# Software Product Description

**PRODUCT NAME: HP OpenVMS for Integrity Servers and HP OpenVMS Alpha Version 8.2 Operating Systems**
**SPD 82.35.01**

**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. Please refer to the Ordering Information section of this SPD for further details.

## DESCRIPTION

OpenVMS is a general-purpose, multiuser operating system that runs in both production and development environments. Starting with OpenVMS Version 8.2, we now introduce support for OpenVMS Industry Standard 64 (I64) for Integrity servers. 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 on the OpenVMS Version 8.2 new features, please refer to the *HP OpenVMS Version 8.2 New Features and Documentation Overview* at:

http://h71000.www7.hp.com/openvms/integrity
/openvms/v82features.html

## 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.

For users who are familiar with the UNIX shell and utilities, OpenVMS is providing an Open Source port of GNU's GNV; that is a GNU-based, UNIX environment for OpenVMS. GNV 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.

**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.

Software Development Kit (SDK), *for the Java™ Platform*)

The HP Software Development Kit (SDK) *for the Java Platform* provides a development and deployment environment for Java applications on OpenVMS Alpha and OpenVMS I64, 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, Java, and PL/I.

With OpenVMS I64, these routines can be called from programs written in such languages as MACRO-32, MACRO-64, BASIC, C, C++, COBOL, Fortran, Pascal, and Java.

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. This feature is only available on OpenVMS Alpha.

### 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.

Refer to the Operating System Environment section of this SPD for more information about RMS.

**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, please refer to the following web site:

http://h71000.www7.hp.com/commercial/cace.html
(under the Tools section)

**Translated Image Environment (TIE) (Integrity servers)**

OpenVMS I64 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 I64. Without requiring special source code, the TIE resolves differences between the Alpha and Integrity architectures, including floating-point.

For additional information, please refer to the following web site:
http://www7.hp.com/commercial/cace.html
(under the Tools section)

## SYSTEM MANAGEMENT ENVIRONMENT

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/

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

**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 node 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.

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 via the OpenVMS System Management web page located at:

http://h71000.www7.hp.com/openvms/
products/availman/what.html

**DECamds**

DECamds is in maintenance mode and is not available on OpenVMS Version 8.2. Availability Manager replaces DECamds. DECamds will install and run on OpenVMS Alpha Version 6.2 through Version 7.3-2. DECamds will not install on OpenVMS Alpha or OpenVMS I64 Version 8.2.

**HP Management Agents for OpenVMS**

The introduction of (Systems) Insight Manager enables management of all your HP platforms inclusive of OpenVMS from a single Microsoft™ Windows server. HP Insight Management Agents for OpenVMS is an example of an Insight Manager Web agent. It provides the means of communication between OpenVMS devices and the web browser. The Systems Insight Manager management server provides a single reference point for all devices on which web agents have been installed trhough the SNMP protocol. Devices can be computer systems, networked printers or network components such as routers. The HP Insight Management Agents for OpenVMS and related documentation is available on the OpenVMS System Management web page located at:

http://h71000.www7.hp.com/openvms/products/
mgmt_agents/index.html

### HP OpenVMS Management Station

HP OpenVMS Management Station (OMS) is a powerful Microsoft Windows based management tool for system managers and others who perform system management tasks on OpenVMS systems. OMS features an intuitive user interface that is meaningful to system managers and their environment by allowing them to manage user accounts, printers, and storage on their systems. System managers and help desk staff no longer need to remember complicated DCL syntax or command procedures to manage their OpenVMS Alpha and Integrity server systems. OMS is based on the Microsoft Management Console (MMC). The Microsoft Management Console provides a common management framework for various administration programs. OpenVMS Management Station is implemented as an MMC snap-in and includes all of the MMC components you need. OpenVMS Management Station and related documentation is available via the OpenVMS System Management web page located at:

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

### Enterprise Capacity and Performance Analyzer

Enterprise Capacity and Performance (ECP) Analyzer works with the data that is collected by a Data Collector (ECP Data Collector for VAX and Performance Data Collector (TDC) version 2.0 for Alpha and Integrity servers). ECP Analyzer provides both graphic (MOTIF-based) and tabular reports for the data assembled by the collector including metrics for CPU, disk I/O, memory, paging, processes, locks, SCS, and TCP/IP. The ECP Analyzer, which runs on Alpha, will process data from:

- ECP Data Collector (VAX)
- TDC2 (Alpha and Integrity servers)
- POLYCENTER Performance Advisor Data Collector for OpenVMS (pre- V2.1.5 data only)

The Performance Analyzer and related documentation is available on the OpenVMS System Management web page located at:

http://h71000.www7.hp.com/openvms/products/ecp/index.html

### Performance Data Collector

Performance data for an AlphaServer and Integrity server system running OpenVMS Version 8.2 can be gathered using the Performance Data Collector (TDC) Version 2. By default, TDC periodically collects and stores data in a file that can be retrieved by user applications.

The Performance Data Collector and related documentation is available on the OpenVMS System Management web page at:

http://h71000.www7.hp.com/openvms/products/tdc/index.html

### 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 run-time environment—Software Development Kit (SDK), *for the Java Platform* V1.2.2 or higher. (Currently, the GCM client is not supported on Java 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 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-ROM devices (CD-RW) that ship with supported Alpha systems and supported Integrity servers. For the application details, please reference the OpenVMS documentation set. For platforms supporting the CD-RW hardware option, please refer to the appropriate page at the following web sites:

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.

**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:

- Secure Sockets Library (SSL for OpenVMS)
- Common Data Security Architecture (CDSA)
- Kerberos
- Per-Thread Security Profiles
- External Authentication

**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.

*Government Security Ratings*

OpenVMS is committed to consistently delivering a secure base operating system, and has been evaluated and certified to be compliant with the *DoD 5200.28-STD Department of Defense Trusted Computer System Evaluation Criteria*. Each release of OpenVMS sucessfully completes the same test suite used to prove C2 compliance to the National Computer Security Center before it is released.

**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*.

## 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 I64. 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 I64 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 I64 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. Refer to the SPDs for the OpenVMS Alpha and OpenVMS I64 compilers for further details.

### Very Large Memory (VLM) Features

OpenVMS Alpha and OpenVMS I64 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 I64 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 I64 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 I64 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 on the AlphaServer ES47, ES80, and GS1280 systems, and the rx1600, rx2600, and rx4640 Integrity Server systems. Support for the USB interconnect enables OpenVMS systems to connect to multiple supported USB devices using a single USB cable. OpenVMS supports the fully qualified USB devices listed in the appropriate AlphaServer platform configuration and options web site:

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

### 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 I64. 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

**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.

## E-BUSINESS AND INTEGRATION TECHNOLOGIES

The HP OpenVMS e-Business and Integration Infrastructure Package provides key Internet, e-business, and integration software technologies that enhance the OpenVMS Alpha and OpenVMS I64 operating systems

and enable the development of e-business and enterprise integration solutions. These technologies are bundled with the OpenVMS Alpha or OpenVMS I64 operating systems. Several of the components are additionally bound by an open source software license.

The following components are included on the e-Business 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)
- HP Software Development Kit (SDK), *for the Java Platform*
- HP Extensible Markup Language (XML) Technology
- Simple Object Access Protocol (SOAP) Toolkit
- Universal Description, Discovery, and Integration (UDDI) Client Toolkit
- 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 Foundation Operating Environment (FOE) for OpenVMS I64:

- HP Secure Web Server (SWS)
- HP Secure Web Browser (SWB)
- HP Software Development Kit (SDK), *for the Java Platform*
- HP Extensible Markup Language (XML) Technology
- Simple Object Access Protocol (SOAP) Toolkit
- Universal Description, Discovery, and Integration (UDDI) Client Toolkit
- 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 Mission Critical Operating Environment (MCOE) for OpenVMS Integrity servers.

Additional details can be found in the *OpenVMS e-Business Infrastructure Package Software Product Description* (SPD 80.58.xx).

## 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, refer to 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, refer to 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 Mission Critical Operating Environment (MCOE) 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 System Interface (SCSI) (Alpha only)
- Shared Memory Cluster Interconnect (SMCI) (Galaxy only, Alpha only)
- Fibre Channel (Storage Only)

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.

Refer to the *HP OpenVMS Cluster Software Software Product Description* (SPD 29.78.xx) for more information.

**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 Enterprise Operating Environment (EOE) 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.

Refer to the *HP Volume Shadowing for OpenVMS Software Product Description* (SPD 27.29.xx) for more information.

**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 Enterprise Operating Environment (EOE) 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. Refer to the *RMS Journaling for OpenVMS Software Product Description* (SPD 27.58.xx) for more information.

**HP Advanced Server for OpenVMS Alpha**

HP Advanced Server for OpenVMS is supported on OpenVMS Alpha systems only. Advanced Server V7.3A ECO4 for OpenVMS is the only version supported on OpenVMS Alpha Version 8.2.

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).

Refer to the *HP Advanced Server for OpenVMS Software Product Description* (SPD 30.50.xx) for more information.

### HP PATHWORKS for OpenVMS (Advanced Server)

HP Pathworks for OpenVMS (Advanced Server), also known as Pathworks Advanced Server, is currently available for Alpha based systems only. Pathworks for OpenVMS Version 6.1 is the only supported version for OpenVMS Alpha Versions 7.3, 7.3-1 and 7.3-2. Pathworks for OpenVMS Version 6.1 is not supported on OpenVMS Version 8.2.

For further information, refer to 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 layered product. For OpenVMS Alpha, a separate license is required. For OpenVMS I64, TCP/IP Services is licensed as part of the Foundation Operating Environment (FOE); 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.

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

### 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 I64 is a component of the Enterprise Operating Environment (EOE) 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 I64 is a component of the Enterprise Operating Environment (EOE) on Integrity servers license bundle. The license for DECnet for OpenVMS Alpha and OpenVMS I64 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, refer to the Associated Products section of this SPD.

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

### 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 either as part of the OpenVMS Enterprise Operating Environment (EOE) or as a separate per-processor license (PPL): BA407AC

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

### HP DECwindows Motif for OpenVMS

HP DECwindows Motif for OpenVMS is a separately licensed layered product offered on the Alpha platform. On the Integrity Server platform, the DECwindows product is part of the Foundation Operating Environment (FOE) 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 on either toolkit will run regardless of which environment the user selects.

Refer to the *HP DECwindows Motif for OpenVMS Software Product Description* (SPD 42.19.xx) for more information.

## 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. Refer to the *HP Distributed Computing Environment (DCE) for OpenVMS Software Product Description* (SPD 43.05.xx) for more detailed information.

### 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 for Information Interchange (1600 CPI, Phase Encoded)
- 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 I64 is distributed as a binary kit on DVD. OpenVMS Alpha is distributed as a binary kit on CD-ROM. 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 8.2 Upgrade and Installation Manual*. The procedures use the POLYCENTER Software Installation (PCSI) utility to configure and install the OpenVMS Alpha and OpenVMS I64 operating systems.

### POLYCENTER Software Installation

The POLYCENTER Software Installation 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 POLYCENTER Software Installation 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 I64, you use the POLYCENTER Software Installation utility to install the operating system and to install layered products that are compliant with the POLYCENTER utility.

**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 verifies that the OpenVMS operating system is properly installed and ready for use on the customer's systems.

You can run diagnostics on individual devices during normal system operation. Certain critical components can operate in degraded mode.

## OpenVMS I64 DISK SPACE REQUIREMENTS

### Operating System Disk Space Requirements

The minimum disk space required for OpenVMS I64 is 3 GB. The disk space requirements for OpenVMS I64 vary according to which options are installed:

| File Category | Space Used |
|---|---|
| Minimum OpenVMS files | 868 MB |
| DECwindows Support | 70 MB |
| Full DECwindows Motif (optional) | 117 MB |
| DECnet Support | 2 MB |
| DECnet/OSI | 79 MB |
| Other optional OpenVMS files | 268 MB |
| Paging file (required) | 1028 MB |
| Swap file (suggested) | 32 MB |
| Dump file (optional) | 181 MB |
| Total | 2645 MB |

## OpenVMS Alpha DISK SPACE REQUIREMENTS

### Operating System Disk Space Requirements

The disk space requirements for OpenVMS Alpha vary according to which options are installed:

| File Category | Space Used |
|---|---|
| Minimum OpenVMS files | 381 MB |
| Optional OpenVMS files | 241 MB |
| DECwindows Support | 142 MB |
| Paging file (required) | 38 MB |
| Swap file (suggested) | 1 MB |
| Dump file (optional) | 28 MB |
| Decompressed Help files (optional) | 10 MB |
| Full DECwindows Motif (optional) | 180 MB |
| Safeguard for upgrading | 50 MB |
| Total | 1071 MB |

**Note:** The minimum OpenVMS files listed in the table will allow you to run with minimal functionality. Not all OpenVMS commands and utilities will function fully as documented in this minimum configuration. Not all HP and other layered products will work in this minimum configuration.

The minimum OpenVMS files are for a system configuration where all optional features have been declined during the initial installation. For most applications, this is not a realistic OpenVMS environment.

The paging, swap, and dump file requirements are the minimum for a system with 64 MB of main memory. Additional memory in most cases adds to the space needed for these files, as will particular needs of your application. With careful system management it is possible to use the paging file space as a temporary dump file.

For an OpenVMS Cluster system disk, paging, swap, and dump files cannot be shared between nodes, so the files must either be duplicated on the system disk or located on some other disk.

**DECwindows Motif for OpenVMS Alpha Disk Space Requirements**

To support full OpenVMS Alpha and full DECwindows Motif for OpenVMS Alpha, a system disk with at least 550 MB is recommended. However, a subset of the DECwindows Motif environment can be installed. The disk space required for the installation of DECwindows Motif is 159 MB. The permanent amount of space used is 145 MB. An additional 33 MB is needed to install the DECwindows X11 Display Server and associated files. (The DECwindows X11 Display Server and associated 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 I64 Disk Space Requirements**

To support full OpenVMS I64 and full DECwindows Motif for OpenVMS I64, 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 I64 operating system, as indicated in the OpenVMS I64 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 I64 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 I64 operating systems.

## MEMORY SPACE REQUIREMENTS

### OpenVMS Alpha and OpenVMS I64 Memory Space Requirements

OpenVMS I64 Version 8.2 is supported by the minimal memory requirements of the specific Integrity Server platform. Please refer to 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

Refer to specific layered product documentation for their memory requirements.

## DISTRIBUTION MEDIA

### OpenVMS Alpha and OpenVMS I64

OpenVMS I64 is available on DVD. The OpenVMS I64 Version 8.2 binary DVD contains the operating system and layered product binaries for all layered products included with the operating environments.

**Note:** The quarterly Layered Products Library DVD will supersede layered products media upon each quarterly release. Quarterly updates for layered products included on the OpenVMS OE media will be delivered on an additional DVD to maintain the integrity of the original OpenVMS I64 Version 8.2 binary distribution.

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

OpenVMS Alpha is available on CD–ROM only. The OpenVMS Alpha Version 8.2 CD–ROMs contain the operating system binaries, layered product binaries, freeware, online documentation, and several hardcopy manuals.

## DOCUMENTATION

For OpenVMS Version 8.2, documentation is available in the following formats:

*Printed Books*

For OpenVMS Alpha, printed documentation is available in two sets: the OpenVMS Full Documentation Set and the OpenVMS Base Documentation Set. For OpenVMS I64 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 I64 Operating Environments: DECnet-Plus for OpenVMS, DECprint Supervisor, DECwindows Motif, DCE, and TCP/IP Services for OpenVMS.

*Online Books*

For OpenVMS Version 8.2, online documentation is provided on two CD-ROMs to meet the needs of users on multiple environments. One CD-ROM is Files-11 formatted for use on OpenVMS systems; the second is ISO 9660 formatted for use on Windows and Macintosh™ systems. The contents of the two CD-ROMs are virtually identical. The ISO 9660 CD-ROM includes the Adobe Acrobat® Reader Version 6.0 for users who want to read PDF files on that CD-ROM.

The OpenVMS Version 8.2 Documentation CD-ROM contains documentation for the OpenVMS operating system, associated products for the OpenVMS Alpha environment, and OpenVMS I64 Operating Environment components. Wherever possible, all documents have been provided in both HTML and PDF formats. In some cases, however, only HTML or only PDF is provided.

Note: For OpenVMS I64, the quarterly Online Documentation Library DVD will supersede the previous Online Documentation media upon each quarterly release.

## 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 I64 Operating System Source Listings are available on DVD. The OpenVMS Alpha Operating System Source Listings are available on CD–ROM. 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 I64 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 I64 Ordering Information

A new packaging plan is introduced with OpenVMS I64. With OpenVMS I64 Version 8.2, the operating system software, layered product software, and online documentation CD-ROM are delivered together in one media kit. Media is offered for Foundation (FOE), Enterprise (EOE), and Mission Critical (MCOE) 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 I64 Media Offerings**

| Product No. | Common Description |
|---|---|
| BA322AA | HP OpenVMS I64 FOE Media |
| BA323AA | HP OpenVMS I64 EOE Media |
| BA324AA[1] | HP OpenVMS I64 MCOE Media |

[1] the MCOE will be introduced later in the *OpenVMS I64 Software Rollout*

**Table 2**
**OpenVMS I64 Media Options**

| Media Option | Description |
|---|---|
| #A18 | HP OpenVMS I64 Version 8.2 |
| #AJR | OE Media Kit on DVD |
| #0D1 | Factory Installation |

Each OE media order must include the OE Version option. Please specify option #A18 for OpenVMS Version 8.2.

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

- OE Media Kit on DVD (option #AJR)
- Factory Installation (option #0D1)
- Both OE Media Kit and Factory Installation (options #AJR and #0D1)

The purchase of at least one OE media kit on DVD per customer site is strongly advised, since not all products are included in Factory Installation.

For a complete description of the OpenVMS I64 Operating Environments, or additional ordering information, please refer to the *HP Operating Environments for OpenVMS Industry Standard 64 Version 8.2 for Integrity Servers Software Product Description* (SPD 82.34.xx).

### OpenVMS I64 Software Licenses

A license is referred to as a "License-to-Use" or LTU. The term "with system" means an Integrity Server is on the order. The term "without system" means an Integrity Server is not on the order.

For OEs, two hardware tiers are defined:

- Maximum of 4 Sockets (for systems available at first customer ship)
- Unlimited Sockets (for larger systems to be supported after first customer ship)

Note: A socket is a receptacle for microprocessor modules. A single microprocessor module can contain one or more CPUs.

The following are licenses offered for each OpenVMS I64 Operating Environment. One license is required for each active processor.

**OpenVMS I64 Operating Environment Software Licenses Sold With System**

| | |
|---|---|
| BA325AC | HP VMS I64 FOE PPL LTU max4 sockt w/sys |
| BA326AC | HP VMS I64 FOE PPL LTU unltd sockt w/sys |
| BA397AC | HP VMS I64 EOE PPL LTU max4 sockt w/sys |
| BA327AC | HP VMS I64 EOE PPL LTU unltd sockt w/sys |
| BA399AC | HP VMS I64 MCOE PPL LTU max4 sockt w/sys |
| BA328AC | HP VMS I64 MCOE PPL LTU unltd sockt w/sys |

**OpenVMS I64 Operating Environment Software Licenses Sold Without System**

| | |
|---|---|
| BA338AC | HP VMS I64 FOE PPL LTU max4 sockt w/o sys |
| BA329AC | HP VMS I64 FOE PPL LTU unltd sockt w/o sys |
| BA398AC | HP VMS I64 EOE PPL LTU max4 sockt w/o sys |
| BA330AC | HP VMS I64 EOE PPL LTU unltd sockt w/o sys |
| BA400AC | HP VMS I64 MCOE PPL LTU max4 sockt w/o sys |
| BA331AC | HP VMS I64 MCOE PPL LTU unltd sockt w/o sys |

**OpenVMS Alpha Ordering Information**

The following are licenses offered for OpenVMS Alpha:

**OpenVMS Alpha Software Licenses**

| | |
|---|---|
| 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–ROM Media and Online Documentation**

| | |
|---|---|
| QA–MT1AA–H8 | OpenVMS Alpha software and online documentation CD–ROM |
| QA–MT3AA–H8 | OpenVMS Alpha/VAX software and online documentation CD–ROM (includes Alpha V8.2 and VAX V7.3 documentation) |

**OpenVMS Hardcopy Documentation Sets**

The OpenVMS Hardcopy Documentation sets includes information on all three operating platforms (I64, 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 service contract for the OpenVMS Documentation Set, you will automatically receive the V8.2 updated documents and do not need to order a new set for Integrity servers.

| | |
|---|---|
| BA555MN | OpenVMS I64 Base Documentation Set |
| BA554MN | OpenVMS I64 Full Documentation Set |
| BA401MN | OpenVMS I64 Operating Environment Extension Manuals |
| QA–09SAA–GZ | OpenVMS Alpha and VAX Base Documentation Set |
| QA–001AA–GZ | OpenVMS Alpha and VAX Full Documentation Set |

**OpenVMS Alpha and I64 Source Listings Kit**

| | |
|---|---|
| BA422AA | OpenVMS I64 Listings DVD Kit and License |
| QB–MT1AB–E8 | OpenVMS Alpha Listings CD–ROM Kit and License |

**OpenVMS Alpha Software Products Library (SPL) CD–ROM 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 (I64 Only)

OpenVMS on Integrity servers is offered with a new license type, a Per-Processor License (PPL). OpenVMS I64 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 PPLs. One PPL is required for each active processor in the system or hard partition. If additional processors are later added to the system or hard partition, each requires an additional PPL.

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

For OpenVMS I64, 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 contract
- 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 offered for OpenVMS I64. Rights to new versions are delivered only through a Support Agreement.
- Trade-in allowances are offered as license "options" rather than as separate licenses.

For more information regarding OpenVMS I64 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 I64)**

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

As of 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 grahpics display software is bundled with the OpenVMS operating system license. Media, documentation, and services are all bundled with the operating system software. Refer to the *OpenVMS Version 8.2 Release Notes* for more information.

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 I64 | 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 I64 operating systems, under the applicable open source software license, or other software license. Additional details can be found in the *HP OpenVMS e-Business 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
- Software Development Kit (SDK), *for the Java Platform*
- Universal Description, Discovery, and Integration (UDDI) Client Toolkit

The following are separately licensed products for OpenVMS Alpha. For information on OpenVMS I64 products, please refer to the *HP Operating Environments for OpenVMS Industry Standard 64 Version 8.2 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

This section lists the Integrity server systems that are supported by OpenVMS Version 8.2 for Integrity servers.

- rx1600-2, 1-2P; 1.0 GHz
- rx2600-2, 1-2P; 1.0, 1.3, 1.4, 1.5 GHz
- rx4640-8, 1-4P; 1.3, 1.5 GHz
- rx4640 2-8P (dual-core); 1.1 GHz
- rx1620, 1.6GHz/3MB 267FSB (DP)
- rx1620, 1.3GHz/3MB (DP)
- rx2620, 1.6GHz/3MB (DP)
- rx2620, 1.3GHz/3MB (DP)
- rx2620, 1.6GHz/6MB
- rx4640, 1.6GHz/6MB
- rx4640, 1.5GHz/4MB
- Fast Bundle: rx4640 4CPU confiig 1.6GHz/9MB

### Alpha Systems Supported

This section lists the Alpha systems that are supported by OpenVMS Alpha Version 8.2. Refer to the appropriate page at 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/500X
- DEC 3000 Models 600/600S
- DEC 3000 Models 700/700LX
- DEC 3000 Models 800/800S
- DEC 3000 Models 900/900LX

*DSSI Bus-Based Systems*

- DEC 4000 Model 600
- DEC 4000 Model 700

*XMI Bus-Based Systems*

- AlphaServer 8400 (All chip speeds)

- DEC 7000 Model 600
- DEC 10000 Model 600

*PCI Bus-Based Systems*

- AlphaServer 300 (All chip speeds)
- AlphaServer 400 (All chip speeds)
- AlphaServer 800 (All chip speeds)
- AlphaServer 1000 (All chip speeds)
- AlphaServer 1000A (All chip speeds)
- AlphaServer 1200 (All chip speeds)
- AlphaServer 2000 (All chip speeds, except 5/375)
- 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 DS15
- AlphaStation DS20e
- AlphaStation DS25
- AlphaStation ES40
- AlphaStation ES47
- AlphaStation XP900/DS10
- 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)

*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

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 Alpha)

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

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, refer to the *Systems and Options Catalog* and the *Network and Communications Buyers Guide*.

Refer to 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.

The following terminals are supported by OpenVMS Alpha:

| | | |
|---|---|---|
| VT200 series | VT300 series | VT400 series |
| VT500 series | VXT2000 series | |

### 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 |
| 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 |

| Disk Drive | Description | Bus | Min. Alpha Version |
|---|---|---|---|
| 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 | Version 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 |

NOTE: The preceding list is not complete in terms of currently shipping disk and tape devices; that list changes frequently. Currently, 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/

After clicking on the requested AlphaServer, you can access links from the left-hand columns under Technical Information and then under 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 |

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

[2] Minimum revision firmware is V6000.

[5] TSZ05 is not supported in Version 7.2. Last version supported was Alpha Version 6.1.

| Tape | Description | Bus | Min. Alpha Version |
|---|---|---|---|
| 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 |

NOTE: The preceding list is not complete in terms of currently shipping disk and tape devices; that list changes frequently. Currently, 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

After clicking on the requested AlphaServer, you can access links from the left-hand columns under Technical Information and then under 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 |

[1] TSZ05 is not supported in Version 7.2. Last version supported was Alpha Version 6.1.

| | |
|---|---|
| InfoServer | An integrated hardware and software system that sits directly on the Ethernet to provide CD–ROM, 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. For more information, refer to 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.) Refer to 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.) Refer to 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.) Refer to 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.) Refer to 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.) Refer to 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.) Refer to 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.) Refer to 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. |
| 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. Refer to 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) |
| 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

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

- DS10
- DS10L
- 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. A separate license is required to run 3D graphics software, license part number is QL–0ADA9–AA.

For more information, refer to 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 network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 1000 mb/s. |
| DEGXA-TA, -TB | A network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10, 100, or 1000 mb/s. |
| DEGPA-SA | A network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 1000 mb/s. |
| DEGPA-TA | A network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10, 100, or 1000 mb/s. |
| DE600-AA | A network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10 or 100 mb/s. |
| DE602-AA, -BB | A dual channel network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10 or 100 mb/s. |
| DE602-TA | A dual-port UTP add-on daughter card for 3X-DE602-AA network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10 or 100 mb/s. |
| DE602-FA | A single-port multi-mode fibre add-on daughter card for 3X-DE602-AA network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 100 mb/s. |

| | |
|---|---|
| DE500-AA, -BA | A network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10 or 100 mb/s. |
| DE500-FA | A network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10 or 100 mb/s. |
| DE504-BA | A quad channel network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10 or 1 00 mb/s. |
| DE500-XA | A network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10 or 100 mb/s. |
| DE450 | A network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10 mb/s. |
| DE436 | A quad channel network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10 mb/s. |
| DE435 | A network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10 mb/s. |
| DE434 | A high-performance network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10 mb/s. |
| DEFPA | A network adapter that connects PCI systems to ANSI FDDI local area networks at 100 mb/s. |
| DAPBA | FORE Systems HE155 network adapter that connects PCI systems to ATM local area networks at 155 mb/s(OC3). |
| DAPCA | FORE Systems HE622 network adapter that connects PCI systems to ATM local area networks at 622 mb/s(OC12). |
| DGLPB | ATMworks 350 network adapter that connects PCI systems to ATM local area networks at 155 mb/s(OC3). |
| DGLPA | ATMworks 351 network adapter that connects PCI systems to ATM local area network at 155 mb/s (OC3). |
| PBXNP-DA | A network adapter that connects PCI systems to a Token Ring local area network at 4 or 16 mb/s. |
| PBXNP-AA | A network adapter that connects PCI systems to a Token Ring local area network at 4 or 16 mb/s. |
| DE205 | A network adapter that connects ISA/EISA systems to both the Ethernet and IEEE 802.3 local area networks at 10 mb/s. |
| DE422 | A network adapter that connects EISA systems to both the Ethernet and IEEE 802.3 local area networks at 10 mb/s. |
| DE425 | A high-performance network adapter that connects EISA systems to both the Ethernet and IEIEEE 802.3 local area networks at 10 mb/s. |
| PB2CA-AA | A network adapter that connects EISA systems to both the Ethernet and IEEE 802.3 local area networks at 10 mb/s. |
| DEFEA | A network adapter that connects EISA systems to ANSI FDDI local area networks at 100 mb/s. |
| DW300 | A network adapter that connects the EISA bus to a Token Ring local area network at 4 or 16 mb/s. |
| PMAD | A network adapter that connects TURBOchannel systems to both the Ethernet and IEEE 802.3 local area networks at 10 mb/s. |
| DEFTA | A network adapter that connects TURBOchannel systems to ANSI FDDI local area networks at 100 mb/s. |
| DEFZA | A network adapter 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 adapter that connects the TURBOchannel systems to a Token Ring local area network at 4 or 16 mb/s. |
| DEFAA | A network adapter that connects FUTUREBUS+ systems to ANSI FDDI local area networks at 100 mb/s. |
| DEMNA | A network adapter that connects XMI systems to both the Ethernet and IEEE 802.3 local area networks at 10 mb/s. |
| DEMFA | A network adapter 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 B (OpenVMS I64)

This appendix describes the options supported on OpenVMS I64.

### LAN Options

| | |
|---|---|
| A5230A | A UTP(copper) interface network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area networks at 10 or 100 mb/s. |
| A5506B | A quad port UTP(copper) interface network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area Networks at 10 or 100 mb/s. |
| A6825A | A UTP(copper) interface network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area Networks at 10, 100 or 1000 mb/s. |
| A6847A | A fibre interface network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area Networks at 1000 mb/s |
| A7011A | A dual port fibre interface network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area Networks at 1000 mb/s. |
| A7012A | A dual port UTP(copper) interface network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area Networks at 10, 100 or 1000 mb/s. |
| AB352A | 1000 A dual port UTP(copper) BaseT interface network adapter that connects PCI systems to both the Ethernet and IEEE 802.3 local area Networks at 10, 100 or 1000 mb/s. This card is supported as a rx4640 core IO option only. |

### Storage Options

| | |
|---|---|
| A6826A | 2-port 2GB QLogic Fibre Channel |
| A7173A | 2-port U320 SCSI |

### Combo Cards

| | |
|---|---|
| A9782A | GigE (Fiber) 2GB FC Combo Card |
| A9784A | GigE (Copper) 2GB FC Combo Card |

### Tape Devices

| | |
|---|---|
| SDLT 160/320 | Desktop Tape Drive |
| Ultrium 460 | Desktop Tape Drive |
| DAT72 | Desktop Tape Drive |

### SCSI Storage Shelves

| | |
|---|---|
| DS2100 | SCSI Storage Shelf |
| MSA30 | SCSI Storage Shelf |

### Miscellaneous Options

| | |
|---|---|
| AB552A | OpenVMS Keyboard |
| A9803A | Management Processor Card (for out of band management and basic 2D graphics) |

## APPENDIX C (OpenVMS Alpha and I64 SAN Solutions)

This appendix describes the SAN components supported on OpenVMS Alpha and I64.

### Enterprise Storage Arrays

| | |
|---|---|
| EMA | StorageWorks Enterprise Modular Array 1200, 1600 |
| EVA | StorageWorks Enterprise Virtual Array 3000, 5000 |
| MSA | StorageWorks Modular Storage Array 1000 |
| XP | StorageWorks XP Storage Array 128/1024, 48/512 |

### Adapters and Switches

| | |
|---|---|
| MDR | StorageWorks Modular Data Router for connecting SCSI tape devices to a FC switch. |
| NSR | StorageWorks Network Storage Router for connecting SCSI 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 http://www.hp.com/go/storage webpage |

### SAN-attached Tape Libraries

| | |
|---|---|
| ESL9595 | Enterprise Storage Library |
| ESL9322 | Enterprise Storage Library |
| ESL9326 | Enterprise Storage Library |
| ESL9198 | Enterprise Storage Library |
| ESL630e | Enterprise Storage Library |
| ESL712e | Enterprise Storage Library |
| MSL5000 Series | Modular Storage Library |
| MSL6000 Series | Modular Storage Library |
| 1/8 Tape Autoloader | |

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

For additional information on the SAN-attached Tape Libraries please refer to the following website:
http://www.hp.com/go/storage webpage

### 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 |

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