Software Product Description

PRODUCT NAME: DECnet/OSI Version 7.0 for OpenVMS Alpha **SPD 50.45.08**

DESCRIPTION

DECnet/OSI Version 7.0 for OpenVMS Alpha is an implementation of Phase V of the Digital Network Architecture (DNA) for the OpenVMS operating system for Alpha hardware. DECnet/OSI integrates DECnet and Open Systems Interconnection (OSI) network protocols, allowing both stacks to share integrated network functions up to the Transport layer. Upper layers have been implemented as separate "towers," allowing existing DECnet and OSI applications to share the integrated Transport layer. Existing DECnet Phase IV and new DECnet and OSI applications are supported by DECnet/OSI. In combination with TCP/IP protocol stacks, OpenVMS systems can participate in multivendor, multiprotocol networks adhering to open networking standards.

DECnet/OSI for OpenVMS features include:

- Support for 64–bit addresses, allowing 64–bit network applications to take advantage of the P2 addressing of Alpha systems running OpenVMS Alpha Version 7.0. Support for 64–bit addressing is limited to the DECnet/OSI $QIO interface.
- Continued support for 32–bit network applications.
- X.25 network management interface, providing more efficient wide area network (WAN) management.
- The ability to configure all members of a cluster from any cluster member.
- OSI application programming interfaces, formerly offered as a separate product.
- A new OSI Session layer programming interface (SPI).
- The ability to run DECnet and OSI applications over TCP/IP transports.
- Expanded naming options, allowing the use of a new and larger local namespace, DECdns, and/or DNS /BIND as naming services.
- The Graphical Network Management user interface for improved network management.
- Routing segregated mode to allow the Routing layer to choose a Phase IV router for those packets having a Phase IV compatible address. (Packets having a Phase V extended address are sent to a Phase V router by default.) This is a configurable option.
- Reverse path caching to capture path information for later use in reaching remote systems.
- Increased network size, supported through the use of ISO OSI addressing.
- Simplified installation and configuration process.
- The Network Control Language (NCL). Network management is based on DNA CMIP, Digital's implementation of the OSI international standard Common Management Information Protocol.
- An NCP emulator to facilitate installation of layered products written for DECnet Phase IV.
- Installation using the POLYCENTER Software Installation utility.
- Network naming, allowing the use of either local naming or fully distributed name services. Note that the use of DECdns requires the presence of an OpenVMS VAX or ULTRIX MIPS system to host the DECdns Server. The server is not supported on Alpha systems.
- Support for topologies using multicircuit and multihomed end nodes.
- Dynamic connections over X.25 networks.
- OSI implementation in accordance with current U.S. and U.K. GOSIP requirements:

  — Application, Presentation, and Session layers

  . File Transfer, Access, and Management (FTAM) application

  . Virtual Terminal application

  - Applicaton Service Elements (ASEs), including ACSE (Association Control Service Element)
- — Transport layer, classes 0, 2, and 4
- — Lower layers
  - OSI addressing formats, supporting very large network topologies
  - End system to intermediate system (ES-IS) routing
  - Connectionless Mode Network Service (CLNS) over local area network (LAN), wide area network (WAN), and X.25
  - Logical Link Control type 2 (LLC2) for Connection–Oriented Network Service (CONS) over LAN
  - Data Link layer, supporting High–level Data Link Control (HDLC) for wide area communications, ISO 8802-3 (Ethernet CSMA/CD) and FDDI LANs, and DDCMP for backwards compatibility. HDLC support includes the LAPB protocol for X.25 communications.
  - Physical layer, with CSMA/CD, HDLC, and FDDI devices supported.

DECnet/OSI for OpenVMS is available in two forms: End System and Extended Function. Extended Function provides all the features of End System plus the OSI application gateways (FTAM - DAP gateway, VT-Telnet, VT-LAT) the OSI application programming interfaces and cluster alias. See the Software Licensing section for more details.

DECnet/OSI for OpenVMS offers task-to-task communications, file management, downline system and task loading, network command terminals, and network resource sharing capabilities using DNA, ISO and TCP/IP protocols. DECnet/OSI for OpenVMS communicates with adjacent and non-adjacent DECnet Phase IV, PATHWORKS, DECnet/OSI implementations on other OpenVMS, ULTRIX, and Digital UNIX systems, as well as OpenVMS systems running TCP/IP transports.

OpenVMS programs written in native mode programming languages can use DECnet/OSI for OpenVMS capabilities.

Depending on the system configuration, networks combining DECnet/OSI for OpenVMS systems with other DECnet, OSI and TCP/IP products may limit the functions available if all products do not support equal features.

Data Link Layer

DECnet/OSI for OpenVMS uses Ethernet, and FDDI communications controllers to interface with other network nodes.

LAN connectivity is provided by the CSMA/CD and FDDI controllers and drivers supporting ISO 8802-2 Logical Link Control (LLC) type 1 connectionless service. DECnet/OSI also supports Ethernet V2 packets on CSMA /CD devices.

Use of FDDI packets larger than 1500 bytes requires a Phase V router on the FDDI LAN. As with cluster alias support, you may configure the Phase V router to run the Phase IV distance vector routing protocol or the Phase V link state routing protocol.

WAN connectivity is provided by optional X.25 software supporting host-based synchronous communications interfaces.

All the synchronous devices support DEC-HDLC and LAPB/E and data link protocols. X.25 for OpenVMS Alpha is required to establish host-based wide area connections

DECnet/OSI for OpenVMS allows up to four circuits to be defined and operational on an end system. This capability allows a single end system to be connected to up to four separate LANs or WANs. Digital recommends that the circuits be equal in capacity and connectivity.

X.25

The Optional X.25 for OpenVMS Alpha software allows DECnet/OSI for OpenVMS Alpha systems to connect to PSDNs conforming to CCITT Recommendation X.25 (1980 or 1984) and/or ISO 7776 and 8208, and to support CONS over local area networks using LLC2 as the data link protocol for X.25. It allows process-to-process as well as terminal-to-process communications between Alpha systems and a remote DTE over a PSDN.

Direct access to a PSDN (using the supported device drivers) requires an X.25 license. See the Optional Software section.

For more details on the X.25 software for OpenVMS Alpha systems, refer to the X.25 for OpenVMS Alpha Software Product Description (SPD 47.37.xx).

Network Layer

DECnet/OSI for OpenVMS supports both the Connectionless-Mode Network Service (CLNS) and the Connection-Oriented Network Service (CONS). DECnet/OSI supports end-system routing only.

Exchange of routing information between end systems and routers uses the ISO 9542 ES-IS routing protocol. This allows DECnet/OSI systems to autoconfigure as end systems with ISO 9542-conformant routers.

Addresses conform to the ISO 8348 Addendum 2 specification, allowing the support of large network topologies. As long as the system address stays within the addressing range of Phase IV systems (up to 1,023 systems per area and up to 63 areas per network), and uses the same initial domain part (IDP), Phase IV or Phase V routers may be used.

The Network layer supports the capability of an end system to be multicircuited and multihomed. Multicircuit support allows multiple circuits to be active simultaneously. This increases network reliability and data throughput. Multihomed end-system support allows a system to have up to three network entity titles.

Segregated routing mode is a settable attribute. It directs routing to choose a Phase IV router for those packets having a destination address that can be translated to the Phase IV format. All other packets will be sent to a Phase V router, if available.

The Routing layer is able to cache information about the paths that are used to reach remote nodes.

Transport Layer

DECnet/OSI for OpenVMS provides support for:

- OSI Transport protocol as specified in ISO 8073
- RFC 1006 and 1006 Extensions (Internet Draft) to allow DECnet and OSI applications to run over TCP/IP
- Network Services Protocol (NSP)

NSP, RFC 1006 and OSI transports support communications between DECnet, TCP/IP and OSI systems. NSP provides backwards compatibility with Phase IV DECnet systems.

RFC 1006 Extensions support for DECnet applications is provided via a kernel interface that has been implemented on all TCP/IP stacks available for use on the OpenVMS operating system. The supported applications include all licensed DECnet applications as well as layered products, and user-written applications that conform to the documented DECnet programming interfaces.

The IETF RFC 1006 is a specification for running OSI applications over TCP/IP. Operation of the FTAM and Virtual Terminal applications over a TCP/IP network is supported along with other layered OSI applications such as X.400 and X.500.

A separate TCP/IP stack is required on the same system with DECnet/OSI. See the Optional Software section of this SPD for information on supported TCP/IP products.

OSI Transport supports Transport Classes 0, 2, and 4 on connection-oriented networks and Class 4 on connectionless networks.

OSI Transport uses two types of network service:

- The Connectionless-Mode Network Service (CLNS) using the Internet protocol (ISO 8473) and ES-IS protocol (ISO 9542) to communicate across linked subnetworks. The inactive subset of ISO 8473 (null internet) is also supported for communications over a single ISO 8802-3 local area network.
- The Connection-Oriented Network Service (CONS).

Upper Layers

DECnet/OSI for OpenVMS software provides the OSI upper layer stack consisting of Session, Presentation and Application layers. The Application layer provides Association Control Service Element (ACSE); File Transfer, Management, and Access (FTAM); and Virtual Terminal (VT).

DECnet/OSI for OpenVMS also provides a range of DECnet applications and services including file and record access, remote terminal access, mail, and phone.

Applications

Transport Options for Applications

Applications written to the DECnet upper layers can now be run over NSP, OSI or TCP/IP transports via RFC 1006. This includes the network applications that are licensed with DECnet/OSI as well as user-written applications that adhere to the documented DECnet programming interfaces. The use of TCP/IP transports via RFC 1006 does not require any modification to the existing application.

Applications written to the OSI upper layers can now be run over OSI or TCP/IP transports.

Remote File Transfer

DECnet/OSI for OpenVMS supports two upper layer protocols for remote file transfer: the OSI Protocol File Transfer, Access and Management (FTAM) and the DECnet Data Access Protocol (DAP).

FTAM

FTAM supports file transfer, access, and management between a DECnet/OSI for OpenVMS system and other systems with software adhering to ISO 8571. In addition, FTAM is conformant with NIST Phase II and Phase III agreements and is certified as being conformant to the released specifications of U.S. GOSIP, U.K. GOSIP and ENV41204.

In addition, FTAM:

- Provides users the ability to create, delete, rename, view, and copy files using DCL commands.
- Is implemented as an Application Service Element (ASE) of the OSI Application layer.
- Acts as the initiator or as the responder in a connection.
- Accesses and transfers files with both binary and character data. FTAM-1, FTAM-2, FTAM-3, and NBS-9 document types are supported.

DECnet/OSI for OpenVMS also supports gateway services between FTAM and DAP.

A full description of the FTAM services in DECnet/OSI for OpenVMS is provided in Appendix A of this document.

DAP

The DECnet Data Access Protocol (DAP) supports task-to-task communications, file and record access, and proxy access.

Task-to-Task Communications: For most applications, task-to-task communications can be programmed in a transparent manner where the remote task is treated as a full-duplex, record-oriented device. Transparent operation is provided with the following interfaces: system Service Calls, RMS calls (OPEN, GET, PUT, and CLOSE), and high-level language I/O statements (which are mapped to RMS calls). A nontransparent mode of task-to-task communications is offered by means of the system service interface that extends the capabilities provided by the transparent mode. These capabilities include support for interrupt messages and multiple inbound connect requests.

Using DECnet/OSI for OpenVMS, an OpenVMS program written in a native mode programming language can exchange messages with other user programs.

File Access: File access is supported to and from remote DECnet/OSI for OpenVMS systems, transparent to native mode high-level language programs using RMS. User programs can sequentially read, create, and delete files on a remote node.

Record Access: User programs can perform record level operations such as GET, PUT, UPDATE, DELETE, FIND, and REWIND to access and modify files residing on a remote OpenVMS node. In addition to sequential access to a file, several other access methods are supported through RMS using DECnet/OSI for OpenVMS. These methods include random access by relative record number, random access by key value, random access by record file address (RFA), and block I/O access by virtual block number.

Proxy Access: Remote users can have access to up to 15 proxy accounts on a specific remote system. One proxy account should be designated as the default proxy account on the remote system.

Command Language File Management: Most OpenVMS Digital Command Language (DCL) commands can be used to perform remote file operations. These commands include: ANALYZE, APPEND, BACKUP, CLOSE, CONVERT, COPY, CREATE, DELETE, DIFFERENCES, DIRECTORY, DUMP, OPEN, PRINT, PURGE, READ, SEARCH, SUBMIT, TYPE, and WRITE. The operation of these commands is transparent except for commands that invoke processing on a specific system (for example, SUBMIT/REMOTE and PRINT /REMOTE). Only a node name added to a file specification is required to invoke the network capabilities via one of these commands.

Using the COPY command, a user can transfer sequential, relative, and indexed-sequential (ISAM) files between DECnet/OSI for OpenVMS nodes that support compatible file structures and record formats. Users can transfer sequential or relative files with fixed length, variable length, or variable length with fixed control field records between two DECnet/OSI for OpenVMS systems. Similarly, multikeyed indexed files with variable or fixed length records are supported.

The SUBMIT/REMOTE command allows command files residing on a remote node to be submitted for execution at the remote node. The command file must be in the format expected by the node responsible for execution. DECnet/OSI for OpenVMS allows OpenVMS command files to be received from other systems and executed.

The DCL command, EXCHANGE/NETWORK, allows the transfer of files to or from heterogeneous systems. This command gives users the option to transfer file types between MS–DOS®, ULTRIX, and UNIX systems and OpenVMS systems regardless of record semantics. Unlike the COPY command, which preserves file and record organization during a file transfer, this command enables the user to modify file and record attributes during file transfer.

OSI Application Programming Interfaces

The OSI application programming interfaces enable users to write distributed applications that communicate over open networks and use the OSI services provided by DECnet/OSI.

The interfaces are provided under the Extended Function license and include:

- An interface to FTAM (File Transfer, Access, and Management)
- Interfaces to the ACSE (Association Control Service Element) and Presentation layers
- An interface to ROSE (Remote Operations Service Element)
- An interface to the OSI Session Layer

The interfaces permit application writers to use the services of the OSI upper layers in their applications.

The APIs allow for the development of applications on DECnet/OSI systems. Source code must be compiled and linked with the APIs. The APIs are required on the development system and the compile/link system. The resulting application can be run on any DECnet/OSI system with the appropriate operating system. The APIs are not required on these target systems. See Appendix C for details on the OSI APIs.

Network Virtual Terminal

DECnet/OSI supports two upper layer protocols for terminal access: the OSI Virtual Terminal protocol and the DECnet Command Terminal protocol.

VT

Virtual Terminal (VT) supports the ISO Virtual Terminal Protocol (ISO 9041). This protocol allows remote logins and access to remote applications between DECnet/OSI for OpenVMS systems and any remote system, including multivendor systems, that also run an ISO-compliant Virtual Terminal implementation.

Virtual Terminal is implemented as an Application Service Element (ASE) of the OSI Application layer.

Virtual Terminal may act as the terminal/initiator (for a local user) or as the host/responder (for the remote user).

A full description of Virtual Terminal features is provided in Appendix B of this SPD.

SET HOST

The DCL command SET HOST allows a terminal user on one DECnet/OSI for OpenVMS node to establish a logical connection to another DECnet/OSI node that uses the Command Terminal (CTERM) protocol. This connection makes the terminal appear to be physically connected to the remote system and the operator can use all the standard system and network utilities supported by that remote node. This capability is particularly useful for doing remote program development and allows the terminal users on smaller application-oriented systems to use the resources of larger development-oriented systems.

Other interfaces are standard parts of DECnet/OSI for OpenVMS. Users can develop programs and procedures based upon these interfaces for such functions as file access and task-to-task communications on individual systems. Because the DECnet/OSI for OpenVMS interfaces stay the same, the programs and procedures developed on an individual system can be used in a network environment without being modified.

Services

Downline Loading

DECnet/OSI for OpenVMS allows for the loading of an unattended system using the services provided by the Maintenance Operations Module (MOM). MOM provides a set of maintenance operations over various types of circuits by using the Maintenance Operations Protocol (MOP). A loadable system is a system that has a load device enabled for MOP service functions and for which a properly formatted load file is supplied. Downline loading involves transferring a copy of the load file image to a remote target node. Load requests can come from the local DECnet/OSI for OpenVMS operator or from the target node. Downline loading is supported for Digital server products.

Downline Task Loading

Initial task images for loadable systems can be stored on OpenVMS file system devices and loaded into remote nodes. Programs already executing on loadable systems can be checkpointed to the host OpenVMS file system and later restored to main memory in the node. These features simplify the operation of network systems that do not have mass storage devices.

Upline Dumping

Memory images of adjacent nodes connected by DECnet/OSI for OpenVMS can be written or dumped into a file on an OpenVMS system. This facility provides assistance in troubleshooting in the event of a system crash. This facility is also supported for Digital server products.

Mail

The OpenVMS Mail utility allows transmission of text messages between users on systems supporting MAIL-11. The DECnet/OSI for OpenVMS software allows users to exchange mail with users of other DECnet/OSI systems.

Phone

The OpenVMS Phone utility allows users to send and receive data interactively from one user's terminal to another user's terminal. DECnet/OSI allows users on different systems in the same DECnet/OSI network to exchange information.

VMScluster Alias

DECnet/OSI for OpenVMS supports the ability to access nodes in a VMScluster using a separate alias node address, while retaining the ability to address each node in the cluster individually. Not all network objects may be accessed using this mechanism. The maximum number of nodes supported for a cluster alias is 94. Refer to the VMScluster Software Product Description (SPD 42.18.xx) for relevant restrictions.

DECnet/OSI no longer requires a cluster member to be configured as a router. Clusters in a DECnet/OSI environment require a reachable IS-IS compliant router on the LAN.

Network Management

Network management is provided with the Network Control Language (NCL). Network management implements the DECnet/OSI layered model, based on the Digital hierarchical structure called Enterprise Management Architecture (EMA).

Users can access NCL through either a command line interface or a graphical user interface (GUI). The GUI allows network managers to view the status of network components and control those components from a Motif-based window interface.

The DECnet/OSI for OpenVMS network management software allows system and network managers to:

- Control and monitor the operation of a network and provide information related to network traffic and performance
- Configure network operating parameters
- Start up and shut down network components as needed
- Detect and isolate network problems, and return the network to service once repaired.

In addition, network management can provide information, warning network managers of faulty or failing network components, both hardware and software.

Network Command Language (NCL) is provided as a utility to the network manager to perform the operations described above.

Network managers can also use NCL to test specific components of the network. NCL enables transmission and reception of test messages either between systems or through controller loopback arrangements. The messages can then be compared for possible errors. NCL helps users isolate network problems.

DECnet/OSI for OpenVMS provides network event logging to a terminal device, disk file, or remote system. NCL users can enable and disable the event logging facility as well as optionally filter specific events.

NCL uses the DNA Common Management Information Protocol (CMIP) which permits entity management from a single location anywhere in the DECnet/OSI network.

The Common Trace Facility (CTF) allows the network manager to collect and display information about specific protocol exchanges between systems.

DECnet/OSI for OpenVMS supports an ISO CMISE application programming interface (API) conforming to the Service Definitions in ISO 9595. The API allows for development of applications that can communicate with other management applications conforming to ISO 9595 on remote nodes in the network.

DECnet/OSI supports the DECnet Phase IV NCP for remote management of Phase IV DECnet systems.

Name Service Options

DECnet/OSI for OpenVMS allows the use of one or more naming services. The available services are DECdns, DNS/BIND and a new local namespace. Node name and addressing information is stored in the native name service; TCP/IP information is maintained in DNS /BIND and DECnet and OSI information is maintained in DECdns or the local namespace.

When more than one name service is being used, a configurable search list defines the order in which the existing services are to be accessed.

Local Namespace

The local namespace replaces the Local Name Option (LNO). Using the local namespace, up to 100,000 nodes can be defined in a local naming database. A migration tool is available to move Phase IV and/or LNO databases to the new large local file format and /or DECdns format.

DNS/BIND

DECnet can now retrieve TCP/IP naming and addressing information from the DNS/BIND name service.

DECdns

DECnet/OSI for OpenVMS provides a global naming service with the Digital Distributed Naming Service (DECdns).

The full DECdns service provides a consistent, network-wide set of names for network resources called the namespace. This namespace is maintained by one or more DECdns server systems. Digital recommends that DECdns servers be installed on at least two systems in every LAN. This should provide adequate service and redundancy.

The DECdns client is included in DECnet/OSI for OpenVMS Alpha. The DECdns server is not supported on Alpha systems. An OpenVMS VAX or ULTRIX MIPS system is required to support the DECdns server.

The features provided by DECdns include:

- A networkwide name-to-attribute mapping service which allows selected Digital applications to create, read, modify, and delete names in the namespace
- A hierarchical structure permitting a large number of names to be stored and distributed across the network
- Access control to each name in the namespace
- Management and event logging

Distributed Time Service

DECnet/OSI for OpenVMS provides a network time service with DECdts, the Digital Distributed Time Service. DECdts provides precise, fault-tolerant clock synchronization for systems in a LAN or WAN. Time is provided in Coordinated Universal Time (UTC) and may be used across a global network. Several forms of time provider are supported, and a callable interface for applications allows users to add their own time providers. DECdts may be used by distributed applications to determine event sequencing, duration, and scheduling.

DECnet/OSI for OpenVMS Operation

DECnet/OSI is implemented under OpenVMS as an Ancillary Control Process (ACP) and a network device driver with Digital-supplied executive-level components and user-level programs.

The normal OpenVMS protection has been incorporated in the operation of DECnet/OSI. For example, incoming connects, including file access and file transfer requests, are protected by the normal OpenVMS login and file protection mechanisms. Outgoing connects, including file access and file transfer requests, can include user password information that is implicitly specified via NCL, or explicitly specified by the user for verification on the remote node.

DECnet/OSI for OpenVMS Configuration and Performance

DECnet/OSI can be configured using either the BASIC or ADVANCED configuration options. The BASIC option is the default. It uses existing system defaults and requires minimal information from the system manager. The ADVANCED option should be used where specific customization is required.

With DECnet Version 6.3 and later, cluster nodes are configurable from any node within the cluster.

As with any network protocol, the performance of a given DECnet/OSI for OpenVMS node is a function not only of the expected network traffic and resultant processing, but also of the amount of concurrent processing specific to that node. Thus, node performance depends on many factors including:

- CPU type
- Number and type of devices attached to the particular CPU
- Number of device interrupts per unit time
- Communications line(s) characteristics
- Number and size of buffers
- Message size and frequency of transmission
- Applications in use

It is important to note that the rate at which user data can be transmitted (throughput) over a communications line can sometimes approach, but will never exceed, the actual line speed. This is because the actual throughput is a function of many factors, including the line quality, protocol overhead, topology, and network application(s), as well as the factors cited in this section.

The performance of DECnet/OSI is comparable to the performance of DECnet Phase IV.

Standards Conformance

DECnet/OSI for OpenVMS has been designed and implemented to conform to the following standards:

- ISO
  - 4335
  - 7776, 7809
  - 8073, 8208, 8327, 8473, 8571, 8650, 8802-2, 8802-3, 8823, 8878, 8881
  - 9314, 9542, 9041
  - 3309
- EN
  - 41 204

- — 41 205
- — 41 206
- — 41 207

- CCITT Recommendation X.25 (1978, 1980, or 1984) using the LAPB or LAPBE variants of the X.25 packet level and data link protocols
- U.S. GOSIP V2.0
- U.K. GOSIP V4.0

Contact your local Digital office for the most recent conformance certificates.

Documentation

The documentation for DECnet/OSI for OpenVMS is supplied in four parts:

- The core documentation set shipped with the H-kit
- An optional end user guide (one copy is shipped with the core documentation)
- An optional programming guide describing $IPC, $QIO, OSI Transport, X.25, WANDD and DECdts programming interfaces
- An optional X.25 documentation set covering accounting, X.29 and X.25 Mail

New features are extensively documented in the Release Notes.

The documentation for DECnet/OSI for OpenVMS is shipped on the OpenVMS layered product CD-ROM. Hard copy of the documentation is available as a separate order.

INSTALLATION

DECnet/OSI software is customer installable. Installation services are available for customers who desire installation of the software product by an experienced Digital Software Specialist.

Digital requires that a customer's first use of X.25 include Digital Installation Services. These services provide for installation of the software product by an experienced Digital Software Specialist.

Customer Responsibilities

Before Digital Services can install the software, the customer must:

- Ensure that the system meets the minimum hardware and software requirements (as specified in the relevant SPDs)
- Prior to installing Digital hardware or software, obtain, install, and demonstrate as operational any modems and other necessary customer equipment or facilities to which Digital's communications hardware or software will connect
- Designate one adjacent node to verify installation /connectivity
- Make available for a reasonable period of time, as mutually agreed upon by Digital and the customer, all hardware communications facilities and terminals that are to be used during installation.

Delays caused by any failure to meet these responsibilities will be charged at the then-prevailing rate for time and materials.

Installation of DECnet/OSI for OpenVMS consists of the following tasks:

- Verify that all components of DECnet/OSI for OpenVMS have been received.
- Verify that the necessary versions of the OpenVMS software and documentation are available.
- Verify the appropriate SYSGEN parameters.
  Note: If a software specialist is required to modify the previously installed operating system parameters, a time and materials charge will apply.
- Create any necessary DECnet/OSI for OpenVMS accounts and directories.
- Enable software by registering the License Product Authorization Key (PAK) .
- Install the DECnet/OSI software on the target system using the POLYCENTER Software Installation (PCSI) utility .
- Verify the proper installation of DECnet/OSI for OpenVMS by running a series of tests to show connectivity to a designated node.

Connectivity to all other nodes within the network is the responsibility of the customer. Digital recommends the use of NCL to help verify connectivity.

In some cases, the PSDN supplier (or PTT) may impose restrictions, limitations, or requirements on the proposed Digital network configuration. The customer must understand and adhere to these controls for each and every network.

HARDWARE REQUIREMENTS

See the OpenVMS Alpha Software Product Description (SPD 41.87.xx) for further details on supported hardware configurations.

For general device or controller descriptions, refer to the *Networks and Communications Buyer's Guide*.

Processors Supported for OpenVMS Alpha Systems

Alpha:
Digital AlphaStation 200 4/100 [1]
Digital AlphaStation 200 4/166 [1]
Digital AlphaStation 200 4/233 [1]
Digital AlphaStation 250 4/233 [1]
Digital AlphaStation 400 4/166 [1]
Digital AlphaStation 400 4/266 [1]
Digital AlphaStation 600 5/266 [1]

Digital AlphaServer 1000 4/200
Digital AlphaServer 2000 4/233
Digital AlphaServer 2100 4/233
Digital AlphaServer 2100 5/250

Digital 2100 Server Model A500MP
Digital 2100 Server Model A600MP
Digital AlphaServer 8200 5/300
Digital AlphaServer 8400 5/300

DEC 2000 Model 300 Alpha Workstation
DEC 2000 Model 500 Alpha Workstation
DEC 3000 Model 300 Alpha Workstation
DEC 3000 Model 300L Alpha Workstation
DEC 3000 Model 300LX Alpha Workstation
DEC 3000 Model 400 Alpha Workstation
DEC 3000 Model 400S Alpha Server
DEC 3000 Model 500 Alpha Workstation
DEC 3000 Model 500S Alpha Server
DEC 3000 Model 500X Alpha Workstation
DEC 3000 Model 600 Alpha Workstation
DEC 3000 Model 600S Alpha Server
DEC 3000 Model 700 Alpha Workstation
DEC 3000 Model 700LX Alpha Workstation
DEC 3000 Model 800 Alpha Workstation
DEC 3000 Model 800S Alpha Server
DEC 3000 Model 900 Alpha Workstation
DEC 3000 Model 900LX Alpha Workstation

DEC 4000 Model 600 series Alpha System [1]
DEC 4000 Model 700 series Alpha System[1]
DEC 7000 Model 600 series Alpha System[1]
DEC 10000 Model 600 series Alpha System[1]

[1] No synchronous communications option available. Connection only available via LLC2. See the X.25 for OpenVMS Alpha SPD (#47.37.xx) for more information.

Disk Space Requirements (Block Cluster Size = 1)

Disk space required for installation:

— Base Software: 8100 blocks

— With All Optional Software: 111,000 blocks

These counts refer to the disk space required on the system disk. The sizes are approximate; actual sizes may vary depending on the user's system environment, configuration, and software options.

Supported LAN Adapters

The LAN adapters listed in Table 1 are supported:

Table 1
LAN Adapters

Adapter	Definition
DEFZA, DEFTA	A high-performance network adapter that connects TURBOchannel systems to ANSI FDDI LANs (DMA receive only).
DEMFA	A high-performance network adapter that connects XMI systems to ANSI FDDI LANs.
DEMNA	A high-performance network adapter that connects XMI systems to both the Ethernet and IEEE 802.3 LANs.
PMAD	A network adapter that connects TURBOchannel systems to both the Ethernet and IEEE 802.3 LANs.

SOFTWARE REQUIREMENTS

- OpenVMS Operating System Version 7.0

OpenVMS Tailoring

For Version 7.0 systems, the following OpenVMS classes are required for full functionality of this layered product:

- OpenVMS Required Save Set
- Network Support
- Programming Support

For more information, refer to the OpenVMS Alpha Operating System Software Product Description (SPD 41.87.xx) OpenVMS classes and tailoring are discussed in the OpenVMS Alpha Installation manual.

OPTIONAL SOFTWARE

TCP/IP

A separate TCP/IP protocol stack is required to use the DECnet over IP features in DECnet/OSI. The following TCP/IP products have been tested with DECnet/OSI.

- DEC TCP/IP Services for OpenVMS Version 3.2 or later

  DEC TCP/IP Client Software License: QL-0M2A*-**
  DEC TCP/IP Services Software License: QL-0LXA*-**

  DEC TCP/IP Client Upgrade License: QL-0PHA*-**
  SPD: 46.46.xx

- Process Software: TCPware

- TGV: Multinet
- The Wollongong Group: PATHWAYS

X.25 Optional License

The DECnet/OSI for OpenVMS Alpha license grants the right to use the OSI applications for CONS over LLC2 or CLNS over DEC-HDLC. All other X.25 software functions over LAPB and LLC2 require the X.25 for OpenVMS Alpha license.

The X.25 for OpenVMS Alpha License is also required to enable the X.25 utilities, such as X.25 Mail and SET HOST/X.25, as well as the X.25 application programming interfaces (APIs).

Software License: QL-0THA*-AA

Media and Documentation: QA-03XAA-H8

(See SPD number 47.37.xx.)

GROWTH CONSIDERATIONS

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

DISTRIBUTION MEDIA

This product is available as part of the OpenVMS Consolidated Software Distribution on CD-ROM. The software documentation for this product is also available as part of the OpenVMS Online Documentation Library on CD-ROM.

ORDERING INFORMATION

Software Licenses:	QL-MTFA*-AA (End System)
	QL-MTGA*-AA (Extended Function)
Software Media:	QA-03XAA-H8
Software Documentation:	QA-MTFAA-GZ
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SOFTWARE PRODUCT SERVICES

Prerequisite Support

For the use of X.25 with PSDNs, the customer and Digital must jointly prepare a Network Profile and Customer Support Plan covering all the intended network nodes, their usage of Switched Virtual Circuits (SVCs), Permanent Virtual Circuits (PVCs), and other network facilities, and their support. Without this Network Profile and Customer Support Plan, Digital cannot support the network connections.

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APPENDIX A: FILE TRANSFER, ACCESS, AND MANAGEMENT (FTAM)

FTAM software provides communications for performing file operations between open systems. These operations are:

- Copying files between local and remote systems.
- Appending, deleting, or renaming files on open systems.
- Displaying information about files on open systems.

An open system is a computer system that implements the standards for each of the seven layers of the Open Systems Interconnection (OSI) Reference Model for communications as defined by the International Organization for Standardization. An FTAM system is any open system containing an FTAM implementation that conforms to the FTAM standard and includes the implementations of the necessary underlying OSI services.

FTAM implements several standards that define the following components of these layers of the OSI Basic Reference Model: the File Transfer, Access, and Management (FTAM) service element and the Association Control Service Element (ACSE) of the Application layer, the Presentation layer, and the Session layer.

Supported Standards

FTAM conforms to the following OSI standards:

- ISO 8571 — File Transfer, Access and Management service and protocol
- ISO 8650 — ACSE protocol
- ISO 8823 — Presentation protocol
- ISO 8327 — Session protocol

The following table provides a comparison of the supported implementation profiles for different standards bodies and their relationship to each other.

International Standardized Profiles (ISP) ISO 10607	NIST	CEN/CENELEC and EWOS
Part 1: Specification of ACSE, Presentation and Session protocols for use by FTAM	—	—
Part 2: Definition of document types, constraint sets, and syntaxes	—	—
Part 3: AFT11 — Simple File Transfer Service (Unstructured)	T1 — Simple File Transfer	A/111 — iENV 41 204
Part 4: AFT12 (DISP) — Positional File Transfer Service (Flat)[1]	T2 — Positional File Transfer	A/112 — ENV 41 206
Part 5: AFT3 (DISP) — File Management Service	M1 — Management	A/13 — ENV 41 205

[1] AFT12 is not supported by DECnet/OSI

DISP indicates a draft ISP.

FTAM Component Software

The component software includes the user facilities (initiators), responders, management tools, and problem determination tools.

FTAM User Facilities

Users access the FTAM user facilities with the following OpenVMS operating system commands: APPEND, COPY, DIRECTORY, RENAME, and DELETE. These commands operate on files stored on any FTAM system whose implementations are compatible with FTAM. These commands cannot be used for manipulating files on your local system.

Support for Any File Naming Convention

A file designation is system-specific information that identifies a file to its storage system. FTAM software lets users specify files using the naming conventions of the systems where the files reside. FTAM supports the OpenVMS operating system RMS format for file specifications and a comparable style of file-specification format that accommodates non-RMS file designations.

Support for Several File Types

FTAM software can access and transfer files containing both binary and ASCII data. FTAM-1, FTAM-2, FTAM-3, and NBS-9 document types are supported.

FTAM-1 files are unstructured text files, FTAM-2 files are sequential text files, and FTAM-3 files are unstructured binary files. The FTAM-1, FTAM-2, and FTAM-3 document types support the following parameters.

Document Type	String Significance	Universal Class	Maximum String Length
FTAM-1	Not significant	IA5String GeneralString	Presence and absence of parameter
	Fixed	VisibleString GraphicString	Presence of parameter
	Variable	VisibleString GraphicString	Presence and absence of parameter
FTAM-2	Not significant	VisibleString GraphicString	Presence or absence of parameter
FTAM-3	Not significant		Presence or absence of parameter
	Fixed		Presence of parameter

NBS-9 files are NBS file directories.

Flexible and Transparent Access for Local Files

FTAM software treats local files the same way that the OpenVMS operating system file system treats them.

File Transfers

The FTAM COPY command transfers files between compatible FTAM systems without modifying the source file. The facility can transfer files in either direction between the local system and a remote FTAM system. The COPY command can also transfer files between two remote FTAM systems for a local FTAM user.

This command also allows you to append one or more files to a single output file within or between FTAM systems.

FTAM-DAP Gateway

The FTAM-DAP Gateway lets you perform file operations from a non-OSI system that supports the DAP protocol to an OSI system supporting FTAM. Remote users of the gateway do not have to establish accounts on the gateway system to use its capabilities. The gateway does not support the APPEND functionality.

File Deletion

The FTAM DELETE command can delete one or more files on any combination of FTAM systems provided that the user has delete access to those files on the specific FTAM system.

Renaming Requests

The FTAM RENAME command allows you to rename files. The command works on files stored on remote FTAM systems (remote files). The command enables you to change the path name or file name of an existing file. For remote files, you must specify whatever type of information the remote FTAM system requires for specifying files.

Directory Requests

The FTAM DIRECTORY command displays the complete set of FTAM file attributes. Specific options allow users to vary the display of attributes that are meaningful in an OpenVMS operating system environment, for example, date/time of last modification of file name.

FTAM File Error Recovery

FTAM provides file error recovery functionality, both in the COPY initiator command and in the FTAM responder. File error recovery is provided for Class 1, Class 2, and Class 3 type errors as detailed in ISO 8571-4.

Class 1 file error recovery provides only the restart functionality, while Classes 2 and 3 file error recovery provide both the restart and recovery functionality as follows:

- If an internal error is detected in the data transfer regime, Class 1 recovery restarts the data transfer regime by retransmitting the file data beginning at the negotiated checkpoint within the data transfer regime.
- Class 2 error recovery provides for the re-establishment of the select and open regimes, and also allows for the retransmission of file data beginning at a negotiated checkpoint within the data transfer regime.
- Class 3 error recovery provides full recovery by re-establishing a lost FTAM association and its select and open regimes. Class 3 recovery will then restart the data transfer regime by retransmitting the file data beginning at the negotiated checkpoint within the data transfer regime.

All restart and recovery operations and procedures are completely transparent to the user.

Management and Problem Determination Tools

FTAM software supplies a number of management tools, including an installation verification procedure (IVP), a tracing utility, event logging, and informational and error messages.

FTAM Installation Verification Procedure (IVP)

The FTAM IVP sets up outbound and inbound application associations. A connection is made to your local system (as a loopback test). The FTAM IVP checks that your installation is able to set up and release presentation and session connections. It tests the FTAM software by starting a responder and reading the attributes of a file with the DIRECTORY command.

FTAM Tracing Utility

The FTAM tracing utility (OSITRACE) is a tool for identifying problems in protocol exchanges between your local system and any remote FTAM system. The tracing utility captures protocol exchanges and transcribes them into easily read text; OSITRACE data is written to SYS$OUTPUT.

The FTAM tracing utility monitors data exchanges for individual associations. The tracing utility can trace data originating from the following components: FTAM (DATA, PROTOCOL, and STRUCTURING), ACSE, Presentation, and Session.

OSI Address Lookup using X.500

The FTAM software is capable of retrieving network addresses from the X.500 directory. You may use this functionality in conjunction with or instead of retrieving addresses from a local repository.

FTAM Event Logging

For event logging, the FTAM responder writes records to OSIF$RESPONDER.LOG.

Requirements for Compatibility with FTAM

FTAM lets an open system perform a specific set of file transfer, access and management activities with any open system having a compatible FTAM implementation.

The Protocol Implementation Conformance Statement (PICS) provides more information about Digital's FTAM implementation.

APPENDIX B: VIRTUAL TERMINAL

DECnet/OSI Virtual Terminal is Digital Equipment Corporation's implementation of the ISO Virtual Terminal Basic Class standard, which is comprised of the service definition (ISO 9040) and the protocol (ISO 9041). The DECnet/OSI Virtual Terminal software adheres to these standards, thereby providing interactive access between DECnet/OSI systems and other multivendor terminal systems and host systems that also adhere to the ISO Virtual Terminal Basic Class standard.

Virtual Terminal is implemented as an Application Service Element (ASE) of the OSI Application layer.

DECnet/OSI Virtual Terminal can run over Transport Layer Classes 0, 2 or 4 over CONS, and TP4 over CLNS. DECnet/OSI Virtual Terminal can also run over TCP/IP networks using RFC 1006.

Virtual Terminal provides terminal/initiator (for a local user) and host/responder (for the remote user) capabilities. Terminal/responder and host/initiator are not supported.

Supported Standards

Virtual Terminal conforms to the following OSI standards:

- ISO 9041 — Virtual Terminal Protocol - Basic Class
- ISO 8650 — ACSE protocol
- ISO 8823 — Presentation protocol
- ISO 8327 — Session protocol

Virtual Terminal Features

Virtual Terminal supports the following features:

- Class of Service
  - Basic class (character cell terminals)
- Mode of Operation
  - Asynchronous Mode (A-Mode)
- Profile Support
  - Default A-mode (per ISO 9040)
  - A-mode Generalized Telnet (adheres to OIW Stable Agreements)
  - A-mode Transparent (adheres to OIW Stable Agreements)
  - A-mode Telnet 1988 (adheres to OIW Stable Agreements)
- Functional Units
  - destructiveBreak
  - structuredCOs
  - urgentData

- Supported Gateways
  - Bidirectional VT/Telnet
  - Bidirectional VT/LAT
- On-Line Help

OSI Address Lookup using X.500

The Virtual Terminal software is capable of retrieving network addresses from the X.500 directory. This functionality may be used in conjunction with or instead of retrieving addresses from a local repository.

Command Mode

Command mode allows the user to execute commands that can modify the characteristics of the Virtual Terminal association with the remote application.

Trace Utility

The Virtual Terminal tracing utility (OSITRACE) is a tool for identifying problems in protocol exchanges between your local system and any remote system. The utility captures protocol exchanges and transcribes them into easily read text.

The tracing utility monitors data exchanges for individual associations. The utility can trace data originating from the VT, ACSE, Presentation, and Session components.

APPENDIX C: OSI APPLICATION PROGRAMMING INTERFACES

FTAM API

The FTAM API supports the OSI standard ISO 8571—Information Processing Systems—Open Systems Interconnection—File Transfer, Access, and Management.

The FTAM API provides the interface to the FTAM protocol machine provided in DECnet/OSI. Communications between the application code and the FTAM protocol machine are carried out using ASN.1 encoded data structures. The API supports the following functions:

- Abort
- Begin-Group
- Cancel
- Change-Attributes
- Create
- Close
- Data
- Data-End
- Delete
- Deselect
- End-Group
- Initialize
- Open
- Read-Attributes
- Read
- Select
- Terminate
- Transfer-End
- Write

ACSE API

The Association Control Service Entity (ACSE) API supports the following OSI standards

- ISO 8650—Information Processing Systems—Open Systems Interconnection—Protocol Specification for the Association Control Service Element.
- ISO 8649—Information Processing Systems—Open Systems Interconnection—Service Definition for the Association Control Service Element.

The ACSE API provides the interface to the Associate and Release services. The services provided are

- Associate
- Release
- Abort
- Redirect

The Redirect service is not an ACSE service. It allows applications to redirect an incoming association to another process on the local system.

Presentation Layer API

The implementation of the Presentation layer in the toolkit supports the following OSI standards:

- ISO 8823—Information Processing Systems—Open Systems Interconnection—Connection-Oriented Presentation Protocol Specification
- ISO 8822—Information Processing Systems—Open Systems Interconnection—Connection-Oriented Presentation Service Definition
- ISO 8327—Information Processing Systems—Open Systems Interconnection—Basic Connection-Oriented Session Protocol Specification
- ISO 8326—Information Processing Systems—Open Systems Interconnection—Basic Connection-Oriented Session Service Definition.

The Presentation API provides the interface to the Presentation layer services and, by passthrough, to the equivalent Session layer services. The API supports the following services:

- Alter-Context
- Data
- Capability-Data
- Expedited-Data
- Typed-Data
- Token-Please
- Token-Give
- Control-Give
- Sync-Major
- Sync-Minor
- Resynchronize
- Exception-Report
- Activity-Start
- Activity-Interrupt
- Activity-Resume
- Activity-Discard
- Activity-End

Session Layer API

The implementation of the Session layer supports the following OSI standards:

- ISO 8327—Information Processing Systems—Open Systems Interconnection—Basic Connection Oriented Session Protocol Specification
- ISO 8326—Information Processing Systems—Open Systems Interconnection—Basic Connection Oriented Session Service Definition.

The Session layer supports ISO Session version 1 and version 2. Session version 1 allows up to 512 octets of user data on a service. Session version 2 supports the restrictions imposed by the National Institute of Standards and Technology allowing up to 10,240 octets of data on a service.

The Session API provides the interface to the Connect and Release services as follows:

- Connect
- Release
- Abort
- Redirect

The Redirect service is not a Session service. It allows applications to redirect an incoming connection to another process on the local system.

The Session API also provides the following services

- Data
- Capability-Data
- Expedited-Data
- Typed-Data
- Token-Please
- Token-Give
- Control-Give
- Sync-Major
- Sync-Minor
- Resynchronize
- Exception-Report
- Activity-Start
- Activity-Interrupt
- Activity-Resume
- Activity-Discard
- Activity-End

ROSE API

The Remote Operations Service Element (ROSE) supports the following OSI standard:

- ISO 9072 — Information Processing Systems — Text Communication — Remote Operations

ROSE supports interactive applications in a distributed open systems environment. It is a service for multivendor distributed processing.

The ROSE functionality provides a mechanism that allows for the encoding and decoding of the Remote Operations Protocol Control Information, as defined in ISO 9072, for the following services:

- Invoke
- Result
- Error
- Reject

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