Software Product Description

PRODUCT NAME: DECnet-VAX, Version 5.4 **SPD 25.03.28**

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 5.4 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.

DECnet-VAX end node and full function products are 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 only for use with Phase III and Phase IV products supported by Digital Equipment Corporation.

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 cannot 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 Software Product Description (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 with the exception 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 if 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 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 cost path. DECnet-VAX routing nodes will split 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 the best available paths. In order to take full advantage of this capability, all intermediate routing nodes should also support this feature and all destination nodes must support out-of-order packet caching.

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, and CLOSE) and high-level language I/O statements (which are mapped to RMS calls). A nontransparent mode of task-to-task communication 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-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 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 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 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 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. Sequential or relative files with fixed length, variable length, or variable length with fixed control field records can be transferred between two VMS systems. 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 DCL 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 MS-DOS ® or ULTRIX systems and VMS systems regardless of record semantics. Unlike the COPY command which preserves file and record organization during a

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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 properly formatted load file image of a remote node's operating system from a VMS node to the unattended target node. For example, DECnet-VAX permits the user to load an RSX-11S Operating System file image from the VMS node downline to the target node. Load requests can come from the local DECnet-VAX operator or from the target node. Downline Loading is supported for Digital server products. However, this facility is not supported over asynchronous DECnet-VAX connections.

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 over asynchronous DECnet-VAX connections.

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 can cause the RSX-11S system to crash. This facility is also supported for Digital server products.

This facility is not supported over asynchronous DECnet-VAX connections.

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 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. More than 64 nodes may operate within a cluster, but the maximum number of nodes allowed to participate in the VAXcluster Alias are 64. Refer to the VAXcluster Software Product Description (SPD 29.78.xx) for relevant restrictions.

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. The NCP facility allows for planning, building, tuning, and controlling DECnet networks. NCP can be used to create and manage networks including local node operation, remote node operation, circuits, lines, and objects.

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. Any logged event can be used to monitor, diagnose, and tune a network. 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 REQUIREMENT* section 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 CIBCI, 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 the VAX P.S.I. Software Product Description (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: 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.

The 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 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 and type of devices attached to the particular CPU
- Number of device interrupts per unit time
- Communication line(s) 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

Notes: 1. If a device is not listed, that device is not supported by DECnet-VAX.

2. An * by a device description indicates that the particular device is no longer offered as an option.

Refer to the VMS Operating System Software Product Description (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.
DEBNI	Ethernet 802.3-to-VAXBI Port Controller interface. Similar to DEBNA in configuration, with increased performance, TK70 tape option disabled.
DEMNA	Ethernet/802.3-to-XMI high-performance Port Controller interface. Smaller footprint than DEBNI in configuration, with increased performance over the DEBNI.
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.
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.
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.

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.
DMR11-AA	Remote point-to-point synchronous interface, supports RS-423-A up 56 to kilobits/second or RS-232-C up to 19.2 kilobits/second, half or full duplex.
DMR11-AC	High speed local synchronous interface with integral modem for local connection, point-to-point, half or full duplex.
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.
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.
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.
DMP11-AB*	CCITT V.35 synchronous communication interface. Maximum data rate 56 kilobits/second; can be used as multipoint 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 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.)
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.
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.
DSB32	Synchronous, 2-line, half or full duplex point-to-point VAXBI communication interface supporting DDCMP (1 or 2 lines up to 64 kilobits/second) with full modem control.
DMB32	VAX BI controller interface: T1012/H3033 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.
DHB32	Asynchronous 16 line terminal multiplexer support for EIA RS-232-C or RS-423-A for BI based system terminal connections. A maximum line speed of up to 19.2 kilobits/second with limited or no modem control for speeds above 9.6 kilobits/second and for the RS-423-A interface is supported.
DHU11	Asynchronous 16 line RS-232-C controller interface, speed up to 9.6 kilobits/second, full modem control.
DZ11	Asynchronous 16 line support for EIA RS-232-C or RS-423-A interface up to 9.6 kilobits/second, partial modem control.
DZ32	Asynchronous 8 line support for EIA RS-232-C or RS-423-A interface up to 9.6 kilobits/second, partial modem control.
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.

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.
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.
CIBCA	CI to BI interface Adaptor. The CIBCA-A ships on 82x0, 83x0, 85x0, 8700, 88x0 and 62x0 and is usable on those systems plus the 63x0 series. The CIBCA-B ships on the 8700, 88x0, 62x0 and 63x0, and is usable on those systems plus 82x0, 83x0.
CIBCA	CI to BI interface Adaptor. The CIBCI ships on 82x0, 83x0, 85x0, 87x0 and 8800, and is usable on all the above plus the 8810 and 8820N.

MicroVAX and VAXstation system configurations ** require one of the following communication devices:

Note:

** For VAXstation 2000 systems, only one on-board 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 asynchronous ports on the MicroVAX 3100 and VAXstation 3100 are supported up to 9.6 kilobits/second with full modem control.

DEQNA*	Ethernet Controller Interface - Minimum revision level required is K3.
DELQA	ETHERNET Controller Interface - replacement for DEQNA. Minimum revision level required is C3. DELQA high performance ROM option (DEQTA) is also supported.
DESVA	Ethernet controller interface for VAXstation 2000 and MicroVAX 2000 Systems.
DESQA	Ethernet Controller Interface for MicroVAX 3300/3400/3500/ 3600/3800/3900 series, VAXserver 3300/3400/3500/3600 series, and VAXstation 3300/3400/3500 series systems. High performance option (similar to DELQA ROM option) is supported.
DSV11	Synchronous, 2-line, half or full duplex point-to-point communication interface supporting DDCMP (1 or 2 lines up to 64 kilobits/second, or 1 line up to 256 kilobits/second).
DIV32	Synchronous, full duplex point-to-point ISDN Basic Rate Access (2B+D) communication interface supporting DDCMP (1 or 2 'lines' ie. ISDN B-Chanels at 64 kilobits/second multiplexed over the ISDN BRA interface). The 16 kilobits/second ISDN D-channel also supported by the DIV32 is reserved for Digital use.
DSF32	DEC WANcontrollor 620 - Two line synchronous commumications controller designed specifically for the VAXft 3000 processors supporting DDCMP. DDCMP is supported at speeds up to 64 kilobits/second per line for a two-line operation.
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.
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.
DMV11-AC	Point-to-point or Multipoint (control or tributary station) synchronous line support used with integral modem for local connection up to 56 kilobits/second, half or full duplex; multipoint configuration limitations based on number of tributaries.
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.
DSH32	DEC TERMINAL/WAN CONTROLLER 581 - Combines DST32 and DHT32 functionality. Asynchronous 8 line EIA RS-232-C or RS-422/3-A interface up to 9.6 kilobits/second, no modem control; and 1 line synch non-DMA DDCMP support up to 9.6 kilobits per second, DEC and Bell 200 modem compatible for bit- and byte-oriented protocols. Expansion adaptor required for MicroVAX 2000 systems. Concurrent use with DHT32 or DST32 is not supported.
DHV11	Asynchronous 8 line support for EIA RS-232-C or RS-423-A interface up to 9.6 kilobits/second, full modem control.

DHQ11	Asynchronous 8 line support for EIA RS-232-C or RS-423-A interface up to 19.2 kilobits/second, with limited or no modem control for speeds above 9.6 kilobits/second and for the RS-423-A interface.
DHT32	Asynchronous 8 line support for EIA RS-423-A interface up to 9.6 kilobits/second, no modem control. Concurrent use with DST32 is not supported.
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.
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.
DZQ11	Asynchronous 4 line support for EIA RS-232-C or RS-423-A interface up to 9.6 kilobits/second, partial modem control.
DZV11	Asynchronous 4 line support for EIA RS-232-C or RS-423-A interface up to 9.6 kilobits/second, partial modem control.

Note: The following RS-422/423 signals are not supported by the DECnet-VAX or VMS software:

NS - New Signal
SR - Signaling Rate Selector
LL - Local Loopback
RL - Remote Loopback
SS - Select Standby

CLUSTER ENVIRONMENT

DECnet-VAX is fully supported when installed on any valid and licensed VAXcluster* configuration without restrictions. The *HARDWARE REQUIREMENTS* sections of the DECnet-VAX Software Product Description (SPD 25.03.xx) and the VMS Operating System Software Product Description (SPD 25.01.xx), detail any special hardware required or not supported by this product.

VAXcluster software provides a distributed computing environment across a highly integrated set of VAX and/or MicroVAX systems that operate as a single environment. VAXcluster members can share many resources such as, disk and tape storage, CPU resources, and system management operations. Within this highly integrated environment, systems retain their independence because they use local, memory-resident copies of VMS. Thus, members can boot and fail independently while benefiting from common resources.

* 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 requirements for the current version.

OPTIONAL HARDWARE

Communication devices may be added from the device class list up to, but not to exceed, the maximum defined by the DECnet-VAX SPD Load Unit Tables or the limits imposed by a bounded CPU system as mentioned in the VMS Operating System SPD (25.01.xx).

SOFTWARE REQUIREMENTS

- VMS Operating System, V5.4
  Only the Base VMS Kit component is required.

OPTIONAL SOFTWARE

- VAX Packetnet System Interface (P.S.I) V4.2
- VAX Packetnet System Interface Access V4.2
- VAX Wide Area Network Device Drivers V1.1 Kit is required for any synchronous device operation.

The VMS/ULTRIX Connection Software (UCX) can be installed to provide a TCP/IP environment on a VMS system. UCX includes capabilities such as file transfer (FTP), TELNET (X.25), Virtual Terminal support, and more. By purchasing and installing UCX, the TCP transport can be used without a PAK under a DECwindows environment. To use the FTP and TELNET applications, the UCX PAK must be installed in the License Management Facility (LMF). Refer to the VMS/ULTRIX Connection Software Product Description (SPD 25.A4.xx) for more information.

VMS Tailoring

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

- VMS Required Saveset

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

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.

Courtesy Installation Service

This software product will be installed by Digital at no additional charge if you purchase it concurrent with a Startup Service Package that includes installation service. Both the host operating system and this product must be installed concurrently.

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. Digital recommends the use of the NCP facility to help verify connectivity.

ORDERING INFORMATION

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

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 per CPU basis and not dependent on CPU Capacity or User/Activity.

For more information on the License Management Facility, refer to the VMS Operating System Software Product Description (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 VMS Services for PCs. VMS Services for PCs has separate documentation, media kits, and service products. Refer to the VMS Services for PCs Software Product Description (SPD 30.50.xx) for further information.

You will need a separate 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.

Base License Option Numbers for DECnet-VAX are:

End Node	QL-D04A*-AA
Full Function	QL-D05A*-AA
Migration Option	QL-D09A*-AA

* Denotes processor variant. Migration indicates an upgrade from End Node (EN) to Full Function (FF). 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 Equipment Corporation's Standard Terms and Conditions.

For the first installation of this software product the user 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, since DECnet-VAX software is included on the VMS Distribution media, you only need the one-time right to copy license for VMS. The VMS Extended or the VMS Base Documentation Options are are not required, but the VMS Base Documentation is recommended for additional CPUs. 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.

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 Equipment Corporation's Standard Terms and Conditions. For more information about Digital's licensing terms and policies, contact your local Digital office.

LICENSE MANAGEMENT FACILITY SUPPORT

This System Integrated Product (SIP) supports the VMS License Management Facility.

License units for this product are allocated on a per CPU basis and are not dependent on CPU Capacity or User/Activity.

For more information on the License Management Facility, refer to the VMS Operating System Software Product Description (SPD 25.01.xx) or the License Management Facility manual of the VMS Operating System documentation set.

For more information about Digital's licensing terms and policies, contact your local Digital office.

SOFTWARE PRODUCT SERVICES

A variety of service options are available. For more information, please contact your local Digital office.

Note: If a device is not listed, that device is not supported by DECnet-VAX.

The following tables 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.

Instructions for using the following tables:

Each communications device belongs to one of the following three classes:

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

Listed below are the communications devices and the class in which each belongs.

Each device class and line speed combination is associated with the following load units:

Load Units by Line Speed and Device Class

	Line Speed (kilobits/second)			
	9.6	19.2	56	>56
Class I	8	16	45	100
Class II	10	20	52	115
Class III	13	26	n/a	n/a

Note: For speeds under 9.6 kilobits/second (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:

Load Units by CPU Type

CPU	Load Units	Main BUS Type
VAX 9xxx-xxx	5400	XMI/BI
VAX 8810,20,30,40	1500	BI
VAX 8800/VAX 8700	1350	BI
VAX 6000-4xx	1300	XMI/BI
VAX 8650	1200	UNIBUS
VAX 8550	1200	BI
VAX 6000-3xx	945 (formerly 63xx)	XMI/BI
VAX 8530	940	BI
MicroVAX 3800/3900	865	Q-bus
VAX 8600	790	UNIBUS
VAX 8500	790	BI
VAX 6000-2xx	655 (formerly 62xx)	XMI/BI
VAX 4xxx	640	Native/Q-bus
MicroVAX 3100, VAXstation 3100	640	Native
VAXstation 3200	640	Native/Q-bus
MicroVAX 3300, VAXstation 3300	640	Native/Q-bus
MicroVAX 3400, VAXstation 3400	640	Native/Q-bus
MicroVAX 3500, VAXstation 3500	640	Native/Q-bus
VAXstation 3520/3540	640	Native/Q-bus
MicroVAX 3600, VAXstation 3600	640	Native
VAX FT3xxx	560	Q-bus
VAX-11/785	360	UNIBUS
MicroVAX II, VAXstation II	280	Q-bus
VAX-11/782	240	UNIBUS
VAX-11/780	240	UNIBUS
VAXstation 8000	240	BI
VAX 8250, VAX 8350	240	BI
VAX 8200, VAX 8300	200	BI
VAX-11/750	170	UNIBUS
MicroVAX 2000/ VAXstation 2000	170 [1]	Q-bus/Native
MicroVAX I, VAXstation I	100 [2]	Q-bus

CPU	Load Units	Main BUS Type
VAX-11/725, VAX-11/730	100 [2]	UNIBUS

Notes: [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.

[2] The following CPUs are no longer offered:

VAX: VAX-11/725, VAX-11/730, VAX-11/782
MicroVAX: MicroVAX I
VAXstation: VAXstation I

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 the VMS Operating System Software Product Description (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/second, a DMR11 (Class I device) at 19.2 kilobits/second and the synchronous line of a DMF32 (Class I device) at 19.2 kilobits/second 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/second) 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
DEBNI [1]	I
DEMNA [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
DIV32	II
DSF32	II
DMV11 [3]	I
DSH32 (synch)	II
DSH32 [2] (asynch)	II
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
DESVA [1]	I
DHV11 [2]	II
DHQ11 [2]	II
DHT32 [2]	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, although 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.

Support for Multiple Ethernet Adapters on Different Bus types

VMS support for multiple, Digital supplied, Ethernet adapters on different bus types allows for:

1. The added capability to Digital's existing multi-rail support

   and

2. The additional throughput capability of newer, faster devices while maintaining customer investment in supported older devices

The following combinations are possible:

Bus Type	Adapter	CPUs Affected
XMI and BI	DEMNA DEBNA, DEBNI	VAX 6xxx, VAX 9xxx
Q-bus and Integrated Ethernet Controller	DELQA/DEQTA (DELQA-Plus or DESQA) DESVA	MicroVAX 3xxx
Q-bus and Integrated Ethernet Controller	DELQA/DEQTA (DELQA-Plus or DESQA) SGEC	VAX 34xx, VAX 4xxx

The following table indicates supported configurations:

CPU Type	DECnet-VAX Load Units	Combination Bus Support
VAX 6000-4xx VAX 6000-3xx VAX 6000-2xx	1300 945 655	Any combination of XMI or BI adapters up to a maximum of 6 adapters
MicroVAX and VAXstation 3xxx	640	2 Q-bus adapters maximum 1 Native adapter maximum or a combination up to 2 adapters of Native and Q-bus
VAX 4xxx and VAX 34xx	640	2 Q-bus adapters maximum 1 Native adapter maximim or a combination up to 2 adapters of Native and Q-bus

Restrictions

Note: If the configuration is not listed here, that configuration is not currently supported by DECnet-VAX.

1. UNIBUS support does not change. DELUA and DEUNAs are still supported at current levels. No combinations beyond existing support are supported.
2. The Q-bus environment is limited to 2 adapters on the same bus type.
3. Failover of adapters is limited to DECnet protocol traffic ONLY. SCA VAXcluster traffic is not supported on multiple adapters on the same CPU for example.
4. No more than TWO different bus types with Ethernet adapters are supported per any CPU.
5. Multiples of different adapters are supported ONLY for Digital Ethernet Adapter hardware.
6. Should average Ethernet utilization exceed 15% on average then failover is not guaranteed from a higher performance device to a lower performance device.

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 stated.

SOFTWARE WARRANTY

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

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