TDC periodically collects and stores data in a file that can be retrieved by user applications. A TDC Software Developers Kit (SDK) supports integration of TDC with new or existing applications and allows processing of "live" data as well as data read from files. TDC Version 2.2 runtime software is installed with OpenVMS Version 8.3-1H1.

Performance Data Collector runtime software (TDC_RT Version 2.2) is installed with OpenVMS Version 8.3-1H1.

Additional Performance Data Collector software and updates, the SDK, and related documentation are available at:

http://www.hp.com/products/openvms/tdc/

Graphical Configuration Manager for OpenVMS

The Graphical Configuration Manager (GCM) for OpenVMS is a portable client/server application that provides a visual means of viewing and controlling the configuration of partitioned AlphaServer systems running OpenVMS. The GCM client, a Java-based application, can run on any operating system that supports a TCP/IP network and the Java runtime environment—Software Development Kit (SDK), v1.2.2 or higher, *for the Java Platform*. (Currently, the GCM client is not supported on SDK Version 1.3 or higher.) A GCM server runs as a detached process on each partitioned OpenVMS instance on one or more AlphaServer systems.

Class Scheduler for CPU Scheduling

The Class Scheduler is a SYSMAN-based interface for defining and controlling scheduling classes for OpenVMS systems that allows you to designate the percentage of CPU time that a system's user may receive by placing users into scheduling classes.

Batch and Print Queuing System

OpenVMS provides an extensive batch and print capability that allows the creation of queues and the setup of spooled devices to process non-interactive workloads in parallel with timesharing or real-time jobs.

The OpenVMS batch and print operations support two types of queues: generic queues and execution queues. A generic queue is an intermediate queue that holds a job until an appropriate execution queue becomes available to initiate the job. An execution queue is a queue through which the job (either print or batch) is actually processed. Because multiple execution queues can be associated with a generic queue, OpenVMS enables load balancing across available systems in an OpenVMS Cluster system, increasing overall system throughput.

Print queues, both generic and execution, together with queue management facilities, provide versatile print capabilities, including support for various print file formats.

Accounting Utility

For accounting purposes, OpenVMS keeps records of system resource usage. These statistics include processor and memory utilization, I/O counts, print symbiont line counts, image activation counts, and process termination records. The OpenVMS Accounting utility allows you to generate various reports using this data.

Audit Analysis Utility

For security auditing purposes, OpenVMS selectively records critical, security-relevant events in the system security audit log file. These records contain the date and time the event occurred, the identity of the associated user process, and information specific to each event type. This information helps the system manager maintain system security and deter possible intruders. The OpenVMS Audit Analysis utility allows you to generate various reports from this data.

Autoconfigure and AUTOGEN Utilities

The Autoconfigure and AUTOGEN utilities automatically configure the available devices in the system tables and set system parameters based on the peripheral and memory architecture. This eliminates the need for a traditional system generation process when the hardware configuration is expanded or otherwise modified.

The OpenVMS AUTOGEN command procedure sets several system parameters automatically by detecting the devices installed in a configuration. A feedback option allows you to generate a report of recommended parameter settings based on previous usage patterns.

Backup Utility

The Backup utility provides both full-volume and incremental file backups for file-structured, mounted volumes and volume sets. Individual files, selected directory structures, or all files on a volume set can be backed up and restored. Files can be selected by various dates (such as creation or modification) and can be backed up to magnetic tape, magnetic disk, or Write Once Read Many (WORM) optical disk. The Backup utility can also be used to restore a saveset or list the contents of a saveset.

A Backup API is included for invoking backup routines from an executable procedure.

The Backup Manager for OpenVMS provides a screen-oriented interface to the Backup utility that assists users in performing routine backup operations. The Backup Manager is menu driven and provides:

- Access to the save, restore, and list operations without having to understand Backup command syntax
- The ability to create, modify, recall, and delete Backup Manager templates that describe the Backup save operations

Recordable DVD

OpenVMS provides the capability on Alpha and Integrity server systems to record locally mastered disk volumes or disk image files onto a CD-R, CD-RW, DVD+R or DVD+RW optical-media recording device on specific drives and configurations.

Recordable CD

OpenVMS provides the capability to write once to CD-R media using an application shipping in the base operating system. The feature supports only those writable CD devices (CD-RW) that ship with supported Alpha systems and supported Integrity servers. For the application details, see the OpenVMS documentation set. For platforms supporting the CD-RW hardware option, see the appropriate page at the following websites:

http://h18002.www1.hp.com/alphaserver/
http://www.hp.com/products1/servers/integrity/index.html

Analyze Disk Structure Utility

The Analyze Disk Structure utility compares the structure information on a disk volume with the contents of the disk, prints the structure information, and permits changes to that information. It can also be used to repair errors detected in the file structure of disks.

License Management Facility (LMF)

The License Management Facility allows the system manager to enable software licenses and to determine which software products are licensed on an OpenVMS system.

System Management Utility (SYSMAN)

The System Management utility allows system managers to define a management environment in which operations performed from the local OpenVMS system can be executed on all other OpenVMS systems in the environment.

HP Services Tools

HP Services provides web-based tools for crash dump analysis and hardware fault isolation. For more information, visit the following web site:

http://h18000.www1.hp.com/support/svctools/

SECURITY

OpenVMS provides a rich set of tools to control user access to system-controlled data structures and devices that store information. OpenVMS employs a reference monitor concept that mediates all access attempts between subjects (such as user processes) and security-relevant system objects (such as files). OpenVMS also provides a system security audit log file that records the results of all object access attempts. The audit log can also be used to capture information regarding a wide variety of other security-relevant events.

User account information, privileges and quotas associated with each user account is maintained in the system user authorization file (SYSUAF). Each user account is assiged a user name, password, and unique user identification code (UIC). To log in and gain access to the system, the user must supply a valid user name and password. The password is encoded and does not appear on terminal displays.

Users can change their password voluntarily, or the system manager can specify how frequently passwords change, along with minimum password length, and the use of randomly generated passwords.

Operations

OpenVMS allows for varying levels of privilege to be assigned to different operators. Operators can use the OpenVMS Help Message utility to receive online descriptions of error messages. In addition, system-generated messages can be routed to different terminals based on their interest to the console operators, tape librarians, security administrators, and system managers.

Security auditing is provided for the selective recording of security-related events. This auditing information can be directed to security operator terminals (alarms) or to the system security audit log file (audits). Each audit record contains the date and time of the event, the identity of the associated user process, and additional information specific to each event.

OpenVMS provides security auditing for the following events:

- Login and logout
- Login failures and break-in attempts
- Object creation, access, deaccess, and deletion; selectable by use of privilege, type of access, and on individual objects
- Authorization database changes
- Network logical link connections for DECnet for OpenVMS, DECnet-Plus, DECwindows, IPC, and SYSMAN
- Use of identifiers or privileges
- Installed image additions, deletions, and replacements
- Volume mounts and dismounts
- Use of the Network Control Program (NCP) utility
- Use or failed use of individual privileges
- Use of individual process control system services
- System parameter changes
- System time changes and recalibrations

Every security-relevant system object is labeled with the UIC of its owner along with a simple protection mask. The owner UIC consists of two fields: the user field and a group field. System objects also have a protection mask that allows read, write, execute, and delete access to the object's owner, group, privileged system users, and to all other users. The system manager can protect system objects with access control lists (ACLs) that allow access to be granted or denied to a list of individual users, groups, or identifiers. ACLs can also be used to audit access attempts to critical system objects.

OpenVMS applies full protection to the following system objects:

- Common event flag clusters
- Devices
- Files
- Group global sections
- Logical name tables
- Batch/print queues
- Resource domains
- Security classes
- System global sections
- ODS-2 volumes
- ODS-5 volumes

OpenVMS provides optional security solutions to protect your information and communications:

- OpenVMS includes encryption for data confidentiality that ships as part of the operating system, thereby removing the requirement to license and install Encrypt separately. The ENCRYPT and DECRYPT commands, now part of OpenVMS, support AES file encryption with 128, 192, or 256 bit keys. AES encryption is also supported by BACKUP/ENCRYPT, allowing for the creation of encrypted tapes and save-sets. The built-in encryption functionality is backward-compatible with file and backup tapes created by the former layered product Encryption for OpenVMS. This layered product featured 56-bit Data Encryption Standard (DES), which continues to function today, allowing for the decryption of archived DES encrypted data. The AES encryption functionality supports Electronic Code Book (ECB) and Cipher Block Chaining (CBC) block modes of encryption. The Cipher Feedback (CFB) and Output Feedback (OFB) 8-bit character stream modes are also supported from the command line as well as by the programmatic APIs.
- Secure Sockets Layer (SSL) for OpenVMS Alpha and Integrity server systems provides secure transfer of sensitive information over the Internet
- Common Data Security Architecture (CDSA) is configured and initialized automatically during installation and upgrades and is required for Secure Delivery purposes and other security features. If you install a newer version of CDSA without upgrading the base operating system, you must initalize the CDSA software, using the following command. Enter the command from an account that has both SYSPRV and CMKRNL privileges (for example, the SYSTEM account). $ @SYS$STARTUP:CDSA$UPGRADE
- Kerberos for OpenVMS
- Per-Thread Security Profiles
- External Authentication
- Global and Local Mapping of LDAP users
- HP Code Signing for OpenVMS: OpenVMS kits will be signed using HP Code Signing Service (HPCSS)

Note: Users who are externally authenticated by their LAN Manager need only remember a single user name/password combination to gain access to their OpenVMS and LAN Manager accounts.

Note: Because no system can provide complete security, HP cannot guarantee complete system security. However, HP continues to enhance the security capabilities of its products. Customers are strongly advised to follow all industry-recognized security practices. OpenVMS recommended procedures are included in the *HP OpenVMS Guide to System Security*.

HP UTILITY PRICING ON OpenVMS FOR INTEGRITY SERVERS

HP Utility Pricing on OpenVMS for Integrity servers enables customers to pay for CPU resources when they need them, thereby allowing them to respond to planned or unplanned permanent load increases and temporary spikes.

- Instant Capacity or iCAP is relevant for systems that are purchased through capital expenditure.

Instant Capacity

Instant Capacity (iCAP) provides reserve capacity that the customer can put into production quickly without disrupting operations.

Benefits:

- Provides a highly available preconfigured "ready-to-run" solution.
- Allows activation of reserve capacity when needed.
- Encompasses cell boards and individual cores.
- Allows you to defer or avoid purchase of capactiy until used.
- Full corporate implementation ensures OpenVMS can share iCAP cores across hard partitions with HP-UX on a common Integrity system.
- Integrated with Global Workload Manager (gWLM) which can automatically reallocate active cores across hard partitions in response to workload demands.

Operational features:

- iCAP cores are purchased at a fraction of the price of active cores and are denoted as Components Without Usage Rights (CWUR).
- Systems are configured at the factory before delivery with a minimum of one active core and the required number of iCAP cores.
- Once iCAP cores are activated, the balance of the price is paid and an activation Rights To Use (RTU) codeword is obtained from the HP iCAP web portal. The iCAP core/memory is then made active by the system manager.
- When a core or cell board is permanently activated, support of the core/cell board is automatically added to the overall support costs of the system.

Note: Activation of iCAP permanently adds a new core, with all the attendant HP software and third-party software licensing and support that this requires.

TiCAP (Temporary iCAP)

- Enables the customer to temporarily activate processors for a set period of time, with a minimum 30 minute granularity per core.
- Permanent activation fee is not required. You can utilize an existing core for as long as needed.
- Accommodates customers with unpredictable or planned temporary processor demands.

Operational features:

- Works with processors, does not include cell boards or memory.
- Customer orders standard iCAP processors and pays the same discounted price.
- Customer then purchases the right to temporarily activate one or more iCAP cores for one or more 30-CPU days.
- Does not require an email connection from customer site to HP.
- The iCAP software issues a warning before the TiCAP license is likely to expire, based on the rate of depletion that it tracks across all relevant cores.
- Hardware services are included for the cores activated by the TiCAP license.
- The relevant operating environment (OE) is automatically licensed on activated TiCAP cores.

Note: Other HP and third-party software have their own licensing policies. HP recommends that customers purchase sufficient software licenses to meet peak needs.

OPERATING SYSTEM ENVIRONMENT

Processes and Scheduling

Executable images consist of system programs and user programs that have been compiled and linked. These images run in the context of a process on OpenVMS systems. Sixty-four process priorities are recognized on OpenVMS Alpha and OpenVMS for Integrity servers. Priorities 0 to 15 are for time-sharing processes and applications (four is the typical default for timesharing processes). Priorities 16 to 63 on Alpha and Integrity servers are for real-time processes. Real-time processes can be assigned higher priorities to ensure that they receive processor time whenever they are ready to execute.

OpenVMS uses paging and swapping to provide sufficient virtual memory for concurrently executing processes. Paging and swapping is also provided for processes whose memory requirements exceed available physical memory.

64-Bit Virtual Addressing

The OpenVMS Alpha and OpenVMS for Integrity servers operating systems provide support for 64-bit virtual memory addressing. This capability makes the 8 TB virtual address space available to the OpenVMS Alpha and OpenVMS for Integrity servers operating systems and to application programs. Future hardware implementations for Integrity servers will provide greater capacity. OpenVMS applications can take advantage of 64-bit processing by using 64-bit data types supported by the compilers. For further details, see the SPDs for the OpenVMS Alpha and OpenVMS for Integrity servers compilers.

Very Large Memory (VLM) Features

OpenVMS Alpha and OpenVMS for Integrity servers provide the following additional memory management VLM features beyond those provided by 64-bit virtual addressing. These features can be used by database servers to keep large amounts of data in memory, resulting in dramatically increased runtime performance. The VLM features provided by OpenVMS Alpha and OpenVMS for Integrity servers are:

- Memory-resident global sections
- Fast I/O for global sections
- Shared page tables
- Expandable global page table
- Reserved memory registry

DECdtm Services

The DECdtm services embedded in the OpenVMS operating system support fully distributed databases using a two-phase commit protocol. The DECdtm services provide the technology and features for distributed processing, ensuring both transaction and database integrity across multiple HP resource managers. Updates to distributed databases occur as a single all-or-nothing unit of work, regardless of where the data physically resides. This ensures the consistency of distributed data.

DECdtm services allow applications to define global transactions that can include calls to any number of HP data management products. Regardless of the mix of data management products used, the global transaction either commits or aborts. OpenVMS is unique in providing transaction processing functionality with base operating system services.

DECdtm features include:

- Embedded OpenVMS system services that support the DECtp architecture, providing the features and technology for distributed transaction processing.
- Ability for multiple disjoint resources to be updated automatically. These resources can be either physically disjointed on different clusters at separate sites, or logically disjointed in different databases on the same node.
- Ability to use the X/Open Distributed Transaction Processing XA interface that enables the DECdtm transaction manager to coordinate XA-compliant resource managers (the HP DECdtm XA Veneer), and XA-compliant transaction processing systems to coordinate DECdtm-compliant resource managers (the DECdtm XA Gateway).
- Robust application development. Applications can be written to ensure that data is never in an inconsistent state, even in the event of system failures.
- Ability to be called using any HP TP monitor or database product. This is useful for applications using several HP database products.

Interprocess Communication

OpenVMS provides the following facilities for applications that consist of multiple cooperating processes:

- Mailboxes as virtual devices that allow processes to communicate with queued messages.
- Shared memory sections on a single processor or an SMP system that permit multiple processes to access shared address space concurrently.
- Galaxywide sections on a Galaxy platform that permit multiple processes in multiple instances to access shared address space concurrently.
- Common event flags that provide simple synchronization.
- A lock manager that provides a more comprehensive enqueue/dequeue facility with multilevel locks, values, and asynchronous system traps (ASTs).
- Intracluster communication services through which two processes running on the same system or on different OpenVMS Cluster nodes can establish a connection and exchange data.
- Logical names through which one process can pass information to other processes running on the same system or on different OpenVMS Cluster nodes.
- Network interprocess communication is available via TCP/IP Services and DECnet-Plus (product licenses are required).

Symmetric Multiprocessing (SMP)

OpenVMS provides symmetric multiprocessing (SMP) support for Alpha and Integrity servers multiprocessor systems. SMP is a form of tightly coupled multiprocessing in which all processors perform operations simultaneously. All processors perform operations in all OpenVMS access modes, user, supervisor, executive, and kernel.

OpenVMS SMP configurations consist of multiple CPUs executing code from a single shared memory address space. Users and processes share a single copy of OpenVMS for Integrity servers or OpenVMS Alpha address space. SMP also provides simultaneous shared access to common data in global sections to all processors. OpenVMS SMP selects the CPU where a process will run based on its priority and in special cases as directed by the application. OpenVMS uses a specialized scheduling algorithm when running a nonuniform memory access (NUMA) platform.

SMP support is an integral part of OpenVMS and is provided to the user transparently. Because an SMP system is a single system entity, it is configured into a network and OpenVMS Cluster configurations as a single node.

The maximum number of supported CPUs in an SMP configuration is 32.

Networking Facilities

OpenVMS provides device drivers for all HP local area network (LAN) adapters listed in the LAN Options section of Appendix A of this SPD. Application programmers can use the QIO system service to communicate with other systems connected via the LAN using either

Ethernet or Institute of Electrical and Electronics Engineers (IEEE) 802.3 packet format. Simultaneous use of HP Ethernet and the IEEE 802.3 protocols are supported on any HP LAN adapter.

OpenVMS Alpha supports Ethernet, FDDI, Token Ring, and ATM for local area networks (LANs). OpenVMS for Integrity servers supports Ethernet only.

OpenVMS Alpha supports the standards defined by the ATM Forum's LANE Version 1.0 specifications for LAN emulation over an ATM network. By implementing an emulated LAN over an ATM network, you enable a group of ATM stations to act like a traditional LAN. LAN emulated over an ATM network allows you to run your existing applications basically unchanged, while the computers on which your applications are running are connected to the ATM network.

OpenVMS supports the following networking products:

- HP TCP/IP Services for OpenVMS, the industry-standard set of protocols for interoperating between different operating systems
- HP DECnet-Plus, the Digital Network Architecture, Phase V
- DECnet, the DIGITAL Network Architecture, Phase IV

These networking products are described in this SPD under Associated Products.

Terminal Server Products

HP terminal server products provide terminal server access to OpenVMS. When used in an OpenVMS Cluster environment, terminal servers distribute users across the available Alpha and Integrity server systems at login time.

OpenVMS can also establish a connection to other devices (such as printers) attached to such terminal servers.

Universal Serial Bus Support

OpenVMS supports the Universal Serial Bus (USB) technology. Support for the USB interconnect enables OpenVMS systems to connect to multiple supported USB devices using a single USB cable. OpenVMS supports one USB keyboard and mouse on systems that are supported by OpenVMS and have USB hardware and a graphics controllers.

Beginning with OpenVMS version 8.3, HP OpenVMS I64 serial support is provided through the USB serial multiplexer (MUX). OpenVMS supports several generic chipsets which allow third-party USB-based serial multiplexers to connect to OpenVMS systems for RS232 serial lines, traditional terminal connections, and low-speed system-to-system connectivity. For more information, see the following website:

http://h71000.www7.hp.com/openvms/integrity/integrity_io_options.html

OpenVMS provides a USB configration tool called UCM that can be used to track USB configuration changes like plug and unplug events. UCM can also be used to restrict the automatic addition of specific devices and classes of devices. The UCM event log is used by HP to help diagnose problems with USB devices.

AlphaServers

OpenVMS supports the fully qualified USB devices listed in the appropriate AlphaServer platform configuration and options web site:

http://h18002.www1.hp.com/alphaserver/

OpenVMS Alpha USB support is limited to low and full speed devices only, and currently supports only the AlphaServer ES47, ES80, and GS1280 systems.

Integrity Server Systems

Starting with OpenVMS version 8.3-1H1, OpenVMS supports USB low-, full-, and high-speed devices for all supported OpenVMS Integrity systems. USB DVD support in OpenVMS version 8.3-1H1 includes both reading and burning DVDs on the following supported Integrity server systems: rx2660, rx3600, rx6600.

Reliability

OpenVMS handles hardware errors as transparently as possible while maintaining data integrity and providing sufficient information to diagnose errors. The system limits the effects of an error by first determining if the error is fatal. If the error occurs in system context, the current OpenVMS system shuts down. If the error is not fatal, the system recovers actions pertinent to the error and continues the current operation.

In all cases, information relevant to the error is written to the error log file for later analysis. Hardware errors include the following categories:

- **Processor errors.** These include processor soft errors, processor hard errors, processor machine checks, and adapter errors.
- **Memory errors.** These can be unrecoverable (hard) errors or recoverable (soft) errors. The system examines memory at startup time and does not use any bad pages. During system operation, the system corrects all single-bit memory errors for those systems with error correction code (ECC) memory.
- **Correctible memory errors.** A primary cause of these correctible memory errors is alpha particle radiation. On some processors, when correctible memory errors occur, the memory controller corrects only the data returned to the CPU or I/O controller. The actual data in memory is left with the error intact. Subsequent read operations cause correction cycles to occur and, in most cases, an interrupt to report the error. On many of these processors, OpenVMS monitors the occurrence of correctible memory errors and, in almost all cases, is able to remove the error condition by rewriting the data in memory. Rewriting the data causes the data to be corrected in that memory location.

Other failures include:

- Operating system errors (system-detected inconsistencies or architectural errors in system context)
- User errors
- I/O errors

The system logs all processor errors, all operating system errors detected through internal consistency checks, all double-bit memory errors (and a summary of corrected single-bit memory errors), and most I/O errors.

If the system is shut down because of an unrecoverable hardware or software error, a dump of physical memory is written. The dump includes the contents of the processor registers. The OpenVMS System Dump Analyzer (SDA) utility is provided for analyzing memory dumps.

Input/Output

The QIO system service and other related I/O services provide a direct interface to the operating system's I/O routines. These services are available from within most OpenVMS programming languages and can be used to perform low-level I/O operations efficiently with a minimal amount of system overhead for time-critical applications.

Device drivers execute I/O instructions to transfer data to and from a device and to communicate directly with an I/O device. Each type of I/O device requires its own driver. HP supplies drivers for all devices supported by the OpenVMS operating system and provides QIO system service routines to access the special features available in many of these devices.

OpenVMS supports a variety of disk and tape peripheral devices, as well as terminals, networks, and mailboxes (virtual devices for interprocess communication), and more general I/O devices.

I/O Performance Features

Fast I/O provides a suite of additional system services that applications can use to improve I/O throughput. The fast I/O services minimize the CPU resources required to perform I/O.

Fast Path provides a streamlined mainline code path through the I/O subsystem to improve both uniprocessor and multiprocessor I/O performance. On multiprocessor systems, Fast Path allows all CPU processing for specific I/O adapters to be handled by a specific CPU. This can significantly lower the demands on the primary CPU and increase the I/O throughput on multiprocessor systems with multiple I/O ports. No user application changes are needed to take advantage of Fast Path. Fast Path can be utilized by the $QIO system service or the Fast I/O services.

Extended File Cache (XFC)

The Extended File Cache (XFC) is a virtual block data cache provided with OpenVMS Alpha and OpenVMS for Integrity servers. Similar to the Virtual I/O Cache, the XFC is a clusterwide, file system data cache. Both file system data caches are compatible and coexist in the OpenVMS Cluster.

The XFC improves I/O performance with the following features that are not available with the virtual I/O cache:

- Read-ahead caching
- Automatic resizing of the cache
- Larger maximum cache size
- No limit on the number of closed files that can be cached
- Control over the maximum size of I/O that can be cached
- Control over whether cache memory is static or dynamic

With OpenVMS Version 8.4 XFC caching attributes of volume can be dynamically modified eliminating the need to dismount the volume.

Virtual I/O Cache (Alpha only)

OpenVMS Alpha provides a standalone or clusterwide, file-oriented disk cache. Applications benefit from the advantages of the virtual I/O cache without any special coding. The virtual I/O file-caching algorithm is chosen based on the type of clusterwide access currently in progress. Virtual I/O caching reduces current and potential I/O bottlenecks within OpenVMS systems. It reduces the number of I/Os to the disk subsystem, thereby reducing systemwide bottlenecks.

Record Management Services (RMS)

RMS is a set of I/O services that helps application programs to process and manage files and records. Although it is intended to provide a comprehensive software interface to mass storage devices, RMS also supports device-independent access to unit-record devices.

RMS supports sequential, relative, and indexed file organizations in fixed-length or variable-length record formats. RMS also supports byte stream formats for sequential file organization.

RMS record access modes provide access to records in four ways:

- Sequentially
- Directly by key value
- Directly by relative record number
- Directly by record file address

RMS also supports block I/O operations for various performance-critical applications that require user-defined file organizations and record formats.

RMS promotes safe and efficient file sharing by providing multiple file access modes and automatic record locking (where applicable). RMS offers the options of enabling global buffers for buffer sharing by multiple processes.

RMS utilities aid file creation and record maintenance. These utilities convert files from one organization and format to another; restructure indexed files for storage and access efficiency; and reclaim data structures within indexed files. These utilities also generate appropriate reports.

For systems that have DECnet or DECnet-Plus installed, RMS provides a subset of file and record management services to remote network nodes. Remote file operations are generally transparent to user programs.

Commands such as EDIT, CREATE, COPY, TYPE, and PRINT allow users to manipulate RMS records within RMS files at the DCL command level.

Disk and Tape Volumes

The system manager can organize disk volumes into volume sets. Volume sets can contain a mix of disk device types and can be extended by adding volumes. Within a volume set, files of any organization type can span multiple volumes. Files can be allocated to the set as a whole (the default) or to specific volumes within the set. Optionally, the system manager can allocate portions of indexed files to specific areas of a single disk or to specific volumes in a volume set.

The system manager can place quotas on a disk to control the amount of space individual users can allocate. Quota assignment is made by UIC and can be controlled for each individual volume set in the system (or for each individual volume if the volume is not part of a set).

The system manager can cache disk structure information in memory to reduce the I/O overhead required for file management services. Although not required to do so, users can preallocate space and control automatic allocation. For example, a file can be extended by a given number of blocks, contiguously or noncontiguously, for optimal file system performance.

The system applies software validity checks and checksums to critical disk structure information. If a disk is improperly dismounted because of user error or system failure, the system rebuilds the disk's structure information automatically the next time the disk is mounted. The system detects bad blocks and prevents their reuse once the files to which the blocks were allocated are deleted. On DIGITAL Storage Architecture (DSA) disks, the disk controller detects and replaces bad blocks automatically.

The system provides 255 levels of named directories and subdirectories whose contents are alphabetically ordered. Device and file specifications follow HP conventions. Users can use logical names to abbreviate the specifications and to make application programs device and file name independent. Users can assign a logical name to an entire specification, to a portion of a specification, or to another logical name.

OpenVMS supports multivolume magnetic tape files with transparent volume switching. Access positioning is done either by file name or by relative file position.

APPLICATION MODERNIZATION AND INTEGRATION TECHNOLOGIES

The HP OpenVMS Application Modernization and Integration Infrastructure Package provides key Internet, e-business, and integration software technologies that enhance the OpenVMS Alpha and OpenVMS for Integrity servers operating systems and enable the development of e-business and enterprise integration solutions. These technologies are bundled with the OpenVMS Alpha or OpenVMS for Integrity servers operating systems. Several of the components are additionally bound by an open source software license.

The following components are included on the Application Modernization and Integration Infrastructure Package on OpenVMS Alpha:

- HP Secure Web Server (SWS), including support for the popular scripting capabilities: mod_PHP, mod_Perl and Perl, and JavaServer Pages (Tomcat)
- HP Secure Web Browser (SWB)
- Java SE Development Kit (JDK)
- HP Extensible Markup Language (XML) Technology
- Simple Object Access Protocol (SOAP) Toolkit
- Universal Description, Discovery, and Integration (UDDI) Client Toolkit
- Web Services Integration Toolkit (WSIT)
- NetBeans and Distributed NetBeans for OpenVMS
- HP OpenVMS Enterprise Directory (LDAP/X.500)
- HP BridgeWorks
- COM for OpenVMS
- HP Reliable Transaction Router (RTR) for OpenVMS Alpha

The following components are included in the Base Operating Environment (BOE) for OpenVMS for Integrity servers:

- HP Secure Web Server (SWS)
- HP Secure Web Browser (SWB)

- Java SE Development Kit (JDK)
- HP Extensible Markup Language (XML) Technology
- Simple Object Access Protocol (SOAP) Toolkit
- Universal Description, Discovery, and Integration (UDDI) Client Toolkit
- Web Services Integration Toolkit (WSIT)
- NetBeans and Distributed NetBeans for OpenVMS
- HP OpenVMS Enterprise Directory (LDAP/X.500)

The HP Reliable Transaction Router (RTR) for OpenVMS Backend for Integrity servers is included in the High Availability Operating Environment (HA-OE) for OpenVMS Integrity servers.

Additional information can be found in the *OpenVMS Application Modernization and Integration Infrastructure Package Software Product Description* (SPD 80.58.xx) or on the OpenVMS Application Modernization and Integration website at:

www.hp.com/go/openvms/ebusiness/

ASSOCIATED PRODUCTS

The products in this section are not licensed as part of the OpenVMS Operating System and require a separate license.

HP Galaxy Software Architecture on OpenVMS Alpha

HP Galaxy Software Architecture on OpenVMS Alpha is available as a separately licensed System Integrated Product (SIP).

By running multiple instances of OpenVMS in a single computer or hard partition, an OpenVMS Galaxy computing environment gives you quantum improvements in:

- Compatibility—Existing applications run without changes.
- Availability—Presents opportunities to upgrade software and expand system capacity without downtime.
- Scalability—Offers scaling alternatives that improve performance of SMP and cluster environments.
- Adaptability—Physical resources can be dynamically reassigned to meet changing workload demands.
- Cost of ownership—Fewer computer systems reduce system management requirements, floor space, and more.

For more information about OpenVMS Galaxy licensing requirements, see the *HP Galaxy Software Architecture on OpenVMS Alpha Software Product Description* (SPD 70.44.xx).

For more information about how to create, manage, and use an OpenVMS Galaxy computing environment, see the *OpenVMS Alpha Partitioning and Galaxy Guide*.

HP OpenVMS Cluster Software

HP OpenVMS Cluster software is available for Alpha and Integrity server systems, both as a separately licensed layered product and within the High Availability Operating Environment (HA-OE) package on Integrity servers. It provides a highly integrated OpenVMS computing environment that is distributed over multiple systems, separated in distance measured from feet up to 500 miles, containing up to 96 nodes.

OpenVMS Cluster systems and storage communicate using a combination of the following interconnects:

- Memory Channel (Alpha only)
- CI (Alpha only)
- DIGITAL Storage Systems Interconnect (DSSI) (Alpha only)
- Fiber Distributed Data Interface (FDDI) (Alpha only)
- Ethernet
- Small Computer Systems Interface (SCSI) (Storage Only)
- Shared Memory Cluster Interconnect (SMCI) (Galaxy only, Alpha only)
- Fibre Channel (Storage Only)

OpenVMS Version 8.4 supports OpenVMS Cluster to use IP for cluster communication. HP TCP/IP Services Version 5.7 is needed for using IP for cluster communication. For more information, see the *Guidelines for HP OpenVMS Cluster Configurations* and *HP OpenVMS Cluster Systems* guides.

In addition, on Alpha only, when configured with suitable FDDI bridges, OpenVMS Cluster configurations can use DS3/T3 and asynchronous transfer mode (ATM) networking infrastructures.

Applications running on one or more nodes in an OpenVMS Cluster system share resources in a coordinated manner. While updating data, the OpenVMS Cluster software synchronizes access to shared resources, preventing multiple processes on any node in the cluster from uncoordinated access to shared data. This coordination ensures data integrity during concurrent update transactions.

Mixed-architecture and mixed-version clusters that contain both Alpha systems and Integrity server systems are supported.

As of OpenVMS Version 8.3, cluster satellite boot support on Integrity server systems is supported. This feature provides support for Integrity-to-Integrity satellite booting. Cross-architecture booting (booting an Integrity satellite node from an Alpha boot server and vice-versa) is not supported.

For more information, see the *HP OpenVMS Cluster Software Software Product Description* (SPD 29.78.xx).

HP Volume Shadowing for OpenVMS

HP Volume Shadowing for OpenVMS Alpha and Integrity servers performs disk mirroring operations using a redundant array of independent disks (RAID-1) storage strategy. Volume Shadowing for OpenVMS is available for Alpha and Integrity server systems as both a separately licensed product, as well as a component of the High Availability Operating Environment (HA-OE) on Integrity servers.

Volume Shadowing for OpenVMS provides high data availability for disk devices by ensuring against data loss that results from media deterioration or controller or device failure. This prevents storage subsystem component failures from interrupting system or application tasks.

For more information, seethe *HP Volume Shadowing for OpenVMS Software Product Description* (SPD 27.29.xx).

HP RMS Journaling for OpenVMS

HP RMS Journaling for OpenVMS Alpha and Integrity servers is available as layered products and as a part of the High Availability Operating Environment (HA-OE) on Integrity servers. Journaling enables a system manager, user, or application to maintain the data integrity of RMS files in the event of a number of failure scenarios. These journaling products protect RMS file data from becoming lost or inconsistent.

RMS Journaling provides the following three types of journaling:

- **After-image journaling.** Allows users to reapply modifications that have been made to a file. This type of journaling allows users to recover files that are inadvertently deleted, lost, or corrupted.
- **Before-image journaling.** Allows users to reverse modifications that have been made to a file. This type of journaling allows users to return a file to a previously known state.
- **Recovery-unit journaling.** Allows users to maintain transaction integrity. A transaction can be defined as a series of file updates on one or more files. If any failure occurs during the transaction, recovery-unit journaling rolls back the partially completed transaction to its starting point.

The binary kit for RMS Journaling ships with the OpenVMS Alpha and Integrity server distribution kits. To run the software, customers must purchase a license and documentation. For more information, see the *RMS Journaling for OpenVMS Software Product Description* (SPD 27.58.xx).

HP Advanced Server for OpenVMS Alpha

HP Advanced Server for OpenVMS is supported on OpenVMS Alpha systems only. Advanced Server V7.3B for OpenVMS is the only version supported on OpenVMS Alpha Version 8.3.

Advanced Server is an OpenVMS-based network operating system (NOS) compatible with Microsoft networking technology. The software lets you establish OpenVMS systems as servers to provide Windows desktop users (including Windows and Windows XP Professional) easy and efficient access to OpenVMS file and print services. Desktop users can use Microsoft products and utilities such as Windows Explorer to access these resources shared over the network. Advanced Server for OpenVMS can function as a file and print server for a small, isolated community of users or as the foundation of a large network distributed over a wide geographical area. The Advanced Server software also provides a flexible system for network administration and security, for both wide area networks (WANs) and local area networks (LANs).

For more information, see the *HP Advanced Server for OpenVMS Software Product Description* (SPD 30.50.xx).

HP TCP/IP Services for OpenVMS

HP TCP/IP Services for OpenVMS is a System Integrated Product (SIP). For OpenVMS Alpha, a separate license is required. For OpenVMS for Integrity servers, TCP/IP Services is licensed as part of the Base Operating Environment (BOE); therefore, a separate license is not required.

HP TCP/IP Services for OpenVMS is HP's industry-standard implementation of the TCP/IP and NFS networking protocols on the OpenVMS platform. TCP/IP Services for OpenVMS is integrated with the OpenVMS operating system installation. TCP/IP Services for OpenVMS provides interoperability and resource sharing among systems running OpenVMS, UNIX™, Windows, and other operating systems that support TCP/IP. TCP/IP provides a comprehensive suite of functions and applications that support industry-standard protocols for heterogeneous network communications and resource sharing. TCP/IP Services for OpenVMS provides a full TCP/IP protocol suite including IP/multicasting, dynamic load balancing, rlogin proxy, network file access, remote terminal access, remote command execution, remote

printing, mail, application development, Post Office Protocol (POP), SNMP Extensible agent (eSNMP), and Finger Utility.

For further information, see the *HP TCP/IP Services for OpenVMS Software Product Description* (SPD 46.46.xx).

HP DECnet-Plus and HP DECnet Software

HP DECnet for OpenVMS Alpha and Integrity server software is a System Integrated Product (SIP). DECnet for OpenVMS Alpha is licensed separately from the OpenVMS operating system. DECnet for OpenVMS for Integrity servers is a component of the Base Operating Environment (BOE) on Integrity servers license bundle.

HP DECnet-Plus (formerly DECnet/OSI) for OpenVMS Alpha is licensed separately from the OpenVMS operating system as well. DECnet-Plus for OpenVMS for Integrity servers is a component of the Base Operating Environment (BOE) on Integrity servers license bundle. The license for DECnet for OpenVMS Alpha and OpenVMS for Integrity servers also grants the rights to use DECnet-Plus. Note that only one version of DECnet can be active on a single system at any one time. Both DECnet and DECnet-Plus allow OpenVMS systems to participate in network task-to-task communications for the purposes of transfer and copy of files, printing, the running of applications, etc.

DECnet-Plus offers task-to-task communications, file management, downline system and task loading, network command terminals, and network resource sharing capabilities as defined in the DIGITAL Network Architecture (DNA) Phase V protocols. DECnet-Plus provides the newest DECnet features such as extended addressing and downline-load performance enhancements. DECnet-Plus integrates DECnet and OSI protocols and now provides a linkage to TCP/IP using Request for Comments (RFC) 1006 and RFC 1859. DECnet and OSI applications can now be run over DECnet (NSP), OSI (CLNS), and TCP/IP transports.

DECnet for OpenVMS Alpha offers the networking capabilities as defined in the DIGITAL Network Architecture (DNA) Phase IV. For more information, see the Associated Products section of this SPD.

For further information, see the *DECnet-Plus for OpenVMS Software Product Description* (SPD 50.45.xx), or the *DECnet for OpenVMS Software Product Description* (SPD 48.48.xx) .

HP DECram for OpenVMS

HP DECram for OpenVMS is a disk device driver that improves I/O performance by allowing an OpenVMS system manager to create pseudo disks (RAMdisks) that reside in main memory. Frequently accessed data can be accessed much faster from a DECram device than from a physical disk device. These RAMdisks can be accessed through the file system just as physical disks are accessed, requiring no change to application or system software.

Because main memory is allocated for the DECram device, extra memory is generally required. The OpenVMS system manager can designate the amount of memory dedicated to the DECram devices and the files that will be stored on it.

Starting with HP OpenVMS Version 8.2, the binary kit for HP DECram ships with the HP OpenVMS Alpha and Integrity servers distribution kits. To run the DECram software, customers must first purchase a separate license.

For HP OpenVMS Alpha customers, the software licenses is: QL-MV3A*-**.

For HP OpenVMS for Integrity server customers, a software license for HP DECram may be purchased as part of the OpenVMS Base Operating Environment (BOE).

For more information, see the *HP DECram for OpenVMS Software Product Description* (SPD 34.26.xx).

HP DECwindows Motif for OpenVMS

HP DECwindows Motif for OpenVMS is a System Integrated Product (SIP). It is a separately licensed layered product offered on the Alpha platform. On the Integrity Server platform, the DECwindows product is part of the Base Operating Environment (BOE) and is licensed under this package.

This product provides support for both OSF/Motif, a standards-based graphical user interface, and the X user interface (XUI) in a single, run-time and development environment. DECwindows Motif displays the OSF/Motif user interface. Because both Motif and XUI are based on X.org X Window System, applications written with either toolkit will run regardless of which environment the user selects.

For more information, see the *HP DECwindows Motif for OpenVMS Software Product Description* (SPD 42.19.xx).

CONFORMANCE TO STANDARDS

OpenVMS is based on the following public, national, and international standards.

Distributed Computing Environment (DCE) Support

The DCE for the OpenVMS product family provides a set of the distributed computing features specified by The Open Group's DCE, as well as tools for application developers. With DCE, The Open Group has established a standard set of services and interfaces that facilitate the creation, use, and maintenance of client/server applications. DCE for OpenVMS serves as the basis for an open computing environment where networks of multivendor systems appear as a single system to the user. Because DCE makes the underlying networks and operating systems transparent, application developers can easily build portable, interoperable client/server applications. Users can locate and share information safely and easily across the entire enterprise. DCE for OpenVMS supplies system managers with a set of tools to consistently manage the entire distributed computing environment, while assuring the integrity of the enterprise.

DCE for OpenVMS currently consists of the following products:

- DCE Run-Time Services for OpenVMS
- DCE Application Developers' Kit for OpenVMS
- DCE Cell Directory Service (CDS)
- DCE Security Server, one of which is required for each DCE

The right to use the DCE Run-Time Services is included with the OpenVMS operating system base license. All other DCE products are available as separate layered products. For more details, see the *HP Distributed Computing Environment (DCE) for OpenVMS Software Product Description* (SPD 43.05.xx).

Support for OSF/Motif and X Window System Standards

DECwindows Motif provides support for OSF/Motif, a standards-based graphical user interface. DECwindows Motif also provides support for the X Consortium's X Window System, Version 11, Release 6 (X11R6) server and the Version 11, Release 5 (X11R5) client.

Standards Supported by OpenVMS

The OpenVMS operating system is based on the following public, national, and international standards. These standards are developed by the American National Standards Institute (ANSI), U.S. Federal Government (responsible for FIPS), Institute of Electrical and Electronics Engineers (IEEE), and the International Organization for Standardization (ISO). The following information may be useful in determining responsiveness to stated conformance requirements as enabled in particular commercial and/or government procurement solicitation documents.

- ANSI X3.4-1986: American Standard Code for Information Interchange
- ANSI X3.22-1973: Recorded Magnetic Tape (800 BPI, NRZI)
- ANSI X3.27-1987: File Structure and Labeling of Magnetic Tapes for Information Interchange
- ANSI X3.298: Limited support. Information Technology—AT Attachment-3 Interface (ATA-3)
- ANSI X3.39-1986: Recorded Magnetic Tape (1600 BPI, PE)
- ANSI X3.40-1983: Unrecorded Magnetic Tape
- ANSI X3.41-1974: Code Extension Techniques for Use with 7-bit ASCII
- ANSI X3.42-1975: Representation of Numeric Values in Character Strings
- ANSI X3.54-1986: Recorded Magnetic Tape (6250 BPI, GCR)
- ANSI X3.131-1986 (SCSI I): Small Computer System Interface
- ANSI X3.131-1994 (SCSI II): Small Computer System Interface
- ANSI/IEEE 802.2-1985: Logical Link Control
- ANSI/IEEE 802.3-1985: Carrier Sense Multiple Access with Collision Detection
- FIPS 1-2: Code for Information Interchange, Its Representations, Subsets, and Extensions

  Note: 1-2 includes ANSI X3.4-1977(86)/FIPS 15; ANSI X3.32-1973/FIPS 36; ANSI X3.41-1974/FIPS 35; and FIPS 7.
- FIPS 3-1/ANSI X3.22-1973: Recorded Magnetic Tape Information Interchange (800 CPI, NRZI)
- FIPS 16-1/ANSI X3.15-1976: Bit Sequencing of the Code for Information Interchange in Serial-by-Bit Data Transmission

  Note: FED STD 1010 adopts FIPS 16-1.
- FIPS 22-1/ANSI X3.1-1976: Synchronous Signaling Rates Between Data Terminal and Data Communication Equipment

  Note: FED STD 1013 adopts FIPS 22-1.
- FIPS 25/ANSI X3.39-1986: Recorded Magnetic Tape

- FIPS 37/ANSI X3.36-1975: Synchronous High-Speed Data Signaling Rates Between Data Terminal Equipment and Data Communication Equipment

  Note: FED STD 1001 adopts FIPS 37.

- FIPS 50/ANSI X3.54-1986: Recorded Magnetic Tape for Information Interchange, 6250 CPI (246 CPMM), Group Coded Recording
- FIPS 79/ANSI X3.27-1987: Magnetic Tape Labels and File Structure for Information Interchange
- FIPS 86/ANSI X3.64-1979: Additional Controls for Use with American National Standard Code for Information Interchange

  Note: Other FIPS are not applicable.

  Note: Information regarding interchangeability of ANSI and FED standards with FIPS is contained in "ADP Telecommunications Standards Index," July 1988, published and maintained by the General Services Administration.

- ISO 646: ISO 7-bit Coded Character Set for Information Exchange
- ISO 1001: File Structure and Labeling of Magnetic Tapes for Information Interchange
- ISO 1863: Information Processing — 9-track, 12, 7 mm (0.5 in) wide magnetic tape for information interchange recorded at 32 rpmm (800 rpi)
- ISO 1864: Information Processing — Unrecorded 12, 7 mm (0.5 in) wide magnetic tape for information interchange — 35 ftpmm (800 ftpi) NRZI, 126 ftpmm (3 200 ftpi) phase encoded and 356 ftmm (9 042 ftpi), NRZI
- ISO 2022: Code Extension Techniques for Use with ISO 646
- ISO 3307: Representations of Time of the Day
- ISO 3788: Information Processing — 9-track, 12, 7 mm (0.5 in) wide magnetic tape for information interchange recorded at 63 rpmm (1 600 rpt), phase encoded
- ISO 4873: 8-Bit Code for Information Interchange — Structure and Rules for Implementation
- ISO 5652: Recorded Magtape (6250)
- ISO 6429: Control Functions for Coded Character Sets
- ISO 9316: 1989 (SCSI-1) Small Computer System Interface
- ISO 9660: Information Processing — Volume and file structure of CD–ROM for information exchange
- ISO 10288: 1994 (SCSI-2) Small Computer System Interface

INSTALLATION

OpenVMS for Integrity servers is distributed as a binary kit on DVD. OpenVMS Alpha is distributed as a binary kit on CD. Procedures for setting up the system disk from media and for preparing the system for day-to-day operations are provided in the *HP OpenVMS Version 8.3-1H1 for Integrity Servers Upgrade and Installation Manual*. The procedures use the POLYCENTER Software Installation (PCSI) utility to configure and install the OpenVMS Alpha and OpenVMS Integrity operating systems.

Network Installation and Upgrade

InfoServer network booting is supported for OpenVMS installations and upgrades on any OpenVMS Alpha and Integrity server systems that support OpenVMS. For OpenVMS Integrity server systems, InfoServer network booting is supported on all LAN cards (also referred to as LAN devices or adapters) that are supported by EFI.

For both OpenVMS Alpha Version 8.3 and Integrity servers Versions 8.3 and 8.3-1H1 installations and upgrades, you can boot from a virtual DVD/CD drive on the LAN using the OpenVMS InfoServer software application. You can use the OpenVMS InfoServer software application on all OpenVMS Integrity server systems running Version 8.2-1 or higher as well as on any Alpha systems running OpenVMS Version 8.3 that support a DVD drive. This support provides the additional advantage of allowing a network administrator to boot multiple OpenVMS systems on the network from a single copy of the OpenVMS distribution CD or DVD.

Using the InfoServer software application on Integrity servers for network booting requires several one-time-only configuration steps unique to OpenVMS Integrity servers. Likewise, using the InfoServer software application on OpenVMS Alpha servers requires an additional, one-time-only software configuration step. Any configuration procedures that might have been performed for network booting using an InfoServer hardware system (traditionally used by Alpha systems) are not valid for the OpenVMS I64 or OpenVMS Alpha InfoServer application. Booting from the InfoServer software application for OpenVMS on Integrity servers differs significantly from booting from the InfoServer hardware system traditionally used by OpenVMS Alpha systems or from the InfoServer software application on OpenVMS Alpha systems.

To install or upgrade the operating system over the network, OpenVMS Integrity server systems must use the InfoServer software application that is integrated with

the OpenVMS operating system. The InfoServer hardware traditionally used by OpenVMS Alpha systems is not equipped to handle DVD drives required for the OpenVMS Integrity server distribution media. OpenVMS Alpha systems can use the OpenVMS InfoServer software application or the traditional InfoServer hardware system that is independent of OpenVMS. OpenVMS Alpha systems can boot from the distribution CD on DVD drives (DVD drives support both DVDs and CDs).

For additional information, see the *HP OpenVMS Version 8.4 Upgrade and Installation Manual*.

Virtual Connect

Virtual Connect is a set of interconnect modules and embedded software for HP BladeSystem c-Class enclosures; it simplifies the setup and administration of server connections. HP Virtual Connect includes the HP 1/10Gb Virtual Connect Ethernet Module for c-Class BladeSystem, the HP 4Gb Fibre Channel module, and the HP Virtual Connect Manager.

Virtual Media (vMedia)

Virtual Media (vMedia) is the overall name for a number of different devices that can exist on a PC. These devices appear as local USB disk devices to the host system. vMedia is part of the iLO2-enhanced feature set. On some systems, the iLO2 license is bundled with the hardware, while with others a separate iLO2 license must be purchased to enable the virtual media device. You can also use vMedia devices to boot, install, or upgrade OpenVMS from over the network, as described in the *HP OpenVMS Version 8.3-1H1 for Integrity Servers Upgrade and Installation Manual*.

OpenVMS supports vMedia in the following Integrity server systems: BL860c, rx2660, rx3600, rx6600, rx7640, rx8640, and Superdomes with the sx2000 chipset.

Note: The rx7640, rx8640, and Superdome cell-based Integrity servers require an AD307A card to be installed in order for vMedia to function.

POLYCENTER Software Installation

The PCSI utility simplifies the installation and management of OpenVMS products. It is used to install, update, and deinstall software products that have been prepared with the utility. In addition, the utility provides a database to track the installation, reconfiguration, and deinstallation of software. For products installed with other installation technologies, the utility provides a mechanism for adding information about them into the product database. The utility also provides the ability to manage dependencies between products during the installation process.

For software providers, the PCSI utility simplifies the task of packaging software by providing a simple, declarative language for describing material for the installation kit and defining how it is installed. The utility handles the functions, while the developer instructs the utility what to do. This significantly reduces the complexity and time to develop installation procedures. The language allows the developer to easily specify dependencies on other software, manage objects in the execution environment (such as files and directories), and anticipate and resolve conflict before it occurs. The utility also significantly simplifies the packaging of multiple software products into one logical product suite.

For OpenVMS Alpha and OpenVMS for Integrity servers, you use the PCSI utility to install the operating system and to install layered products that are compliant with the POLYCENTER utility.

Most of the software product kits included on the OpenVMS Version 8.3-1H1 distribution media are signed using Secure Delivery. A notable exception is the OpenVMS Operation System (the VMS product) because it is shipped in bootable form, not as a single file kit that is signed.

For OpenVMS for Integrity servers, when you install or upgrade the operating system by booting from the distribution media, layered products that have been signed are validated by the PCSI utility with the aid of a digital signature file (called a manifest). Validation involves using the Secure Delivery component of CDSA to authenticate the originator of the product kit and to verify its contents.

For OpenVMS Alpha, layered product kit validation is not performed when installing or upgrading OpenVMS from the distribution media (CD). This restriction is due to space limitations on the OpenVMS Alpha distribution CD which prevents CDSA from being present in usable form while booted from the CD. However, after installation or upgrade of OpenVMS to Version 8.3, signed kits that you subsequently install go through the validation process (including any signed kits that ship on the distribution media).

In addition, on both OpenVMS Alpha and OpenVMS for Integrity server systems, the PRODUCT SHOW HISTORY command displays the validation status of installed products and identifies those that were installed from unsigned kits or were installed prior to the availabity of the Secure Delivery functionality.

VMSINSTAL

OpenVMS includes the VMSINSTAL facility to handle the installation of optional HP supplied software products that have not been converted to use the POLYCENTER Software Installation utility.

Test Package and Diagnostics

OpenVMS includes a User Environment Test Package (UETP), which verifi

files are included in the OpenVMS Alpha operating system media.) These disk space requirements are in addition to the disk space required for the OpenVMS Alpha operating system, as indicated in the OpenVMS Alpha Disk Space Requirements table.

Installation of the DECwindows Motif layered product gives customers the option of installing any or all of the following components:

- **Run-time support base kit** — 33 MB. This section provides support for running DECwindows Motif for OpenVMS Alpha applications on Alpha compute servers and is a required part of the installation.
- **New Desktop** — 24 MB. This is an optional component that allows use of the New Desktop environment. It includes applications and application programming interfaces (APIs).
- **DECwindows desktop** — 11 MB. This component is also optional, but you should install either the New Desktop or the DECwindows desktop to create a usable system. The DECwindows desktop is the user interface that was included in previous versions of DECwindows Motif and includes the DECwindows Session Manager, FileView, and the Motif Window Manager.
- **Programming support** — 32 MB. This section includes support for the C, C++, Fortran, and Pascal programming languages. If you install a subset of languages, the amount of disk space required will be less.
- **Example files** — approximately 26 MB.
- **Translated image support** — approximately 20 MB.

DECwindows Motif for OpenVMS for for Integrity servers Disk Space Requirements

To support full OpenVMS for Integrity servers and full DECwindows Motif for OpenVMS for Integrity servers, a system disk with at least 707 MB is recommended. However, a subset of the DECwindows Motif environment can be installed. The permanent amount of space used is 135 MB. These disk space requirements are in addition to the disk space required for the OpenVMS for Integrity servers operating system, as indicated in the OpenVMS for Integrity servers Disk Space Requirements table.

Installation of the DECwindows Motif layered product gives customers the option of installing any or all of the following components:

- **Run-time support (base kit)** - 60 MB. This section provides support for running DECwindows Motif for OpenVMS for Integrity servers applications on Integrity servers and is a required part of the installation.
- **New Desktop** - 35 MB. This is an optional component that allows use of the New Desktop environment. It includes applications and application programming interfaces (APIs).
- **DECwindows desktop** - 8 MB. The DECwindows desktop is the user interface that was included in previous versions of DECwindows Motif and includes the DECwindows Session Manager, FileView, and the Motif Window Manager.
- **Programming support** - 8 MB. This number includes support for the C, Pascal, and Fortran programming languages and for the New Desktop. If only a subset of languages is installed, the amount of disk space required will be less.
- **Programming examples** - 8 MB. This number includes example audio files, the DECwindows desktop, and the New Desktop. If only a subset of example files is installed, the amount of disk space required will be less.

Layered Product Disk Space Requirements

In addition to the disk space used directly by HP or third-party layered products, there may be additional space used to store information from those products in OpenVMS help libraries, command tables, object libraries, and elsewhere. The amount of additional disk space required cannot be exactly predicted due to the possibility of recovering unused space already existing in those library files. Unusually large modules contributed by layered products can also affect the amount of space required for upgrading to a new version of the OpenVMS Alpha or OpenVMS for Integrity servers operating systems.

MEMORY SPACE REQUIREMENTS

OpenVMS Alpha and OpenVMS for Integrity servers Memory Space Requirements

OpenVMS for Integrity servers is supported by the minimal memory requirements of the specific Integrity server platform. See the supported platform list located at:

http://www.hp.com/products1/servers/integrity/index.html

The minimum amount of memory required to install, boot, and log in to an OpenVMS Alpha system is 64 MB. Additional memory may be required to ensure satisfactory performance for either of the following:

- Particular applications or number of users
- Particular hardware configurations

See the specific layered product documentation for their memory requirements.

DISTRIBUTION MEDIA

OpenVMS for Integrity servers

OpenVMS for Integrity servers is available on DVD. The OpenVMS for Integrity servers binary DVD contains the operating system and layered product binaries for all layered products included with the Operating Environments.

Other items in the OpenVMS for Integrity Servers kit are delivered on CD or DVD. A single media kit contains the operating system, Operating Environment component products, layered products, freeware, online documentation, and several hardcopy manuals.

Some Integrity servers do not include a built-in CD/DVD drive. You can use an external USB CD/DVD drive (you must supply this drive and the required cable; they are not included with the Integrity servers). You can use InfoServer network booting to boot from a virtual DVD drive on the network. In addition, beginning with OpenVMS Version 8.3-1H1, you can use HP SIM provisioning for similar purposes, in which case you can install or upgrade OpenVMS on multiple servers (up to 8) in the network simultaneously. You can also use virtual media (vMedia) devices to allow you to boot, install, or upgrade OpenVMS from over the network, as described in the *HP OpenVMS Version 8.3-1H1 for Integrity Servers Upgrade and Installation Manual*.

Note: The Integrity quarterly Layered Products Library DVD will supersede layered products media upon each quarterly release. Quarterly updates for layered product components included on the OpenVMS OE media are delivered on an additional OpenVMS OE Update DVD to maintain the integrity of the original OpenVMS for Integrity servers binary distribution.

OpenVMS Alpha

OpenVMS Alpha is available on CD only. The OpenVMS Alpha CDs contain the operating system binaries, layered product binaries, freeware, online documentation, and several hardcopy manuals.

DOCUMENTATION

For OpenVMS Version 8.4, documentation is available in the following formats:

Printed Books

For OpenVMS Version 8.4, the following three new hardcopy books supplement the books in the OpenVMS Version 8.4 documentation set. These new books are also available on the OpenVMS documentation website, or in .TXT formats on the OpenVMS OE DVD:

- *HP OpenVMS Version 8.4 for New Features and Documentation*
- *HP OpenVMS Version 8.4 Release Notes*
- *HP OpenVMS Version License Management Utility Manual*
- *HP OpenVMS Version 8.4 Upgrade and Installation Manual*

For OpenVMS Alpha, printed documentation is available in two sets: the OpenVMS Full Documentation Set and the OpenVMS Base Documentation Set. For OpenVMS for Integrity server customers, a third set is available: the OpenVMS OE Extension Manuals.

The Full Documentation Set is for users who need extensive explanatory information on all major OpenVMS resources, complete reference information on system routines and utilities, detailed examples, OpenVMS Cluster guidelines, programming concepts, and information on the Help Message utility. This set meets the needs of system managers and of system and application programmers. It includes the Base Documentation Set.

The Base Set includes the most commonly used OpenVMS manuals, addressing the needs of general users and system managers of small, standalone systems. Manuals such as the Release Notes, New Features, and the DCL Dictionary are included in the Base Set.

The OpenVMS OE Extension Manuals contain documentation for the following products that are licensed with the OpenVMS for Integrity servers Operating Environments: DECnet-Plus for OpenVMS, DECprint Supervisor, DECwindows Motif, DCE, and TCP/IP Services for OpenVMS.

Online Books

The OpenVMS Version 8.4 for Integrity servers media kit contains online documentation CDs for the Operating Environments and the Layered Products.

Upon each subsequent quarterly release, these CDs will be replaced by the Online Documentation Library media for the Operating Environments and Layered Products.

GROWTH CONSIDERATIONS

The minimum hardware and software requirements for any future version of this product may be different from the requirements for the current version.

SOURCE LISTINGS

The OpenVMS for Integrity servers Operating System Source Listings are available on DVD. The OpenVMS Alpha Operating System Source Listings are available on CD. These discs contain source listing files and

the Alpha and Integrity servers specific debug symbol files that make up the OpenVMS operating system. HP provides source listings for key modules of the OpenVMS operating system that are appropriate for end users or application developers. The debug symbol files (DSF) on the OpenVMS Alpha and OpenVMS for Integrity servers Source Listings media contain information used by the OpenVMS System-Code Debugger. Certain company confidential source listings and debug symbol files, however, are excluded from the CD–ROM.

The orderable media kits include the license required to view these files on a standalone system or an OpenVMS Cluster system. If users want to make these files available to another system (possibly at a remote site), they must purchase another kit.

ORDERING INFORMATION

OpenVMS for Integrity Servers Ordering Information

With OpenVMS Version 8.4 for Integrity servers, the operating system software, layered product software, and online documentation are delivered together in one media kit. Media is offered for Base (BOE) and High Availability (HA-OE) Operating Environments. Purchase of an OE media product requires the purchase of a corresponding OE license on the same order.

Table 1 lists the media product offerings for the three Operating Environments. Table 2 lists the options available with each media product offering.

Table 1
OpenVMS for Integrity Servers Media Offerings

Product No.	Common Description
BA322AA[1]	HP OpenVMS Integrity servers BOE Media
BA322AJ	HP OpenVMS/Japanese Integrity servers BOE Media
BA324AA[1]	HP OpenVMS Integrity servers HA-OE Media
BA324AJ	HP OpenVMS/Japanese Integrity servers HA-OE Media

[1] Translated offerings for Hanzi and Hangul are included in the English media offerings.

Table 2
OpenVMS for Integrity Servers Media Options

Media Option	Description
#A58	HP OpenVMS for Integrity servers and Alpha Version 8.4
#A57	HP OpenVMS for Integrity servers Version 8.3-1H1
#A35	HP OpenVMS for Integrity servers Version 8.3
#AJR	OE Media Kit on DVD
#0D1	Factory Installation[1]

[1] English-only factory installation is offered for Hanzi and Hangul.

Each media order must include the OE Version option. Please specify option #A58 for HP OpenVMS for Integrity servers Version 8.4.

For each media order, one of the following must be ordered:

- DVD Media (option #AJR)
- Factory Installation (option #0D1)
- DVD Media and Factory Installation (options #AJR and #0D1)

The purchase of at least one DVD Media option per customer site is strongly advised, since not all items on the DVD media are included in the Factory Installation.

Note: OpenVMS Version 8.2-1 replacement media is available without Software Updates Service. BA831AA delivers DVD media for OpenVMS Version 8.2-1.

For a complete description of the OpenVMS for Integrity servers Operating Environments, or for additional ordering information, see the *HP Operating Environments for OpenVMS for Integrity Servers Software Product Description* (SPD 82.34.xx).

OpenVMS for Integrity Servers Software Licenses

A license is referred to as a "License-to-Use" or LTU.

For OEs, the following hardware tiers are defined:

- Maximum of 2 Processors (rx1600, rx1620, rx2600, rx2620)
- Maximum of 4 Processors (rx4640)
- Unlimited Processors (rx7620, rx7640, rx8620, rx8640, Superdome)
- Tier C for BL860c

The following are licenses offered for each OpenVMS for Integrity servers Operating Environment. One license is required for each active processor core.

Software Licenses

Product Number	Description
BA991ACN	HP OpenVMS BOE Trade-in
BA991ACN#211	PCL VMS I64 BOE 2P/4C Trade-in
BA991ACN#221	PCL VMS I64 BOE Max2 Proc Trade-in
BA991ACN#241	PCL VMS I64 BOE Max4 Proc Trade-in
BA991ACN#291	PCL VMS I64 BOE Unltd Proc Trade-in
BA992ACN	HP OpenVMS HAOE Trade-in
BA992ACN#211	PCL VMS I64 HA-OE 2P/4C Trade-in
BA992ACN#221	PCL VMS I64 HA-OE Max2 Proc Trade-in
BA992ACN#241	PCL VMS I64 HA-OE Max4 Proc Trade-in
BA992ACN#291	PCL VMS I64 HA-OE Unltd Proc Trade-in
BA993AC	HP OpenVMS I64 BOE to HA-OE Upgrade
BA993AC#211	PCL VMS I64 2P/4C upgrade LTU
BA993AC#221	PCL VMS I64 2Skt upgrade LTU
BA993AC#241	PCL VMS I64 4Skt upgrade LTU
BA993AC#291	PCL VMS I64 Unltd upgrade LTU

Ordering OE License Upgrades

The OE license upgrade allows the customer to trade in an existing OE license to move to a higher OE processor core license or to a higher OE level for OpenVMS for Integrity servers. A new PAK is required for the new license. The old license and PAK are terminated, following the process for trade-ins.

Process:

1. The customer orders the new OE that is required, using the standard OE product number.

2. The field applies an upgrade credit option product number for the OE the customer is upgrading (trading in).

3. The original license is terminated and must be returned to HP and removed from the Customer's Support Agreement (if covered). Software Support Service for the new license is then added to the order and to the Customer's Support Agreement.

Table 3 lists the OE license upgrade options:

Table 3
OE License Upgrade Options

Product No.	Common Description
BA453ACN#130	HP LTU Upgr credit from VMS FOE 2 Processor
BA325ACN#130	HP LTU Upgr credit from VMS FOE 4 Processor
BA326ACN#130	HP LTU Upgr credit from VMS FOE Unlimited
BA819ACN#130	HP Upg credit from VMS FOE Tier C LTU
BA451ACN#130	HP LTU Upgr credit from VMS EOE 2 Processor
BA397ACN#130	HP LTU Upgr credit from VMS EOE 4 Processor
BA327ACN#130	HP LTU Upgr credit from VMS EOE Unlimited
BA817ACN#130	HP Upg credit from VMS EOE Tier C LTU
BA455ACN#130	HP LTU Upgr credit from VMS MCOE 2 Processor
BA399ACN#130	HP LTU Upgr credit from VMS MCOE 4 Processor
BA821ACN#130	HP Upg credit from VMS MCOE Tier C LTU

OpenVMS Alpha Ordering Information

The following software licenses are offered for OpenVMS Alpha:

QL–MT1A*–6*	OpenVMS Alpha Operating System Base License
QL–MT1A*–7*	OpenVMS Alpha Operating System Base Update License
QL–MT1A9–6*	OpenVMS Alpha Operating System Symmetric Multiprocessing (SMP) Base Extension License
QL–MT1A9–7*	OpenVMS Alpha Operating System Symmetric Multiprocessing (SMP) Base Extension Update License
QL–MT2A9–**	OpenVMS Alpha Individual User License (No Longer Available...order the Concurrent Use License or Unlimited User License)
QL–MT2A*–AA	OpenVMS Alpha Unlimited User License
QL–MT2A*–Y*	OpenVMS Alpha Individual User Update License
QL–MT3A*–B*	OpenVMS Alpha Distributed Interactive User License (No Longer Available...order the Concurrent Use License)
QL–MT3A*–Y*	OpenVMS Alpha Distributed Interactive User Update License
QL–MT3A*–3*	OpenVMS Concurrent Use License
QL–MT3A*–5*	OpenVMS Concurrent Use Update License

Alpha CD Media and Online Documentation

QA–MT1AA–H8	OpenVMS Alpha software and online documentation CD–ROM
QA–MT3AA–H8	OpenVMS Alpha Version 8.3 and VAX Version 7.3 software and online documentation CD

OpenVMS Hardcopy Documentation Sets

The OpenVMS Hardcopy Documentation set includes information on all three operating platforms (OpenVMS for Integrity servers, Alpha, and VAX). Due to different ordering systems for Integrity server and AlphaServer platforms, customers should order a BAxxxMN documentation set with Integrity server orders, or a QA–xxxAA–GZ documentation set with AlphaServer orders. Either order number delivers the same documentation at the same price. If you already have a Support Agreement for the Alpha OpenVMS Documentation Set, you will automatically receive the Version 8.4 updated documents and do not need to order a new set for Integrity servers.

Description	Integrity Order #	Alpha and VAX Order #
HP OpenVMS Base Documentation Set	BA555MN	QA-09SAA-GZ
HP OpenVMS Full Documentation Set	BA554MN	QA-001AA-GZ
HP OpenVMS for Integrity Servers OE Extension Manuals	BA401MN	N/A

OpenVMS Alpha and Integrity servers Source Listings Kit

BA832AA	OpenVMS for Integrity Servers V8.3-1H1 Listings DVD Kit and License
BA486AA	OpenVMS for Integrity Servers V8.3 Listings DVD Kit and License
BA469AA	OpenVMS for Integrity servers V8.2-1 Listings DVD Kit and License
QB–MT1AB–E8	OpenVMS Alpha Listings CD Kit and License

OpenVMS Alpha Software Products Library (SPL) CD Offerings

QA–5FX8A–A8	OpenVMS Alpha Software Layered Products and Operating System Library (Software Layered Product binaries only—no online documentation, complete Operating System kit)
QA–4KM8A–G8	OpenVMS Alpha Online Documentation Library
QA–5G98A-H8	OpenVMS Alpha Software Layered Products and Operating System Library Package (Software Layered Product binaries and online documentation, complete Operating System kit)
QA–03XAA–H8	OpenVMS Alpha Software Library Package (Software Layered Product binaries and online documentation)

SOFTWARE PRODUCT SERVICES

A variety of service options are available from HP. For more information, contact your local HP account representative or distributor. Information is also available from:

http://www.hp.com/hps/software.

SOFTWARE LICENSING

The OpenVMS operating system software is furnished under the licensing provisions of HP's Standard Terms and Conditions.

License Management Facility Support

The OpenVMS operating system supports the OpenVMS License Management Facility (LMF).

If an OpenVMS license is not registered and activated using LMF, only a single login is permitted for system management purposes through the system console (OPA0:).

Some of the OpenVMS license types are based on the number of concurrent users, called an activity license. Every product has the option to define an activity as related to the LMF. OpenVMS Interactive User and ADL Interactive User Licenses define the number of concurrent users who have activity licenses as defined by the LMF. OpenVMS defines activities, sometimes referred to as an OpenVMS user, as follows:

- Each remote terminal connection is considered an activity. This is true even if users set host to their local nodes (SET HOST 0).
- Each connection from a terminal server is considered an activity.
- A multiple-window session on a workstation is considered one activity, regardless of the number of windows.
- A batch job is not considered an activity.
- A remote network connection (a connection other than a remote terminal connection) is not considered an activity.

For more information about HP's licensing terms and policies, contact your HP account representative.

Software License Information (OpenVMS for Integrity Servers Only)

OpenVMS for Integrity servers is offered with a Per-Processor Core License (PCL). OpenVMS for Integrity servers licenses are also packaged differently, using Operating Environment (OE) bundles. The License Management Facility (LMF) has been updated to support these changes.

The OE bundles are groups of individual products offered together under a single license. OEs are offered with PCLs. One PCL is required for each active processor core in the system or hard partition. If additional processor cores are later added to the system or hard partition, each requires an additional PCL.

An OE license grants the right to use all the components included in the specified OE.

For OpenVMS for Integrity servers, once a customer purchases a new license, the only way the customer can obtain rights to new versions of the product are:

- Through a Support Agreement
- Through a purchase of a new, full priced, license for that product

Other differences from OpenVMS Alpha licensing practices:

- User licenses are not required. The Foundation Operating Environment (FOE) license includes unlimited OpenVMS users.
- Version update licenses are not available. Update services are available only through a Support Agreement.
- Trade-in allowances are offered as license "options" rather than as separate licenses.

For more information regarding OpenVMS for Integrity servers licensing terms and policies, contact your local HP sales office, or find HP software licensing information on the World Wide Web at:

http://h18000.www1.hp.com/products/software/

info/terms/swl_sld.html

Software License Information (Alpha and Integrity servers)

The right to use Capacity On Demand for OpenVMS is included with the OpenVMS Operating System Base License.

Beginning with OpenVMS Version 8.2, the OpenVMS operating system license includes the right to use Open3D Graphics Software. With this version of the operating system, the right to use Open3D graphics display software is bundled with the OpenVMS operating system license. Media and documentation are bundled with the operating system software. For more information, see the *HP OpenVMS Version 8.2 Release Notes*.

The OpenVMS Alpha operating system license includes the right to use OpenVMS Alpha licenses for multiple instances of OpenVMS on the first and then once again on each subsequent hard partition of a single AlphaServer ES80 or GS80/160/320/1280 system.

The following technologies are licensed as part of the OpenVMS Alpha operating system:

Product Name	Software Product Description (SPD)
BridgeWorks	SPD 80.58.xx
COM for OpenVMS	SPD 70.45.xx
DECprint Supervisor (DCPS) for OpenVMS	SPD 44.15.xx
ECP Data Collector	SPD 80.89.xx
ECP Performance Analyzer	SPD 80.88.xx
Open3D for OpenVMS Alpha	SPD 45.08.xx.
OpenVMS Enterprise Directory (LDAPv3/X.500)	SPD 81.03.xx
Reliable Transaction Router	SPD 51.04.xx

The following technologies are licensed as part of the OpenVMS for Integrity servers operating system:

Product Name	Software Product Description (SPD)
DECprint Supervisor (DCPS) for OpenVMS	SPD 44.15.xx
HP Distributed Computing Environment (DCE)	SPD 43.05.xx
Open3D for OpenVMS for Integrity servers	SPD 45.08.xx.
OpenVMS Enterprise Directory (LDAPv3/X.500)	SPD 81.03.xx

The following technologies are distributed with the OpenVMS Alpha and OpenVMS for Integrity servers operating systems, under the applicable open source software license, or other software license. Additional information can be found in the *HP OpenVMS Application Modernization Infrastructure Package Software Product Description* (SPD 80.58.xx).

- Extensible Markup Language (XML) Technology
- NetBeans and Distributed NetBeans
- Secure Web Server including mod_PHP, mod_Perl, Perl, Tomcat, and Secure Sockets Layer (bundled with SWS)
- Secure Web Browser
- Simple Object Access Protocol (SOAP) Toolkit
- Java SE Development Kit (JDK)
- Universal Description, Discovery, and Integration (UDDI) Client Toolkit

The following are separately licensed products for OpenVMS Alpha. For information on OpenVMS for Integrity servers products, see the *HP Operating Environments for OpenVMS Version 8.3-1H1 for Integrity Servers Software Product Description* (SPD 82.34.xx).

Product Name	Software Product Description (SPD)
Advanced Server for OpenVMS	SPD 30.50.xx
DECnet-Plus for OpenVMS Alpha	SPD 50.45.xx
DECnet for OpenVMS Alpha	SPD 48.48.xx
DECram for OpenVMS	SPD 34.26.xx
DECwindows Motif for OpenVMS	SPD 42.19.xx
Galaxy Software Architecture on OpenVMS Alpha	SPD 70.44.xx
PATHWORKS for OpenVMS (Advanced Server)	SPD 30.50.xx
OpenVMS Cluster Software	SPD 29.78.xx
RMS Journaling for OpenVMS	SPD 27.58.xx
TCP/IP Services for OpenVMS	SPD 46.46.xx
Volume Shadowing for OpenVMS	SPD 27.29.xx

System Support Services

HP provides the proper license type with the purchase of the system. Not all license types are available for every system model.

OpenVMS Alpha License Information

There are five types of OpenVMS licenses available on Alpha processors:

1. Operating System Base License (QL–MT1A*–6*)

LMF Product Name: OpenVMS-ALPHA

This license grants the right to noninteractive use of the remote batch, print, application, and computing services of the OpenVMS Alpha operating system on a single processor. This license authorizes one direct login for system management purposes only. For dual-processor systems (AlphaServer 8200, 8400 and AlphaServer GS60, GS60E, and GS140), the base license for these specific systems grants the right to noninteractive use of the remote batch, print, application, and computing services of the OpenVMS Alpha operating system on a dual processor.

The Operating System Base License is a prerequisite for OpenVMS User Licenses and SMP Base Extension Licenses.

The Operating System Base License provides the right to use only the OpenVMS features of the current or prior versions of the OpenVMS Operating System.

For the AlphaServer ES47, ES80, and GS1280 systems, the Base License part number does not include an SMP license for the first CPU. For these systems, an SMP Extension is required for each CPU, including the first. The Operating System Base License, in combination with SMP Extensions, grants the right to use the operating system on a single, specified system model for purposes of executing remotely submitted requests for batch, print, and file services, as well as noninteractive display of information.

2. Symmetric Multiprocessing (SMP) Base Extension License (QL–MT1A9–6*)

LMF Product Name: OpenVMS-ALPHA

SMP Base Extensions extend the Operating System Base License to enable symmetric multiprocessing capability on those OpenVMS Alpha systems that support SMP. SMP Base Extensions are permanently tied to the Operating System Base License and cannot be separated from the Operating System Base License if an SMP board is removed from the system.

SMP Extensions grant the right to use the same version of the operating system software as permitted for the corresponding Operating System Base License at the time when the SMP Extension is granted.

For the AlphaServer ES47, ES80, and GS1280 systems, each dual SMP Extension to an Operating System Base License grants the rights to an additional dual CPU system module. The required dual SMP licenses are bundled with each AlphaServer ES47, ES80, and GS1280 system board as an add-on part number.

3. Individual User License (QL–MT2A*–**)

   (No Longer Offered)

LMF Product Name: OpenVMS-ALPHA-USER

This license grants the right to interactive use of the OpenVMS Alpha operating system, provided the appropriate Operating System Base License has been previously installed on the OpenVMS Alpha system. The Individual User Licenses are available in any quantity desired or as an unlimited user license.

Individual User Licenses can be redesignated and may be installed and used on a single OpenVMS Alpha processor only. They may not be shared in a single OpenVMS Cluster environment. A user is defined as an individual who is logged in to an OpenVMS Alpha processor or is interactively using the operating system software by means other than a login.

This license grants the right to use the same version of the operating system software as permitted for the corresponding Operating System Base License at the time when the User License is installed.

4. OpenVMS Alpha Distributed Interactive User License (QL–MT3A*–**)

   (No Longer Offered)

LMF Product Name: OpenVMS-ALPHA-ADL

This license grants the right to interactive use of the OpenVMS Alpha operating system, provided the appropriate Operating System Base License has been previously installed on the Alpha system. The ADL Interactive User Licenses are concurrent-use licenses and are available in any quantity desired except unlimited. ADL Interactive User Licenses can be redesignated and may be installed and used on a single OpenVMS Alpha processor, or shared in a single OpenVMS Cluster environment.

A distributed interactive user is defined as an individual who is logged in to an OpenVMS Alpha processor or OpenVMS Cluster or is interactively using the operating system software by means other than a login.

This license grants the right to use the same version of the operating system software as permitted for the corresponding Operating System Base License at the time when the User License is installed.

5. OpenVMS Concurrent-Use License (for VAX and Alpha) (QL–MT3A*–3*)

LMF Product Name: OpenVMS-ALPHA-ADL

This license grants the right to interactive use of the OpenVMS operating system, provided the appropriate OpenVMS Operating System Base License is installed on an OpenVMS VAX processor, and/or on an OpenVMS Alpha processor, or on OpenVMS VAX processors if one of the five types of VAX VMS Licenses has been previously installed on a VAX system. The OpenVMS Concurrent-Use Licenses are available in any quantity desired except unlimited. OpenVMS Concurrent-Use Licenses are mobile (can be redesignated) and may be installed and used on a single OpenVMS VAX or OpenVMS Alpha processor, or shared in a single OpenVMS VAXcluster or a single OpenVMS Cluster, or shared in a mixed-architecture OpenVMS Cluster.

A user that enables a Concurrent-Use License is defined as an individual who is logged in to an OpenVMS VAX processor, or an OpenVMS Alpha processor, or an OpenVMS VAXcluster, or an OpenVMS Cluster, or a mixed OpenVMS Cluster and/or is interactively using the OpenVMS operating system software by means other than a login.

When an Alpha SMP system upgrade is performed, the SMP Base Extension to the OpenVMS Alpha Operating System License permits the use of all existing User Licenses on the upgraded system.

This license grants the right to use the same version of the operating system software as permitted for the corresponding Operating System Base License at the time when the User License is installed.

SYSTEMS SUPPORTED

Integrity Server Systems Supported

The following HP Integrity servers are supported by OpenVMS Version 8.3-1H1:

- HP BladeSystems Integrity BL860c Server Blade (2P/2C; 2P/4C); 1.6GHz/6MB, 1.4GHz/12MB, 1.6GHz/18MB; included in c7000 and c3000 enclosure.
- HP BladeSystems Integrity BL870c Server Blade (2P/2C; 2P/4C); 1.6GHz/18MB, 1.4GHz/12MB, 1.6GHz/24MB; included in c7000 and c3000 enclosure.
- HP Integrity rx1600 Server (2P/2C); 1.0GHz
- HP Integrity rx1620 Server (2P/2C); 1.6GHz/3MB 267FSB (DP), 1.3GHz/3MB (DP)
- HP Integrity rx2600 Server (2P/2C); 1.5, 1.4, 1.3, 1.0 GHz
- HP Integrity rx2620 Server (2P/4C); 1.6GHz/18MB 1.4GHz/12MB
- HP Integrity rx2620 Server (2P/2C); 1.6GHz/6MB 1.6Ghz/3MB (DP), 1.3GHz/3MB (DP)
- HP Integrity rx2660 Server (2P/2C, 2P/4C); 1.6GHz/6MB, 1.4GHz/12MB, 1.6GHz/18MB
- HP Integrity rx3600 Server (2P/4C); 1.6GHz/18MB,1.4GHz/12MB
- HP Integrity rx4640 Server (4P/8C); 1.6GHz/24MB; 1.6GHz/18MB
- HP Integrity rx4640 Server (4P/4C); 1.6GHz/9MB, 1.6GHz/6MB, 1.5GHz/4MB , 1.5GHz, 1.3GHz
- HP Integrity rx4640 Server (8P/8C); 1.1GHz
- HP Integrity rx6600 Server (4P/8C); 1.6GHz/24MB, 1.6GHz/18MB, 1.4GHz/12MB
- HP Integrity rx7620 Server, 2 cell (8P/8C); 1.6GHz/6 MB, 1.5GHz/4 MB
- HP Integrity rx7620 Server FAST Base Systems-2,4,6,8-core
- HP Integrity rx7640 Server, 2 cell (8P/16C); 1.6GHz/18MB, 1.4GHz/12MB
- HP Integrity rx7640 Server FAST Base Systems-4,8,12,16-core
- HP Integrity rx8620 Server, 4 cell (16P/16C); 1.6GHz/6 MB, 1.5GHz/4 MB
- HP Integrity rx8620 Server FAST Base Systems-2,4,8,12,16-core
- HP Integrity rx8640 Server, 4 cell (16P/32C); 1.6GHz/24MB, 1.6GHz/18MB , 1.4GHz/12MB
- HP Integrity rx8640 Server FAST Base Systems-4,8,16,24,32-core
- HP Integrity Superdome with sx2000 chipset, 16 cell (64P/128C) - maximum hard partition (nPar) size 4 Cells; 1.6GHz/24MB;1.6GHz/18MB
- HP Integrity Superdome with sx1000 chipset, 16 cell (64P/64C) - maximum hard partition (nPar) size 4 Cells; 1.6GHz/9MB

Alpha Systems Supported

This section lists the Alpha systems that are supported by OpenVMS Alpha. See the following website for details concerning Alpha hardware configurations and options:

http://h18002.www1.hp.com/alphaserver/

TURBOchannel Bus-Based Systems

- DEC 3000 Models 300/300L/300LX/300X
- DEC 3000 Models 400/400S
- DEC 3000 Models 500/500S
- DEC 3000 Models 600/600S
- DEC 3000 Models 700
- DEC 3000 Models 800/800S
- DEC 3000 Models 900

XMI Bus-Based Systems

- AlphaServer 8400 (All chip speeds)
- DEC 7000 Model 600

PCI Bus-Based Systems

- AlphaServer 300 (All chip speeds)
- AlphaServer 800 (All chip speeds)
- AlphaServer 1000 (All chip speeds)
- AlphaServer 1000A (All chip speeds)
- AlphaServer 1200 (All chip speeds)
- AlphaServer 2100 (All chip speeds, except 5/375)
- AlphaServer 2100A (All chip speeds, except 5/375)
- AlphaServer 2100A LP (All chip speeds)
- AlphaServer 4000 (All chip speeds)
- AlphaServer 4100 (All chip speeds)
- AlphaServer 8200 (All chip speeds)
- AlphaServer 8400 (All chip speeds)

- AlphaServer DS10
- AlphaServer DS10L
- AlphaServer DS15
- AlphaServer DS20
- AlphaServer DS20E
- AlphaServer DS25
- AlphaServer ES40
- AlphaServer ES45
- AlphaServer ES47
- AlphaServer ES80
- AlphaServer GS60
- AlphaServer GS60E
- AlphaServer GS80
- AlphaServer GS140
- AlphaServer GS160
- AlphaServer GS320
- AlphaServer GS1280
- DIGITAL 2100 Server Model A500MP, A600MP
- AlphaStation 200 (All chip speeds)
- AlphaStation 250 (All chip speeds)
- AlphaStation 255/233, 255/300
- AlphaStation 400 (All chip speeds)
- AlphaStation 500/266, 500/333, 500/400, 500/500
- AlphaStation 600 (All chip speeds)
- AlphaStation 600A (All chip speeds)
- Digital Personal Workstation 433au, 500au, 600au
- AlphaStation DS10/XP900
- AlphaStation DS15
- AlphaStation DS20e
- AlphaStation DS25
- AlphaStation ES40
- AlphaStation ES47
- AlphaStation XP1000

The following semiconductor microprocessor development reference boards are supported by OpenVMS Alpha:

- Alpha 21064/21064A PCI reference board (EB64+)
- Alpha 21164 PCI reference board (EB164)
- Alpha PC64 reference board (APC64)

OpenVMS Alpha Version 7.3-1 is the final version to support the following systems:

- DEC 2000 Models 300/500
- Tadpole AlphaBook 1

OpenVMS Alpha Version 8.2 is the final version to support the following systems:

DSSI Bus-Based Systems

- DEC 4000 Model 600
- DEC 4000 Model 700

XMI Bus-Based Systems

- DEC 10000 Model 600

PCI Bus-Based Systems

- AlphaServer 400
- AlphaServer 2000

Modular Computing Component

- Alpha 4/233 PICMG SBC
- Alpha 4/266 PICMG SBC
- Alpha 5/366 PICMG SBC
- Alpha 5/500 PICMG SBC
- CompactPCI CS-1000

APPENDIX A (OpenVMS for Integrity servers)

This appendix describes the options supported on OpenVMS for Integrity servers.

LAN Options

A5230A	UTP (copper) network interface card (NIC) that connects PCI systems to Ethernet and IEEE 802.3 local area networks at 10 or 100 Mb/s.
A5506B	Quad port UTP (copper) network interface card (NIC); connects PCI systems to Ethernet and IEEE 802.3 local area networks at 10 or 100 Mb/s.
A6825A	UTP (copper) network interface card (NIC); connects PCI-X systems to Ethernet and IEEE 802.3 local area networks at 10, 100, or 1000 Mb/s.
A6847A	Fiber-optic interface network card (NIC) that connects PCI-X systems to Ethernet and IEEE 802.3 local area networks at 1000 Mb/s.
A7011A	Dual port fibre-optic network interface card (NIC) that connects PCI-X systems to Ethernet and IEEE 802.3 local area networks at 1000 Mb/s.

A7012A	Dual port UTP (copper) network interface card (NIC) that connects PCI-X systems to the Ethernet and IEEE 802.3 local area networks at 10, 100, or 1000 Mb/s.
AB287A	Fiber-optic network interface card (NIC) that connects PCI-X systems to Ethernet and IEEE 802.3 local area networks at 10 Gb/s. [1]
AB545A	Quad port UTP (copper) network interface card (NIC); connects PCI-X to Ethernet and IEEE 802.3 local area networks at 10, 100, or 1000 Mb/s.
AB352A	Dual port UTP (copper) network interface card (NIC) that connects PCI-X to Ethernet and IEEE 802.3 local area networks at 10, 100, or 1000 Mb/s. This card is supported as an rx4640 core I/O option only.
AD331A	UTP (copper) network interface card (NIC); connects PCI-X systems to Ethernet and IEEE 802.3 local area networks at 10, 100, or 1000 Mb/s.
AD332A	Fiber-optic network interface card (NIC) that connects PCI-X systems to Ethernet and IEEE 802.3 local area networks at 10, 100, or 1000 Mb/s.
AD337A	Dual port UTP (copper) network interface card (NIC); connects PCIe to Ethernet and IEEE 802.3 local area networks at 10, 100, or 1000 Mb/s.[1]
AD338A	Dual port fiber-optic network interface card (NIC) that connects PCIe to Ethernet and IEEE 802.3 local area networks at 10, 100, or 1000 Mb/s.[1]
AD385A	Fiber-optic network interface card (NIC) that connects PCI-X systems to Ethernet and IEEE 802.3 local area networks at 10 Gb/s. [1]
NC364M	Quad port UTP (copper) network interface card (NIC); connects PCIe to Ethernet and IEEE 802.3 local area networks at 10, 100, or 1000 Mb/s.

[1] No boot support.

Fibre Channel Storage Options

AB378A, AB378B	1-port 4Gb Fibre Channel adapter; connects PCI-X systems to a switched fabric up to 4Gb/s
AB379A, AB379B	2-port 4Gb Fibre Channel adapter; connects PCI-X systems to a switched fabric up to 4Gb/s
A6826A	2-port 2GB Fibre Channel a330(4Gb/s)008(ber-optCI-X)-330(PCIe)-347.8(T1(PCI-X)-330(systems)-332.5(to)-330(a)-330(switched)-330(fab

Ultrium 960	800GB LTO Ultrium 3 Tape Drive
Ultrium 920	800GB LTO Ultrium 3 Tape drive
Ultrium 1840	1.6TB LTO Ultrium 4 Tape Drive
DAT72	72GB DAT Tape Drive
DAT160	160GB DAT Tape Drive
1/8 Autoloader	Tape Autoloader
VLS6000	Virtual Tape Library
MSL6000	Ultrium and SDLT Tape Library
MSL2024	Ultrium Tape Library
MSL2048	Ultrium Tape Library
MSL8096	Ultrium Tape Library
ESL E-Series	Ultrium and SDLT Tape Library
EML E-Series	Ultrium Tape Library

Note: Compressed capacity; assumes 2:1 data compression.

Parallel SCSI and SAS Storage Shelves

MSA30 SB	14 disk Ultra320 single-bus enclosure
MSA30 DB	14 disk Ultra320 double-bus enclosure
MSA30MI	14 disk Ultra320 2-node Shared SCSI enclosure[1]
MSA60	12 3.5" SAS disk storage enclosure
MSA70	25 SFF SAS disk storage enclosure
SB40c	Half-height c-Class storage Blade with 6 SFF SAS disk

[1]Shelf is supported only on Integrity servers rx2620, rx2660, rx3600, rx6600.

Miscellaneous Options

AB552A	OpenVMS Keyboard and Mouse
A9803A	Management Processor Card (for out of band management and basic 2D graphics)
AB551A	Radeon 7500 Graphics 2D/3D Adapter
AD307A	HP lights out advanced/KVM card. This card is supported on rx76xx, rx86xx, and Superdome.
A6869A	1-port VGA DB15 + 2-port USB 2.0 PCI Card. USB port is supported on rx76xx, rx86xx, and Superdome. VGA port is not supported.

APPENDIX B (OpenVMS Alpha)

This appendix lists the options supported on OpenVMS Alpha. Some restrictions for specific devices are listed.

HP reserves the right to change the number and type of devices supported by OpenVMS Alpha, DECnet for OpenVMS Alpha, DECnet-Plus for OpenVMS, TCP/IP Services for OpenVMS, and OpenVMS Cluster software. The minimum hardware requirements for future versions and updates of these software products may be different from current hardware requirements. For configuration details about Alpha or VAX hardware, see the *Systems and Options Catalog* and the *Network and Communications Buyers Guide*.

See the following SPDs for detailed product information: DECnet for OpenVMS (SPD 48.48.xx), DECnet-Plus for OpenVMS (SPD 50.45.xx, 25.03.xx), TCP/IP Services for OpenVMS (SPD 46.46.xx), OpenVMS Cluster (SPD 29.78.xx), and Open3D for OpenVMS Alpha (SPD 45.08.xx).

Terminals and Terminal Line Interfaces

To prevent input from overflowing a buffer, terminals use the ASCII control characters DC1, also known as XON, and DC3, also known as XOFF, for synchronization as defined by HP STD 111, Revision A. VXT windowing terminals support standard ANSI applications and X Windows Systems using the LAT transport protocol.

OpenVMS Alpha supports the VT200 series, VT300 series, VT400 series, VT500 series, and VXT2000 series terminals.

Disks

The following table lists the disk drives that are supported on OpenVMS Alpha, the bus the device is supported on, and the minimum required version of OpenVMS Alpha that supports the device.

Disk Drive	Description	Bus	Min. Alpha Version
ESE-52[3]	120 MB solid state	SDI	1.0
ESE-56	600 MB solid state	SDI	1.5
ESE-58	960 MB solid state	SDI	1.5
EZ31	134 MB solid state	SCSI	6.2-1H3
EZ32	268 MB solid state	SCSI	6.2-1H3
EZ51R[3]	100 MB solid state	SCSI	1.5
EZ54R	467 MB solid state	SCSI	1.5
EZ58R	855 MB solid state	SCSI	1.5
EZ64	475 MB solid state	SCSI	6.2-1H3
EZ69	950 MB solid state	SCSI	6.2-1H3
DS-EZ41	134 MB solid state	SCSI	6.2-1H3
DS-EZ42	268 MB solid state	SCSI	6.2-1H3
DS-EZ705	536 MB solid state	SCSI	6.2-1H

[3]Device cannot be used as an OpenVMS VAX system disk.

Disk Drive	Description	Bus	Min. Alpha Version
DS-EZ711	1.07 GB solid state	SCSI	6.2-1H3
DS-EZ716	1.6 GB solid state	SCSI	6.2-1H3
PBXRW-JC	2 GB wide fixed disk	UltraSCSI	6.2-1H3
PBXRW-NB	4 GB wide fixed disk	UltraSCSI	6.2-1H3
PBXRW-SA	9 GB wide fixed disk	UltraSCSI	6.2-1H3
PBXRZ-JC	2 GB narrow fixed disk	SCSI	6.2-1H3
PBXRZ-NB	4 GB narrow fixed disk	SCSI	6.2-1H3
PBXRZ-SA	9 GB narrow fixed disk	SCSI	6.2-1H3
RA72	1 GB fixed disk	SDI	1.0
RA73	2 GB fixed disk	SDI	1.0
RA90	1.2 GB fixed disk	SDI	1.0
RA92	1.5 GB fixed disk	SDI	1.0
RF31	381 MB fixed disk	DSSI	1.5
RF31T	381 MB fixed disk	DSSI	1.5
RF35	800 MB fixed disk	DSSI	1.0
RF36	1.6 GB fixed disk	DSSI	6.1
RF71	400 MB fixed disk	DSSI	1.5
RF72	1 GB fixed disk	DSSI	1.5
RF74	3.5 GB fixed disk	DSSI	6.1
RRD42	600 MB read-only optical disk drive	SCSI	1.0
RRD43	680 MB read-only optical disk drive	SCSI	6.1
RRD44	680 MB read-only optical disk drive	SCSI	6.1
RRD45	600 MB 4x read-only optical disk drive	SCSI	6.1
RRD46	600 MB 12x read-only optical disk drive	SCSI	6.2-1H3
RRD47	600 MB 32x read-only optical disk drive	SCSI	6.2-1H3
RX23L	1.44 MB diskette drive	SCSI	6.2-1H3
RX26	2.8 MB diskette drive	I82077	1.5-1H1
RX26	2.8 MB diskette drive	SCSI	1.0
RZ1BB	2 GB wide fixed disk	UltraSCSI	6.2-1H3
RZ1CB	4 GB wide fixed disk	UltraSCSI	6.2-1H3
RZ1DB	9 GB wide fixed disk	UltraSCSI	6.2-1H3
RZ23L[3]	121 MB fixed disk	SCSI	1.5
RZ24[1]	209 MB fixed disk	SCSI	1.5
RZ24L	245 MB fixed disk	SCSI	1.0
RZ25	425 MB fixed disk	SCSI	1.0
RZ25L	500 MB fixed disk	SCSI	1.5
RZ25M	540 MB fixed disk	SCSI	6.1
RZ26	1.05 GB fixed disk	SCSI	1.0
RZ26B	1.05 GB fixed disk	SCSI	1.5
RZ26L	1.0 GB fixed disk	SCSI	1.5
RZ26N	1.0 GB fixed disk	SCSI	6.2
RZ28	2.1 GB fixed disk	SCSI	1.5
RZ28B	2.1 GB fixed disk	SCSI	1.5
RZ28D	2.1 GB fixed disk	SCSI	6.2
RZ28L	2 GB narrow fixed disk	SCSI	6.2-1H3
RZ28M	2.1 GB fixed disk	SCSI	6.2-1H3
RZ29B	4.3 GB fixed disk	SCSI	6.1
RZ29L	4 GB narrow fixed disk	SCSI	6.2-1H3
RZ40	9 GB narrow fixed disk	SCSI	6.2-1H3
RZ55	332 MB fixed disk	SCSI	1.0
RZ56	665 MB fixed disk	SCSI	1.0
RZ57[2]	1 GB fixed disk	SCSI	1.5
RZ58	1.35 GB fixed disk	SCSI	1.0
RZ73	2 GB fixed disk	SCSI	1.0
RZ2CC	4 GB fixed disk	SCSI	7.1-1H2
RZ2DC	9 GB fixed disk	SCSI	7.1-1H2
RZ1EF	18 GB fixed disk	SCSI	7.1-1H2

[1] Specific tailoring is required to use this device as an OpenVMS Alpha or VAX system disk with the DECwindows Motif environment.

[2] Minimum revision firmware is V6000.

[3] Device cannot be used as an OpenVMS VAX system disk.

Note: The preceding list is incomplete in terms of currently shipping disk and tape devices; it changes frequently. Supported disk and tape devices are reflected in the AlphaServer Supported Options Lists that can be found at the individual AlphaServer web pages:

http://h18002.www1.hp.com/alphaserver/

Click on the requested AlphaServer, and then access links from the left-hand columns under Technical Information, followed by Supported Options. From there, you can sort by the type of option.

Tapes

The following table lists the tapes that are supported on OpenVMS Alpha, the bus the device is supported on, and the minimum required version of OpenVMS Alpha that supports the device.

Tape	Description	Bus	Min. Alpha Version
TA78	1600/6250 BPI, STI TU78	STI	1.0
TA81	145 MB tape drive	STI	1.0
TA90	1.2 GB tape cartridge subsystem. (5-inch 200 MB cartridge)	STI	1.0
TF85	2.6 GB streaming tape cartridge drive	DSSI	6.1
TF857	18.2 GB tape cartridge loader	DSSI	6.1
TF86	6.0 GB DLT tape cartridge	DSSI	6.1
TF867	42 GB DLT tape loader	DSSI	6.1
TKZ09	5.0 GB, 8mm tape drive	SCSI	1.5
TKZ9E	1-14 GB, 8mm tape drive	SCSI	6.2-1H3
TKZ15	Exabyte 8505 8mm tape drive	SCSI	6.1
TKZ20	2 GB, DC2000 tape drive	SCSI	6.1
TKZ60	200/400 MB, 3480/3490 tape drive	SCSI	1.0
TKZ61	4.4 GB, 3480/3490 tape loader	SCSI	6.1
TKZ62	24 GB, 3480/3490/3490E tape loader	SCSI	6.1
TL893	18.4 TB, 4mm, DAT tape drive	SCSI	6.2-1H3
TL894	3.3 TB, 4mm, DAT tape drive	SCSI	6.2-1H3
TL896	12.3 TB, 4mm, DAT tape drive	SCSI	6.2-1H3
TLZ04	1.2 GB, 4mm, DAT tape drive	SCSI	1.0
TLZ06	4 GB, 4mm, DAT tape drive	SCSI	1.0
TLZ07	8 GB, 4mm, DAT tape drive	SCSI	6.1
TLZ09	4 GB, DAT tape drive	SCSI	6.1
TLZ10	12/24 GB, DAT tape drive	SCSI	6.2-1H3
TLZ6L	4 GB, 3.5-inch, 4mm DAT tape loader	SCSI	6.1
TLZ7L	8 GB, 3.5-inch, 4mm DAT tape loader	SCSI	6.1
TLZ9L	32/64 GB, 3.5-inch, 4mm DAT tape loader	SCSI	6.2-1H3
TL812	1.92 TB, DLT tape library	SCSI	6.2-1H3
TL822	10.4 TB, DLT tape library	SCSI	6.2-1H3
TL826	7.0 TB, DLT tape library	SCSI	6.2-1H3
DS-TL890	1.12 TB, DLT tape library	SCSI	6.2-1H3
DS-TL891	700 GB, DLT tape library	SCSI	6.2-1H3
DS-TL893	18.4 TB, DLT tape library	SCSI	6.2-1H3
DS-TL894	3.3 TB, DLT tape library	SCSI	6.2-1H3
DS-TL895	6.7 TB, DLT tape library	SCSI	6.2-1H3
DS-TL896	12.3 TB, DLT tape library	SCSI	6.2-1H3
TSZ05[1]	1600 bits/in tape drive	SCSI	1.5
TSZ07	1600/6250 BPI tape drive	SCSI	1.0
TZ30	95 MB, half-height DLT tape drive	SCSI	1.0
TZ85	2.6 GB DLT tape drive	SCSI	1.0
TZ857	18 GB, DLT tape loader	SCSI	1.0
TZ86	6.0 GB, DLT tape drive	SCSI	1.5
TZ867	42 GB, DLT tape loader	SCSI	1.5
TZ87	20 GB, DLT tape drive	SCSI	6.1
TZ875	100 GB, DLT tape loader	SCSI	6.1
TZ877	140 GB, DLT tape loader	SCSI	6.1
TZ88	20/40 GB, DLT tape drive	SCSI	6.2
TZ88N	40/80 GB, DLT tape drive	SCSI	6.2
TZ89N	35/70 GB, DLT tape drive	SCSI	6.2-1H3
TZ885	40/80 GB, DLT tape loader	SCSI	6.2-1H2
TZ887	40/80 GB, DLT tape loader	SCSI	6.2-1H2
TZK08	2.2 GB 8mm, tape drive	SCSI	6.1
TZK10	320/525 MB, QIC tape drive	SCSI	1.0
TZK11	2.0 GB, QIC tape drive	SCSI	6.1
TZS20	25/50 GB, AIT 8mm, tape drive	SCSI	7.1
ESL9326	40/80 GB, DLT tape library family	SCSI	7.2
ESL9198	40/80 GB, DLT tape library family	SCSI	7.2
SDLT 320	320GB SDLT Tape Drive	SCSI	7.3-1
SDLT 600	600GB SDLT Tape Drive	SCSI	7.3-2
Ultrium 460	400GB LTO Ultrium 2 Tape Drive	SCSI	7.3-2
Ultrium 448	400GB LTO Ultrium 2 Tape Drive	SCSI	7.3-2
Ultrium 960	800GB LTO Ultrium 3 Tape Drive	SCSI/FC	7.3-2
Ultrium 920	800GB LTO Ultrium 3 Tape drive	SCSI/FC	7.3-2
Ultrium 1840	1.6TB LTO Ultrium 4 Tape Drive	SCSI/FC	7.3-2
DAT72	72GB DAT Tape Drive	SCSI	7.3-2
DAT160	160GB DAT Tape Drive	SCSI	7.3-2
1/8 Autoloader	Tape Autoloader	SCSI	7.3-2
VLS6000	Virtual Tape Library	FC	7.3-2

[1] TSZ05: last version supported is Alpha Version 6.1.

Tape	Description	Bus	Min. Alpha Version
MSL6000	Ultrium and SDLT Tape Library	FC	7.3-2
MSL2024	Ultrium Tape Library	SCSI/FC	7.3-2
MSL2048	Ultrium Tape Library	SCSI/FC	7.3-2
MSL8096	Ultrium Tape Library	SCSI/FC	7.3-2
ESL E-Series	Ultrium and SDLT Tape Library	FC	7.3-2
EML E-Series	Ultrium Tape Library	FC	7.3-2

Note: The preceding list is incomplete in terms of currently shipping disk and tape devices; it changes frequently. Supported disk and tape devices are reflected in the AlphaServer Supported Options Lists that can be found at the individual AlphaServer web pages:

http://h18002.www1.hp.com/alphaserver

Click on the requested AlphaServer, and then access links from the left-hand columns under Technical Information, followed by Supported Options. From there, you can sort by the type of option.

Networks Storage Servers

HS111	StorageWorks FDDI StorageServer
HS121	StorageWorks FDDI StorageServer
HS211	StorageWorks FDDI StorageServer
HS221	StorageWorks FDDI StorageServer
HS241	StorageWorks FDDI StorageServer
SWXNA	StorageWorks FDDI StorageServer
InfoServer	An integrated hardware and software system that sits directly on the Ethernet to provide CD, hard disk, magneto-optical, and tape access to OpenVMS clients in a LAN. It supports up to 14 SCSI devices and can be used for software distribution and initial system load (ISL). ISL is for Alpha only, and not supported on Integrity platforms for OpenVMS Version 8.2 or higher. For more information, see the *InfoServer Software Product Description* (SPD 33.20.xx.)

Enterprise Storage Arrays

SWXES	StorageWorks Enterprise Storage Array 10000, 12000
SWXRA	StorageWorks RAID Array 7000, 310, 450, 3000, 8000

Controllers and Adapters

HSC40	Hierarchical storage controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 8.1.) See the SPD 42.81.xx for supported configurations.
HSC50	Hierarchical storage controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 4.1.) See the SPD 42.81.xx for supported configurations.
HSC60	Hierarchical storage controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 8.1.) See SPD 42.81.xx for supported configurations.
HSC65	Hierarchical storage controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 8.1.) See the SPD 42.81.xx for supported configurations.
HSC70	Hierarchical storage controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 8.1.) See the SPD 42.81.xx for supported configurations.
HSC90	Hierarchical storage controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 8.1.) See the SPD 42.81.xx for supported configurations.
HSC95	Hierarchical storage controller for MSCP served disks and TMSCP served tapes. (HSC software must be at minimum Version 8.1.) See the SPD 42.81.xx for supported configurations.
HSD05	DSSI to SCSI-2 FSE StorageWorks bus adapter. (Firmware must be at minimum Version X36.)
HSD10	DSSI to SCSI-2 FSE StorageWorks bus adapter.
HSD30	DSSI based StorageWorks controller that supports up to three SCSI-2 FSE ports. (HSD firmware must be at minimum Version V15D.)
HSD50	DSSI based StorageWorks controller that supports up to six SCSI-2 FSE ports. (HSD firmware must be at minimum Version 5.0D.)
HSJ30	CI based StorageWorks controller that supports up to three SCSI-2 FSE ports. (HSJ firmware must be at minimum Version V15J.)

HSJ40	CI based StorageWorks controller that supports up to six SCSI-2 FSE ports. (HSJ firmware must be at minimum Version V15J.)
HSJ50	CI based StorageWorks controller that supports up to six SCSI-2 FSE ports. (HSJ firmware must be at minimum Version 5.0J–2 or later.)
HSJ80	CI based StorageWorks controller that has 512 MB cache and dual CI host ports. (HSJ firmware must be at minimum ACS Version 8.5J–2 or later.)
HSZ20	Fast-wide differential SCSI based StorageWorks controller that supports up to three SCSI-2 FSE ports.
HSZ40-Bx/Cx	Fast-wide differential SCSI based StorageWorks controller that supports up to six SCSI-2 FSE ports. (HSZ firmware must be at minimum Version V2.5Z.)
HSZ50	Fast-wide differential SCSI based StorageWorks controller that supports up to six SCSI-2 FSE ports. (HSZ firmware must be at minimum Version 5.0Z.)
HSZ70	UltraSCSI wide differential based StorageWorks controller that supports up to six UltraSCSI wide single-ended device ports and one host port.
HSZ80	UltraSCSI wide differential based StorageWorks controller that supports up to six UltraSCSI wide single-ended device ports and two host ports.
HSZ22	UltraSCSI wide differential based StorageWorks controller that supports up to two UltraSCSI wide single-ended device ports and two host ports.
HSG60	Fibre Channel based StorageWorks controller that supports up to two UltraSCSI wide single-ended device ports and two host ports. (Version 7.2-1 and higher)
HSG80	Fibre Channel based StorageWorks controller that supports up to six UltraSCSI wide single-ended device ports and two host ports. (Version 7.2-1 and higher)
HSV110	Fibre Channel based StorageWorks virtualizing controller that supports Fibre Channel native device ports and two host ports. (Version 7.2-2 and higher)
KDM70	Mass storage controller for XMI systems with eight SDI ports.
KFESA	Mass storage controller for EISA systems with one DSSI port.
KFESB	Mass storage controller for EISA systems with one DSSI port.
KFMSB	Mass storage controller for XMI systems with two DSSI ports.
KFPSA	Mass storage controller for PCI systems with one DSSI port. (Version 6.2-1H2 minimum support)
KZESC-AA	Backplane RAID controller for EISA systems with one SCSI-2 FSE port.
KZESC-BA	Backplane RAID controller for EISA systems with three SCSI-2 FSE ports.
KZMSA	Mass storage controller for XMI systems with two SCSI ports. (Limited SCSI-2 support)
KZPAA	Mass storage adapter for PCI systems with one SCSI-2 FSE port.
KZPBA-CA	Mass storage adapter for PCI based servers with one UltraSCSI port. Single-host support in Version 6.2-1H3, and Version 7.1-1H1 and higher.
KZPBA-CB	Mass storage adapter for PCI based servers with two UltraSCSI ports. Single-host support in Version 6.2-1H3, and multi-host support in Version 7.1-1H1 and higher.
KZPBA-CC	Mass storage adapter for PCI-X based servers with two UltraSCSI ports. Multi-host support in Version 7.3 and higher.
KZPDA	Mass storage adapter for PCI systems with one SCSI-2 FWSE port.
KZPEA	Mass storage LVD adapter for PCI based servers with two Ultra3 SCSI ports. Single-host support only. Support for Version 7.2-2 and higher.
KZPSA	Mass storage adapter for PCI systems with one SCSI-2 FWD port. (26 per system maximum with Version 6.2-1H3 and Version 7.1)
KZPSC-AA	Backplane RAID controller for PCI systems with one SCSI-2 FSE port.
KZPSC-BA	Backplane RAID controller for PCI systems with three SCSI-2 FSE ports.
KZPAC-AA,CA,CB	One- and two-channel Backplane RAID controller for PCI systems.
KZPDC-BE, DF	Smart Array Backplane RAID controller for PCI systems with 2 or 4 Ultra SCSI ports.
KZPEC	U320 Smart Array Backplane Raid controller for PCI systems with 2 or 4 Ultra SCSI ports.
KZPCM	Mass storage/network adapter for PCI systems with one SCSI-2 FSE port, an Ethernet port to connect to IEEE 802.3 local area networks. (Version 6.2-1H1 minimum support)
KZPCA	Mass storage adapter for PCI based servers with one UltraSCSI, Ultra-2 port.

KGPSA-BC, CA, DA	Mass storage adapter for PCI-based servers with one Fibre Channel port. (Version 7.2-1 and higher)
KZTSA	Mass storage adapter for TURBOchannel systems with one SCSI-2 FWD port.
PB2HA-SA	Mass storage controller for EISA systems with one SCSI port. (Limited SCSI-2 support. Alpha only on systems with no greater than 1 GB of memory.)
PMAZB	Mass storage adapter for TURBOchannel systems with two SCSI-2 single-ended ports.
PMAZC	Mass storage adapter for TURBOchannel systems with two fast SCSI-2 FSE ports.

Hubs and Switches

DWZZH-03	3-port SCSI hub
DWZZH-05	5-port SCSI hub

Asynchronous Terminal Controllers

PBXDA-AA	4-port PCI asynchronous terminal controller
PBXDA-AB	8-port PCI asynchronous terminal controller
PBXDA-AC	16-port PCI asynchronous terminal controller

Synchronous Controllers

The X.25 for OpenVMS Alpha Systems software product contains the synchronous device drivers and is required when using synchronous communications options. See the SPD 47.37.xx for more information.

SCC	Integral Synchronous Communications controller on DEC 3000 systems
DSYT1	2-port TURBOchannel/Synchronous Communications controller
DNSES	2-port EISA/Synchronous Communications controller (Version 6.2-1H2 minimum support)
PBXDD-Ax	2- or 4-port ISA/Synchronous Communications controller
PBXDI-Ax	2- or 4-port ISA/Synchronous Communications controller
PBXDP-Ax	2-, 4-, or 8-port PCI/Synchronous Communications controller

Graphics Options

PBXGK	ELSA/GLoria Synergy+ graphics option that provides 2D acceleration for supported PCI-based Alpha Workstations and Servers.
PBXGD	PowerStorm 300/500 graphics option that provides 3D acceleration or 3D acceleration with stereo viewing capabilities for supported PCI-based Alpha Workstations and Servers.
PBXGF	3DLabs OXYGEN VX1 graphics option that provides 2D acceleration for supported PCI-based Alpha Workstations and Servers.
PBXGG	ATI RADEON 7500 2D and 3D, PCI and AGP graphics option.

OpenGL 1.1 supports PowerStorm 350 and 300 graphics accelerators on the following platforms:

- XP900
- XP1000
- DS10
- DS20
- DS20e
- DS25
- ES40
- ES45

A version of the Mesa 3D Graphics Library equivalent to OpenGL 1.2 is supported on ATI RADEON 7500 PCI graphics accelerators on the following platforms:

- DS10
- DS10L
- DS15
- DS20e
- DS25
- ES40
- ES45
- ES47
- ES80
- GS1280

OpenGL 1.2 supports ATI RADEON 7500 3D AGP graphics accelerators on the following platforms:

- ES45
- ES47
- ES80
- GS1280

OpenGL is included with the OpenVMS Alpha operating system distribution kit. As of OpenVMS Version 8.2, a separate license is no longer required to run 3D graphics software. Prior versions of OpenVMS will continue to require a license to run 3D graphics software, license part number is QL–0ADA9–AA.

For more information, See the *Open3D for OpenVMS Alpha Software Product Description* (SPD 45.08.xx), and the *DECwindows Motif Software Product Description* (SPD 42.19.xx).

LAN Options

DEGXA-SA, -SB	A fibre-optic network interface card (NIC) that connects PCI-X systems to Ethernet and IEEE 802.3 local area networks at 1000 Mb/s.
DEGXA-TA, -TB	A UTP (copper) network interface card (NIC) that connects PCI-X systems to Ethernet and IEEE 802.3 local area networks at 10, 100, or 1000 Mb/s.
DEGPA-SA	A fiber-optic network interface card (NIC) that connects PCI-X systems to Ethernet and IEEE 802.3 local area networks at 1000 Mb/s.
DEGPA-TA	A UTP (copper) network interface card (NIC) that connects PCI-X systems to Ethernet and IEEE 802.3 local area networks at 10, 100, or 1000 Mb/s.
DE600-AA	A UTP (copper) network interface card (NIC) that connects PCI systems to Ethernet and IEEE 802.3 local area networks at 10 or 100 Mb/s.
DE602-AA, -BB	A dual port UTP (copper) network interface card (NIC) that connects PCI systems to Ethernet and IEEE 802.3 local area networks at 10 or 100 Mb/s.
DE602-TA	A dual-port UTP (copper) add-on daughter card for the DE602 network interface card (NIC) that connects PCI systems to Ethernet and IEEE 802.3 local area networks at 10 or 100 Mb/s.
DE602-FA	A single-port multi-mode fiber-optic add-on daughter card for the DE602 network interface card (NIC) that connects PCI systems to Ethernet and IEEE 802.3 local area networks at 100 Mb/s.
DE500-AA, -BA	A UTP (copper) network interface card (NIC) that connects PCI systems to Ethernet and IEEE 802.3 local area networks at 10 or 100 Mb/s.
DE500-FA	A fiber-optic network interface card (NIC) that connects PCI systems to Ethernet and IEEE 802.3 local area networks at 100 Mb/s.
DE504-BA	A quad port UTP (copper) network interface card (NIC) that connects PCI systems to Ethernet and IEEE 802.3 local area networks at 10 or 1 00 Mb/s.
DE500-XA	A UTP (copper) network interface card (NIC) that connects PCI systems to Ethernet and IEEE 802.3 local area networks at 10 or 100 Mb/s.
DE450	A network interface card (NIC) that connects PCI systems to Ethernet and IEEE 802.3 local area networks at 10 Mb/s.
DE436	A quad port network interface card (NIC) that connects PCI systems to Ethernet and IEEE 802.3 local area networks at 10 Mb/s.
DE435	A network interface card (NIC) that connects PCI systems to Ethernet and IEEE 802.3 local area networks at 10 Mb/s.
DE434	A UTP (copper) network interface card (NIC) that connects PCI systems to Ethernet and IEEE 802.3 local area networks at 10 Mb/s.
DEFPA	A network interface card (NIC) that connects PCI systems to ANSI FDDI local area networks at 100 Mb/s.
DAPBA	FORE Systems HE155 network interface card (NIC) that connects PCI systems to ATM local area networks at 155 Mb/s(OC3).
DAPCA	FORE Systems HE622 network interface card (NIC) that connects PCI systems to ATM local area networks at 622 Mb/s(OC12).
DGLPB	ATMworks 350 network interface card (NIC) that connects PCI systems to ATM local area networks at 155 Mb/s(OC3).
DGLPA	ATMworks 351 network interface card (NIC) that connects PCI systems to ATM local area network at 155 Mb/s (OC3).
PBXNP-DA	A network interface card (NIC) that connects PCI systems to a Token Ring local area network at 4 or 16 Mb/s.
PBXNP-AA	A network interface card (NIC) that connects PCI systems to a Token Ring local area network at 4 or 16 Mb/s.
DE205	A network interface card (NIC) that connects ISA/EISA systems to Ethernet and IEEE 802.3 local area networks at 10 Mb/s.
DE422	A network interface card (NIC) that connects EISA systems to Ethernet and IEEE 802.3 local area networks at 10 Mb/s.

DE425	A network interface card (NIC) that connects EISA systems to Ethernet and IEEE 802.3 local area networks at 10 Mb/s.
PB2CA-AA	A network interface card (NIC) that connects EISA systems to Ethernet and IEEE 802.3 local area networks at 10 Mb/s.
DEFEA	A network interface card (NIC) that connects EISA systems to ANSI FDDI local area networks at 100 Mb/s.
DW300	A network interface card (NIC) that connects the EISA bus to a Token Ring local area network at 4 or 16 Mb/s.
PMAD	A network interface card (NIC) that connects TURBOchannel systems to Ethernet and IEEE 802.3 local area networks at 10 Mb/s.
DEFTA	A network interface card (NIC) that connects TURBOchannel systems to ANSI FDDI local area networks at 100 Mb/s.
DEFZA	A network interface card (NIC) that connects TURBOchannel systems to ANSI FDDI local area networks. Not supported as a cluster interconnect or boot device at 100 Mb/s.
DETRA	A network interface card (NIC) that connects the TURBOchannel systems to a Token Ring local area network at 4 or 16 Mb/s.
DEFAA	A network interface card (NIC) that connects FUTUREBUS+ systems to ANSI FDDI local area networks at 100 Mb/s.
DEMNA	A network interface card (NIC) that connects XMI systems to Ethernet and IEEE 802.3 local area networks at 10 Mb/s.
DEMFA	A network interface card (NIC) that connects XMI systems to ANSI FDDI local area networks at 100 Mb/s.

CI Options

CIPCA	Native CI adapter for PCI AlphaServer systems with one CI port. (Alpha only—Version 6.2-1H2 minimum support)
CIXCD-AC	Native CI adapter for Alpha XMI systems. (Minimum microcode version Rev 1.0 is required.)

Memory Channel Options

CCMAA-AA	PCI-based Memory Channel Controller
CCMAA-BA	PCI-based Memory Channel Controller
CCMHA-AA	Memory Channel Hub With 4 Line Cards
CCMLA-AA	Memory Channel Line Card for use with Memory Channel Hub (CCMHA-AA)
CCMAB-AA	PCI-based Memory Channel 2 Controller
CCMHB-AA	Memory Channel 2 Hub with 4 Line Cards
CCMLB-AA	Memory Channel 2 Line Card for use with Memory Channel 2 Hub (CCMHB-AA)

Miscellaneous

PC4XD-AA	Parallel/serial port adapter.
PMTCE	TURBOchannel extender.

APPENDIX C (OpenVMS Alpha and OpenVMS for Integrity servers SAN Solutions)

This appendix describes the SAN components supported on OpenVMS Alpha and OpenVMS for Integrity servers.

Enterprise Storage Arrays

EMA	StorageWorks Enterprise Modular Array 1200, 1600
EVA	StorageWorks Enterprise Virtual Array 3000, 4000, 5000, 6000, 8000
MSA	StorageWorks Modular Storage Array 1000, 1500 (Note: OpenVMS support for the MSA1500 requires a minimum MSA firmware of Version 7.)
XP	StorageWorks XP Storage Array 128/1024, 48/512, 10000, 12000, 24000

Adapters and Switches

MDR	StorageWorks Modular Data Router for connecting SCSI and FC tape devices to a FC switch.
NSR	StorageWorks Network Storage Router for connecting SCSI and FC tape devices to a FC switch.
DSGGA-AA/B	8/16-port Fibre Channel switch
DSGGD	16-port 2 GB Fibre Channel switch
B-Series, M-Series, and C-Series Switches	SAN-based FC Switches as supported by HP StorageWorks, new variants as available via the following website: http://www.hp.com/go/storage

SAN-attached Tape Libraries

EML-E Series	Enterprise Storage Library
ESL-E Series	Enterprise Storage Library
ESL9595	Enterprise Storage Library
ESL9322	Enterprise Storage Library
ESL9326	Enterprise Storage Library
ESL9198	Enterprise Storage Library
MSL2024	Business Class Library
MSL4048	Business Class Library
MSL8096	Business Class Library
MSL5000 Series	Modular Storage Library
MSL6000 Series	Modular Storage Library
VLS 6000	Enterprise Virtual Tape Library

Note: OpenVMS supports both SDLT and Ultrium 460/960 tape drives within HP StorageWorks Tape libraries.

For additional information on the SAN-attached Tape Libraries, see this website:
http://www.hp.com/go/storage

Abbreviations

APMP	Adaptive Partitioned Multi-Processing
ATA	AT/Attachment
ATAPI	ATA Packet Interface
COM	Component Object Model
DLT	Digital Linear Tape
DSSI	DIGITAL Storage Systems Interconnect
EISA	Extended Industry Standard Architecture
FDDI	Fiber Distributed Data Interface
FSE	Fast Single Ended (SCSI)
FWD	Fast-Wide Differential (SCSI)
GigE	Gigabit Ethernet
IDE	Integrated Device (or Drive) Electronics
IEEE	Institute of Electrical and Electronics Engineers
I80277	Intel® 82077 PC Compatible Floppy Interface
LVD	Low Voltage Differential
MSCP	Mass Storage Control Protocol
NCS	National Character Set
PCI	Peripheral Component Interconnect
QIC	Quarter Inch Cartridge
RAID	Redundant Array of Independent Disks
RMC	Remote Procedure Call
RMS	Record Management Services
SDI	Standard Drive Interface
SMP	Symmetric Multiprocessing
STI	Standard Tape Interface
TFF	Terminal Fallback Facility
TIE	Translated Image Environment
TMSCP	Tape Mass Storage Control Protocol
USB	Universal Serial Bus
VLM	Very Large Memory
XMI	Extended Memory Interconnect

SOFTWARE WARRANTY

This software product is provided by HP with a 90-day conformance warranty in accordance with the HP warranty terms applicable to the license purchase.