Software
Product
Description

PRODUCT NAME: Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2.

Note:
This SP describes OpenVMS software for the Alpha and VAX computer family. It applies equally to both Alpha and VAX systems. 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. OpenVMS Alpha supports Compaq Computer Corporation's Alpha series computers, while OpenVMS VAX supports VAX, MicroVAX, VAXstation, and VAXserver series computers. OpenVMS software supports industry standards, facilitating application portability and interoperability. OpenVMS provides symmetric multiprocessing (SMP) support for multiprocessing Alpha and VAX systems. The OpenVMS Alpha operating system provides support for 64-bit virtual memory addressing and Very Large Memory (VLM).

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.

OpenVMS Alpha Version 7.2-2 has been designed as a follow-on release to replace both OpenVMS Alpha Version 7.2-1 and OpenVMS Alpha Version 7.2-1H1. OpenVMS Version 7.2-2 is the version Compaq recommends for coexistence with OpenVMS Version 7.3 in mixed-version OpenVMS Cluster systems.

OpenVMS Alpha Version 7.2-2 includes all the capabilities of its predecessors and introduces new features and hardware support. Some new features have already been released in update kits for certain software modules and system integrated products. Other new features are available in OpenVMS Alpha Version 7.3.

The major new features and hardware supported in OpenVMS Alpha Version 7.2-2 are:

- SMP performance enhancements that include improved process scheduling, faster locking operations, and a dedicated CPU mode for locking
- AlphaServer GS80/160/320 systems support for using AlphaServer EV68 modules and EV67 modules in the same system
- Minicopy support in host-based volume shadowing
- Fibre Channel tape support

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- S P perfor ance enhan ce ents that include i pro ed process schedulin faster loc in operations and a dedicated P ode for loc in
- lphaSer er S yste s support for us in lphaSer er odules and odules in the sa e yste
- incopy support in host based olu e shadowin
-ibre hannel tape support

Important:
Please read the HP Software Technical Support section before you proceed further.
Support for the Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08

Support for the Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08

- Support for the Compaq OpenVMS Alpha Registry Server
- Support for Kerberos Security Client Version 1.0 for OpenVMS based on MIT Kerberos Version 5.0.5.
- New SDA commands, qualifiers and parameters
- New documentation on writing system dump file off the system disk
- Support for the DAPBA (HE155) and DAPCA (HE622) PCI based LAN ATM adapters
- Remedial fixes through April 2001

Now, with Version 2.0 of Compaq DECprint Supervisor (DCPS) for OpenVMS, the right to use all DCPS products (-Base, -Open, and -Plus) is bundled with the OpenVMS Operating System license. Media, documentation, and services are sold separately.

USER ENVIRONMENT

Users can access the Compaq 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. With the DCL command PIPE, individual DCL operations can be connected using a UNIX-like command syntax. OpenVMS prompts users to enter required DCL parameters, making it easy for novice users.

Users can enter 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 on DCL and OpenVMS utilities is available on line through the OpenVMS Help system. Online help includes summary information on all aspects of system operation.

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

Text Processing

The Extensible Versatile Editor (EVE), one of several text editors supplied by Compaq, is the default editor for OpenVMS. EVE allows users to insert, change, and delete text quickly. Written in the DIGITAL Text Processing Utility (DECTPU) language, 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. Ultimate operation is a ail able if a net or T P P product is installed and licensed on each participating node on the network.

Command-Level Programming

Users can enter 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.

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PROGRAM DEVELOPMENT ENVIRONMENT

pen S includes a comprehensive set of tools for developing programs, including: run-time libraries (RTLs), a linker, a librarian, and a symbolic debugger. The assembly-level VAX MACRO-32 language is supplied with OpenVMS VAX. In addition, the Java 2 SDK provides an environment in which to develop and deploy Java applications on OpenVMS Alpha. The following tools are available to the OpenVMS programmer.

Java 2 Software Development Kit

The a a S is a set of building blocks that contain basic de elopent tools and a rich set of class libraries.

Language and Run-Time Library Support

pen S includes se eral T s that pro ide

Strin manipulation

Parallel processin support

routines

con ersion

Ter inal independent screen handlin ate and ti e for attin routines

Hi hly accurate athe atical functions

Si nalin and condition handlin ther eneral purpose functions

ith pen S these routines can be called fro pro ra s written in such lan ua es as

o pa da o pa S SS

ple entation an ua e o pa o pa o pa o pa ortran o pa Pascal and P .

ith pen S lpha these routines can be called fro pro ra s written in such lan ua es as

o pa da o pa S o pa o pa o pa o pa ortran o pa Pascal a a and o pa P .

iso included in pen S lpha are lan ua e support libraries. hile each lan ua e is different all pro ide support for se unital fil and ost support direct and inde ed fil . an ua e T s also pro ide sup por for for attin error handlin and in o pa ortran the ability to read unfor ated file that contain data fro other endors.

T s are pro ided to support translated i a e T s are used to support a few ar chitectural features that differ between and lpha syste s such as floa and H float They also support pro ra s con ered to run on lpha syste s before nati e lpha comiler were a ailable for partic ular pro ra in lan ua es.

any o pa lan ua es adher to the co on call in standard. This means that routines written in any of these lan ua es can directly call routines written in any other lan ua e. e elop ent of applications usin ultiple lan ua es is si ple and strai tforward.

Il user accessible routines in the T s follow the pen S lpha or pen S callin standard and condition handlin con entions and ost are contained within shareable i a es.

t a lower le el pro ra s can call syste ser ices di rectly for security e ent fla asynchro n syste trap lo ical na e record and fil process control ti er ti e con ersion condition handlin loc ana e ent and e ory ana e ent. ain syste ser ices use the pen S or pen S lpha callin standard and condition handlin con entions.

pen S supports the e xecution of user ode i a es created on earlier versio ns of pen S. Typically re co pilin and relin in are not re uired.

MACRO Compiler (Alpha Only)

or i ration purposes the co piler is sup plied with the pen S lpha software.

ith inor odificaions sources can be co piled for e xecution on lpha.

Compaq POSIX Threads Library (Formerly Named DECthreads)

pen S includes a user ode ultithreading capa bility called o pa PS Threads library. o pa PS Threads library pro ides a PS . standard style threads interface. ditioally o pa PS Threads library pro ides an interface that is the pen S i ple entation of istributed o putn iron ent threads as define by The pen roup.

o pa PS Threads library is a library of run ti e routines that allows the user to create ultiple threads of e xecution within a sin le address space. ith o pa PS Threads library emer Threads feat ures enabled o pa PS Threads library pro ides for concurrent processin across all PS in a sy etic ultiprocessor syste by allowin a ulti threaded application to ha e a thread e xecutin on e very P. n anasy etric e. syste a sin le process can ha e a thread e xecutin on all proces sors in the process s ho e . ultithreadin allows
Visual Threads

Visual Threads is a new tool that lets you analyze your multithreaded applications. You can use it to detect potential thread-related issues that only occur due to slight timing differences. You can also use Visual Threads to pinpoint bottlenecks and performance problems. Visual Threads features include the following:

- Detects violation conditions based on the application of particular rules in your code. Several predefined rules look for deadlock conditions, program errors, and performance issues.
- Allows you to use templates to define your own rules to specify criteria for violation conditions.
- Records events to a trace file so that you can play them back and analyze them later.
- Dynamically displays events as they occur, with controls for searching and filtering.
- Suspends execution of the application when it detects violation conditions. You can choose from several options at this point, including invoking the debugger in the appropriate context for your application.
- Dynamically monitors multithreading objects (threads, mutexes, and so on) in real time.
- Provides easy access to object-level statistics and current state information, including use of resources (for example, the mutexes a particular thread holds).
- Automatically analyzes lock contention and lock granularity, statistical hotspots, and processor utilization.
- Visualizes thread state over time, level of contention, and object-level usage statistics.

Librarian Utility

The librarian utility permits storage of object modules, image files, macros, help text, or any general record-oriented information in central, easily accessible files. Object modules and image files are searched by the linker when it finds a symbol that it cannot resolve in one of its input files. Alpha macro libraries, when compiled, are searched by the linker. VAX macro libraries are searched by the assembler when the assembler finds a macro that is not defined in the input. Hypersort

Hypersort is a portable library of user-callable routines that pro ide a hi h perfor ance sortin capability for VAX systems.

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 them in the source code.

Debugger

The 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.

Alpha System-Code Debugger

The Alpha 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 Alpha 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 to identify the state of the system at the time of failure. The dump file can be located on any locally connected disk. On Alpha only, dump compression allows both full and selective dumps to be written to smaller file than required for uncompressed dumps. Full memory dumps, if not compressed, require a dump file big enough to hold all necessary information.

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**SYSTEM MANAGEMENT ENVIRONMENT**

- 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. The Spinlock Tracing Utility is supported on OpenVMS Alpha Version 7.2-1H1 and above.

- 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 only, 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 environment 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 peratin system. The RMS file utility section of the OpenVMS Alpha version 7.1 and above system.

- File Differences Utility

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

- Translated Image Environment (TIE) (Alpha Only)

  - The Translated Image Environment (TIE) converts images that 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 on a system that has been translated elsewhere.

**Compaq Availability Manager Version 2.0**

- Compaq Availability Manager is a system management tool that enables you to monitor one or more OpenVMS Alpha systems on an extended local area network (LAN). This tool helps system managers and analysts target specific nodes or processes for detailed analysis. The Availability Manager collects system and process data from multiple OpenVMS Alpha nodes simultaneously. It analyzes the data and displays the output using a native Java GUI. It is included in the OpenVMS distribution kit.

- The Availability Manager Data Analyzer requires a run-time environment, it does not run on OpenVMS VAX, which does not support Java. To perform real-time system monitoring on VAX systems, one should use DECamds.

- Installation of the Availability Manager Version 2.0 client on an OpenVMS system requires Java Version 1.1.8 or later. Compaq recommends using, at a minimum, the following hardware configuration: 500 MHz Alpha processor with 128 MB of memory. The Availability Manager Version 2.0 kit for OpenVMS includes the Data Analyzer and Data Collector:
  - The Java Data Analyzer can be installed only on OpenVMS Alpha Versions 7.2, 7.2-1, and 7.2-2.
  - The Data Collector can be installed on OpenVMS VAX and Alpha Versions 6.2, 7.1, 7.1-2, 7.2, 7.2-1, 7.2-1 variants, and 7.2-2.

- On a Windows system, Compaq recommends using, at a minimum, either of the following hardware configurations:
  - Windows NT or 2000—300 MHz Intel Pentium processor with 96 MB of memory
  - Windows NT—500 MHz Alpha processor with 128 MB of memory

- You can install the Availability Manager Data Analyzer on any system running Windows NT 4.0 SP3 or later or on Windows 2000. Please note that you must reinstall Availability Manager Version 2.0 after upgrading to Windows 2000.
DECamds Version 7.2-1B

a ds erion . is a ailable on the pen S distribution it. a ds is a separately installable real ti e hi h perfo ance ultisystem ontitor util ity. t is supported on any syste runnin pen S erion . or hi her. ith pen S erion . the ri ht to use a ds was included under the ter s and conditions of the pen S operatin syste base license for both lpha and a ds is the pre decessor of the newer application ailability ana er.

a ds pro ides syste resource ontitor in es ti ation aid and correction capability. This enables sys te ana ers to proacti ely and effecti ely ana e ulipute syste s fro a centrai ed windows dis play. a ds software includes an pen S de ice dri er which is installed on e ery node on the that is to be ontitored. The software includes a ofi application that allows a syste ana er to perfo ontitorin functions. The ofi application can be installed on any pen S lpha or wor station. a ds is currently in aintence ode.

Il new syste ana e ent functionaity re uested for a ds will be directed to the ailability ana er product.

Compaq Management Agents for OpenVMS Version 2.2

o pa ana e ent ents fo pen S erion . consists of a web ser er for syste ana e ent with ana e ent a ents that allow you to co unicate with de ices on your pen S syste s o er the internet or intranet. o pa ana e ent ents fo pen S utili es eb based enterprise ana e ent ar chitecture. This is an architecture that allows one to use a web browser to onitore any de ices that are connected to a networ . e ices can co puter sys te s networ ed printers or networ co ponents such as router. uses a three tiered ar chitecture that includes a ana e ent ser er de ices ana ed by web a ents and a web browser.

o pa ana e ent ents fo pen S use S P and T P P protocols that allow the ana e ent ser er to co unicate with pen S de ices. The ana e ent ents use co on web enablin co ponents to pro ide re istration disco ery HTTP co unication and a ho e pa e for the ana ed de ices. The ana e ent a ents can send infor ation directly to the ana e ent ser er. or they can create an HT fi to co unicate directly with a browser.

OpenVMS Management Station Version 3.0

pen S ana e ent Station is a powerful icrosoft indows T based ana e ent tool for syste ana e ers and others who perfo syste ana e ent tas s on pen S syste s. pen S ana e ent Station features a powerful intuiti e user interface. Sys te ana ers and help des staff no lon er need to re e ber co plicated synta or co and proced ures to ana e their pen S syste s. pen S ana e ent Station a es syste ana e ent uch easier.

Three functional areas are now i ple ented in pen S ana e ent Station user account ana e ent printer ueue ana e ent and stora e confi uratio ana e ent. or user account ana e ent pen S ana e ent Station supports account creation oduction and deletion as well as rea in ac counts and displayin account attributes. Printer ueue ana e ent a es it possible for syste ana ers to ana e all printers print ueues and obs in their en iron ent usin a centrali ed indows . This in cludes ontitorin one or ore printers addin or re o in printers and their associated ueues e a inin and odiofin ueue and printer attributes and re uerin or dele tin obs.

The current release of pen S ana e ent Station adds stora e ana e ent support. pen S an a e ent Station now a es it easy for one to ana e their dis stora e de ices across ulipute pen S luster syste s and pen S odes. ith pen S ana e ent Station one no lon er needs to aintain co plicated co and file to control their stora e en iron ent. ne can create delete and ana e stor a e fro an easy to use indows interface. t pro ides a persistent database that can auto atically deter ine and confi ur your syste s stora e confi uratio at syste startup.
OpenVMS Management Station is now based on the Microsoft Management Console (MMC). The MMC provides a common management framework for various administration programs. OpenVMS Management Station is implemented as an MMC snap-in and includes all of the components you need.

Features include:

• Storage Configuration Management—You can create, delete, and manage a disk volume under one interface. Wizards make it easy to add systems to be managed, create a volume, and so forth.

• Configuration Control Over Reboots—If you allow it to, OpenVMS Management Station preserves the disk configuration across reboots. OpenVMS Management Station can mount and maintain your storage configuration without intervention. And, OpenVMS Management Station mounts volumes much faster than is possible with DCL or command procedures, so performance is enhanced.

• Coexistence with Established Environment—You do not have to change your existing DCL command procedures if you don't want to. You can use the display capabilities of OpenVMS Management Station without having to use the automated mount feature. In this way, you can give OpenVMS Management Station as little or as much control as you are comfortable with.

• Remote Management Supported—You can use OpenVMS Management Station to remotely manage your OpenVMS systems. Once you establish a TCP/IP RAS connection, you can then use OpenVMS Management Station to manage your OpenVMS systems from home or on the road.

Note:

The version of MMC included in this baselevel requires file provided by Microsoft Internet Explorer. Version 3.02 or later of Internet Explorer must be present on the system. The OpenVMS Management Station supports only TCP/IP connections for primary servers, so at least one OpenVMS system must be running TCP/IP. If you are running Version 6.2 of OpenVMS and plan to manage shadow volumes, remedial kits are required. Additional TCP/IP stacks for OpenVMS have not been tested. However, TCP/IP stacks that are 100% compliant with the QIO interface for Compaq TCP/IP Services should also work. Contact your TCP/IP vendor for additional information and support issues.

Enterprise Capacity and Performance (ECP) Data Collector and ECP Performance Analyzer

P ata ollector and P Perfor ane naly er

S ata ollector and P Perfor ane naly er are licensed with the pen S operatin syste and is a alable fro the pen S Syste ana e ent web pa e at

http www.open.s.co pa .co open s syste ana e ent.html

P ata ollector and P Perfor ane naly er are licensed with the pen S lpha and peratin Syste enion . to enion .

P ata ollector is a hi hly eficient detaled per for ane data collector and P Perfor ane naly e pro ides raphic historical reportin of pen S per for ane para eters. Satisfyin the needs of nter prise ane ent P ata ollector also contains an P that pro ides an interface for the access of collecte perfor ane data. This interface con ets the contents of the . P data fil enerated by the data collector into a for atted co a separated S fil that can then be used for perfor ane analysis and re portin pro ra s.

The P ata ollector pro ides

• Robust data collection set—It collects more system metrics than other vendors (for example, over 250 VMS performance parameters).

• Flexible data collection—The sampling rate of data can be tuned down to sub-second intervals.

• Low overhead—Audited production systems now running have routinely shown that the collector has less than 1.5% impact on CPU.

The ECP Performance Analyzer provides:

• Native OpenVMS product running under Motif

• Viewing of performance data in graphical format

• Analyzed data including CPU, Memory and I/O

• User-selected sampling rate

Software Support Service for these products is sold separately. Please contact your OpenVMS representative for further details.

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 noninteractive workloads in parallel with timesharing or real-time jobs.
The pen S batch and print operations support two types of uuees e en e uuees and e eution uuees. e enic uue is an inter eti ate uue that holds a ob until an appropriate e eution uue beco es a ail able to initiate the ob. n e eution uue is a uue throu h which the ob either print or batch is actually processed.

The syste uuees batch obs for e ection. The sys te ana er can re ulate the nu ber of uuees and the nu be r of stream s per uue the nu ber of batch obs in the uuee that can e eute concurrently.

oth e enic e eution batch uuees can ha e dif ferent attributes such as the a i u P ti e per itted wor in set si e a priority, ailities are pro ided for startin g and stoppin g uuees and for startin g and stoppin obs in a uuee. ecause ultiple e ection uuees can be associated with a enic uue pen S enables load balancin across a ailable P s in an pen S lustre syste increasin o er all syste throu h put.

Print uuees both e enic e ection to ether with uue ana e e nt facilities pro ide er sai soluble print ca pabilities includin support for arious print fil for ats.

The a i u nu ber of process identifier for uuein re ues is .

Accounting Utility

or accountin purposes pen S eeps records of syste resource usa e. These statistics include pro cessor and e ory utili ation counts print sy biont line counts i a e acti ation counts and process ter ination records. The pen S countin utility allows you to ener ate arious reports usin this data.

Audit Analysis Utility

or security auditin purposes pen S selecti ely records critical security rele ant e ents in the syste security audit lo file. These records contain the date and ti e the e ent occurred the identity of the asso ciated user process and infor ation specifi to each e ent type. This infor ation helps the syste ana er ain syste security and deter possible intruders. The pen S udit alysis utility allows you to ener ate arious reports fro this data.

Autoconfigure/AUTOGEN Utilities

The uutoconfi ur and T utilities auto atically confi ur the a ailable de ices in the syste tables and set syste para eters based on the peripheral and e ory architecture. This eli nates the need for a tra ditional syste eneration process when the hardware confi uratio is e panded or otherwise odiffed.

Backup Utility

The ac up utility pro ides both full olu e and incre ental fil bac ups for file structured ounted olu es and olu e sets. ndi idal files selected directory structures or all file on a olu e set can be bac ed up and restored. il es can be selected by arious dates such as creatin or odi fi cation and can be bac ed up to a netic tape a netic dis or rite nec ead any optical dis. The ac up utility can also be used to restore a sa e set or list the contents of a sa e set.

P P has been added for in o in bac up routines fro an e euctable procedure.

The ac up ana er for pen S pro ides a screen oriented interface to the ac up utility that assists users in perfor in routine bac up operations. The ac up ana er is enu dri en and pro ides accs to the sa e restore and list operations with out ha in to understand ac up co and synta.

The ability to create odify recall and delete ac up ana er te plates that describe the ac up sa e operations.

The ac up ana er wor s on all supported pen S confi uration with a ide o ter nal t uses the Screen ana e ent S T routines to pro ide a window li e user interface. The software does not assu e any pri ile e on the part of its user beyond access to the file and de ices bein operated upon.

Standalone BACKUP Utility (VAX Only)

Standalone P pro ides a echanis for syste ana ers to bac up and restore syste dis s. This utility can also be used durin the installation of the pen S operatin syste.

Analyze Disk Structure Utility

The naly e is Structure utility co pare the struc ture infor ation on a dis olu e with the contents of the dis prints the structure infor ation and per its chan es to that infor ation. t can also be used to re pair errors detected in the fil structure of dis s.
Monitor Utility

The utility enables the system administrator to monitor different classes of systemwide performance data including: process activity, I/O activity, memory-management activity, vector-processing activity (VAX only), and two-phase commit-transaction activity at specific intervals. The data can be displayed as it is gathered or saved in a file for later use.

License Management Facility (LMF)

The facility allows the system administrator to enable software licenses and to determine which software products are licensed on a system.

System Management Utility (SYSMAN)

The utility allows system administrators 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. The environment can include OpenVMS Alpha and VAX systems configured in an OpenVMS Cluster or multiple systems networked through DECnet or DECnet-Plus.

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

Kerberos

Kerberos is a network authentication protocol designed to provide strong authentication for client/server applications by using secret-key cryptography. The Kerberos for OpenVMS authentication system, based upon work done by Massachusetts Institute of Technology (MIT), is provided in three separate components:

- Key Distribution Center (KDC) server
- Client subsystem
- Two application-programming interfaces, one written to comply with the Generic Security Service Application Programming Interface (GSS-API V2) as defined by RFC2078. The second API presents the Kerberos interface to the users. Other APIs are delivered as sharable images on OpenVMS.

Kerberos was created by the Massachusetts Institute of Technology as a solution to network security problems. The Kerberos protocol uses strong cryptography so that a client can prove its identity to a server and vice versa across an insecure network connection. After a client and server have used Kerberos to prove their identity, they can also encrypt all of their communications to assure privacy and data integrity.

Per-Thread Security Profiles

Thread-level security allows for simplified multiprocessor application development and improves overall performance while maintaining a high level of security. This feature allows each execution thread of a multithreaded process to run an independent security profile without impacting the security profile of other threads in the process.

This feature, known as Per-thread security profiles, includes a new security structure known as the Persona Security Block (PSB), which supersedes many process-wide structures and fields including the ARB, JIB user-name and account information, PHD privilege bits, and the PCB NOAUDIT cell.

A new SYSGEN parameter, ARB_SUPPORT, has been added to allow system administrators to control the level by which the current security data in the PSB will be backported to these old privilege data cells. There are four levels of support ranging from NONE (ARB_SUPPORT = 0) to FULL (ARB_SUPPORT = 3).

External Authentication

External authentication is an optional feature that enables OpenVMS systems to authenticate designated users within a LAN Manager domain using their LAN Manager user name and password.

If you want to enable external authentication on your system, you need DECwindows Version 1.2-4 or later and any requirements outlined in the Compaq Advanced Server for OpenVMS Server Installation and Configuration Guide and the Compaq PATHWORKS for OpenVMS Server Installation and Configuration Guide. See these manuals and the OpenVMS Guide to System Security for detailed information about using external authentication. Additional information on advanced security features is available in the OpenVMS Guide to System Security.
The password stored in the S S is not the pass word used to erify the user at lo in ti e.

The S S user na e selected to be used for pen S process profil pri ile es uotas and so on and to apply specifi lo in restric tions. Howe er there are two ey differences between e ternally authenticated users and nor al pen S users. or e ternally authenticated users

Security APIs

Security P s for intrusion detection pro y access and i personation ser ices are a ailable on both the I pha and plattor s to pro ide better security in client ser er applications.

The Security Persona ser ices pro ide the ability to sup port alternate security odels. pen S security per sona ser ices allow pen S applications the ability to attach T or any other on pen S security creden tials to an pen S security profile

Government Security Ratings

The followin table ilustrates pen S is co it ted to consistently deli erin rated security in our base products.

### Version | Rating | Evaluation Date
--- | --- | ---
pen S lpha . H | | |
pen S lpha . | | |
S S lpha . | | |
pen S | | |
S S | | | | |
pen S | | |
S S | | |
S | | |

These ratin s represent the ational o puter Secu rity enter alization of the desi n of the pen S and S S operatin syste s a ainst DoD 5200.28-STD Department of Defense Trusted Computer System Evaluation Criteria. To obtain an e aluation su ary please isit the S S at Trusted Product aluation Pro ra TP P ho epa e at

http www.radiu ncsc. il tpepl epl historical.htm | 

pen S pro ides a rich set of tools to control user ac cess to syste controlled data structures and de ices that store infor ation. pen S e ples a reference onitor concept that ediates all access atte pts be tween subects such as user processes and security rele syste obects such as files pen S also pro ides a syste security audit lo fil that records the results of all ob ect access atte pts. The audit lo can also be used to capture infor ation re arin a wide ariety of other security rele ent e ents.

The syste ana er aintains user account infor ation in the syste user authori ation fil S S . hen creatin user accounts with the authori e utility the syste ana er assi ns the pri ile es and uotas associated with each user account. The syste ana er also assi ns a user na e password and uni ue user identificatio code to each account. ddi tional identifi er can be assi ned to each account al lowin users to belon to ulitple o erlapping roups or pro ects. The syste ana er can li it account use by the ti e of day day of wee and type of access such as local re ote networ or batch.

To lo in and ain access to the syste the user ust supply a alid user na e and password. The pass word is encoded and does not appear on ter inal dis plays. sers can chan e their password oluntarily or the syste ana er can specify how frequ ently pass words chan e alon with ini u password len th and the use of rand o ly enerated passwords.
Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08

pen S pro ides a password dictionary filte that screens password choices for co on words and a user password history filte that pre ents users fro re usin passwords that they ha e used within the past year. n addition to these built in filters a site can desi n and install its own filte to screen passwords accordin to a site specifi password policy.

The system password hash al orth can also be re placed with a pri ate al orth for those sites that ha e contractual obli ations to use specifi public or pri ate password encryption al orth s. The syste ana er can enable this feature on a per user per password ba sis.

o in security includes brea in detection which dis ables ter inals when password uessin is detected. sers retain a secure lo in path which can thwart Tro an horse attac s a ainst local ter inals. dditionally the syste ana er can associate a syste password with dial in ter inal lines to pre ent the display of any operatin syste specifi identificatio that i ht yield clues to possible attac ethods. hen a user lo s in the syste displays a essa e statin when the last lo in for the account occurred and the nu ber of failed atte pts since the last successful lo in.

ey security rele ant syste ob cts is labeled with the of its owner alon with a si ple protection as . The owner consists of two fields the user fiel and a roup field. Syste ob cts also ha e a protec tion as that allows read e cute and delete access to the ob cts owner roup pri ile ed syste users and to all other users. The syste ana er can protect syste ob cts with access control lists s that allow access to be ranted or denied to a list of in di idual users roup s or identifiers s can also be used to audit access atte pts to critical syste ob cts.

pen S applies full protection to the followin syste ob cts

apabilities only
o on e ent fla clusters
e ices
roup lobal sections
o ical na e tables
atch print ueues
esource do ains
Security classes
Syste lobal sections
olu es S
olu es S

pen S pro ides security attribute defaults in the for of security profil te plates. These te plates are referenced when er a new ob ect is created and pro ide a eans of associatin default security infor ation with each syste ob ect class ecept for files. Protec tion infor ation for file is inherited fro the pre ous version of an e istin file the parent directory or the default protection of the creatin process.

ata sca en in protection can be enabled in the for of hi h water ar in and erase on delete attributes. These attributes ensure that the contents of a fil can not be read after the fil has been deleted. The syste ana er can enforce fil erasure on a per olu e basis. The syste ana er can also replace the dis erasure pat tern with a pri ate pattern for those sites that ha e contractual obli ations to use a specifi pattern.

Security auditin is pro ided for the selecte e recordin of security related e ents. This auditin infor ation can be directed to security operator ter inals alar s or to the syste security audit lo fil audits. ach au dit record contains the date and ti e of the e ent the identity of the associated user process and additional infor ation specifi to each e ent.

pen S pro ides security auditin for the followin e ents

o in and lo out
o in failures and brea in atte pts
b ect creation access deaccess and deletion se lectable by use of pri ile e type of access and on indi idual ob cts
uthori ation database chan es
etwor lo ical lin connections for net for pen S net Plus windows P and S S
se of identifier or pri ile es
nstalled i a e additions deletions and replace ents
olu e ounts and dis ounts
se of the etwor ontrol Pro ra P utility
se or failed use of indi idual pri ile es
se of indi idual process control syste ser ices
Syste para eter chan es
Syste ti e chan es and recalibrations

Note: ecause no syste can pro ide co ple se curity o pa cannot guarantee co ple syste se curity. Howe er o pa continues to enhance the security capabilities of its products. usto ers are
strongly advised to follow all industry recognized security practices. The recomended procedures are included in the *OpenVMS Guide to System Security*.

**OPERATING SYSTEM ENVIRONMENT**

**OpenVMS VAX Processes and Scheduling**

The basic unit of execution in OpenVMS VAX is the process. Each process consists of individual address space and resides known as the context and code called the executable image. The context identifies the process and describes its current state. Executable images consist of system programs and user programs that have been compiled and linked.

The number of concurrent processes is per OpenVMS system.

Processes receive the context of the system services the event and then passes control to the highest priority process ready to execute. The system automatically ad justs the priorities of processes in the range of 0 to 16 and bound and interacting processes. However, the system does not ad just the priority of a process in the range of 16 to 63 for Alpha.

Each time an event such as an interrupt occurs, the system services the event first and then passes control to the highest priority kernel thread ready to execute. The system adjusts the priorities of kernel threads un a thread as ready to execute.

Kernel threads can be assi red to the priority by the programmer. Each kernel thread has a priority in the range of 0 to 15.

Pen is a primary unit of execution in OpenVMS VAX. Each kernel thread consists of individual address space and registers known as context, and code called an executable image. The context identifies the process and describes its current state. Executable images consist of system programs and user programs that have been compiled and linked.

The number of concurrent processes is per OpenVMS VAX system.

The maximum number of concurrent processes is 16,384 per OpenVMS Alpha system.

Processes receive the context of the kernel thread and describes its current state. Each process can have up to 256 kernel threads. Executable images consist of system programs and user programs that have been compiled and linked.

The system or a specific group of users. The system controls interactively terminal and one or more printers.

**OpenVMS Alpha Processes and Scheduling**

The basic unit of execution in OpenVMS Alpha is the kernel thread. Each kernel thread consists of individual address space and resides known as the context and code called the executable image. The context identifies the kernel thread and describes its current state. Each process can have up to 256 kernel threads. Executable images consist of system programs and user programs that have been compiled and linked.

The number of concurrent processes is per OpenVMS Alpha system.

Teams receive the context of the kernel thread as ready to execute. The system does not adjust the priority of a kernel thread in the range of 0 to 16 on VAX and 16 to 63 on Alpha.

Each time an event such as an interrupt occurs, the system services the event first and then passes control to the highest priority kernel thread ready to execute. The system adjusts the priorities of kernel threads un a thread as ready to execute.

Kernel threads can be assi red to the priority by the programmer. Each kernel thread has a priority in the range of 0 to 15.

Pen is a primary unit of execution in OpenVMS Alpha. Each kernel thread consists of individual address space and registers known as context, and code called an executable image. The context identifies the process and describes its current state. Executable images consist of system programs and user programs that have been compiled and linked.

The number of concurrent processes is per OpenVMS Alpha system.

The maximum number of concurrent processes is 16,384 per OpenVMS Alpha system.

Processes receive the context of the kernel thread and describes its current state. Each process can have up to 256 kernel threads. Executable images consist of system programs and user programs that have been compiled and linked.

The system or a specific group of users. The system controls interactively terminal and one or more printers.
64-Bit Virtual Addressing (Alpha Only)

The OpenVMS Alpha operating system provides support for 64-bit virtual memory addressing. This capability makes the 8TB virtual address space, defined by the Alpha architecture, available to the OpenVMS Alpha operating system and to application programs. Future hardware implementations will provide greater capacity.

OpenVMS Alpha compilers and applications take advantage of 64-bit processing by using 64-bit data types. Refer to the SPDs for the OpenVMS Alpha compilers for further details. Note that the application virtual address space defaults to a 32-bit implementation for compatibility and migration purposes.

Very Large Memory (VLM) Features (Alpha Only)

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

Memory-resident global sections allow a database server to keep larger amounts of "hot" data cached in physical memory. The database server then accesses the data directly from physical memory without performing I/O read operations from the database file on disk. With faster access to the data in physical memory, runtime performance increases dramatically.

As of OpenVMS Alpha Version 7.2, VLM applications that share a large memory-resident cache can use Fast I/O for memory shared by processes through global sections. Fast I/O improves the ability of a VLM application, such as a database server, to handle larger capacities and higher data throughput rates. By reducing the CPU costs per I/O request, Fast I/O and memory-resident global sections dramatically increase performance for critical database server I/O operations.

Shared page tables allow that same database server to reduce the amount of physical memory consumed within the system because multiple I/O processes can share a single cached database. This increases overall system capacity and decreases response time to client requests.

Extended Physical Addressing (VAX Only)

Physical address space is 32 bits. The OpenVMS VAX operating system can provide 3.5 GB of physical memory and .5 GB of I/O and adapter space. This enables large applications and workloads to access the large amounts of physical memory they require.

The following table lists the VAX processors that support this extended physical addressing:

<table>
<thead>
<tr>
<th>System</th>
<th>Accessible Physical Memory</th>
<th>I/O and Adapter Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>model 600</td>
<td>1.25 GB</td>
<td>.5 GB</td>
</tr>
<tr>
<td>series 6000</td>
<td>3.5 GB</td>
<td>.5 GB</td>
</tr>
<tr>
<td>series 10000</td>
<td>3.5 GB</td>
<td>.5 GB</td>
</tr>
</tbody>
</table>

Vector Processing (VAX Only)

A single data item with only one value is known as a scalar value. A group of related scalar values, or elements, with the same data type is known as a vector.

The system parameters GBLPAGES and GBLPAGFIL are dynamic parameters. Users with the CMKRNL privilege can change these parameter values on a running system. Increasing the value of the GBLPAGES parameter allows the global page table to expand, on demand, up to the new maximum size.

The Reserved Memory Registry supports memory-resident global sections and shared page tables. Through its interface within the system, the register allows an OpenVMS system to be configured with large amounts of memory set aside for use within memory-resident sections or other privileged code. The register also allows an OpenVMS system to be properly tuned through AUTOGEN, thus accounting for the preallocated reserved memory.

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A more detailed description of the VAX vector architecture, vector registers, and vector instructions appears in the VAX MACRO and Instruction Set Reference Manual.

The OpenVMS VAX operating system provides fully shared, multiprogramming support for VAX vector processing systems. By default, OpenVMS VAX loads vector support code when initializing vector-present systems but does not load it when initializing vector-absent systems. System managers can control this behavior by using the VECTOR_PROC system parameter.

The presence of vector support code in a system has little effect on processes running in a scalar only system or scalar processes running in a vector present system. Any processes using the vector processor resources run with control and privilege in the vector system.

The OpenVMS VAX operating system makes the services of the vector processor available to system users by means of a software abstract known as a capability. A system manager can restrict the use of the vector processor to users holding a particular identifier by associating an ACL entry with the VECTOR object.

The VAX Vector Instruction Emulation Facility (VVIEF) is a standard feature of the OpenVMS VAX operating system. It allows vectorized applications to be written and debugged in a VAX system in which vector processors are not available. VVIEF emulates the VAX vector processing environment, including the nonprivileged VAX vector instructions and the OpenVMS VAX vector system services. Use of VVIEF is restricted to code in user mode.

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 Compaq 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.

The DECdtm services allow applications to define local transactions that can include calls to any number of database resources and for distributed resources to be updated automatically. These resources can be either physically shared on different clusters at separate sites or logically shared in different databases on the same node.

The DECdtm services can be written to ensure that data is never in an inconsistent state at any point in the system's failure.

Interprocess Communication

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

- Interprocess communication services
- 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, barriers, 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)

The OpenVMS operating system supports symmetric multiprocessing (SMP) for both Alpha and Ultrix processor systems. SMP is a form of tightly coupled multiprocessor in which all processors perform operations simultaneously. All processors perform operations in all OpenVMS access modes, user, supervisor, executive, and kernel.
pen S P configuration consist of multiple P s e ecution code from a sin le shared e ory address space. Sers and processes share a sin le copy of pen S lpha or pen S address space. S P also pro ides si ultaneous shared access to co on data in lobal sections to all processors. pen S P selects the P where a process will run based on its priority and in special cases as directed by the application. pen S uses a special ed schedulin al orth when runnin a nonuniform e ory access platfor .

S P support is an inte ral part of pen S and is pro ided to the user transparently. e acue an S P syste is a sin le syste entity it is confi ure into a networ and pen S luster confi uration as a sin le node.

Networking Facilities

pen S pro ides de ice dri ers for all o pa local area networ adapters listed in the sections of appendix of this SP . Application pro ra ers can use the syste ser ice to co unic ate with other syste s connected ia the usin either thernet or institute of lectrical and electronics n neers . Pac et for at. Si ultaneous use of o pa thernet and the . protocols are supported on any o pa adapter.

pen S supports the standards defined by the T oru s erion . Specification for e u lation o er an T networ . yi ple entin an e u lated o er an T networ you enable a roup of T stations to act li e a traditional . e u lated o er an T networ allows you to run your e istin ap lications basically unchan ed while th e co uters on which your applications are runnin are connected to the T networ .

net Plus offers tas to ta co unic ations fil ana e ent downline syste and tas loadin net wor co and ter inals and networ resource shar in capabilities as define in the T etwor r chitecture Phase protocols. net Plus pro ides the newest net features such as e tended addressin and downline load perfor ance enhance ents. net Plus inte rates net and S pro tocols and now pro ides a lin a e to T P P usin e use for o ents and net and S applications can now be run o er net SP S S and T P P transports.

For pen S and lpha offers the net wor in capabilities as define in the T etwor r chitecture Phase . or e infor ation re fer to the net Plus and net Software portion of the Asso ciated Products section of this SP .

Terminal Server Products

pen S ter inal ser er products pro ide ter inal ser er access to pen S. hen used in an pen S luster en iron ent ter inal ser ers distribute users across the a ailable lpha and syste s at lo in ti e.

pen S can also establish a connection to other de ices such as printers attached to such ter inal ser ers.

Reliability

pen S handles hardware errors as transparently as possible while aintainin data inte rty and pro id suficien infor ation to dia nose errors. The syste li its the effects of an error by firs deter in if the error is fatal. f the error occurs in syste conte t the current pen S syste shuts down. f the error is not fatal the syste reco e actions pertinent to the error and continues the current operation.

n all cases infor ation rele ant to the error is written to the error lo fil for later analysis. Hardware errors include the followin cate ories

Processor errors. These include processor soft errors processor hard errors processor achine chec s and adapter errors.

Memory errors. These can be unrec e erable hard errors or reco erable soft errors. The syste e a ines e ory at startup ti e and does not use any bad pa es. urin syste operation the sys te corrects all sin le bit e ory errors for those syste s with error correction code e ory. n pen S an unrec e erable error causes the e ory pa e on which the error occurred to be added to the bad pa e list. f the pa e has not been odifid syste operation continues with a new copy of the pa e.

Correctable memory errors. pri ary cause of these correctable e ory errors is alpha particle radiation. n so e processors when correctable e ory errors occur the e ory controller corrects only the data returned to the P or controller. The actual data in e ory is left with the error intact. Subse ut read operations cause correction cycles to occur and in ost cases an interrupt to report the error. n any of these processors pen S onitors the occurrence of correctable e ory er rors and in al ost all cases is able to e the er ror condition by rewritin the data in e ory. ewrit in the data causes the data to be corrected in that e ory location. n pen S if the cause of the error is not transient and the error condition persists the operatin syste atte pts to e the data fro the e istin pa e which contains the error
Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08

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.

Power Failures (VAX Only)

The system restarts de ice and communication lines and all operating system processes including network tape operations. A system shutdown occurs automatically if the system is set up to do so. If the system is set up to try to restart the system, it will attempt to start all processes that were running at the time of the power failure. If the system is not set up to try to restart the system, it will not attempt to start any processes.

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. The CI port and DSA disk drivers have been enhanced to take advantage of the Fast Path capability. 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.

Virtual I/O Cache

OpenVMS provides a standalone or clusterwide file-oriented disk cache. Applications benefit from the ability to access data quickly without special coding. The virtual file caching mechanism is chosen based on the type of clusterwide access currently in progress. Virtual file caching reduces I/O by caching files in memory and accessing them directly without hitting the disk.

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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. The CI port and DSA disk drivers have been enhanced to take advantage of the Fast Path capability. 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.

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OpenVMS provides a standalone or clusterwide file-oriented disk cache. Applications benefit from the ability to access data quickly without special coding. The virtual file caching mechanism is chosen based on the type of clusterwide access currently in progress. Virtual file caching reduces I/O by caching files in memory and accessing them directly without hitting the disk.

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**Record Management Services (RMS)**

RMS is a set of services that helps application programs process and manipulate files and records. It provides a comprehensive software interface to mass storage devices. RMS supports device-independent access to unit-record devices.

RMS supports sequential, relative, and indexed file organizations in fixed-length and 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.

**Disk and Tape Volumes**

The system supports file system quotas on a disk to control the amount of space individual users can allocate. RMS supports the use of quotas on a per file basis. These quotas can be controlled for each individual file set in the system or for each individual file if the file is not part of a set.

The system can cache disk structure information to reduce overhead for file access. 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.

**OpenVMS Alpha Support for New AlphaServer GS Series Systems**

OpenVMS Version 7.2-2 provides support for Compaq's AlphaServer GS80, GS160, and GS320 systems. This support includes:

- OpenVMS support for hard and soft partitions (Galaxy) on AlphaServer GS80, GS160, and GS320 systems.
- OpenVMS Resource Affinity Domain (RAD) support for applications.
- OpenVMS support for CPU online replace.

**OpenVMS Support for Hard and Soft Partitions**

Hard partitioning is a physical separation of computing resources by hardware-enforced access barriers. It is possible to read or write across a hard partition boundary. There is no resource sharing between hard partitions.
Soft partitioning is a separation of computing resources by software-controlled access barriers. Read and write access across a soft partition boundary is controlled by the operating system. OpenVMS Galaxy is an implementation of soft partitioning.

The way that customers choose to partition their systems depends on their computing environments and application requirements. For more information about using hard partitions and OpenVMS Galaxy, see the OpenVMS Alpha Partitioning and Galaxy Guide.

OpenVMS Application Support for Resource Affinity Domains (RADs)

The large amount of physical memory in the AlphaServer GS80/160/320 systems provides opportunities for extremely large databases to be completely in memory. The nonuniform memory access (NUMA) system architecture of the new AlphaServer GS80/160/320 systems provides the bandwidth to efficiently access this large amount of memory. NUMA is an attribute of a system in which the access time to any given physical memory is not the same for all CPUs.

The operating system treats the hardware as a set of resource affinity domains (RADs). A RAD is a set of hardware components (CPUs, memory, and I/O) with common access characteristics. On AlphaServer GS80/160/320 systems, a RAD corresponds to a quad building block (QBB) in an AlphaServer GS80, GS160, or GS320 system.

The OpenVMS RAD support for application features see the OpenVMS Alpha Partitioning and Galaxy Guide.

E-BUSINESS TECHNOLOGIES

The OpenVMS e-Business Infrastructure Package provides key Internet and e-Business software technologies that enhance the OpenVMS Alpha operating system. All of the components are supported on OpenVMS Alpha Version 7.2-1 and higher. These technologies are licensed as part of the OpenVMS Alpha operating system and are provided on the OpenVMS e-Business Infrastructure CD-ROM (order number QA-6LYAA-H8). Additional details can be found in the OpenVMS e-Business Infrastructure Package Software Product Description (SPD 80.58.xx). Most of these technologies can also be downloaded from:

http://www.openvms.compaq.com/ebusiness/index.html

Java 2 Software Development Kit for OpenVMS Alpha

The Java 2 Software Development Kit (SDK) provides an environment in which to develop and deploy Java applications on OpenVMS Alpha. A Java application can be written once and run on any operating system that supports the Java Virtual Machine (JVM). The Java 2 SDK is a set of building blocks containing basic development tools and a rich set of class libraries including:

- Java Compiler
- Java Virtual Machine (JVM)
- Java Class Libraries
- Java Applet Viewer
- Java Debugger and other tools
- A POSIX threads (pthreads) implementation that provides increased performance on multiprocessor systems
- Flexible options for representing UNIX directory and file specifications on OpenVMS systems

Services for the Java 2 SDK for OpenVMS Alpha are provided under existing OpenVMS Operating System service agreements.

Compaq Secure Web Server for OpenVMS Alpha

Compaq Secure Web Server for OpenVMS Alpha (CSWS) provides a powerful, flexible web server based on the popular Apache Web Server 1.3.12 from the Apache Software Foundation and provides the following features:

- HTTP/1.1 compliance (RFC2616)
- All standard Apache extensions (modules)
- Perl support (mod_perl)
- Java support (mod_jserv)
- Secure Sockets Layer (SSL) support (mod_ssl) using OpenSSL and RSA Crypto-C (BSAFE)
- Digital certificate from VeriSign Inc.

Services for Compaq Secure Web Server for OpenVMS Alpha are provided under existing OpenVMS Operating System service agreements.

http www.openvms.compaq.com ebusiness inde.ht I

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- a o plier
- a a virtual machine
- a a class libraries
- a a pllet viewer
- a a ebus er and other tools
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- le ible options for representin directory and fil specification on pen Syste

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- All standard Apache extensions (modules)
- Perl support  od perl
- a a support  od ser
- Secure Socket ayer SS  support  od ssl usin penSS and Srypto S
- Digital certificate from eriSi n nc.

Services for the a a S for pen S Ipha are pro ided under e istin pen S peratin Syste ser ice a ree ents.
Attunity Connect “On Platform” Package

Attunity Connect is object oriented middleware that facilitates the development of applications that access, integrate, and update data from multiple, heterogeneous sources across a wide range of operating systems and platforms. Additional data adapters for OpenVMS Alpha and Attunity Connect are available directly from Attunity.

The full Attunity Connect product provides ODBC, JDBC, XML, ADO, and OLEDB client APIs and adapters for a large number of relational and nonrelational data sources and support for a large number of popular platforms including UNIX, Windows, OpenVMS, Tandem, and mainframes.

Services for the Attunity Connect “On Platform” Package for OpenVMS Alpha are provided under existing OpenVMS Operating System service agreements.

Extensible Markup Language (XML) Technology

Using open source software from Apache Software Foundation, an XML parser and an XSLT stylesheet processor are provided that give applications the ability to parse, generate, manipulate, validate, and transform XML documents and data.

Services for the XML Technology for OpenVMS Alpha are provided under existing OpenVMS Operating System service agreements.

Compaq OpenVMS Enterprise Directory for e-Business (LDAPv3/X.500)

The OpenVMS Enterprise Directory for e-Business, based on the X.500 standard, delivers robust and scalable directory services across intranets, extranets and the Internet to customers, suppliers and partners. It combines the best of both the industry standard LDAPv3 and X.500 capabilities. The former allows access by a myriad of Lightweight Directory Access Protocol (LDAP) clients, user agents and applications and the latter brings very high performance, resilience, advanced access controls, and easy replication across the enterprise.

Certified with Entrust/PKI 5, this directory ensures a single sign-on that all users may be authenticated with zero latency and that each gains access only to those resources they are authorized to use.

The full OpenVMS Enterprise Directory for e-Business is available on the OpenVMS e-Business Infrastructure CD-ROM. It is also available on the OpenVMS Alpha Software Layered Products Library. Software Support Service for this product is sold separately. Refer to the Compaq OpenVMS Enterprise Directory for e-Business Software Product Description (SPD 40.77.xx) for additional information.

Reliable Transaction Router

Reliable Transaction Router (RTR) is fault tolerant transactional messaging middleware used to implement large, distributed applications using client/server technology. Reliable Transaction Router enables computing enterprises to deploy distributed applications on OpenVMS Alpha and VAX systems.

Software Support Service for this product is sold separately. Refer to the Reliable Transaction Router for OpenVMS Software Product Description (SPD 51.04.xx) for additional information.

Compaq BridgeWorks

Compaq BridgeWorks is a distributed application development and deployment tool for OpenVMS 3GL applications. Compaq BridgeWorks consists of a GUI development tool on the Windows NT desktop, a server manager component on OpenVMS, and extensive online help. Compaq BridgeWorks provides developers with an easy means to create distributed applications using OpenVMS as the enterprise server and Windows NT as the departmental server. Compaq BridgeWorks enables software developers to develop components that encapsulate selected functionality in 3GL OpenVMS applications using an interactively defined interface that encapulates selected functionality in a manner that is transparent to the client.

Certified with Entrust/PKI 5, this directory ensures at single sign-on that all users may be authenticated with zero latency and that each gains access only to those resources they are authorized to use.
Compaq COM for OpenVMS

Component Object Model (COM) is a technology from Microsoft that allows developers to create distributed network objects. Compaq Computer Corporation and Microsoft jointly developed the COM specification. First released by Microsoft on Windows NT as Network Object Linking and Embedding (NetOLE), and then renamed Distributed COM (DCOM), the COM specification now includes network objects.

COM is used to create distributed applications made up of reusable objects. It locates objects locally or in a network and uses the Remote Procedure Call (RPC) wire protocol to communicate between these objects across the network.

COM on OpenVMS delivers connectivity and interoperability between OpenVMS and Windows NT systems. With Compaq COM for OpenVMS, programmers write distributed applications that run across a heterogeneous environment of systems. Compaq COM for OpenVMS is based on the Microsoft COM shipped on Windows NT 4.0 SP3 and implements many of the features of Microsoft COM including activation, automation, monikers, Type Libraries, and structured storage on OpenVMS.

COM on OpenVMS requires OpenVMS Alpha Version 7.2 or higher.

The binary kit for COM (both developer kit and runtime) ships on the OpenVMS e-Business Infrastructure CD-ROM. COM is not available on VAX. Software Support Service for this product is sold separately. For more information, see the Compaq COM for OpenVMS Software Product Description (SPD 70.45.xx).

Netscape FastTrack Server for OpenVMS Alpha

Netscape FastTrack Server Version 3.02 for OpenVMS Alpha is a general-purpose Web server for creating, building, publishing, and serving Web pages and applications.

Netscape FastTrack Server is being replaced by Compaq Secure Web Server (based upon Apache) for OpenVMS Alpha. FastTrack will continue to be supported until June 30, 2002 on OpenVMS Version 7.1 and Version 7.2 systems.

Services for the Netscape FastTrack Server for OpenVMS Alpha are provided under existing OpenVMS service agreements.

ASSOCIATED PRODUCTS

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

Compaq Advanced Server for OpenVMS Alpha

Compaq Advanced Server for OpenVMS is supported on OpenVMS Alpha systems only. Compaq Advanced Server is an open standard network operating system that provides networking features for OpenVMS Alpha.

Compaq Advanced Server V7.2A and V7.3 for OpenVMS are supported on OpenVMS Alpha Version 7.2-2. The Advanced Server for OpenVMS product evolved from the PATHWORKS for OpenVMS (Advanced Server).

Advanced Server is an OpenVMS-based network operating system (NOS) compatible with Microsoft networking technology. The software lets you establish Compaq OpenVMS systems as servers to provide Windows desktop users 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 on 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).

Compaq PATHWORKS for OpenVMS (Advanced Server)

PATHWORKS for OpenVMS (Advanced Server), also known as PATHWORKS Advanced Server, runs on OpenVMS Alpha and VAX systems. Both Versions 6.0C and 6.0D of Compaq PATHWORKS for OpenVMS (Advanced Server) are supported on OpenVMS Version 7.2-2. PATHWORKS Advanced Server, as with Advanced Server for OpenVMS, is an OpenVMS-based network operating system compatible with, and enhancing, the Microsoft networking technology, and providing file and print services for Windows desktop users. It is compatible with Windows NT servers running in the same network.

Compaq Galaxy Software Architecture on OpenVMS Alpha

Galaxy Software Architecture is a software development framework that provides a foundation for building distributed applications. It includes tools and libraries for creating, deploying, and managing applications.
Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08

Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08

Compaq 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 companies looking to improve their ability to manage unpredictable, variable, or growing IT workloads, OpenVMS Galaxy technology provides a flexible way to dynamically reconfigure and manage system resources.

An OpenVMS Galaxy computing environment is ideal for high-availability applications, such as:

- Database servers
- Transaction processing systems
- Data warehousing
- Data mining
- Internet servers

With OpenVMS Alpha Version 7.2-2 and higher, you can create an OpenVMS Galaxy computing environment that allows you to run multiple instances of OpenVMS on AlphaServer systems, and also allows you to:

- Reassign CPUs between instances
- Perform independent booting and shutdown of instances
- Use shared memory for inter-instance communication
- Create a shared memory RAMdisk with Compaq DE-Cram for OpenVMS Alpha Version 3.0
- Cluster instances within an OpenVMS Galaxy using the shared memory cluster interconnect
- Cluster instances with non-Galaxy systems
- Create applications using OpenVMS Galaxy APIs for resource management, event notification locking for synchronization, and shared memory for global sections
- Use the Galaxy Configuration Utility to view and control the OpenVMS Galaxy environment
- Run a single-instance OpenVMS Galaxy on any Alpha system for application development

Compaq Galaxy Software Architecture on OpenVMS Alpha requires OpenVMS Alpha Version 7.2 or later. For more information about OpenVMS Galaxy licensing requirements, refer to the 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, refer to the OpenVMS Alpha Partitioning and Galaxy Guide.

Compaq OpenVMS Cluster Software

Compaq OpenVMS Cluster software is available for Alpha and VAX systems as a separately licensed System Integrated Product (SIP). It provides a highly integrated OpenVMS computing environment that is distributed over multiple systems containing up to 96 nodes.

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

- Memory Channel
- C I
- DIGITAL Storage Systems Interconnect (DSSI)
- Fiber Distributed Data Interface (FDDI)
- Ethernet
- Small Computer System Interface (SCSI)
- Shared Memory Cluster Interconnect (SMCI) (Galaxy only)
- Fibre Channel (Storage Only) Version 7.2-1 and above

In addition, when configured with suitable FDDI bridges, OpenVMS Cluster configuration 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. Application programs specify the level of OpenVMS Cluster file sharing that is required; access is then coordinated by the extended QIO processor (XQP) and Record Management System (RMS).

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The pen S user ana er controls the pen S luster batch and print uues which can be accessed by any node in the pen S luster. atch obs sub titted to pen S luster uues are routed to any a ailable P so that the batch load is shared.

The oc ana er pro ides synchroni ed ser ices be tween syste s in a cluster for use by both syste co ponents such as S and P and for direct use by applications.

Two or ore lpha and co puters connected to the sa e e ory hannel SS or S S interconnect ust be coni ure as e bers of the sa e pen S luster syste . i ed architecture and i ed erison clusters that contain both lpha syste s and sys te s are supported.

pen S luster syste s pro ide a unifor co put in en iron ent that is hi hly scalable hi hly a ailable and secure. pen S luster software i ple ents a sin le security en iron ent within a cluster coni ura tion. The security subsyste ensures that all cluster isible ob ects maintin consistent security profile and that syste security auditin controls operate cluster wide.

Compaq TCP/IP Services for OpenVMS

As pro ides olu e Shadowin for pen S I pha and products for perfor in dis irrin op erations usin a reduent array of independent dis s stora e strate y.

Compaq Volume Shadowing for OpenVMS

olu e Shadowin for pen S is a ailable for lpha and syste s as a separate licensed Sys te nte ration Product S P . olu e Shadowin for pen S pro ides hi h data a ability for dis de ices by ensurin a ainst data loss that results fro e dia deieration or controller or de ice failure. This pre ents stora e subsyste co ponent failures fro in terruin syste or application tas s.

The syste dis and lies n is Structure S S data dis s can be olu e shadowed.

olu e Shadowin for pen S supports the cluster wide shadowin of o pa S S and S stora e sys te s. olu e Shadowin for pen S also supports shadowin of all S P ser ed S dis s and o pa S S dis s. Il dis s in a sin le shadow set ust ha e the sa e nu ber of lo ical bloc s. Shadow set e bers can be located on a sin le syste or anywhere in an pen S luster syste . is s can be confi ure on any S P or o pa S S co pliant controller.

olu e Shadowin for pen S pro ides fault toler ance resultin fro dis e dia de errors or controller errors across the full ran e of lpha and processors and coni urations Shadow set e ber units can be lo cated on different controllers and pen S lpha and pen S S P ser ers pro idin coni uratio fle ibilit and a hi h de ree of data a ability.

olu e Shadowin for pen S supports up to sin le e ber shadow sets and up to de ices in utiple e ber two or three e ber shadow sets on a standalone or pen S luster syste .

The binary it for olu e Shadowin ships with the pen S lpha and distribution its. To run the software custo ers ust purchase a license. efer to the o pa Volume Shadowing for OpenVMS Software Product Description (SPD 27.29.xx) for ore infor a tion.

Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08
Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08

Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2.

versions of TCP/IP Services for OpenVMS and is supported on OpenVMS Alpha Versions 7.1 and 7.2 and OpenVMS VAX Versions 7.1 and 7.2.

Compaq DECnet-Plus and DECnet Software

Compaq DECnet for OpenVMS VAX and Alpha software is a System Integrated Product (SIP) that is licensed separately from the OpenVMS operating system. Refer to the Compaq DECnet for OpenVMS VAX and Alpha Software Product Description (SPD 48.48.xx) for further information on supported communications devices and software features.

Compaq DECnet-Plus (formerly DECnet/OSI) is licensed separately from the OpenVMS operating system. The license for Compaq DECnet for OpenVMS VAX and Alpha 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. Refer to the Compaq DECnet-Plus for OpenVMS Alpha Software Product Description (SPD 50.45.xx) and the Compaq DECnet-Plus for OpenVMS VAX Software Product Description (SPD 25.03.xx) for further information on supported hardware configuration and software features.

Compaq RMS Journaling for OpenVMS

Compaq provides the RMS Journaling for OpenVMS Alpha and VAX products as separately licensed SIPs that enable a system manager, user, or application to maintain the data integrity of RMS file 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 modification that have been made to a file. This type of journaling allows users to recover files that are inadvertently deleted, lost, or corrupted. RMS Journaling recovers the file by applying the journaled modification to a backup copy, thereby restoring its final state. Application modification are not necessary to use after-image journaling.

- **Before-image journaling.** Allows users to reverse modification that have been made to a file. This type of journaling allows users to return a file to a previous known state. This is useful if a file is updated with incorrect or bad data. Application modification are not necessary to use before-image journaling.

- **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, the partially completed transaction is aborted. This allows completion of transactions to be completed as an atomic entity. Partially completed transactions can be re-entered. Application modification are not necessary to use recovery-unit journaling.

The binary file for RMS journaling ships with the OpenVMS Alpha and distribution. To run the software, customers must purchase a license and documentation. Refer to the Compaq RMS Journaling for OpenVMS Software Product Description (SPD 27.58.xx) for more information.

Compaq DECram for OpenVMS

Compaq 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 RAMdisk than from a physical disk device. These RAMdisks can be accessed through the file system just as physical disks are accessed. No change is required to application or system software.

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

In Compaq DECram for OpenVMS Version 3.0, DECram’s capability is extended to use OpenVMS Galaxy shared memory to create a VMS shared memory disk. This will allow customers to take advantage of OpenVMS Galaxy shared memory with no modification to any of their applications.

Compaq DECwindows Motif for OpenVMS

Compaq offers a separately licensed layered product called DECwindows Motif for OpenVMS. 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.

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DCE Run-time Services for OpenVMS, which is following products:

- Compaq DCE for OpenVMS currently consists of the
- assurance the integrity of the enterprise.
- aging the entire distributed computing environment, while
- system managers with a set of tools to consistently man-
- cate and share information safely and easily across the
- interoperable client/server applications. Users can lo-
- parent, application developers can easily build portable,
- the underlying networks and operating systems trans-
- as a single system to the user. Because DCE makes
- VMS serves as the basis for an open computing envi-
- faces that facilitate the creation, use, and maintenance
- by The Open Group's DCE, as well as tools for
- provides and define a consistent user interface for end
- users and a consistent de elop ent en iron ent for ap-
- plication de elopers across ultiple platfor s.

The pen S software installation procedure contains an optional step to install the windows otif for pen S wor station and font support which is re
- uired to run the windows otif for pen S lay ered product. efer to the OpenVMS Alpha Version 7.2 Upgrade and Installation Manual or OpenVMS VAX Version 7.2 Upgrade and Installation Manual for details concernin the optional installation of the windows otif for pen S de ice support.

CONFORMANCE TO STANDARDS

pen S is based on the followin public national and international standards.

Distributed Computing Environment (DCE) Support

The o pa for the pen S product fa ily pro
- ides a set of the distributed co putin features spec ifie by The pen roup s as well as tools for application de elopers. ith The pen roup has established a standard set of ser ies and inter faces that facilitate the creation and maintenance of client ser er applications. o pa for pen
- Ser es as the basis for an open co putin en i
- ron ent where networ s of ul tendor syste s appear as a sin le syste to the user. ecause a es the underlyin networ s and operatin syste s trans parent application de elopers can easily build portable interoperae client ser er applications. ser s can lo cate and share infor a eion safely and easily across the entire enterprise. o pa for pen S supplies syste ana ers with a set of tools to consistently an a e the entire distributed co putin en iron ent while assurin the inte rity of the enterprise.

o pa for pen S currently consists of the followin products

- un ti e Ser ies for pen S which is re
- uired for all syste s participatin in the cell. The un ti e Ser ies include client functions as well as ad ministration tools. un ti e Ser ies allow client ser er applications to interop erate o er net T P P and P P networ pro
tocols.

- application e elopers it for pen S
which is re uired for de elopers of distributed appli-
cations but is optional for other users. The p
- plication e elopers it pro ides pro ra ers with an
interface efinitio an ua e an easy to
use S based lan ua e for writin re ote pro
- cedure calls.

- ell irectory Ser ice S one of which is re
- uired for each cell. The Ser ice pro-
tests resources fro ille al access and pro ides se
- cure co unications within and between cells.

The ri ht to use the un ti e Ser ies is included with the pen S operatin syste base license. ll other products are a ilable as separate layered products. efer to the o pa istributed o putin en iron ent for pen S Software Product e
- scription SP . . for ore detailed infor aion.

Support for OSF/Motif and X Window System Standards

windows otif pro ides support for S otif a
- standards based raphical user interface. windows
- otif also pro ides support for the onsortiu s
- indow Syste ersion elease ser er and the version elease client.

Standards Supported by OpenVMS

The pen S operatin syste is based on the fol-
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Standards Supported by OpenVMS

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- licitation docu ents.
Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2.

SPD 41.87.08

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INSTALLATION

pen S is distributed as binary on and tape. pen S release for which T and a netic tape edia will be distributed. T is used to install confi ure reconfi ure and dein stall software products that ha e been prepared with the utility. n addition the P T utility pro ides a database to trac the installation reconfi uration and deinstallation of software. or products installed with other installation techno ies the P T utility pro ides a echanism for addin infor ation about the into the product database. The P T utility also pro ides the ability to ana e dependencies between products durin the installation process.

or software pro iders the P T Software n stallation utility si plifie the tas of pac a in software by pro idin a si ple declarati e lan ua e for descri in material for the installation it and definin how it is installed. The P T utility handles the func tions while the de eloper instructs the utility what to do. This si nificant redues the co ple ity and ti e to de elop installation procedures. The lan ua e allows the de eloper to easily specify dependencies on other software ana e ob ects in the e ecution en iron ent such as file and directories and anticipate and re sol e confl c before it occurs. The P T util ity also si nificant plifie the pac a in of ulitple software products into one lo ical product suite.

or pen S you use the P T Software instalation utility to install layered products that are co pliant with the P T utility.

VMSINSTALL

pen S includes the S ST facility to handle the installation of optional o pa supplied software products that ha e not been converted to use the P T Software installation utility. pen S also includes the S ST facility to auto ate oper atin syste software updates.

Test Package and Diagnostics

pen S includes a ser n iron ent Test Pac a e TP which erfi e that the pen S operatin syste is properly installed and ready for use on the cus to e syste s.

ou can run dia nostics on indi dail de ic es durin nor al syste operation. ertain critical co ponents can operate in de raded ode.

OpenVMS Alpha DISK SPACE REQUIREMENTS

Operating System Disk Space Requirements

The dis space re uire ents for pen S ary accordin to which options are installed

<table>
<thead>
<tr>
<th>File Category</th>
<th>Space Used</th>
<th>Running Total</th>
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</thead>
<tbody>
<tr>
<td>ini u pen S file</td>
<td>space optional</td>
<td>pen S file windows Support</td>
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<tr>
<td>Pa in fil re uired</td>
<td>Swap fil su ested</td>
<td>u p fil optional</td>
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<tr>
<td>eco pressed Help file optional</td>
<td>ull windows otif ersion . optional</td>
<td>Safe uard for up radin</td>
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</tbody>
</table>

Note: The ini u pen S file listed in the table will allow you to run with ini al functionality. ot all pen S co ands and utilities will function fully as docu ented in this ini u confi uration ot all o pa and other layered products will wor in this ini u confi uration.

The ini u pen S file are for a syste confi uration where all optional features ha e been declined durin the initial installation. or ost applications this is not a realistic pen S en iron ent.
The paging, swap, and dump file requirements are the minimum for a system with 32 MB of main memory. Additional memory in most cases adds to the space needed for these files as will particular needs of your application. It is possible to use the paging file as a temporary dump file for an OpenVMS Cluster system disk, paging, swap, and dump files cannot be shared between nodes, so the file must either be duplicated on the system disk or located on some other disk.

To support OpenVMS Alpha and DECwindows Motif for OpenVMS Alpha, Compaq recommends a system disk of greater than 550 MB. However, you can install a subset of DECwindows Motif. 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. 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 Version 1.2-6 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 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.

In addition to the disk space used directly by the OpenVMS Alpha operating system, there may be additional space used to store information for those products in the system disk space. The amount of additional space required cannot be accurately predicted due to the possibility of unused space already existing in those library files. Normally, large modules contributed by layered products can also affect the amount of space required.

To support the complete OpenVMS VAX system, Compaq recommends a system disk of greater than 150 MB. When you use a smaller disk, additional tailoring is required before installing some of the OpenVMS VAX options. This does not include the dump file space. Refer to the OpenVMS VAX Version 7.2 Upgrade and Installation Manual for information on tailoring.

### Operating System Disk Space Requirements

<table>
<thead>
<tr>
<th>File Category</th>
<th>Space Used</th>
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<td>ini unit works file</td>
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<td>DECwindows Motif windows support</td>
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<td>.S .S etc.</td>
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</table>

Note: The ini unit works file listed in the table will allow you to run with initial functionality of all commands and utilities will function fully as documented in this ini unit configuration. All other layered products will work in this ini unit configuration.
The data in the table was created from an installation on a server with an operating system for Alpha and VAX, Versions 7.2, 7.2.1, 7.2-1H1, and 7.2-2.

Additional memory adds to the space required for page, swap, and dump files and the variable additional space increases with larger operating systems.

**Compaq DECwindows Motif for OpenVMS VAX Disk Space Requirements**

To support OpenVMS VAX and the DECwindows Motif for OpenVMS VAX layered product, Compaq recommends a system disk of greater than 300 MB. The disk space required for the installation of DECwindows Motif is 60 MB. The permanent amount of space used is 54 MB. An additional 16 MB are needed to install the DECwindows X11 Display Server and associated files (The DECwindows X11 Display Server and associated file are included in the OpenVMS VAX Version 7.3 media.) These disk space requirements are in addition to the disk space required for the OpenVMS VAX Version 7.2-2 operating system, as indicated in the OpenVMS VAX Disk Space Requirements table.

Installation of the DECwindows Motif Version 1.2-6 layered product gives customers the option of installing any or all of the following components:

- **Run-time support files base kit** — 41 MB. This section provides support for running DECwindows Motif for OpenVMS VAX applications on VAX computer servers and includes support for the OpenVMS VAX operating system and applications libraries.
- **Programming support** — 7 MB. This section includes support for the OpenVMS VAX programming languages, including Pascal and Prolog.
- **Example files** — approximately 7 MB. Note that the individual sizes add up to more than the total because some components are shared by multiple portions of the environment.

**MEMORY SPACE REQUIREMENTS**

**OpenVMS Alpha Memory Space Requirements**

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 particular applications or number of users. Refer to specific layered product documentation for their memory requirements.

**OpenVMS VAX Memory Space Requirements**

The minimum amount of memory required to install, boot, and log in to an OpenVMS VAX system is 14 MB. To ensure satisfactory performance for particular applications or number of users, additional memory may be required. Refer to specific layered product documentation for their memory requirements.

**DISTRIBUTION AND BACKUP MEDIA**

**OpenVMS Alpha**

OpenVMS Alpha is available on CD-ROM only. The OpenVMS Alpha Version 7.2-2 Binary CD-ROM contains the operating system binaries and selected documentation in both text and PostScript format. An InfoServer or local drive is required for upgrades and system disk backups.

The OpenVMS Alpha operating system is also available as part of the OpenVMS Alpha Software Products Library offering.

**OpenVMS VAX**

OpenVMS VAX is available on CD-ROM, TK50, or 9-track 6250 BPI magnetic tape media. The 9-track 6250 BPI magnetic tape media is available only through the OpenVMS VAX media and hardcopy documentation update service.

The TK50 streaming tape contains the OpenVMS VAX Version 7.2 save sets and OpenVMS VAX Version 7.2 standalone BACKUP.

The 9-track 6250 BPI magnetic tape contains the OpenVMS VAX Version 7.2 save sets.

The OpenVMS VAX Version 7.2 Binary CD-ROM contains the OpenVMS VAX Version 7.2 save sets, OpenVMS VAX Version 7.2 standalone BACKUP, and selected OpenVMS documentation in text and PostScript format.

The OpenVMS VAX operating system is also available as part of the OpenVMS VAX Software Products Library offering.
DOCUMENTATION

or pen S version . docu entation is a ailable in the followin for ats.

Printed Books

pen S printed docu entation is a ailable in two sets the pen S ull ocu entation Set and the pen S ase ocu entation Set.

The ull ocu entation Set is for users who need e tensi e e planatory infor ation on all a or pen S resources co plete reference infor ation on syste routines and utilities detailed e a ples pen S luster guidelines pro ra in concepts a aster in de and infor ation on the Help essa e utility. This set eets the needs of syste ana ers and of sys te and application pro ra ers. t includes the ase ocu entation Set.

The ase Set includes the ost co only used pen S anuals addressin the needs of eneral users and syste ana ers of s all standalone syste s. anuals such as the eleas es ew ea tures and the ictionary are included in the ase Set.

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Online Books

line docu ents are pro ide on the pen S er sion . ocu entation an S for at that can be oued and read on pen S indows and acintosh syste s. This contains the entire pen S docu entation set and docu entation sets for associated products in HT for at. Selected product docu ents are pro ided in PostScript Te t and P for ats. pen S archi ed anuals are in P for at.

GROWTH CONSIDERATIONS

The ini u hardware and software re uire ents for any future er sion of this product ay be different fro the re uire ents for the current er sion.

SOURCE LISTINGS

pen S lpha and peratin Syste Source listin s are a ailable on . These discs contain source listin file and the lpha specifi debu sy bol file that a e up the pen S operatin syste . o pa pro ides source listin s for ey odules of the pen S operatin syste that are appropriate for end users or application de eloers. The debu sy bol file S on the pen S lpha Source istin s contain infor ation used by the pen S lpha Syste ode ebu er. ertain co pany confidentia

source listin s and debu sy bol files howe er are e cluded fro the .

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ORDERING INFORMATION

Alpha Software Licenses

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VAX Software Licenses
Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08

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SOFTWARE LICENSING

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

Software License Information (Alpha Only)

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 an AlphaServer system.

The right to use Compaq DECprint Supervisor (DCPS) for OpenVMS products (-Base, -Open, and -Plus). The DECprint Supervisor (DCPS) for OpenVMS has separate documentation, media kit, and service products. Refer to the Compaq DECprint Supervisor for OpenVMS Software Product Description (SPD 44.15.xx) for more information.

The right to use the DCE Run-time Services is included with the OpenVMS base operating system license. Refer to the Compaq Distributed Computing Environment (DCE) Software Product Description (SPD 43.05.xx) for more detailed information on the DCE for OpenVMS product family.

The right to use Compaq Capacity On Demand for OpenVMS is included with the OpenVMS base operating system license.

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

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Related Software Product Description (SPD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attunity Connect &quot;On Platform&quot; Package for OpenVMS Alpha</td>
<td>SPD 80.58.xx</td>
</tr>
<tr>
<td>Compaq COM for OpenVMS Alpha</td>
<td>SPD 70.45.xx</td>
</tr>
<tr>
<td>Compaq BridgeWorks</td>
<td>SPD 80.58.xx</td>
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<tr>
<td>Compaq Secure Web Server for OpenVMS Alpha</td>
<td>SPD 80.58.xx</td>
</tr>
<tr>
<td>ECP Data Collector for OpenVMS</td>
<td>SPD 80.88.00</td>
</tr>
<tr>
<td>ECP Performance Analyzer for OpenVMS</td>
<td>SPD 80.89.00</td>
</tr>
<tr>
<td>Extensible Markup Language</td>
<td>SPD 80.58.xx</td>
</tr>
<tr>
<td>Java 2 Software Development Kit for OpenVMS Alpha</td>
<td>SPD 80.58.xx</td>
</tr>
<tr>
<td>Netscape FastTrack Server for OpenVMS Alpha</td>
<td>SPD 80.58.xx</td>
</tr>
<tr>
<td>OpenVMS Enterprise Directory for e-Business (LDAPv3/X.500)</td>
<td>SPD 40.77.xx</td>
</tr>
<tr>
<td>Reliable Transaction Router (Alpha and VAX)</td>
<td>SPD 51.04.xx</td>
</tr>
</tbody>
</table>

The following are separately licensed products:

- 32
Software License Information (VAX Only)

The OpenVMS VAX operating system uses one of two different categories of licenses depending on the hardware and software configuration used and currently supported. This information is also provided in the applicable country’s Price List.

These are the two categories of operating system licenses for OpenVMS VAX:

- **VAX VMS Licensing**
- **OpenVMS VAX Licensing**

VAX VMS License Information

Note: Effective February 6, 1995, the VAX VMS licenses no longer include the rights for the Oracle Rdb Run-Time option for OpenVMS VAX, and do not permit use of Rdb Run-time on prior versions of OpenVMS VAX.

There are four types of VAX VMS licenses:

**1. Traditional License (QL-001A**)**

This type of license provides unlimited use to the users on a defined system. VAX VMS traditional licenses are sized to capacity according to system type.

**2. Multi-User License (QL-001A**)**

This type of license provides use according to a specified number of concurrent users. This is an activity-based license. The multi-user license provides the customer with the right to use the operating system up to the limit of users specified in the license. An operating system user is a person who is logged in to the system and is using the system interactively. This license is only available on limited system models, primarily MicroVAX and VAX 4000 systems.

The customer can increase interactive use of VAX systems licensed with the Multi-User License by the addition of OpenVMS User Licenses (for one or more users). Refer to the section on Ordering Information for further information.

**3. VAX VMS Workstation License (QL-001A**)**

This type of license provides use for a single user on a VAX workstation. This license type allows one direct login for the single user and one additional login for system management purposes only.

Additional interactive use of VAX workstations licensed with the VAX VMS Workstation License requires the addition of an OpenVMS User License (for one or more users). Refer to the section on Ordering Information for further information.

**4. File and Application Server License (QL-001A**)**

This type of license provides for the noninteractive use of OpenVMS.

System Support Services

Additional interactive use of VAX stations licensed with the VAX VMS license requires the addition of an OpenVMS User License for one or more users. Refer to the section on Ordering Information for further information.

**VAX VMS License Information**

Note: Effective February 6, 1995, the VAX VMS licenses no longer include the rights for the Oracle Rdb Run-Time option for OpenVMS VAX, and do not permit use of Rdb Run-time on prior versions of OpenVMS VAX.

Each of the following licenses are for a specific hardware system which is either the system the license was originally shipped with or the system on which the license was first used.

- **perating System License**
- **perating System Server License for pen S**

There are four types of VAX licenses.

- **Traditional License for pen S**

This type of license provides unlimited use to the users on a defined system. Traditional licenses are sized to capacity according to system type.

- **Multi-user License for pen S**

This type of license provides use according to a specific number of concurrent users. This is an activity-based license. The multi-user license provides the customer with the right to use the operating system up to the limit of users specified in the license. An operating system user is a person who is logged in to the system and is using the system interactively. This license is only available on limited system models, primarily MicroVAX and VAX 4000 systems.

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- **File and Application Server License for pen S**

This type of license provides for the noninteractive use of OpenVMS.
Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2.  SPD 41.87.08

OpenVMS VAX License Information

There are five types of OpenVMS VAX licenses:

1. OpenVMS VAX Operating System Base License
   (QL–005A*–**)  LMF Product Name: BASE-VMS-250136

   The OpenVMS VAX Operating System Base License grants the right to unrestricted, noninteractive use of the OpenVMS VAX operating system for the execution of remotely submitted requests for batch, print, application, and computing services, on a designated, single processor. This license authorizes one direct login for system management purposes only.

   The OpenVMS VAX Operating System Base License also includes the license for DECprint Supervisor for OpenVMS VAX. The DECprint Supervisor for OpenVMS VAX has separate documentation, media kits, and service products. Refer to SPD 44.15.xx for further details.

2. Symmetric Multiprocessing (SMP) Base Extension License (QL–005A9–6*)
   LMF Product Name: BASE-VMS-250136

   SMP Base Extensions extend the Operating System Base License to enable symmetric multiprocessing capability on a select number of OpenVMS VAX systems supporting 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.

3. OpenVMS VAX Individual User License (QL–XULA*–**)
   LMF Product Name: VMS-USER

   The OpenVMS VAX Individual User License provides the right to interactively use the operating system by the specified or unlimited number of concurrent users on a designated, single processor. A user is an individual who is logged in to a processor and is interactively using the operating system software by means other than a login. An OpenVMS VAX Operating System Base License or one of the five types of VAX VMS Licenses (QL–001A*–**) is a prerequisite for the OpenVMS User License.

   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 VAX Distributed Interactive User License (QL–09SA*–**)
   LMF Product Name: ADL-USER

   This license grants the right to interactive use of the OpenVMS VAX operating system, provided the appropriate Operating System Base License or one of the five types of VAX VMS Licenses has been previously installed on a VAX system. The Distributed Interactive license is a prerequisite for the OpenVMS User License.

   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 license is installed.

The pen S peratin Syste ase incene also includes the license for print Super isor for pen S. The print Super isor for pen S has separate docu enta ion eda its and ser ice products. efer to SP . . for further details.

S P ase tensions e tend the peratin Syste ase incene to enable sy etric ulitproces nin ca pability on a select nu ber of pen S syste s supportin S P S P ase tensions are per anently tied to the peratin Syste ase incene and cannot be separated fro the peratin Syste ase incene if an S P board is re o ed fro the syste .

S P tensions rant the ri ht to use the sa e version of the operatin syste software as per itted for the correspondin peratin Syste ase incene at the ti e when the S P tension is ranted.

pen S ndi idual ser incene

Product a e S S

S P ase tensi ons e tend the peratin Syste ase incene to enable sy etric ulitproces nin ca pability on a select nu ber of pen S syste s supportin S P S P ase tensions are per anently tied to the peratin Syste ase incene and cannot be separated fro the peratin Syste ase incene if an S P board is re o ed fro the syste .

S P tensions rant the ri ht to use the sa e version of the operatin syste software as per itted for the correspondin peratin Syste ase incene at the ti e when the S P tension is ranted.

pen S ndi idual ser incene

Product a e S S

The pen S ndi idual ser incene pro ides the ri ht to interacti ely use the operatin syste by the speifie or unli ited nu ber of concurrent users on a desi nated sin le processor. user is an indi idual who is lo ed in to a processor and is interacti ely us in the operatin syste software by means other than a lo in. n pen S peratin Syste ase i cence or one of the fi types of S incenes is a preui site for the pen S ser incene.

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 license is installed.

The pen S peratin Syste ase the S P ase tension and interac e ser incenes are not supported by the S or pen S operatin syst e releases prior to pen S er ision .

pen S istributed interac e ser incene

Product a e S

This license grants the right to interactive use of the pen S operatin syste pro ided the appro priate peratin Syste ase incene or one of the fi types of S incenes has been pre iously installed on a syste . The istributed interac e
ser licenses are concurrent use licenses and are available in any quantity except unlimited. Distributed interactiveUser licenses are mobile (and can be redesignated) and may be installed and used on an OpenVMS VAX processor or shared in a sinle pen S cluster.

Distributed interactive user is defined as an individual who is logged into a pen S processor or a VAX cluster system or is interactively using the operating system software by means other than a login.

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

OpenVMS Alpha License Information

There are five types of pen S licenses available on Alpha processors.

Operating System Base License

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 (Compaq AlphaServer 8200, 8400 and the AlphaServer GS60, GS60E, and GS140), the base license for these 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.

SMP Base Extension License

This license extends the Operating System Base License to enable symmetric multiprocessing capability on those OpenVMS Alpha systems supporting SMP. SMP Base Extensions are permanently tied to the Operating System Base License and may not be separated from the Operating System Base License if an SMP board is removed from the system.

Individual User License

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.
Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08

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*–**)

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 an 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 both VAX and Alpha) (QL–MT3A*–3*)

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 VAX cluster, a single OpenVMS Cluster, or shared in a mixed OpenVMS Cluster.

A user that enables a concurrent use license is defined as an individual who is logged into an OpenVMS VAX processor, an OpenVMS Alpha processor, an OpenVMS VAX cluster, 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.

License Management Facility Support

The OpenVMS operating system supports the Compaq 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:).

Several of the VAX VMS and OpenVMS VAX 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 Compaq's licensing terms and policies, contact your Compaq Account Representative.
SOFTWARE PRODUCT SERVICES

A variety of service options are available from Compaq. System Support Services provides integrated hardware and software remedial support, telephone advisory support, and the right to use new version of kernel software. For more information, contact your local account representative.

SYSTEMS SUPPORTED

Alpha Systems Supported

This section lists the Alpha systems that are supported by OpenVMS Alpha Version 7.2-2. Refer to the appropriate page at the following website for details concerning Alpha hardware configuration and options: http://www.compaq.com/alphaserver/configure.htm

EISA Bus-Based Systems

- DEC 2000 Models 300/500
- 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

TURBOchannel Bus-Based Systems

- DEC 4000 Model 600
- DEC 4000 Model 700

DSSI Bus-Based Systems

- DEC 4000 Model 600
- DEC 7000 Model 600
- DEC 10000 Model 600

XMI Bus-Based Systems

- AlphaServer 8400 (All chip speeds)
- DEC 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)
- AlphaStation 8000 433au, 500au, 600au
- Compaq AlphaStation DS20e
- Compaq AlphaStation ES40
- Compaq AlphaStation XP900/DS10
- Compaq AlphaStation XP1000

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

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

Laptop Systems

- Tadpole ALPHAbook 1

Compaq Modular Computing Component

- AlphaStation P reference board
- Alpha P reference board
- Alpha P reference board

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Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08

VAX Systems Supported

This section of the SPD lists the systems that are supported by OpenVMS VAX Version 7.2-2. Refer to the Systems and Options Catalog and the Network and Communications Buyers Guide for details concerning hardware configuration and options.

Q–bus Based Systems

• MicroVAX II
• MicroVAX 3300, VAXserver 3300
• MicroVAX 3400, VAXserver 3400
• MicroVAX 3500, VAXserver 3500, VAXstation 3500, VAXstation 3520, VAXstation 3540
• MicroVAX 3600, VAXserver 3600
• MicroVAX 3800, VAXserver 3800
• MicroVAX 3900, VAXserver 3900
• VAX 4000, Models 100, 200, 300, 400, 500, 600
• VAX 4000, Models 50, 100A, 105A, 106A, 108, 500A, 505A, 600A, 700A, 705A,
• VAXserver 4000, Models 200, 300, 400, 500, 600

XMI Bus-Based Systems

• VAX 6000 Series, Models 210, 220, 230, 240
• VAX 6000 Series, Models 310, 320, 330, 340, 350, 360
• VAX 6000 Series, Models 410, 420, 430, 440, 450, 460
• VAX 6000 Series, Models 510, 520, 530, 540, 550, 560
• VAX 6000 Series, Models 610, 620, 630, 640, 650, 660
• VAXserver 6000, Models 210, 220, 310, 320, 410, 420, 510, 520, 610, 620, 630
• VAX 7000, Models 610, 620, 630, 640, 650, 660, 710, 720, 730, 740, 750, 760, 810, 820, 830, 840, 850, 860
• VAX 8530, VAXserver 8530, VAX 8550, VAXserver 8550
• VAX 8700, VAXserver 8700
• VAX 8800, VAX 8810, VAX 8820, VAX 8830, VAX 8840
• VAXserver 8800, VAXserver 8810, VAXserver 8820, VAXserver 8830, VAXserver 8840, VAX 8842, VAX 8974, VAX 8978
• VAX 10000, Models 610, 620, 630, 640, 650, 660

VAX-BI Bus-Based Systems

• VAX 8200, VAX 8250, VAXserver 8200, VAXserver 8250
• VAX 8300, VAX 8350, VAXserver 8300, VAXserver 8350

SBI Bus-Based Systems

• VAX 8600, VAX 8650, VAXserver 8600, VAXserver 8650

Special System-Specific Internal Bus

• MicroVAX 3100, Models 10, 10E, 20, 20E, 30, 40, 80, 85, 88, 90, 95, 96, 98
• VAXserver 3100, Models 10, 10E, 20, 20E
• VAXstation 4000, Models 60, 90, 95, 96
• VAXstation 4000-VLC
• VAX 9000, Models 110, 110VP5, 210, 210VP, 310, 310VP
• VAX 9000, Models 320, 320VP, 330, 330VP, 340, 340VP
• VAX 9000, Models 410, 410VP, 420, 420VP, 430, 430VP, 440, 440VP
System Restrictions

DECwindows Restrictions

The following list describes version-specific restrictions. The DECwindows environment is not supported on these systems.

MicroVAX I and VAXstation I Systems

OpenVMS Restrictions

The final version of OpenVMS VAX that supports the following systems is VMS Version 5.1-1.

VAX–11/725

OpenVMS VAX Version 6.2 was the final version to support the following:

VAX–11/730
VAX–11/750
VAX–11/751
VAX–11/780
VAX–11/782
VAX–11/785
VAXft 110
VAXft 310
VAXft 410
VAXft 610
VAXft 810

MicroVAX I
VAXstation I

OpenVMS VAX Version 7.2 is the final version to support the following:

MicroVAX II
VAXstation II/GPX, VAXstation II/QVSS
VAXstation 2000, VAXstation 2000/GPX, VAXstation 2000/MFB
MicroVAX 2000

APPENDIX A

This appendix describes the following terminals, tapes, controllers, graphics, and network options. Some restrictions for specific devices are listed, if applicable.

MicroVAX 2000

APPENDIX A

This appendix describes the following terminals, tapes, controllers, graphics, and network options. Some restrictions for specific devices are listed, if applicable.

This appendix describes the following terminals, tapes, controllers, graphics, and network options. Some restrictions for specific devices are listed, if applicable.

Terminals and Terminal Line Interfaces

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

The following table lists the terminals supported by OpenVMS Alpha:

<table>
<thead>
<tr>
<th>VT200 series</th>
<th>VT300 series</th>
<th>VT400 series</th>
</tr>
</thead>
<tbody>
<tr>
<td>VT500 series</td>
<td>VXT2000 series</td>
<td></td>
</tr>
</tbody>
</table>

The following table lists the terminals supported by OpenVMS VAX:

| VT52 | VT100 series | LA series |
| VT300 series | VT1000 series | LQP02 |
| VT200 series | VT500 series |

Terminals on Professional 350, Rainbow 100, and DECmate II systems emulate VT100 terminals. Only limited support is available for the VT52. The VT131, when running an application, operates in block mode. When interacting with OpenVMS VAX and associated utilities, the VT131 operates only in VT100 (or interactive) mode and not in block mode.
Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2.  SPD 41.87.08

**Note:** The VT1000 is a monochrome windowing terminal that supports standard ANSI applications and the X Window System. The transport protocol supported is LAT for VMS. The product supports 15-inch and 19-inch monitors.

### Disks

The first column lists the disk drive. The second column describes the device. The third column lists the bus the device is supported on. The fourth column lists the minimum required version of OpenVMS Alpha that supports these devices. The fifth column lists the minimum required version of OpenVMS VAX that supports these devices. (NS stands for Not Supported.)

<table>
<thead>
<tr>
<th>Disk Drive</th>
<th>Description</th>
<th>Bus</th>
<th>Alpha Version</th>
<th>VAX Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF51R3</td>
<td>107 MB solid state</td>
<td>DSSI</td>
<td>NS</td>
<td>5.5-2</td>
</tr>
<tr>
<td>EF52R4</td>
<td>205 MB solid state</td>
<td>DSSI</td>
<td>NS</td>
<td>5.5-2</td>
</tr>
<tr>
<td>EF53R3</td>
<td>267 MB solid state</td>
<td>DSSI</td>
<td>NS</td>
<td>5.5-2</td>
</tr>
<tr>
<td>ESE-20R3</td>
<td>120 MB solid state</td>
<td>SDI</td>
<td>NS</td>
<td>5.5-2</td>
</tr>
<tr>
<td>ESE-52R3</td>
<td>120 MB solid state</td>
<td>SDI</td>
<td>1.0</td>
<td>5.5-2</td>
</tr>
<tr>
<td>ESE-56</td>
<td>600 MB solid state</td>
<td>SDI</td>
<td>1.5</td>
<td>5.5-2</td>
</tr>
<tr>
<td>ESE-58</td>
<td>960 MB solid state</td>
<td>SDI</td>
<td>1.5</td>
<td>5.5-2</td>
</tr>
<tr>
<td>ESE-63R3</td>
<td>100 MB solid state</td>
<td>DSI</td>
<td>1.5</td>
<td>5.5-2</td>
</tr>
<tr>
<td>ESE</td>
<td>134 MB solid state</td>
<td>SCSI</td>
<td>6.2-1H3</td>
<td>NS</td>
</tr>
<tr>
<td>ESE-72L</td>
<td>268 MB solid state</td>
<td>SCSI</td>
<td>6.2-1H3</td>
<td>NS</td>
</tr>
<tr>
<td>ESE-80</td>
<td>100 MB solid state</td>
<td>DSSI</td>
<td>1.5</td>
<td>5.5-2</td>
</tr>
<tr>
<td>ESE-59</td>
<td>600 MB solid state</td>
<td>SDI</td>
<td>1.5</td>
<td>5.5-2</td>
</tr>
<tr>
<td>ESE-64</td>
<td>475 MB solid state</td>
<td>SDI</td>
<td>1.5</td>
<td>5.5-2</td>
</tr>
<tr>
<td>ESE-63R3</td>
<td>950 MB solid state</td>
<td>SCSI</td>
<td>6.2-1H3</td>
<td>5.5-2</td>
</tr>
<tr>
<td>DS-EZ41</td>
<td>134 MB solid state</td>
<td>SCSI</td>
<td>6.2-1H3</td>
<td>6.2-1H3</td>
</tr>
<tr>
<td>DS-EZ42</td>
<td>268 MB solid state</td>
<td>DSSI</td>
<td>6.2-1H3</td>
<td>6.2-1H3</td>
</tr>
<tr>
<td>DS-EZ70</td>
<td>536 MB solid state</td>
<td>DSSI</td>
<td>6.2-1H3</td>
<td>6.2-1H3</td>
</tr>
<tr>
<td>DS-EZ71L</td>
<td>1.07 GB solid state</td>
<td>DSSI</td>
<td>6.2-1H3</td>
<td>6.2-1H3</td>
</tr>
<tr>
<td>DS-EZ71LE</td>
<td>1.6 GB solid state</td>
<td>DSSI</td>
<td>1.5</td>
<td>5.5-2</td>
</tr>
<tr>
<td>PBXRW-JC</td>
<td>2 GB wide fixed disk</td>
<td>UltraSCSI</td>
<td>6.2-1H3</td>
<td>6.2-1H3</td>
</tr>
<tr>
<td>PBXRW-NB</td>
<td>4 GB wide fixed disk</td>
<td>UltraSCSI</td>
<td>6.2-1H3</td>
<td>6.2-1H3</td>
</tr>
<tr>
<td>PBXRW-SA</td>
<td>9 GB wide fixed disk</td>
<td>UltraSCSI</td>
<td>6.2-1H3</td>
<td>6.2-1H3</td>
</tr>
<tr>
<td>PBXRZ-JC</td>
<td>2 GB narrow fixed disk</td>
<td>SCSI</td>
<td>6.2-1H3</td>
<td>6.2-1H3</td>
</tr>
<tr>
<td>PBXRZ-NB</td>
<td>4 GB narrow fixed disk</td>
<td>SCSI</td>
<td>6.2-1H3</td>
<td>6.2-1H3</td>
</tr>
<tr>
<td>PBXRZ-SA</td>
<td>9 GB narrow fixed disk</td>
<td>SCSI</td>
<td>6.2-1H3</td>
<td>6.2-1H3</td>
</tr>
<tr>
<td>RA60R4</td>
<td>205 MB removable</td>
<td>SDI</td>
<td>NS</td>
<td>6.1</td>
</tr>
<tr>
<td>RA70</td>
<td>280 MB fixed disk</td>
<td>SDI</td>
<td>NS</td>
<td>6.1</td>
</tr>
<tr>
<td>RA71</td>
<td>700 MB fixed disk</td>
<td>SDI</td>
<td>NS</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RA72</td>
<td>1 GB fixed disk</td>
<td>SDI</td>
<td>NS</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RA73</td>
<td>2 GB fixed disk</td>
<td>SDI</td>
<td>1.0</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RA80R3</td>
<td>128 MB fixed disk</td>
<td>SDI</td>
<td>NS</td>
<td>6.1</td>
</tr>
<tr>
<td>RA81</td>
<td>456 MB fixed disk</td>
<td>SDI</td>
<td>NS</td>
<td>6.1</td>
</tr>
<tr>
<td>RA82</td>
<td>622 MB fixed disk</td>
<td>SDI</td>
<td>NS</td>
<td>6.1</td>
</tr>
<tr>
<td>RA90R3</td>
<td>1.2 GB fixed disk</td>
<td>SDI</td>
<td>1.0</td>
<td>6.1</td>
</tr>
<tr>
<td>RA92</td>
<td>1.5 GB fixed disk</td>
<td>SDI</td>
<td>1.0</td>
<td>6.1</td>
</tr>
<tr>
<td>RC2S3</td>
<td>2 disks each 26 MB (1 fixed and 1 removable) disk drive with shared spindle</td>
<td>Q-bus</td>
<td>5.5-2</td>
<td></td>
</tr>
<tr>
<td>RD32R3</td>
<td>VAX 42 MB fixed disk</td>
<td>Q-bus</td>
<td>NS</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RD31R3</td>
<td>10 MB fixed disk</td>
<td>Q-bus</td>
<td>NS</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RD82R3</td>
<td>31 MB fixed disk</td>
<td>Q-bus</td>
<td>NS</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RD83R3</td>
<td>71 MB fixed disk</td>
<td>Q-bus</td>
<td>NS</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RD84R3</td>
<td>159 MB fixed disk</td>
<td>Q-bus</td>
<td>NS</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RF30L</td>
<td>150 MB fixed disk</td>
<td>DSSI</td>
<td>NS</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RF31</td>
<td>381 MB fixed disk</td>
<td>DSSI</td>
<td>1.5</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RF31T</td>
<td>200 MB fixed disk</td>
<td>DSSI</td>
<td>NS</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RF31T1</td>
<td>400 MB fixed disk</td>
<td>DSSI</td>
<td>1.5</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RF31T2</td>
<td>600 MB fixed disk</td>
<td>DSSI</td>
<td>1.5</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RF31T3</td>
<td>800 MB fixed disk</td>
<td>DSSI</td>
<td>1.5</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RF31T4</td>
<td>1 GB fixed disk</td>
<td>DSSI</td>
<td>1.5</td>
<td>5.5-2</td>
</tr>
<tr>
<td>RF31T5</td>
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Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08

<table>
<thead>
<tr>
<th>Disk Drive</th>
<th>Description</th>
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<th>VAX Version</th>
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</table>

Note: The preceding list is not complete in terms of currently shipping disk and tape devices as 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://www.compaq.com/alphaserver/servers.html

After clicking on the requested AlphaServer, one can access links from the left hand columns under Technical Information under Supported Options. From there you can sort by type of option and have it display disk and tape devices.

Disk Options Supported by Compaq's Services Enterprise Integration Center (SEIC) (VAX Only)

- Re o able dis SS
- Re o able dis SS
- Re o able dis SS

Specific tailoring is required to use this disc as an OpenVMS Alpha or VAX system disk with the DECwindows environment. See DECwindows Motif for more information.

Device cannot be used as an OpenVMS Alpha or VAX system disk.

Device cannot be used as an OpenVMS VAX system disk.

Device cannot be used as an OpenVMS VAX system disk with DECwindows environment.

TS is not supported in Version 7.2. Last version supported was Alpha Version 6.1.
### Tapes

The first column lists the device name. The second column describes the device. The third column lists the bus the device is supported on. The fourth column lists the minimum required version of OpenVMS Alpha, and the fifth column lists the minimum required version of OpenVMS VAX that supports these devices. (NS stands for Not Supported.)

<table>
<thead>
<tr>
<th>Tape</th>
<th>Description</th>
<th>Bus</th>
<th>Alpha Version</th>
<th>VAX Version</th>
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<td>STI TU79</td>
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<td>NS</td>
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<td>TA90</td>
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<td>TA90E</td>
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<td>NS</td>
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<td>TA91</td>
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<td>Q-bus and SCSI</td>
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<tr>
<td>TZ86</td>
<td>6.0 GB, DLT tape drive</td>
<td>SCSI</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>TZ867</td>
<td>42 GB, DLT tape loader</td>
<td>SCSI</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>TZ87</td>
<td>20 GB, DLT tape drive</td>
<td>SCSI</td>
<td>6.1</td>
<td>6.1</td>
</tr>
<tr>
<td>TZ875</td>
<td>100 GB, DLT tape loader</td>
<td>SCSI</td>
<td>6.1</td>
<td>6.1</td>
</tr>
<tr>
<td>TZ877</td>
<td>140 GB, DLT tape loader</td>
<td>SCSI</td>
<td>6.1</td>
<td>6.1</td>
</tr>
<tr>
<td>TZ88</td>
<td>20/40 GB, DLT tape drive</td>
<td>SCSI</td>
<td>6.2</td>
<td>5.5-2H4</td>
</tr>
<tr>
<td>TZ88N</td>
<td>40/80 GB, DLT tape drive</td>
<td>SCSI</td>
<td>6.2</td>
<td>5.5-2H4</td>
</tr>
<tr>
<td>TZ89N</td>
<td>35/70 GB, DLT tape drive</td>
<td>SCSI</td>
<td>6.2-1H3</td>
<td>5.5-2H4</td>
</tr>
<tr>
<td>TZ885</td>
<td>40/80 GB, DLT tape loader</td>
<td>SCSI</td>
<td>6.2-1H2</td>
<td>5.5-2H4</td>
</tr>
<tr>
<td>TZ887</td>
<td>40/80 GB, DLT tape loader</td>
<td>SCSI</td>
<td>6.2-1H2</td>
<td>5.5-2H4</td>
</tr>
<tr>
<td>TZK08</td>
<td>2.2 GB 8mm, tape drive</td>
<td>SCSI</td>
<td>6.1</td>
<td></td>
</tr>
<tr>
<td>TZK10</td>
<td>320/525 MB, QIC tape drive</td>
<td>SCSI</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>TZK11</td>
<td>2.0 GB, QIC tape drive</td>
<td>SCSI</td>
<td>6.1</td>
<td></td>
</tr>
<tr>
<td>TZS20</td>
<td>25/50 GB, AIT 8mm, tape drive</td>
<td>SCSI</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td>ESL9326</td>
<td>40/80 GB, DLT tape library family</td>
<td>SCSI</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td>ESL9198</td>
<td>40/80 GB, DLT tape library family</td>
<td>SCSI</td>
<td>7.2</td>
<td></td>
</tr>
</tbody>
</table>

Note: The preceding list is not complete in terms of currently shipping disk and tape devices as that list changes frequently. For more information, refer to the official Compaq AlphaServer Supported Options Lists available at the Compaq website:

http://www.compaq.com/alphaserver/servers.html

After clicking on the requested AlphaServer, one can access links from the left hand columns under Technical Information to sort by type of option and display devices, tapes, etc.

### Networks Storage Servers

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS</td>
<td>Stora e or s StorageWorks FDDI StorageServer</td>
</tr>
<tr>
<td>HS</td>
<td>Stora e or s StorageWorks FDDI StorageServer</td>
</tr>
<tr>
<td>HS</td>
<td>Stora e or s StorageWorks FDDI StorageServer</td>
</tr>
<tr>
<td>HS</td>
<td>Stora e or s StorageWorks FDDI StorageServer</td>
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<tr>
<td>HS</td>
<td>Stora e or s StorageWorks FDDI StorageServer</td>
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<td>HS</td>
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<tr>
<td>HS</td>
<td>Stora e or s StorageWorks FDDI StorageServer</td>
</tr>
<tr>
<td>S</td>
<td>Stora e or s StorageWorks FDDI StorageServer</td>
</tr>
<tr>
<td>S</td>
<td>Stora e or s StorageWorks FDDI StorageServer</td>
</tr>
</tbody>
</table>

### Enterprise Storage Arrays

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Stora e or s InfoServer</td>
</tr>
<tr>
<td>S</td>
<td>Stora e or s InfoServer</td>
</tr>
</tbody>
</table>

### Controllers and Adapters

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS</td>
<td>Hierarchical stora e controller for ser ed dis s and T ser ed tapes.</td>
</tr>
<tr>
<td>HS</td>
<td>Hierarchical stora e controller for ser ed dis s and T ser ed tapes.</td>
</tr>
<tr>
<td>HS</td>
<td>Hierarchical stora e controller for ser ed dis s and T ser ed tapes.</td>
</tr>
<tr>
<td>HS</td>
<td>Hierarchical stora e controller for ser ed dis s and T ser ed tapes.</td>
</tr>
</tbody>
</table>
Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SP 41.87.08

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

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 512MB 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. (Alpha only)

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.) (Alpha only)

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) (Alpha only)

HSZ70 UltraSCSI wide differential based StorageWorks controller that supports up to six UltraSCSI wide single ended device ports and one host port. (Alpha only)

HSZ80 UltraSCSI wide differential based StorageWorks controller that supports up to six UltraSCSI wide single ended device ports and two host ports. (Alpha only)

HSZ22 UltraSCSI wide differential based StorageWorks controller that supports up to two UltraSCSI wide single ended device ports and two host ports. (Alpha only)

HSG60 Fibre Channel based StorageWorks controller that supports up to two UltraSCSI wide single ended device ports and two host ports. (Alpha only - 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. (Alpha only - Version 7.2-1 and higher)

HSV110 Fibre Channel based StorageWorks virtualizing controller that supports Fibre Channel Native device ports and two host ports. (Alpha only - Version 7.2-2 and higher)

MDR Compaq StorageWorks Modular Data Router for connecting SCSI tape devices to a switch. (Alpha only)

KDM70 Mass-storage controller for XMI systems with eight SDI ports.

KFESA Mass-storage controller for EISA systems with one DSSI port. (Alpha only)

KFESB Mass-storage controller for EISA systems with one DSSI port. (Alpha only)

KFMSB Mass-storage controller for XMI systems with two DSSI ports. (Alpha only)

KFPSA Mass-storage controller for PCI systems with one DSSI port. (Alpha only - Version 6.2-1H2 minimum support)

KZESC-AA Backplane RAID controller for EISA systems with one SCSI-2 FSE port. (Alpha only)

KZESC-BA Backplane RAID controller for EISA systems with three SCSI-2 FSE ports. (Alpha only)

KZMSA Mass-storage controller for XMI systems with two SCSI ports. (Limited SCSI-2 support - Alpha only)

44
**Hubs and Switches**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Port S S hub</td>
</tr>
<tr>
<td>H</td>
<td>Port S S hub</td>
</tr>
<tr>
<td>S</td>
<td>Portibrechannel switch</td>
</tr>
</tbody>
</table>

**Controllers (VAX Only)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS</td>
<td>S S based Storad or s controller that supports up to two S S ports.</td>
</tr>
<tr>
<td></td>
<td>nte rated is controller for and syste s.</td>
</tr>
<tr>
<td>T</td>
<td>nte ral is and Tape controller for and syste s.</td>
</tr>
<tr>
<td>P</td>
<td>Microprocessor controller for laboratory ac usision de ices accodatlin up to two one one two s and fi de ices. ne P controller is supported per S and a a i u of two are supported per syste .</td>
</tr>
<tr>
<td></td>
<td>bus S P dis controller. The dis controller supports up to four of the followin dri es and .</td>
</tr>
<tr>
<td>S</td>
<td>bus to SS bus adapter. This adapter allows up to se en SS stora e de ices to attach to the SS bus. Si SS stora e de ices are allowed in a ultii host confi uration.</td>
</tr>
<tr>
<td>S</td>
<td>bus S and tape controller for the T Plus or .</td>
</tr>
<tr>
<td></td>
<td>bus controller for the co pact disc reader.</td>
</tr>
<tr>
<td>S</td>
<td>bus to S S bus adapter. This adapter allows up to se en SS stora e de ices to attach to the S S bus. Supported only for and specifi tape de ices.</td>
</tr>
<tr>
<td></td>
<td>odel SS bus adapter. This adapter allows up to se en SS stora e de ices to attach to the SS bus. Si SS stora e de ices are allowed in a ultii host confi uration.</td>
</tr>
<tr>
<td></td>
<td>odel SS bus adapter. This adapter allows up to se en SS stora e de ices to attach to the SS bus. Si SS stora e de ices are allowed in a ultii host confi uration.</td>
</tr>
<tr>
<td>P</td>
<td>Parallel hi h speed line printer controller for the P printers.</td>
</tr>
</tbody>
</table>
### Asynchronous Terminal Controllers (Alpha Only)

<table>
<thead>
<tr>
<th>Controller</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBXDA-AA</td>
<td>4-port PCI asynchronous terminal controller</td>
</tr>
<tr>
<td>PBXDA-AB</td>
<td>8-port PCI asynchronous terminal controller</td>
</tr>
<tr>
<td>PBXDA-AC</td>
<td>16-port PCI asynchronous terminal controller</td>
</tr>
</tbody>
</table>

### Disk Controllers

- **P**  
  - **bus** parallel high-speed line printer controller.
  - **S** disk controller for disk drives.
  - **S** disk controller for the disk drive.
  - **bus** disk controller for micro and station systems. There is an and an controller.
  - The disk controller supports as many as four disk drives as two units.
  - A controller has limitations the system supports at a number of devices the system supports depends on the enclosure. The disk controller is required for the and disk drives.
  - **S** diskette controller for two disk drives. The diskette controller is supported per system.
  - **S** diskette controller for disk drives. The diskette controller is supported per system.

- **T**  
  - **SS** tape controller for the tape drive.
  - **bus** tape controller only with large record support.
  - **SS** tape controller for the tape drive.
  - **bus** tape controller for the tape drive.
  - **bus** tape controller for the tape drive.
  - **bus** tape controller for the tape drive.
  - **bus** tape controller for the tape drive.
  - **bus** tape controller for the tape drive.
  - **bus** tape controller for the tape drive.

- **TS**  
  - **S** tape controller for the tape drive.
  - **bus** tape controller for the tape drive.
  - **bus** tape controller for the tape drive.
  - **bus** tape controller for the tape drive.

- **SPA**  
  - **P** disk controller. The controller must have a minimum microcode version of REV 3. The controller supports up to four of the following disk drives: RA60, RA80, RA81, and RA82.
Asynchronous Terminal Controllers (VAX Only)

- CXA16 16-line serial terminal multiplexer (DEC-423), maximum baud rate supported: 38400. (No modem control) (Q–bus)
- CXB16 16-line serial terminal multiplexer (RS422), maximum baud rate supported: 38400. (No modem control) (Q–bus)
- CXY08 8-line serial terminal multiplexer (RS232), maximum baud rate supported: 19200. (Full modem control) (Q–bus)
- DHB32 16-line asynchronous terminal controller for VAXBI, maximum baud rate supported: 19200. (VAXBI)
- DHF11 32-line asynchronous terminal controller (DEC 423), maximum baud rate supported: 19200. (No modem control) (Q–bus)
- DHT32 8-line asynchronous terminal controller (DEC 423). (No modem control) (MicroVAX 2000)
- DHQ11 8-line asynchronous terminal controller (EIA RS-232-C or RS-423-A), maximum baud rate supported: 19200. (Full modem control) (Q–bus)
- DHU11 16-line asynchronous terminal controller (RS-232-C), maximum baud rates supported: OpenVMS VAX, 19200; DECnet–VAX, 9600. (Full modem control) (UNIBUS)
- DHV11 8-line asynchronous terminal controller (EIA RS-232-C or RS-423-A), maximum baud rates supported: OpenVMS VAX, 19200; DECnet–VAX, 9600. (Full modem control) (Q–bus)
- DMB32 8-line asynchronous terminal controller, maximum baud rates supported: OpenVMS VAX, 19200; DECnet–VAX, 9600. (Full modem control) (VAXBI)
- DMF32 8-line asynchronous terminal controller, maximum baud rates supported: OpenVMS VAX, 19200; DECnet–VAX, 9600. (Full modem control on first two lines) (UNIBUS)
- DMZ32 24-line asynchronous terminal controller (EIA RS-232-C or RS-423-A), maximum baud rates supported: OpenVMS VAX, 19200; DECnet–VAX, 9600. (Modem support dependent on configuration (UNIBUS)
- DZ11 8-line asynchronous terminal controller (EIA RS-232-C or RS-423-A), maximum baud rate supported: 9600. (Partial modem control) (UNIBUS)
- DZ32 8-line asynchronous terminal controller (EIA RS-232-C or RS-423-A), maximum baud rate supported: 9600. (Partial modem control) (UNIBUS)
- DZQ11 4-line asynchronous terminal controller (EIA RS-232-C or RS-423-A), maximum baud rate supported: OpenVMS VAX, 19200; DECnet–VAX, 9600. (Partial modem control) (Q–bus)
- DZV11 4-line asynchronous terminal controller (EIA RS-232-C or RS-423-A), maximum baud rate supported: OpenVMS VAX, 19200; DECnet–VAX, 9600. (Partial modem control) (Q–bus)

Synchronous Controllers—(Alpha Only)

The software product contains the synchronous device drivers and is required when using synchronous communications options. Refer to SPD 47.37xx for more information.

- DSB32 2-line, multiple protocol, synchronous adapter. (VAXBI)

Synchronous Controllers (VAX Only)

The software product contains the synchronous device drivers and is required when using synchronous communications options. Refer to SPD 25.03.xx for more information.

- Synchronous Controllers—(Alpha Only)

The software product contains the synchronous device drivers and is required when using synchronous communications options. Refer to SPD 25.03.xx for more information.
SH line synchronous full mode control and
line asynchronous no mode control
considered not supported. Available baud rates supported are 9600 bps for
communications controllers. psi as is not supported.

ST Synchronous single-line support for up to 9600 bps full duplex for micro
controllers. Concurrent use with the HT is not supported.

S Synchronous line half or full duplex point point to point communication interface supporting
P one or two lines at 9600 bps.

S controller line synchronous controller designed specifically for the FT processors supporting
P. It is supported at speeds up to 19200 bps per line for a full line operation.

Graphics Options

P Soria Synergy graphics option that includes acceleration for supported P based Alpha Workstations and Servers.

P PowerStorm graphics option that includes acceleration or acceleration with stereo window capabilities for supported P based Alpha Workstations and Servers.

P PowerStorm graphics option that includes acceleration for supported P based Alpha Workstations and Servers.

LAN Options (VAX and Alpha)

T network adapter that connects T channel systems to S local area network s. bits sec

T network adapter that connects T channel systems to S local area network s. bits sec

T network adapter that connects systems to both the network and local area network s. bits sec

P network adapter that connects systems to the network and local area network s. bits sec

LAN Options (Alpha Only)

P network adapter that connects systems to the network and local area network s. bits sec

P network adapter that connects systems to the network and local area network s. bits sec

P network adapter that connects systems to the network and local area network s. bits sec

P network adapter that connects systems to the network and local area network s. bits sec

P network adapter that connects systems to the network and local area network s. bits sec

P network adapter that connects systems to the network and local area network s. bits sec

P network adapter that connects systems to the network and local area network s. bits sec

P network adapter that connects systems to the network and local area network s. bits sec

P network adapter that connects systems to the network and local area network s. bits sec
**LAN Options (VAX Only)**

- **DEUNA** A network adapter that connects UNIBUS systems to both Ethernet and IEEE 802.3 local area networks. (10 mbits/sec)
- **DELUA** A network adapter that connects UNIBUS systems to both the Ethernet and IEEE 802.3 local area networks. The minimum revision required is F1. (10 mbits/sec)
- **DEBNA** A network adapter that connects VAXBI systems to both the Ethernet and IEEE 802.3 local area networks. (10 mbits/sec)
- **DEBNI** A network adapter that connects VAXBI systems to both the Ethernet and IEEE 802.3 local area networks. (10 mbits/sec)
- **DESVA** An embedded network adapter that connects VAX systems to both the Ethernet and IEEE 802.3 local area networks. (10 mbits/sec)
- **DEQNA** A network adapter that connects Q–bus systems to both the Ethernet and IEEE 802.3 local area networks. The minimum revision level required is K3. Supported for application use only. Not supported beyond Version 5.4-3. (10 mbits/sec)
- **DELQA** A network adapter that connects Q–bus systems to both the Ethernet and IEEE 802.3 local area networks. This is the replacement for DEQNA. The minimum revision level required is C3. (10 mbits/sec)
- **DESQA** A network adapter that connects Q–bus for S-BOX configuration to both the Ethernet and IEEE 802.3 local area networks. (10 mbits/sec)
Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08

network adapter that connects Q–bus systems to local area network. (100 mbits/sec)

DEFQA A network adapter that connects Q–bus systems to ANSI FDDI local area networks.

DGLTA-FA ATMworks 750 network adapter that connects Turbochannel systems to local area networks. (OC3)

KFE52 Ethernet adapter for the VAX ft 3000. Minimum of two adapters per system providing redundant connection to the Ethernet and the DSSI buses.

CI Options (Alpha Only)

P at a e adapter for P 1phaServer systems with one port. (Alpha only. Hi ini u support)

at a e adapter for syste s. ini u icrocode erision . is re uired.

at a e adapter for syste s. ini u icrocode erision . is re uired.

at a e adapter for syste s. ini u icrocode erision . is re uired.

CI Options (VAX Only)

cluster software can support multiple adapters per syste s. refer to the cluster Software Product description SP . for the supported configuration.

adapter for syste s. ini u icrocode erision . is re uired.

at a e adapter for syste s. ini u icrocode erision . is re uired.

at a e adapter for syste s. ini u icrocode erision . is re uired.

Memory Channel Options (Alpha Only)

P based e ory hannel onroller

P based e ory hannel onroller

H e ory hannel Hub ith ine ards e ory hannel ine ard for use with

H e ory hannel Hub with ine ards e ory hannel ine ard for use with

Miscellaneous

P Parallel serial port adapter.

P TT channel e tender.

Miscellaneous (VAX Only)

ard reader. ne card reader is supported per syste .

eneral purpose interface. bus

eneral purpose hi h speed interface one interface supported per

S.

Hi h perf orance eneral purpose interface for the . ne interface is supported per syste . This de ice cannot be used in con uction with the .

Hi h perf orance eneral purpose interface for the . and the and as any as four per syste are per itted pro ided that the

is used.

S adapter.

do adapter also the adapter used to connect the to e pander cabinet.

P loatin point accelerator for the

ector processin option for the

H e ory battery bac up for and syste s. This is re uired for power fail reco ery.

H SS S controller for the and syste s.

S Syste bac plane interconnect and bus for the and syste s.

S plane raphics coprocessor.

S station SP raphics option.

Abbreviations

P P dapted Partitioned ocessin

T T tach ent erion

o ponent bect edel

T ial inear Tape

SS T Stora e Syste s nterconnect

S tended ndustry Standard nterconnect

iber is tributed ata nterface

S ast S le nded S S

ast ide i ferential S S
Compaq OpenVMS Operating System for Alpha and VAX, Versions 7.2, 7.2-1, 7.2-1H1, and 7.2-2. SPD 41.87.08

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HP Software Technical Support

Effective December 1st, 2014, the HP OpenVMS products listed in the following table will undergo a support status change from Standard Support to Mature Product Support without Sustaining Engineering.

As a result of the support status change, these products will no longer have active engineering development to produce subsequent versions. This change will affect all the supported versions of the products. For more information on the support available, see http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA2-5741ENW.

HP OpenVMS products undergoing support status change

<table>
<thead>
<tr>
<th>Affected Product</th>
<th>Replacement and workaround</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distributed Queuing Service (DQS)</td>
<td>- Standard OpenVMS PRINT commands, such as lpr and lpq. With the availability of DECNET over IP, the PRINT command is more comprehensive than DQS.</td>
</tr>
<tr>
<td></td>
<td>- If you do not want to use DECnet, you can use the telnet Symbiont to access remote queues in addition to lpd. The equivalent commands for telnet Symbiont queues are the standard VMS commands.</td>
</tr>
<tr>
<td>Software RAID</td>
<td>Controller RAID or Shadowing</td>
</tr>
<tr>
<td>Debug Clients for Windows (also known as Windex)</td>
<td>DECwindows Motif client interface offers similar features as the Windex.</td>
</tr>
<tr>
<td>OpenView Operations (OVO) DCE Agent</td>
<td>HP OpenVMS Operations Manager HTTPS Agent and SPI</td>
</tr>
<tr>
<td>Management Station (also known as Argus)</td>
<td>DCL syntax or command procedures</td>
</tr>
<tr>
<td>Enterprise Capacity and Performance (ECP)</td>
<td>- You can replace ECP Data Collector with Performance Data Collector (TDC). - You can replace ECP Performance Analyzer with TLViz and T4.</td>
</tr>
</tbody>
</table>