Software
Product
Description

PRODUCT NAME: DECnet-11S, Version 4.3   SPD 10.74.14

DESCRIPTION

DECnet-11S allows a suitably configured RSX-11S system to participate as a routing or nonrouting (end) node in DECnet computer networks. DECnet-11S is a Phase IV network product and is warranted for use only with supported Phase III and Phase IV products supplied by DIGITAL.

DECnet Phase IV networks can contain up to 1023 nodes per network area given proper planning. Phase III nodes participating in Phase III/IV networks are limited to the Phase III routing capability of 255 nodes. Phase II nodes are not supported.

DECnet-11S offers task-to-task communications, utilities for network file operations, homogeneous network command terminal support, and network resource-sharing capabilities using the DIGITAL Network Architecture (DNA) protocols. DECnet-11S communicates with adjacent nodes over synchronous and asynchronous communication lines, Ethernet Local Area Networks (LANs), and parallel interfaces. Access to DECnet-11S is supported for RSX-11S tasks written in MACRO-11, FORTRAN IV, and FORTRAN-77, which have been assembled/compiled and subsequently linked on a host system.

The functions available to an RSX-11S user depend, in part, on the configuration of the rest of the network. Each DECnet product offers its own level of functionality and its own set of features to the user. Networks consisting entirely of DECnet-11S nodes can have the full functionality described in this SPD. Networks that mix DECnet-11S nodes with other DECnet products can limit the functions available to the DECnet-11S user because some DECnet-11S features are not supported by all DECnet products. Some supplied optional features require hardware configurations larger than the minimum supported systems.

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

Adaptive Routing

Adaptive routing is the mechanism by which one or more nodes in a network can route or forward messages between another pair of nodes in the same network. This routing capability will forward such messages even if no direct physical link exists between the pair of nodes apart from the sequence of physical links that includes the routing node(s).

A DECnet-11S node must function as a routing node whenever multiple lines are used simultaneously by that node. DECnet-11S end nodes provide all the capabilities of DECnet-11S 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 store or update routing databases. Consequently, end nodes use less system resource and generate less network traffic than routing nodes.

For this same reason, end node operation consumes less processing power than routing node operation. The Full Function DECnet-11S software must be installed 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-11S software must be installed on that node. Full Function DECnet-11S software allows a node to be set up as either a routing node or as an end node.

Although two adjacent routing nodes can be connected by more than a single 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 node to adjacent node.

In addition to adaptive routing, which all DECnet Phase IV implementations use, DECnet-11S supports Area Routing. Area Routing is a method by which DECnet can send and route messages between the nodes in the same or different areas of the network. If the network manager chooses to separate the network into areas, up to 63 (Area 1 through Area 63), with up to 1023 nodes per area, may be defined. For single area networks, Area 1 is the default. Area-based DECnet networks are hierarchical networks and some restrictions apply to communications from nodes in one area to nodes in another. For example, Phase III nodes in area-based networks can communicate only with nodes within their own areas. Proper network planning is essential when using Area Routing or configuring large networks.

Task-To-Task Communication

Using DECnet-11S, an RSX-11S user program written in MACRO-11 or one of the supported high level languages can exchange messages with other network user programs. These two user programs can be on the same node, or on any other Phase III or Phase IV node in the network. The messages sent and received by the two user programs can be in any data format.

Network Resource Access

File Access

File access is supported to and from remote DECnet systems by explicit subroutine calls in the supported high level languages. READ, WRITE, OPEN, CLOSE, and DELETE operations can be initiated by local tasks for sequential files residing at remote DECnet systems. Fixed and variable length record formats containing either ASCII or binary data are supported.

Network Command Terminal

DECnet-11S supports DIGITAL's Terminal Services Architecture Command Terminal protocol (CTERM), giving the terminal user the ability to establish a virtual connection to remote Phase IV DECnet systems which provide similar support. This is particularly useful for doing remote program development, and allows terminal users on small application-oriented systems to utilize the resources of larger development-oriented systems.

Note that some functions using CTERM between VMS and non-VMS systems are not supported. Specifically, VMS-style command line editing, VMS TDMS applications and VMS FMS applications are not supported under DECnet-RSX products.

DECnet-11S also provides an unsupported utility (RMT) that allows a terminal user to establish a virtual connection to other Phase III or Phase IV DECnet-RSX nodes. This utility may not be included in future releases of DECnet-11S.

Down-line System Loading

Initial memory images for RSX-11S nodes in the network can be stored on RSX-11M, RSX-11M-PLUS, Micro/RSX, or VAX/VMS file system devices and loaded into nodes across point-

to-point, multi-point (DMP/DMV only), and Ethernet links. Generation of initial memory images of DECnet-11S systems for down-line loading is supported by VAX/VMS, RSX-11M, or RSX-11M-PLUS. Down-line system loading requires the use of an appropriate bootstrap loader (Refer to the Optional Hardware section) in conjunction with certain devices. Down-line system loading across multi-point links requires multi-point communication hardware (DMP/DMV). Memory images including those greater than 124K words are supported.

Up-line Dumping

Memory images can be up-line dumped to DECnet hosts (DECnet-11M, DECnet-11M-PLUS, DECnet-Micro/RSX, and DECnet-VAX). A crash dump analyzer program can be used to aid in problem resolution.

Down-line Task Loading

Programs to be executed on DECnet-11S nodes in the network can be stored on host RSX-11M, RSX-11M-PLUS, Micro/RSX, or VAX/VMS file system devices and loaded on request into memory partitions of DECnet-11S systems. In addition, programs already executing on DECnet-11S nodes can be checkpointed to the host file system and later restored to main memory of the DECnet-11S node. These features simplify the operation of network systems that do not have mass storage devices.

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. An operator can display the status of DECnet activity at the local node. The user can choose to display statistics related to both node and communication lines, including data on traffic and errors. DECnet-11S also provides local network event logging to the console and/or to a remote node.

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

Communications

DECnet-11S supports the DIGITAL Data Communications Message Protocol (DDCMP) for full- or half-duplex transmission in point-to-point and multi-point operation using serial synchronous or asynchronous facilities. DDCMP provides error detection/correction and physical link management facilities. In addition, an auto-answer capability is provided if supported by the modem in use.

Multi-point and auto-answer function with EIA-type devices only. Parallel communication devices use special link protocols (not DDCMP) optimized for their characteristics.

The Ethernet bus interfaces, when used in conjunction with DIGITAL's Ethernet transceivers, or DELNI, allow DECnet-11S to utilize Ethernet as a data link transmission medium.

The maximum number of physical links that can be supported by a DECnet-11S node is sixteen, depending on CPU, type of communications interface, and speed of interfaces.

DECnet-11S multi-point will support up to a maximum of twelve tributaries on a single multi-point line. Aggregate bandwidth of tributaries is limited to that of the control station device. The communication path to each tributary counts as a link with respect to the limits on number of links specified above. Multi-point line configurations will be supported for the following devices:

Multi-point Devices

Devices	Multi-point Control Station (Master)	Multi-point Tributary (Slave)
DL11/DLVE1	YES	YES
DUP11	YES	YES
DUV11	YES	YES
DPV11	YES	YES
DZ11/DZV11/DZQ11	YES	NO
DHU11/DHV11/DHQ11	YES	NO
KMC11 (DZ11)	YES	NO
KMC11 (DUP11)	YES	YES
DV11	YES	YES
DMP11*	YES	YES
DMV11*	YES	YES

*   Multi-point communication hardware device

Direct Line Access

User-written MACRO-11 tasks will be provided with Direct Line Access (DLX) support to all supported devices (including Ethernet Controller). DLX will allow direct control of the communications lines, bypassing the logical link control and transport mechanism provided by the DECnet software. User programs are required on both ends of the link in order to use this interface. Direct Line Access supports both Ethernet and IEEE 802.3 frame formats in a LAN environment.

DECnet-11S Configuration

The process of configuring a DECnet-11S node is based primarily on trade-offs of cost, performance, and functionality, within the realm of satisfying the user's application requirements. It can be readily expected that network applications will run the full gamut from low-speed, low-cost situations to those of relatively high performance and functionality. The performance of a given DECnet node is a function not only of the expected network traffic and resultant processing ("global" conditions), but also of the amount of concurrent processing specific to that node (local conditions). Thus, node performance depends on many factors, including:

* CPU type and Memory Size

* Number of device interrupts per unit time

* Communication line characteristics

* Number and size of buffers

- Message size and frequency of transmission

- Local applications

- Size and frequency of route-through traffic

Note that the rate at which user data can be transmitted (throughput) over a communications line may sometimes approach, but will never equal or exceed, the actual line speed. The reason is that the actual throughput is a function of many factors, such as the network application(s), topology, protocol overhead and line quality, as well as the factors cited above.

Note: Careful analysis is required when configuring routing nodes with 124K words or less.

Six basic groups of communications interfaces are presented in the tables below. They differ in many respects, particularly in their effect upon CPU utilization.

- With character interrupt devices such as the DUP11, CPU cycles are required for not only the line protocol processing (DDCMP), but also for each character sent and received.

- Devices such as the DV11 are direct memory access (DMA) for both transmission and reception. Since the line protocol (DDCMP) is in the PDP-11 software, CPU cycles are required for its processing.

- Devices such as the DHQ11 are direct memory access (DMA) on transmit, and character interrupt on receive. While CPU cycles are consumed for line protocol processing, and for each character received, the load is reduced for messages transmitted.

- The DMR11 and DMV11 are DMA devices with the line protocol (DDCMP) executed in microcode, thus off-loading the PDP-11 CPU. The only DECnet load the processor sees is completed incoming and outgoing messages.

- The PCL11-B is a high speed DMA device which uses local parallel communications lines. It has its own line protocol and does not use DDCMP. CPU cycles are only required for processing of incoming and outgoing data messages and to perform control functions.

- The DELUA and DEUNA, UNIBUS-to-Ethernet, and DELQA and DEQNA, Q-BUS-to-Ethernet controllers are high speed DMA controllers supporting CSMA/CD protocol. CPU cycles are only required for processing of incoming and outgoing messages.

The following tables describe the physical hardware configurations supported by DECnet-11S in terms of CPU type and communication interface. The numbers given in the tables are "load costs". Maximum line speeds (the fastest clock rate at which the device can be driven under DECnet-11S relative to the load cost), expressed in kilobits per second, are shown in parentheses.

Device loading provides a method by which one can compute a maximum system configuration for a variety of communications devices. The load cost indicates the maximum load that a device can put on a particular type of CPU. The load cost limit for each CPU type is 16.

For communications devices which support half/full duplex, the load costs in the tables are for full duplex configurations. The load cost for a half duplex configuration can be calculated as one half of the load cost in the table except at very low speeds, in which case the load cost is the same as in the full duplex case.

DECnet-11S UNIBUS Device Load Table

Processor Type

Device Type	11/24	11/44	11/70	11/84
DELUA (10meg) DEUNA (10meg)	16 16	16 16	16 16	16 16
PCL (4meg)	16	16	16	16
DMP (to 19.2K) DMP (56K) DMP (1meg)	2 3 16	1 3 16	1 3 16	1 1 16
DMR (to 19.2K) DMR (56K) DMR (1meg)	2 3 16	1 3 16	1 3 16	1 1 16
DV (to 9.6K)	4	3	3	3
DHU (to 9.6K)	2	2	2	2
DL (to 9.6K) DU (to 9.6K) DUP (to 9.6K)* DZ (to 9.6K)	2 2 2 2	2 2 2 2	2 2 2 2	2 2 2 2

*   Maximum 4.8K bps for 11/24 processor

Note: For processor types not shown, use the load costs associated with the PDP-11/24 to
compute device loading

DECnet-11S Q-BUS Device Load Table

Processor Type

Device Type	11/23	11/23-PLUS	11/53	11/73	11/83
DEQNA (10meg)	16	16	16	16	16
DELQA (10meg)	16	16	16	16	16
DMV (to 19.2K)	2	2	1	1	1
DMV (56K)	3	3	3	3	3
DHV (to 9.6K)	2	2	2	2	2
DHQ (to 9.6K)	2	2	2	2	2
DLV (to 4.8K)	2	2	2	2	2
DPV (to 4.8K)	2	2	2	2	2
DUV (to 4.8K)	2	2	2	2	2
DZV (to 9.6K)	2	2	2	2	2

Maximum Line Configurations Guidelines
(Multi-point)

Maximum Line Speed
(Kilobits per Second, half- or full-duplex)

Device Group	19.2	56	250	500	1000
DMV11 (All Options)	2/8	2/8			
DMP11 (RS232-C, V.35)	+4/8	2/8	1/12	1/12	1/12*
(local)		2/8	1/12	1/12	1/12*
(RS422/449)	+4/8	2/8			

* Half-duplex
+ 11/24 is limited to 2 controllers

Note: Left side of slash (/) indicates number of controllers per node and right side indicates total number of tributaries per control node.

Total number of circuits not to exceed 16 per node.

Number of tributaries on lines should be carefully configured for performance considerations.

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.

MINIMUM HARDWARE REQUIRED

Any valid RSX-11S system configuration and any valid RSX-11M, RSX-11M-PLUS, or VAX/VMS system for RSX-11S and DECnet-11S generation with:

● The following additional memory must be available:

   DECnet-11S end node - 20KW
   DECnet-11S routing node - 22KW

Ethernet support will add 6KW to the above memory requirements.

- The following additional disk space must be available for DECnet-11S network software:

DECnet-11S end node - 4200 blocks (2,150,400 bytes)
DECnet-11S routing node - 4700 blocks (2,406,400 bytes)

- PDP-11/24, PDP-11/34, PDP-11/40, PDP-11/44, PDP-11/45, PDP-11/55, PDP-11/60, PDP-11/70, or PDP-11/84, central processor with one of the following communications devices:

DUP11	low-speed synchronous interface[4]
DMP11	synchronous UNIBUS interface (RS232-C/RS423A, CCITT V.35/DDS, or RS449/RS422)[3,4]
DMP11	local synchronous UNIBUS interface[3,4]
DMP11	synchronous UNIBUS interface (RS232-C/RS423A, CCITT V.35/DDS, or RS449/RS422)[4]
DMR11	local synchronous UNIBUS interface[4]
DL11	asynchronous EIA interface with modem control[4]
DL11	asynchronous 20mA current loop interface[1,4]
DZ11	multi-line asynchronous EIA interface[2,4]
DZ11	multi-line asynchronous 20mA current loop interface.[1,2,4]
DHU11	multi-line asynchronous interface[2,4]
DV11	multi-line NPR synchronous interface[2,4]
PCL11-B	multiple CPU link
DEUNA	UNIBUS-to-Ethernet controller
DELUA	UNIBUS-to-Ethernet controller

- PDP-11/23, 11/23-PLUS or MicroPDP-11 (11/23, 11/53, 11/73 and 11/83) central processors with one of the following communications devices. Note that the KDJ11-A 11/73 option is only supported as per the RSX-11S Operating System (SPD 09.21.xx).

DMV11	synchronous Q-BUS interface (RS232-C/RS423A or CCITT V.35?DDS)[4,5]
DMV11	local synchronous Q-BUS interface[4,5]
DUV11	low-speed EIA synchronous interface[4]
DLVE1	asynchronous EIA interface with full modem control for a single line[4]
DZV11	multi-line asynchronous Q-BUS EIA interface[2,4]
DZQ11	multi-line asynchronous Q-BUS EIA interface[2,4]
DHQ11	multi-line asynchronous Q-BUS interface
DHV11	multi-line asynchronous Q-BUS interface[2,3,4]
DPV11	synchronous Q-BUS interface[4]
DELQA	Q-BUS-to-Ethernet controller
DEQNA	Q-BUS-to-Ethernet controller

OPTIONAL HARDWARE

- Additional lines and/or communication interfaces (from above) up to maximum as defined in Device Load tables for mapped systems.
- KG11-A Communications Arithmetic Element[3] (may be used in conjunction with DV11, DZ11, and DL11)
- KMC11-A (can be used in conjunction with up to eight DUP11s or with one sixteen line DZ11)
- Appropriate hardware for down-line load
  - — M9301-YE: w/bootstrap for DECnet on DL11-E and DUP11
  - — M9301-YJ: w/bootstrap for DECnet on DMR11
  - — MR11-EA: M9312 and all current bootstrap ROMs
  - — M9312: bootstrap terminator with empty ROM sockets and MR11K-Ax ROM set for use on M9312 option where x denotes DUP11 or DEUNA
  - — BDV11: w/bootstrap for DECnet on DLVE1 and DUV11

Notes:

[1]   Requires either the H319 option for optical isolation or one side of the 20mA line to be in passive mode.

[2]   All lines on this interface must be dedicated as DECnet links.

[3]   These products are no longer marketed by DIGITAL and may not be supported in future releases of DECnet-11S.

[4]   With appropriate FCC-compliant cabinet option.

[5]   Not supported on the PDP-11/23.

Bootstrap Support for Downline System Loading

	Remote Load Detect	Power-On Boot	Console Boot
DMP11	1	1	N/A
DMV11	1	1	N/A
DELUA	1	1	2
DEUNA	1	1	2
DMR11	3	3	3
DL11-E	N/A	3	3
DUP11	N/A	3	3
DLV11-E/F	N/A	4	4
DUV11	N/A	4	4
DELQA	N/A		
DEQNA	N/A	5	5

1   Device configuration (switch settings) required.

2   M9312 with appropriate ROMs required.

3   M9301 or M9312 with appropriate ROMs required.

4   BDV11 required on PDP-11/23; appropriate hardware included in KDF11-B based systems.

5   Not available for 11/23; appropriate ROMs required for KDF11-B.

N/A Not available.

PREREQUISITE SOFTWARE

RSX-11S Operating System, at least at Version 4.2

OPTIONAL SOFTWARE

FORTRAN-77/RSX

FORTRAN IV

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.

INSTALLATION

This software product can be installed by the customer using the step-by-step documentation available for this product. Optionally, you can purchase DIGITAL Installation Services which provide for the 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.

Before DIGITAL can install the software, the customer must:

• Ensure that system meets the minimum hardware and software requirements (as specified in the SPD).

- Obtain, install, and demonstrate as operational any modems and other equipment and facilities necessary to interface DIGITAL's communication equipment.

- For multi-node networks, designate one adjacent node to verify installation/connectivity.

- Make available for a reasonable period of time, as mutually agreed upon by DIGITAL and the customer, all hardware communications facilities and terminals that are to be used during installation.

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

ORDERING INFORMATION

Single-Use licensed software is furnished under the licensing provisions of DIGITAL's Standard Terms and Conditions of Sale, which provide, in part, that the software and any part thereof may be used on only the single CPU on which the software is first installed, and may be copied, in whole or in part (with the proper inclusion of DIGITAL's copyright notice and any proprietary notices on the software) for use on that same CPU.

You will need a separate license 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 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.** If you are already familiar with these options, you may obtain the ordering information directly from the Software Options Chart.

LICENSE OPTIONS

Single-Use License Option

The Single-Use License is your right to use the software product on a single CPU.

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

- Single-Use License Option, and
- Distribution and Documentation Option

The license gives you the right to use the software on a single CPU and the Distribution and Documentation Option provides the machine-readable software and related documentation.

To use this software product on additional CPUs, you must purchase for each CPU as a minimum:

- Single-Use License Option

In addition to the right to use, the license gives you the one-time right to copy the software from your original CPU installation to the additional CPU. Therefore, the Distribution and Documentation Option is not required, but optional.

Distribution and Documentation Option

The Distribution and Documentation Option provides the machine-readable software and the basic documentation. You must have, or order, a Single-Use License to obtain this option. You will need this option to install the software for the first time. When revised versions of this software product become available, they may also be obtained by purchasing this option again.

Software Revision Right-To-Copy Option

The Right-To-Copy Option allows a customer with multiple CPUs to copy a revised version of a software product from one CPU to another. Each CPU must be licensed for that product. You first install the revised software on one CPU; then you can make copies for additional CPUs by purchasing the Right-To-Copy Option for each additional CPU.

Documentation-Only Option

The Documentation-Only Option provides one copy of the basic documentation.

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 OPTIONS CHART

The distribution Media Codes used in the Software Options Chart are described below. You specify the desired Media Code at the end of the Order Number, e.g., QJ762-HD = binaries on 9-track 800 BPI Magtape (NRZI).

5 = TK50 Cartridge   M = 9-track 1600 BPI Magtape (PE)
D = 9-Track 800 BPI Magtape (NRZI)   Z = No hardware dependency
H = RL02 Disk Cartridge

Note: The availability of these software product options and services may vary by
        country. Contact your local DIGITAL office for information on availability.

	ORDER NUMBER FULL FUNCTION	ORDER NUMBER END NODE
LICENSE OPTION: A LICENSE IS REQUIRED FOR EACH CPU.		
Single-Use License	QJ762-UZ	QJ763-UZ
MATERIALS AND SERVICE OPTIONS:		
Distribution and Documentation Option	QJ762-HD QJ762-HH QJ762-HM QJ762-H5	QJ763-HD QJ763-HH QJ763-HM QJ763-H5
Software Revision Right-to-Copy Option	QJ762-HZ	QJ763-HZ
Documentation-Only Option	QJ764-GZ	QJ763-GZ
Documentation Update Service	QJ762-KZ	QJ763-KZ

	ORDER NUMBER FULL FUNCTION	ORDER NUMBER END NODE
Installation Service Option	QJ762-ID QJ762-IH QJ762-IM QJ762-I5	QJ763-ID QJ763-IH QJ763-IM QJ763-I5
DECsupport Service	QJ762-9D QJ762-9H QJ762-9M QJ762-95	QJ763-9D QJ763-9H QJ763-9M QJ763-95
Basic Service	QJ762-8D QJ762-8H QJ762-8M QJ762-85	QJ763-8D QJ763-8H QJ763-8M QJ763-85
Self-Maintenance Service	QJ762-3D QJ762-3H QJ762-3M QJ762-35	QJ763-3D QJ763-3H QJ763-3M QJ763-35