Software Product Description

PRODUCT NAME: DECnet Router Server, Version 1.2 **SPD 30.34.06**

DESCRIPTION

The DECnet Router Server is a software product that runs on an Ethernet Communications Server hardware unit to provide DECnet routing functions in a network of one or more host computers. These hosts may be Phase IV routing nodes or endnodes, or Phase III routing nodes or endnodes (for example, DECnet-RT, Version 2.1 and DECnet/E, Version 2.1). The DECnet Router Server connects directly to the Ethernet to provide routing to nodes off the Ethernet connected via the unit's synchronous/asynchronous lines.

Phase IV DECnet networks are hierarchical networks that can be segmented into areas. The DECnet Router supports both intra-area (Level 1) routing for transporting messages between nodes and inter-area (Level 2) routing for transporting messages between areas. The DECnet Router Server transports messages between Phase III or Phase IV routing and endnodes in the same area, as well as transporting messages between Phase IV routing and endnodes in different areas. Endnodes connected directly to an Ethernet must use DECnet Router Servers or Phase IV host routing nodes on the same Ethernet for message routing off that Ethernet. A routing node is not required on an Ethernet if the endnodes connected to that Ethernet communicate only with each other. However, if the Ethernet directly connects nodes with different area addresses, an area routing node is required to transport messages between these areas. Use of the DECnet Router Server offloads certain communications processing from host nodes that would otherwise serve as routing nodes on the Ethernet.

The DECnet Router Server can act as the ''designated'' router for an Ethernet segment. A ''designated'' router is necessary for endnodes to communicate with nodes off the Ethernet.

The DECnet Router Server implements Phase IV DECnet asynchronous and synchronous DDCMP routing and network management. Through the use of Phase IV DECnet protocols, DECnet networks can contain up to 63 areas, each containing up to 1023 nodes given proper network planning. The DECnet Router Server can also be used to connect to Phase III nodes; this provides migration of Phase III networks with connectivity to Phase IV Ethernet nodes.

The DECnet Router Server is warranted for use only with supported Phase III and Phase IV DECnet products supplied by DIGITAL.

Adaptive Routing and Areas

The DECnet Router Server is a dedicated area routing node with one or more communications lines connecting nodes off an Ethernet to nodes on that Ethernet. With adaptive routing, a message received from a Phase IV/III node addressed to another Phase IV/III node will be forwarded by the intermediate Phase IV/III routing nodes - in this case the Router Server. Routing is not supported to or from Phase II nodes. Phase IV adaptive routing supports up to 63 areas, each containing up to 1023 routing or endnodes in a DECnet network and up to 32 routing nodes on a single Ethernet.

Routing nodes can be one of two types; Level 1 or Level 2. Level 1 routing nodes handle routing within an area and keep the state of all nodes within that area, but not outside the area. All requests to nodes outside the area are routed to the nearest Level 2 routing node. A Level 1 routing node is the same as a routing node under Phase III. Note that messages from a Phase III node will only be routed within an area (Level 1 only). Phase III nodes can communicate with Phase III nodes in the same area, or with Phase IV nodes in the same area which have a node address less than 256.

All communications between areas must be through Level 2 routing nodes. Each Level 2 routing node keeps track of the least cost path to each area in the network, as well as the state of the nodes within its own area (acting itself as a Level 1 router). Note that routing cost is an arbitrary network management parameter set by the network manager to control network traffic flow. A node that wishes to communicate outside of its area does so by accessing the nearest Level 2 routing node. The nearest Level 2 routing node is determined by the minimum cost algorithm.

Although two adjacent routing nodes can be connected by more than one physical link, messages will be sent over only one of the links. All other lines will serve as ''hot standbys'' such that the least cost path available between two nodes is the one that will be used for message traffic. A line cost parameter set by the system manager determines the line over which all messages will be sent from one node to an adjacent node.

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Network Management

The Network Management Utility on any Phase IV DECnet host node can execute commands remotely at the DECnet Router Server to perform three primary functions: display statistical and error information, control the operation of the server, and test network operation. All network management functions are performed from a node logically connected to the server, rather than from the server itself.

A remote operator can choose to display statistics related to the server node itself or the communications lines, including traffic and error data. The remote operator can also perform many network control functions such as starting and stopping lines, setting parameters, down-line loading the Router software into the server, and forcing an up-line dump of Router software to a maintenance node on the same Ethernet.

A remote operator can log network events (for the DECnet Router server node) to a terminal device or other event sink on a Phase IV DECnet host maintenance node supporting this capability. The Network Management utility can be used to enable and disable the event logging facility at the host.

Network Management can also be used to test components of the network. A remote operator can transmit and receive test messages over individual server lines between the server and remote nodes. The messages can then be compared for possible errors. Network Management allows a logical series of tests to be performed, thereby aiding in isolating network problems.

Communications

The DECnet Router Server uses Ethernet Communications Server line cards to connect network nodes. The Communications Server line cards connect to an intelligent controller in the unit that provides DMA access to server memory and implements line control and error recovery procedures. This module implements the Digital Data Communications Message Protocol (DDCMP), Version 4.0 to provide full- or half-duplex communications over point-to-point synchronous and asynchronous lines. The Communications Server line cards interface to supported DIGITAL synchronous line controllers via DIGITAL-supplied EIA RS-232-C/CCITT V.24 and V.35 cables. Note that the Communications Server does not support multi-point lines.

The DECnet Router Server has been designed and tested to be compatible with the Bell standard modems. Note that there is no guarantee that the line will function properly when multiplexing-type devices are connected to the line card.

The following is a list of supported devices to which the Router line cards interface:

- DUP11-AP/M low-speed synchronous interface
- DMC11-AR-DA remote synchronous CCITT V.24/EIA RS-232-C interface
- DMC11-AR-FA remote synchronous CCITT V.35/DDS interface
- DMP11-AP/M synchronous UNIBUS RS-232-C/ RS-423-A interface
- DMP11-BP/M synchronous UNIBUS CCITT V.35/DDS interface
- * DMR11-AP/M synchronous UNIBUS RS-232-C/ CCITT V.24 interface
- * DMR11-BP/M synchronous UNIBUS CCITT V.35/ DDS interface
- DMF32-AA/AB synchronous UNIBUS RS-232-C/ RS-423-A interface
- DMB32-M synchronous BI bus RS-232-C/RS-423-A interface
- DV11-AP/M multi-line NPR synchronous interface
- DMV11-AP/M synchronous Q-bus RS-232-C/ RS-423-A interface
- DMV11-BP/M synchronous Q-bus CCITT V.35/DDS interface
- DPV11-AP/M synchronous Q-bus interface
- DL11-AP/M asynchronous UNIBUS RS-232-C interface with modem control
- DZ11-DP/M multi-line asynchronous UNIBUS RS-232-C interface
- DLEV1-DP/M asynchronous Q-bus RS-232-C interface with modem control
- DZV11-DP/M multi-line asynchronous QBUS RS-232-C interface

* DMRs running in DMC compatibility mode are not supported

The Ethernet Communications Server interfaces to the Ethernet via an intelligent Ethernet controller packaged with the hardware unit.

DECnet Router Server Operation

The Ethernet Communications Server hardware provides the necessary maintenance operation protocols for loading DECnet Router software from an Ethernet load host, over the Ethernet, and into server memory. All software, including diagnostics, is down-line loaded into the unit. In the event of certain hardware or software malfunction, the unit will attempt to up-line dump the Router server software to any available load host on the Ethernet and automatically invoke reload.

A configuration file on one or more host load nodes defines parameters for the operation of the Router server. This information is defined at installation time and can be modified by the System/Network Manager for reconfiguring the server upon subsequent reloading.

Router Server Configuration and Performance

The process of configuring the DECnet Router node is based primarily on tradeoffs of cost and performance while satisfying the user's application requirements. It can be expected that network applications will range from low-speed, low-cost situations (for example, connecting few remote nodes over low speed communications lines) to those of relatively high performance (for example, connecting two Ethernets). Primarily, the performance of a given DECnet Router node is a function of the expected network traffic and resultant processing pursuant to the dedicated function of the unit. Thus Router performance depends on several factors:

- Communication line characteristics
- System throughput characteristics
- Server memory characteristics

All three factors must be considered when configuring a DECnet Router node.

Communication Line Characteristics

It is important to note that the rate at which user data can be transmitted (throughput) over a communications line may approach, but will never reach, the actual line speed. 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 table below describes the physical hardware configurations (number of communications lines) supported by the DECnet Router server.

Note that the maximum number of lines supported by the hardware unit is thirty-two, and that the aggregate line throughput cannot exceed 500 kilobits per second. You can mix the line card types within the same system as long as you adhere to the aggregate bandwidth restriction. Total system throughput (below) must also be considered when configuring the DECnet Router Server.

The Router software supports dynamic hardware configuration while the system is running, with the following restrictions:

- You cannot use line slots which do not have a line card in place when the system is loaded.
- If you want to run one line at 500 kilobits, you may only have one line card in the unit when the system is loaded.
- If you want to run two lines at 250 kilobits each or four lines at 125 kilobits each, you must have the line cards in consecutive order in slots 1-4 of the unit. None can be in slots 5-8.
- After the system is loaded, you may not swap incompatible line cards.

Maximum Line Speed (Kilobits/sec)					
Line Card Type	**9.6**	**19.2**	**56**	**250**	**500**
DCSAX-LA \(FDX/HDX)	16	16	N/A	N/A	N/A
DCSAX-LB (FDX/HDX)	N/A	N/A	8	2	1
DCSAX-LC (FDX/HDX)	16	16	N/A	N/A	N/A

In order to achieve a viable configuration, the user and/or a DIGITAL software specialist should perform a level of application analysis which addresses the factors above. In the preceding table, the following definition applies: Maximum line speed - the fastest clock rate at which the number of line cards specified can be driven under the DECnet Router Server. The actual maximum data throughput can not be calculated by multiplying the number of lines by the line speed, since many factors already discussed in this section will reduce the actual throughput.

System Throughput Characteristics

Having determined from above that the line card limitations are not exceeded, the processing power of the DECnet Router Server must be taken into consideration. The DECnet Router Server is able to route a maximum of 140 packets per second. Care must be taken when designing a viable configuration that the average route through packet per second rate does not exceed this value. Determining the average packet per second rate requires an understanding of the types of applications which will generate data routed by the DECnet Router Server in the overall network. Useful equations to assist you in computing the packet per second rate include the following.

Computing Packet Per Second Rate From Available Routers

DECnet Packets (messages to be routed) are 150 bytes long on average. The actual average packet size for your network may be different depending upon the types and amounts of different traffic. The average can be computed from an existing router by examining the various circuit counters for that router and using the following equations:

Total Packets = (Transit Packets Sent + Transit Packets Received + Originating Packets Sent + Terminating Packets Received)

Total Bytes = (Bytes Received + Bytes Sent)

Average Packet Size =((total packets) / (total bytes))

In the absence of existing routers, use 150 bytes per packet as the average packet size.

Once the average packet size has been selected, the average packet per second rate can be computed. The average can be computed from an existing router by examining the various circuit counters for that router and using the following equation:

Average Transit Packets = ((Transit Packets Sent + Transit Packets Received)/2)

Average Packets per Second =((Average Transit Packets)/ (Seconds since counters were last cleared))

Note that the ''Transit Packet'' counters should contain values much larger that the ''Originating Packets'' or the ''Terminating Packets'' counters. If not, then the circuit under investigation is not being used for route through traffic. Note also that the counters being used for these computations should have been accumulating statistics for as long as possible in order to make the results of the equation as accurate as possible.

Computing Packet Per Second Rate From Line Speeds

An alternate metric is the maximum possible packet delivery rate possible for any particular line. This value is computed as follows:

Characters per second = ((line speed)/(bits per character)) where asynchronous lines have ten bits per character and synchronous lines have eight bits per character, and where line speed is expressed in bits per second.

Max packets per second = ((characters per second)/(avg packet size))

Note that if the line is full duplex, the resulting Max packets per second must be doubled.

If the actual packet per second rate which will be delivered to the DECnet Router Server can be determined, then this value should be used to assure that the maximum of 140 packets per second is not exceeded.

If the actual packet per second rate cannot be determined ahead of time, then the computation of the maximum packet per second rate based upon the line speed should be used, and the total of the maximum packet per second rates for all the proposed lines should be kept below the 140 packet per second limit. By using this technique to configure the DECnet Router Server it is very possible that the resulting configuration is overly restrictive. After the DECnet Router Server has been run for some time and the actual packet per second rate has been determined, then it may be possible to add more lines based upon the actual packet per second rate measured as above.

In configurations where the DECnet Router Server is used to link large sections of your network, such as linking two large Ethernet segments with DECnet Router Servers, then it is expected that the actual packet per second rate will approach the maximum packet per second rate as computed based upon line speed. This is because the DECnet Router Servers are the focus of traffic for many nodes on both sides of the large network sections.

In configurations where the DECnet Router Server is used to couple a small network section, or a series of endnodes, to the Ethernet, then it is expected that the actual packet per second rate may not approach the maximum packet per second rate as computed based upon line speed. This is because individual nodes generally do not saturate the communications lines in both directions for extended periods of time.

Also, note that configuring the DECnet Router Server as the ''designated'' router will reduce the amount of processing power available to be used for routing packets. It is desirable in many configurations to configure the DECnet Router Server as the designated router in order to offload this function from a host system, however, it is important that this additional work be taken into account when designing the DECnet Router Server into a viable configuration. Typically, by configuring the DECnet Router Server as the ''designated'' router will reduce the maximum packet per second rate from 140 to 120 packets per second.

Router Server Memory Configuration

The DECnet Router Server has a fixed amount of memory to use for storing routing databases. The number of nodes within an area supported by the DECnet Router Server is determined by the number of other Routing nodes on the same Ethernet segment as the DECnet Routing Server, and by the number of lines configured into the DECnet Routing Server. Note that the other routing nodes on the Ethernet segment can be any Phase IV routing node. The relationship between these is described as follows:

Number of lines in the image is determined by which DECnet Router Server system image is to be used. If there are eight or less synchronous lines to be used, and no asynchronous lines, then the number of lines in the image is eight. Otherwise, if (number of asynchronous lines + (2*(number of synchronous lines))) is less than or equal to 16, then the number of lines in the image is 16. If neither of the two above cases apply, the number of lines in the image is 32.

Using the following relationship, the number of lines, the number of routers on the same Ethernet segment, and the maximum node address supported can be traded off against each other. Note that the number of Ethernet Routers is defined as the number of Level 1 routers which are on the same Ethernet segment and in the same area as the DECnet Router Server being configured. An Ethernet segment is defined as containing the DELNI or Coax Ethernet cable to which the DECnet Router Server is directly connected, and any DELNIs or Coax Ethernet cable segments directly connected or connected via a DEBET or a DEREP.

((Maximum Nodes)*(3.5+(Number of lines in the image)+ Ethernet routers)) must be less than or equal to 24500.

PREREQUISITE SUPPORT

A Network Profile and DECnet Customer Support Plan covering all intended network nodes and their support may be required.

HARDWARE REQUIREMENTS

VAX, MicroVAX, or VAXstation configuration as specified in the System Support Addendum (SSA 30.34.06-x).

DECSA hardware unit as specified in the System Support Addendum.

SOFTWARE REQUIREMENTS*

For each VAX system acting as a load host or dump receiver:

VMS Operating System or MicroVMS Operating System
DECnet-VAX (either end-node or full-function)

For each PDP-11 system acting as a load host or dump receiver:

RSX-11M operating system or RSX-11M-PLUS operating system
DECnet-11M or DECnet-11M-PLUS (either end-node or full-function)

* Refer to the System Support Addendum for availability and required versions of Prerequisite software (SSA 30.34.06-x).

OPTIONAL SOFTWARE

None

ORDERING INFORMATION

For VMS and MicroVMS Operating Systems:

Software License: QL-725A*-**
Software Media: QA-725AA-**
Software Documentation: QA-725AA-GZ
Software Product Services: QT-725A*-**

For RSX-11M and RSX-11M-PLUS Operating Systems:

Software License: QP725-UZ
Software Media: QP725-**
Software Documentation: QP725-GZ
Software Product Services: QP725-**

* Denotes variant fields. For additional information on available licenses, services, and media refer to the appropriate price book.

SOFTWARE WARRANTY

The DECnet Router is warranted for use only with supported Phase III and Phase IV DECnet products supplied by DIGITAL. Any system connected to one of the DECnet Router's synchronous links must run a current version of a DECnet Phase III/IV product using any supported synchronous interface.

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.

SOFTWARE LICENSING

You will need a separate license for each DECSA unit on which you will be using the software product (except as otherwise specified by DIGITAL).

The licensing provisions of DIGITAL's Standard Terms and Conditions provide, in part, that the software and any part thereof (but excluding those parts specific to the load hosts) may be used only on the single DECSA hardware unit on which the software is operated, but may be copied, in whole or in part (with the proper inclusion of DIGITAL's copyright notice and any proprietary notices on the software) between multiple load hosts on the same LAN.

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.

SOFTWARE PRODUCT SERVICES

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

The above information is valid at the time of release. Please contact your local DIGITAL office for the most up-to-date information.

System Support Addendum

PRODUCT NAME: DECnet Router Server, Version 1.2 **SSA 30.34.06-A**

HARDWARE REQUIREMENTS

Processor Support (Load Host System)

VAX: VAX 6210, VAX 6220, VAX 6230, VAX 6240, VAX 8200, VAX 8250, VAX 8300, VAX 8350, VAX 8500, VAX 8530, VAX 8550, VAX 8600, VAX 8650, VAX 8700, VAX 8800, VAX 8810, VAX 8820, VAX 8830, VAX 8840, VAX 8974, VAX 8978

VAX-11/725, VAX-11/730, VAX-11/750, VAX-11/780, VAX-11/782, VAX-11/785

MicroVAX: MicroVAX I, MicroVAX II, MicroVAX 2000, MicroVAX 3300, MicroVAX 3400, MicroVAX 3500/3600

VAXstation: VAXstation II, VAXstation 2000, VAXstation 3200/3500, VAXstation 8000

VAXserver: VAXserver 3500/3600/3602

Not supported: VAXstation I

Processor Restrictions

The VAX-11/782 processor is not supported by VMS Operating System V5.0 or later.

The DECnet Router needs at least one DECnet Phase IV node to act as a load host. That system needs to be a VAX-based system running the MicroVMS or VMS Operating System, or PDP-based system running the RSX-11M or RSX-11M-PLUS operating system.

Every load host on which the DECnet Router software is installed must contain:

- A valid system configuration for the relevant operating system and for the appropriate DECnet product (Refer to the DECnet and appropriate operating system SPDs).
- A supported connection on the same LAN as the DECnet Router
- An appropriate device available to read the software during installation:

  For VMS and MicroVMS Operating Systems: one magnetic tape, RX50, or TK50 drive

  For RSX-11M and RSX-11M-PLUS Operating Systems: one magnetic tape or RL02 drive

Block Space Requirements (Block Cluster Size = 1) for VMS and MicroVMS Operating Systems:

Disk space required for installation: 2200 blocks (1127K bytes)

Disk space required for use (permanent): 3224 blocks (1651K bytes)

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. The space indicated for permanent occupancy includes 1024 blocks that should be reserved to receive one upload dump.

The DECnet Router software runs on the following Ethernet Communications Server packaged hardware options:

DECSA-EA Ethernet Communications Server hardware, including one DCSAX-LA line card (single line EIA RS-232-C/CCITT V.24 synchronous to 19.2K bps, FDX/HDX).

DECSA-CA Ethernet Communications Server hardware, including eight DCSAX-LC line cards (dual line EIA RS-232-C/CCITT V.24 asynchronous to 19.2K bps, FDX/HDX).

DECSA-DA Ethernet Communications Service hardware, including sixteen DCSAX-LC line cards (dual line EIA RS-232-C/CCITT V.24 asynchronous to 19.2K bps, FDX/HDX).

One of the following cables must be used with the DCSAX-LA line card:

- BC17D - Null modem cable for local EIA RS-232-C/CCITT V.24 connections
- BC17C - EIA RS-232-C/CCITT V.24 extension cable for remote (modem) connections

  The following cable must be used with the DCSAX-LB line cards:

- BC17E-50 - CCITT V.35 extension cable for remote (modem) connections

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One of the following cables must be used with the DCSAX-LC line cards:

- BC22D - Null modem cable for local EIA RS-232-C/CCITT V.24 connections
- BC22E - EIA RS-232-C/CCITT V.24 extension cable for remote (modem) connections

The DECSA has a built-in LAN controller but needs a suitable connection to connect to the customer's LAN, together with any necessary extension cables.

OPTIONAL HARDWARE

Additional Ethernet Communications Server line cards, up to the maximum defined in the Configuration and Performance section of the SPD, can be added to the packaged hardware. Line card types:

DCSAX-LA Single line EIA RS-232-C/CCITT V.24 synchronous to 19.2K bps, FDX/HDX. Use BC17D (null modem) or BC17C (EIA extension) cables.

DCSAX-LB Single line CCITT V.35 synchronous to 500K bps, FDX/HDX. Use BC17E (full modem) cables. Use cables longer than 25 feet for Bell DDS modems.

DCSAX-LC Dual line EIA RS-232-C/CCITT V.24 asynchronous to 19.2K bps, FDX/HDX. Use BC22D (null modem) or BC22E (EIA extension) cables.

The DECSA-EA hardware unit can be upgraded with an additional Protocol Assist Module (PAM) set, DCSAX-UA, to provide support for the maximum hardware configuration.

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 System Support Addendum 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.

SOFTWARE REQUIREMENTS

For each VAX System acting as a load host or dump receiver:

VMS Operating System V4.4 - V5.0 or
MicroVMS Operating System V4.4 - V4.7

DECnet-VAX V4.4 - V5.0 (either end-node or full-function)

For each PDP-11 system acting as a load host or dump receiver:

RSX-11M operating system V4.3
or RSX-11M-PLUS operating system V4.0

DECnet-11M V4.3 (either end-node or full-function) or DECnet-11M-PLUS V4.0 (either end-node or full-function)

VMS Tailoring

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

- VMS Required Saveset
- Network Support

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

MicroVMS Tailoring

For MicroVMS V4.x systems, the following components of MicroVMS are required for full functionality of this product:

- Base System

OPTIONAL SOFTWARE

None

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.

DISTRIBUTION MEDIA

Disk: RL02 Disk Cartridge, RX33 Floppy Diskette

Tape: 9-track 1600 BPI Magtape (PE), TK50 Streaming Tape

ORDERING INFORMATION

For VMS and MicroVMS Operating Systems:

Software License: QL-725A*-**
Software Media: QA-725AA-**
Software Documentation: QA-725AA-GZ
Software Product Services: QT-725A*-**

For RSX-11M and RSX-11M-PLUS Operating Systems:

Software License: QP725-UZ
Software Media: QP725-**
Software Documentation: QP725-GZ
Software Product Services: QP725-**

* Denotes variant fields. For additional information on available licenses, services, and media refer to the appropriate price book.

The above information is valid at the time of release. Please contact your local DIGITAL office for the most up-to-date information.