

Software Product Description

PRODUCT NAME: DECnet-VAX, Version 5.1
VMS Network Software (Full Function and End Node)

SPD 25.03.25

DESCRIPTION

DECnet-VAX allows a suitably configured VMS system to participate as a routing or end node in DECnet computer networks. With proper network planning, DECnet-VAX, Version 5.1 networks can contain up to 1023 nodes per network area and up to 63 areas per network. DECnet-VAX interfaces are standard components of VMS for use on a local, standalone system.

The DECnet-VAX end node and full function products are each licensed separately for VMS. The DECnet-VAX License Product Authorization Key (PAK), when registered on a VMS system, enables communication between different, networked systems that use the same protocols.

DECnet-VAX is a Phase IV network product and is warranted for use only with Phase III and Phase IV products supplied by DIGITAL.

DECnet-VAX offers task-to-task communications, file management, downline system and task loading, network command terminals, and network resource sharing capabilities using the DIGITAL Network Architecture (DNA) protocols. DECnet-VAX communicates with adjacent and non-adjacent Phase III and Phase IV nodes (adjacent nodes are connected by a single communications line).

VMS programs written in VAX MACRO and native mode high-level languages can use DECnet-VAX capabilities, but programs executing in PDP-11 compatibility mode can not use DECnet-VAX.

The network functions available to a DECnet-VAX user depend, in part, on the configuration of the rest of the network. Each DECnet product offers its own subset of DIGITAL Network Architecture (DNA) functions and its own set of features to the user. Networks consisting entirely of DECnet-VAX Phase IV nodes have all the functions described in this SPD. Networks that combine different DECnet implementations may limit the functions available to the DECnet-VAX user on non-DECnet-VAX nodes since other DECnet implementations may not implement certain functions. Similarly, a user of another

DECnet implementation may not be able to access all DECnet-VAX functions.

The functions available to users on mixed networks can be determined by a comparison of the SPDs for the appropriate DECnet products.

Routing

A Full Function DECnet-VAX License PAK must be registered on a node in order for that node to operate as a routing node. For a node to operate as an end node, either the Full Function or the End Node DECnet-VAX license PAK must be registered on that node. Full Function DECnet-VAX software allows a node to be set up as either a routing node or as an end node.

A DECnet-VAX node must function as a routing node whenever multiple circuits are used by that node. Routing nodes maintain information on the paths to other nodes in the network. DECnet-VAX end nodes provide all the capabilities of DECnet-VAX routing nodes except that end nodes cannot route messages on behalf of other nodes in the network. Since end nodes do not route messages, they do not need to maintain routing information. Consequently, end nodes initiate less overhead message traffic than routing nodes, and, therefore, consume less processing power than routing nodes.

Adaptive Routing is the mechanism which routing nodes use to "adapt" or choose other physical paths should the physical path the routing nodes are using fail or change line cost.

In addition to adaptive routing, which all DECnet Phase IV implementations use, DECnet-VAX supports area routing. Area routing is a method by which DECnet can send and route messages between the nodes in different areas of the network. Up to 63 areas with up to 1023 nodes per area are allowed. The network manager has the option of separating a network into areas. Area-based DECnet networks are hierarchical networks and some restrictions apply to communications from nodes in one area to nodes in another area. However, it is not required that all nodes in the network be DECnet-VAX or even Phase IV nodes. Proper network

™MS is a trademark of Microsoft Corporation

digital
software

January 1989

AE-D624Z-TE

planning is essential when using area routing or configuring large networks. Valid topologies are the responsibility of the customer.

Note: Only 32 routers are supported on an extended LAN.

A DECnet-VAX node has the ability to communicate with a remote node over multiple circuits simultaneously, as long as those circuits are all of equal cost and provide the lowest path cost. DECnet-VAX routing nodes will split data transmission of a packet load to a destination node via multiple paths if those paths are of equal lowest cost. This capability is called Equal Cost Path Splitting. This feature can increase throughput of data by using all of the best available paths. All intermediate routing nodes should also support this feature, and all destination nodes must support out-of-order packet caching, in order to take full advantage of this capability.

Standard DECnet-VAX Capabilities

Task-to-Task Communication

For most applications, task-to-task communication can be programmed in a transparent manner, where the remote task is treated as a full duplex, record-oriented device. Transparent operation is provided via the following interfaces: System Service calls, RMS calls (OPEN, GET, PUT, CLOSE), and high-level language I/O statements (which are mapped to RMS calls). A non-transparent mode of task-to-task communication is offered via 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-VAX, a VMS program written in VAX MACRO or a native mode, high-level language can exchange messages with other user programs. The two user programs can be on the same node, on adjacent Phase III or Phase IV nodes, or on any two non-adjacent Phase III or Phase IV nodes in the same network connected by Phase III or Phase IV routing nodes. DECnet-VAX imposes no special data formatting requirements on the user.

Network Resource Access

File Access - File access is supported to and from remote DECnet systems transparent to VAX MACRO and 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 VMS node. In addition to sequential access to a file, several other access methods are supported through RMS using DECnet-VAX. These 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 several (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 VMS DIGITAL Command Language (DCL) commands can be used to perform network file operations. These 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 those commands which invoke processing on a specific system (i.e., 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 nodes which support compatible file structures and record formats. Between two VMS systems, sequential or relative files with fixed length, variable length, or variable length with fixed control field records can be transferred. Similarly, multi-keyed indexed files with variable or fixed length records are supported.

The SUBMIT 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. Conversely, DECnet-VAX allows VMS command files to be received from other systems and executed.

A new command, EXCHANGE/NETWORK, which allows for the transfer of files to or from heterogeneous systems, is now available. This new command gives users the option to transfer file types between MSTTM-DOS or ULTRIX and VMS 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

Downline System Loading

DECnet-VAX 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 which 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 file image of a remote node's operating system from a VMS node to the unattended target node. For example, DECnet-VAX permits you to load an RSX-11S operating system file image from your VMS node downline to the target node. Load requests can come from the local DECnet-VAX operator

or from the target node. Down-line Loading is supported for DIGITAL server products. However, this facility is not supported by asynchronous DECnet-VAX.

Downline Task Loading

Initial task images for loadable systems can be stored on VMS file system devices and loaded into remote nodes. Programs already executing on loadable RSX-11S systems can be checkpointed to the host VMS file system and later restored to main memory in the RSX-11S node running DECnet-RSX. Overlays for RSX-11S tasks can also be stored on VMS file system devices. These features simplify the operation of network systems that do not have mass storage devices.

This facility is not supported by asynchronous DECnet-VAX.

Upline Dumping

Memory images of adjacent RSX-11S nodes connected by DECnet can be written or dumped into a file on a VMS system. This facility helps a programmer understand what may have caused the RSX-11S system to crash. This facility is also supported for DIGITAL server products.

This facility is not supported by asynchronous DECnet-VAX.

Network Command Terminal

The DCL command, SET HOST, allows a terminal user on one DECnet-VAX node to establish a logical connection to another DECnet-VAX node or other types of DECnet nodes that utilize the Heterogeneous Command Terminal Protocol (consult the appropriate SPDs). This connection makes the terminal appear as if it were 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 utilize the resources of larger development-oriented systems.

VMS MAIL Utility

VMS MAIL allows transmission of text messages between users of a stand-alone VAX system. The DECnet-VAX software allows users to send and receive VMS MAIL to or from users of other VMS systems that operate within the same DECnet network.

VMS PHONE Utility

The VMS PHONE Utility allows users to send and receive data interactively from one user's terminal to another user's terminal. DECnet-VAX increases the scope of PHONE to allow active users on different VMS systems in the same network to exchange information.

VAXcluster Alias

DECnet-VAX supports the ability to access some or all nodes in a VAXcluster 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.

At least one node in the VAXcluster must be configured as a router in order to use this feature.

Network Management

The Network Control Program (NCP) performs three primary functions: displaying statistical and error information, controlling network components, and testing network operation. These functions can be performed locally or executed at remote Phase III or Phase IV nodes that support these functions.

An operator can display the status of DECnet activity at any Phase III or Phase IV node in the network. The user can choose to display statistics related to the node itself or the communication lines attached to that node, including traffic and error data. The local operator can also perform many network control functions such as starting and stopping lines, activating the local node, and downline loading systems.

DECnet-VAX provides network event logging to a terminal device or disk file. The NCP utility can be used to enable and disable the event logging facility.

NCP can also be used to test components of the network. NCP enables transmission and reception of test messages over individual lines either between nodes or through other controller loopback arrangements. The messages can then be compared for possible errors. NCP allows performance of a logical series of tests that will aid in isolating network problems.

Integrated Interfaces

DECnet-VAX interfaces are standard parts of the VMS Operating System for use on local, standalone systems. Users can develop programs and procedures based upon these interfaces for such functions as file access and task-to-task communication on individual systems. Since the DECnet-VAX interfaces stay the same, the programs and procedures developed on an individual system can be used in a network environment without being modified.

Communications Options

DECnet-VAX uses synchronous, asynchronous, Ethernet, and CI communications controllers to interface with other network nodes. Synchronous controllers use DDCMP, either when directly connected or when connected via modems, to provide full or half duplex communications over point-to-point lines, or full duplex over multipoint lines. Asynchronous controllers use DDCMP, either when directly connected or when connected via modems, to provide only full duplex communications over point-to-point lines. (NOTE: Error Correcting and data suppression modems are not supported. Refer to HARDWARE REQUIREMENTS for a short description of controllers).

Asynchronous lines are supported only to other systems running DECnet-VAX, DECnet-RSX, PRO/DECnet, DECnet-Rainbow, DECnet-VAXmate and DECnet-DOS.

DDCMP operation is not supported in cases where an asynchronous physical communication line is emulated by lower level protocols or communication subsystems. Examples of this include X.29 virtual terminals, asynchronous connections as emulated by terminal servers, and connections via data switches.

The Ethernet controllers allow DECnet-VAX to use Ethernet as its datalink transmission medium.

The CIBCA, CI780 and CI750 employ unique protocols to provide services similar to those of DDCMP.

VAX Packetnet System Interface (VAX P.S.I.) is the software product that provides an interface to X.25 Packet Switching Data Networks (PSDNs). When DECnet-VAX is used in conjunction with VAX P.S.I., DECnet-VAX can utilize a virtual circuit (SVC or PVC) of the PSDN as though it were a standard datalink to transmit messages between DECnet nodes. (Note: Up to 128 X.25 virtual circuits are currently supported for Data Link Mapping (DLM), depending on CPU loading and capability. Refer to VAX P.S.I. (SPD 25.40.xx) for more detailed information.

A VMS system can be used as either a control or a tributary node in a multipoint environment. DECnet-VAX supports a maximum of 32 tributaries controlled by one or more DMP11 or DMV11 control stations on a single node; a maximum of 8 tributaries can be controlled on one DMV11 multipoint line and a maximum of 16 tributaries can be controlled on one DMP11 multipoint line. The DMF32 may also be used with any UNIBUS VAX system as a tributary node. The DMP11 can be used in point-to-point communications configurations in DMC11 compatibility mode. The DMR11 is program compatible with the DMC11 and is supported in DMC11 compatibility mode as well DMR11 mode.

Maximum throughput for a specific tributary node is equal to the maximum aggregate data rate for the control node, divided by the sum of the number of active tributaries plus one.

When configuring your system with specific devices, please refer to the DECnet-VAX Load Unit Tables included in this SPD for calculating configuration loads and for support information.

DECnet-VAX Operation

DECnet-VAX is implemented under VMS as an Ancillary Control Process (ACP) and a network device driver with DIGITAL-supplied executive-level components and user-level programs.

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

DECnet-VAX Configuration and Performance

The process of configuring a DECnet-VAX node is based primarily on trade-offs of cost, performance, and functionality, while satisfying the user's application requirements. It can be readily expected that network applications will range from low-speed, low-cost situations to those of relatively high performance and functionality. The performance of a given DECnet-VAX 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 of device interrupts per unit time
- Communication line characteristics
- Number and size of buffers
- Message size and frequency of transmission
- Applications in use
- Size and frequency of route-through traffic (routing nodes only)

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. The reason is that 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.

Refer to the DECnet-VAX Load Unit Tables for maximum system configuration information.

HARDWARE REQUIREMENTS

Note: IF A DEVICE IS NOT LISTED, THEN THAT DEVICE IS NOT SUPPORTED BY DECnet-VAX.

* equals retired devices, no longer offered as an option.

Refer to VMS Operating System (SPD 25.01.xx) for hardware requirements and processor support. Reference can be made to the configuration charts listed in the VMS Operating System SPD. For general device or controller descriptions, please refer to the Networks and Communications Buyers Guide.

One of the following communication devices is required:

DEUNA-AA	Ethernet controller interface
DELUA	Ethernet controller interface, Minimum revision level F1 required.
DEBNA	Ethernet 802.3-to-VAXBI Port Controller interface replacement for DEBNT. Concurrent use with DEBNT is not supported. The TK50/Ethernet port option is supported for concurrent TK50/Ethernet operation on packaged 8000 class workstation systems only.

DMC11-AR, -DA	Remote synchronous point-to-point interface, supports V.24/EIA RS-232-C, maximum speed 19.2 kilobits/second, full or half duplex. Not supported on DWBUA Adaptors.*		500 kilobits/second FDX or 1000 kilobits/second HDX; can be used as multipoint control or tributary station; configuration limitations based on number of tributaries.*
DMC11-AL, -MD	High speed local point-to-point synchronous interface, speed at 56 kilobits/second via coax, full or half duplex. Not supported on DWBUA Adaptors.*	DMP11-AE	RS-422-A remote synchronous communication interface. The maximum data rate is 1000 kilobits/second; can be used as multipoint control or tributary station; half or full duplex; configuration limitations based on number of tributaries.*
DMC11-AL, -MA	High speed local point-to-point synchronous interface, speed at 1000 kilobits/second via coax, full or half duplex. Not supported on DWBUA Adaptors.*	DMF32-LP	Synchronous point-to-point or multipoint (tributary only) line support for RS-232-C or RS-423-A interface up to 19.2 kilobits/second, half or full duplex. Asynchronous point-to-point only line support for RS-232-C or RS-423-A interface up to 9.6 kilobits/second, half or full duplex. Supported on DWBUA adaptors.
DMC11-AR, -FA	Remote CCITT V.35 point-to-point synchronous interface, speed up to 56 kilobits/second via modems (up to 250 kilobits/second via coax), full or half duplex Not supported on DWBUA Adaptors.*	DSB32	Synchronous, 2-line, half or full duplex point-to-point VAXBI communication interface supporting DDCMP (1 or 2 lines up to 64Kbps) with full modem control.
DMR11-AA	Remote point-to-point synchronous interface, supports RS-423-A up to 56 kilobits/second or RS-232-C up to 19.2 kilobits/second, half or full duplex.	DMB32	VAX BI controller interface: T1012/H033 half or full duplex synchronous point-to-point only ports are compliant with RS232-C, RS422A/RS449, V.11, X.27, and V.35 and are compatible with RS423A/RS440, V.28/V.24, V.10 and X.26. T1012/H3033 asynchronous point-to-point only ports are compliant with EIA RS232-C and compatible with V.28/V.24. T1012 also compliant with RS423-A, V.10, and X.26, but H3033 distribution panel is not because of pin limitation on the 25 pin D-type connector.
DMR11-AC	High speed local synchronous interface with integral modem for local connection, point-to-point, half or full duplex.	DHB32	Asynchronous 16 line terminal multiplexer support for EIA RS-232-C or RS-423-A for BI based system terminal connections, up to 19.2 kilobits/second.
DMR11-AB	Remote CCITT V.35 synchronous interface, speed up to 56 kilobits/second via modems (up to 1000 kilobits/second via local coax), point-to-point, half or full duplex.	DHU11	Asynchronous 16 line RS-232-C controller interface, speed up to 9.6 kilobits/second, full modem control.
DMR11-AE	EIA RS-422 synchronous interface, speed up to 1,000 kilobits/second (Modem switch selectable speeds: 56, 250, 500, 1000 kilobits/second), point-to-point, half or full duplex.	DZ11	Asynchronous 16 line support for EIA RS-232-C or RS-423-A interface up to 9.6 kilobits/second, partial modem control.
DMP11-AA	EIA RS-232-C up to 19.2 kilobits/second or RS-423-A (up to 56 kilobits/second) synchronous communication interface; can be used as multipoint control or tributary station; half or full duplex; configuration limitations based on number of tributaries.*	DZ32	Asynchronous 8 line support for EIA RS-232-C or RS-423-A interface up to 9.6 kilobits/second, partial modem control.
DMP11-AB	CCITT V.35 synchronous communication interface. Maximum data rate 56 kilobits/second; can be used as multi-point control or tributary station; half or full duplex; configuration limitations based on number of tributaries.*		
DMP11-AC	Local synchronous communication interface with integral modem (switch selectable speeds: 56, 250, 500 or 1000 kilobits/second; Maximum data rate		

DMZ32	Asynchronous 24 line support for EIA RS-232-C or RS-423-A interface up to 9.6 kilobits/second. Modem support dependent on configuration.	DMV11-AF	Point-to-point or Multipoint (control or tributary station) synchronous line support for RS-423-A/449 interface up to 56 kilobits/second; half or full duplex; multipoint configuration limitations based on number of tributaries.
CI750-AA, -AB	Interconnect for VAX-11/750 systems within a maximum distance of 90 meters. The effective maximum data rate of the CI750 using DECnet-VAX is limited to 1000 kilobits/second between any pair of nodes.	DMV11-AC	Point-to-point or Multipoint (control or tributary station) synchronous line support for with integral modem for local connection up to 56 kilobits/second, half or full duplex; multipoint configuration limitations based on number of tributaries.
CI780-AA, -AB	Interconnect for VAX-11/750, VAX-11/780, VAX-11/782, VAX-11/785, VAX 8600, and VAX 8650 systems within a maximum distance of 90 meters. The effective maximum data rate of the CI780 using DECnet-VAX is limited to 1000 kilobits/second between any pair of nodes.	DMV11-AB	Remote point-to-point or multipoint (control or tributary station) CCITT V.35 synchronous line support up to 56 kilobits/second; half or full duplex; multipoint configuration limitations based on number of tributaries.
CIBCA	CI to BI interface Adaptor.	DHV11	Asynchronous 8 line support for EIA RS-232-C or RS-423-A interface up to 9.6 kilobits/second, full modem control.
MicroVAX and VAXstation system configurations ** require one of the following communication devices:		DHQ11	Asynchronous 8 line support for EIA RS-232-C or RS-423-A interface up to 19.2 kilobits/second, full modem control.
NOTES:		DHT32	Asynchronous 8 line support for EIA RS-423-A interface up to 19.2 kilobits/second, full modem control for MicroVAX 2000 systems. Concurrent use with DST32 is not supported.
* Retired Device, no longer offered as an option.		DST32	Synchronous single line support for DDCMP up to 9.6 kilobits/second, full duplex for MicroVAX 2000 systems. Concurrent use with DHT32 is not supported. The DST32 is not supported on the VAXstation 2000.
** For VAXstation 2000 systems, only one asynchronous data/modem RS-232C serial line is supported up to 9600 baud. For MicroVAX 2000 systems, up to 4 asynchronous data/modem RS-232C serial lines are supported up to 9600 baud.		CXY08	Asynchronous 8 line support for EIA RS-232-C interface up to 19.2 kilobits/second, full modem control, for VAX 3000 series systems.
DEQNA	Ethernet Controller Interface - Minimum revision level required is K3.	DZQ11	Asynchronous 4 line support for EIA RS-232-C or RS-423-A interface up to 9.6 kilobits/second, partial modem control.
DELQA	Ethernet Controller Interface - replacement for DEQNA. Minimum revision level required is C3.	DZV11	Asynchronous 4 line support for EIA RS-232-C or RS-423-A interface up to 9.6 kilobits/second, partial modem control.
DESVA	Ethernet controller interface for VAXstation 2000 and MicroVAX 2000 Systems.	Note:	The following RS-422/423 signals are not supported by the DECnet-VAX or VMS software:
DESQA	Ethernet Controller Interface for MicroVAX 3300/3400/3500/ 3600 series, VAXserver 3300/3400/3500/3600 series, and VAXstation 3300/3400/3500 series systems.	NS	- New Signal
DSV11	Synchronous, 2-line, half or full duplex point-to-point communication interface supporting DDCMP (1 or 2 lines up to 64Kbps).	SR	- Signaling Rate Selector
DMV11-AA	Point-to-point or Multipoint (control or tributary station) synchronous line support for EIA RS-232-C up to 19.2 kilobits/second or RS-423-A (up to 56 kilobits/second) synchronous communication interface; half or full duplex; multipoint configuration limitations based on number of tributaries.	LL	- Local Loopback
		RL	- Remote Loopback
		SS	- Select Standby

CLUSTER ENVIRONMENT

This layered product is fully supported when installed on any valid and licensed VAXcluster* configuration without restrictions. The **HARDWARE REQUIREMENTS** sections of this product's Software Product Description and the VMS Operating System Software Product Description (SPD 25.01.xx) detail any special hardware required by this product.

- * V5.x VAXcluster configurations are fully described in the VAXcluster Software Product Description (29.78.xx) and include CI, Ethernet and Mixed Interconnect configurations.

GROWTH CONSIDERATIONS

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

OPTIONAL HARDWARE

Communication devices may be added from the above lists, up to, but not to exceed the maximum defined by the DECnet-VAX load unit tables or the limits imposed by a bounded CPU system as mentioned in VMS Operating System (SPD 25.01.xx).

SOFTWARE REQUIREMENTS

VMS Operating System, Version 5.1
Only the Base VMS Kit component is required.

OPTIONAL SOFTWARE

VAX P.S.I.

VAX P.S.I. Access

VAX WAN Device Drivers kit is required for any synchronous device operation.

INSTALLATION

Only experienced customers should attempt installation of this product. DIGITAL recommends that all other customers purchase DIGITAL's Installation Services. These services provide for installation of the software product by an experienced DIGITAL Software Specialist.

VMS Tailoring

For VMS V5.x systems, the following VMS class is required for full functionality of this layered product:

- VMS Required Saveset

For more information on VMS classes and tailoring, refer to the VMS System Software Product Description (SPD 25.01.xx).

Customer Responsibilities

Before DIGITAL can install the software, the customer must:

- Ensure that 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 communication 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 communication facilities and terminals that are to be used during installation.

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

Installation for DECnet-VAX will consist of the following:

- Verification that all components of DECnet-VAX have been received.
- Verification that the necessary versions of the VMS software and documentation are available.
- Verification of the appropriate SYSGEN parameters.

Note: Should a software specialist be required to modify the previously installed operating system parameters, a time and materials charge will apply.

- Create any necessary DECnet-VAX accounts and directories.
- Enable software via License Product Authorization Key (PAK) registration.
- Define and create a local node DECnet database.
- Modify the system's startup command procedure to include start up of the DECnet-VAX network.
- Verify the proper installation of DECnet-VAX 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.

ORDERING INFORMATION

DECnet-VAX software is shipped on the VMS kit for all processors including MicroVAX-based processors.

You will need a separate license and license PAK for each CPU on which you will be using the software product (except as otherwise specified by DIGITAL). Then Materials and Service Options are selected to utilize the product more effectively. THE LICENSE OPTIONS ARE DESCRIBED BELOW. IF YOU ARE NOT FAMILIAR WITH THE SERVICE OPTIONS, YOU MAY OBTAIN THE APPROPRIATE SOFTWARE PRODUCT SERVICE DESCRIPTION(S) FROM YOUR LOCAL DIGITAL OFFICE.

End Node: QL-D04A*-AA

Full Function: QL-D05A*-AA

Migration Option: QL-D09A*-AA

- * Denotes processor variant. Contact your local DIGITAL Sales Office for Rental License Option Availability.

LICENSE OPTIONS

Single-Use License Option

The Single-Use License is your right to use the software product on a single CPU. Single-Use licensed software is furnished under the licensing provisions of DIGITAL's Standard Terms and Conditions of Sale.

For your first installation of this software product you must purchase as a minimum:

- Single-Use License Option, and
- One VMS Extended Documentation Option (Includes full DECnet-VAX Documentation)

The license gives you the right to use the software on a single CPU and includes the delivery of a License Product Authorization Key (PAK) to enable the DECnet-VAX software. The VMS Distribution and Extended Documentation Options provides the machine-readable software and related documentation.

To use this software product on additional CPUs, you must purchase a Single-Use License Option for each CPU.

The one-time right to copy the software is no longer included with your Single-Use License Option. For additional CPUs, the VMS Extended or the VMS Base Documentation Options are optional. Note that the VMS Base Documentation does not include the full set of DECnet-VAX documentation, but is sufficient for those users who need to get started using the basic capabilities of DECnet-VAX.

VAXcluster License Option

You are eligible for a VAXcluster license option on your second or each subsequent CPU (NOTE: Valid only for 7xx and 86xx class processors) that is part of a VAXcluster system. This is a Single-Use License offered at a reduced price and provides all of the License rights described above. A full price Single-Use DECnet-VAX License Option (example: QL-xxxx-AA) is required for the first CPU in a VAXcluster and a DECnet-VAX VAXcluster license (QL-XXXXX-QZ) is required for the additional CPUs of a VAXcluster system.

For software configuration purposes, a VAXcluster system is a set of VAX processors, each running the VMS Operating System, where each VAX processor has a direct path to every other VAX processor.

Migration Option - DECnet-VAX End Node to Full Function

Current licensed users of DECnet-VAX End Node software are eligible for the migration option to upgrade a system from End Node capability to Full Function capability. This is a Single-Use License offered at a reduced price and provides all of the License rights described above under a full function license.

For each CPU running DECnet-VAX End Node that is to be upgraded to Full Function, you must purchase as a minimum:

- Migration Option Single-Use License

Documentation Option

You will receive DECnet-VAX documentation as part of either the VMS Extended or VMS Base Documentation Options. Note that the VMS Extended Set contains the full DECnet-VAX Networking Documentation while the Base set contains a subset of this information for users who need only to get started using DECnet-VAX. You do not need to order any license option to obtain documentation; you need only order those manuals or sets which are appropriate for your needs.

It is suggested that the VMS Extended Documentation option be purchased as system management becomes more important to you; however, you only need the VMS Base Documentation option to use the DECnet-VAX software to get started. When revised versions of this software product become available, you may obtain additional copies of the Documentation by purchasing either VMS option again or by purchasing individual manuals. For your convenience, a separate DECnet-VAX documentation-only kit is available (QA-001AN-GZ).

SOFTWARE LICENSING

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

LICENSE MANAGEMENT FACILITY

This software product supports the VMS License Management Facility and will be enabled by a License Product Authorization Key (PAK) which is included as part of the purchase of a Single-Use license. License units for this product are allocated on a CPU-capacity basis.

For more information on the License Management Facility, refer to VMS Operating System (SPD 25.01.xx) or the License Management Utility Manual included in the VMS Operating System documentation set.

DECnet-VAX licenses also include the right to use VAX/VMS Services for MS-DOS. VAX/VMS Services for MS-DOS has separate documentation, media kits, and service products. Refer to SPD 30.50.xx for further information.

SOFTWARE PRODUCT SERVICES

A variety of service options are available. For more information on these or other services, please contact your local DIGITAL office.

SOFTWARE WARRANTY

Warranty for this software product is provided by DIGITAL with the purchase of a license for the product as defined in the Software Warranty Addendum of this SPD.

LOAD UNIT TABLES

Note: IF A DEVICE IS NOT LISTED, THEN THAT DEVICE IS NOT SUPPORTED BY DECnet-VAX.

The tables below describe the physical hardware configurations supported by DECnet-VAX in terms of CPU type and communication interface. The numbers given in the tables are "load units."

Load units are incurred when a device is in active operation at the indicated speed. An idle device incurs no load. However, in general, systems should be configured so they can sustain peak load rates.

Configuration limits such as power supply, air conditioning, and backplane space requirements are not considered in the following tables. Please verify system configurations with your DIGITAL representative. In addition, please note that each device requires its own memory space for buffering and link control. Particular consideration should be taken when configuring eight or more DECnet-VAX links on a single CPU; if in doubt, please contact your DIGITAL representative.

How to use these tables:

Each communications device belongs to one of three classes. The three classes are:

- Class I - DMA devices with firmware datalink protocol
- Class II - DMA devices with datalink protocol in handling software
- Class III - Low end non-DMA devices with software-handling datalink protocol and primarily per-character interrupts

See below for a listing of the communications devices, and the class to which each belongs.

Each device class and line speed combination has a number of load units associated with it, as follows:

Load Units by Line Speed and Device Class

	Line Speed (kilobits/sec)			
	9.6	19.2	56	>56
Class I	8	16	45	100
Class II	10	20	n/a	n/a
Class III	13	26	n/a	n/a

Note: For speeds under 9.6 kilobits/sec (= 9600 baud), load units are proportional. Thus a 2400 baud Class III (e.g. a DZV11) line would represent about 3 units.

Each CPU can support a given number of load units. In general, the faster the CPU, the greater the number of load units it can support. The load units that can be supported by each CPU are as follows:

Load Units by CPU Type

CPU	Load Units
VAX 8810,20,30,40	1500
VAX 8800	1200
VAX 8650	1200
VAX 8700	1200
VAX 8550	1200
VAX 8530	940

Load Units by CPU Type

CPU	Load Units
VAX 8600	790
VAX 8500	790
VAX 6210,20,30,40	655
MicroVAX 3xxx, VAXstation 3xxx	640
VAX-11/785	360
MicroVAX II, VAXstation II	280
VAX-11/782	240
VAX-11/780	240
VAX 8250, VAX 8350	240
VAX 8200, VAX 8300	200
VAX-11/750	170
MicroVAX 2000/VAXstation 2000	170 ¹
MicroVAX I, VAXstation I	100
VAX-11/725, VAX-11/730	100

¹ For VAXstation 2000 systems, only one asynchronous data/modem RS-232C serial line is supported up to 9600 baud. For MicroVAX 2000 systems, up to 4 asynchronous data/modem RS-232C serial lines are supported up to 9600 baud.

The maximum system configuration, with a mix of device types, is computed by adding the load costs (in load units) for each device up to the limit for a given processor type. For general information on possible supported configurations, see the configuration charts in VMS Operating System (SPD 25.01.xx).

Example:

For a VAX-11/750 used to route messages in a DECnet network

Assume that the system uses a DMR11 (Class I device) at 500 kilobits/sec, a DMR11 (Class I device) at 19.2 kilobits/sec, and the synchronous line of a DMF32 (Class I device) at 19.2 kilobits/sec. When the network is heavily used, the processor loading totals 136 load units. Adding a device with a load of greater than 34 load units (e.g., another DMR11 at 56 kilobits/sec) would mean that the VAX-11/750 may not be able to sustain heavy demand.

Device Classes

Device Type	Class
DELUA ¹	I
DEUNA ¹	I
DEBNA ¹	I
DHU11 ²	II
DMC11	I
DMR11	I
DMP11	I
DMF32 (synch)	II
DMF32 ² (asynch)	II
DSB32	II
DMB32 (synch)	II
DMB32 ² (asynch)	II
DSV11	II
DMV11 ³	I

Device Classes

Device Type	Class
DZ11 ²	III
DZ32 ²	III
DMZ32 ²	III
CXY08	II
CI780 ⁴	I
CI750 ⁴	I
CIBCA	I
DEQNA ¹	I
DELQA ¹	I
DESQA ¹	I
DEVA ¹	I
DHV11 ²	II
DHQ11 ²	II
DHT32	II
DST32 ²	II
DHB32	II
DZV11 ²	III
DZQ11 ²	III

¹ When two or more Ethernet controllers are used on a single CPU, each controller must be connected to a different Ethernet cable. These cables must not be joined by a bridge or a repeater, though they may be joined by another DECnet router.

² Load costs are for each line of a device at 9600 baud. Higher data rates are not supported.

³ Load costs are for each line at 56 kilobits/second. Higher data rates are not supported.

⁴ DECnet-VAX supports up to 16 VAX systems connected to one SC008 star coupler via CI780/750 interfaces. The effective maximum data rate through the CI780/750 using DECnet-VAX is limited to 1000 kilobits/second at each node.

In order to achieve a viable configuration the user and/or a DIGITAL software specialist must perform a level of application analysis which addresses the factors above.