Networks • Communications

Ethernet Communications Server DECnet Router

Software Installation Guide

digital software

Ethernet Communications Server DECnet Router

Software Installation Guide

Order No. AA-X019B-TK

September 1984

The *DECnet Router Software Installation Guide* explains how to install and configure the software on a host system, and how to load the software into an Ethernet Communications Server hardware unit. This manual also explains how to design and configure local area and multiple area networks.

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Preface

This manual explains how to install, configure, and load the DECnet Router Server V1.1 software. More specifically, it explains how to:

- Install the distribution kit on a host system.
- Create and modify configuration files for the server software on a host system.
- Design and configure local area and multiple area networks.
- Load the software from the host into a Communications Server hardware unit.
- Check that the software is loaded correctly.

Intended Audience

This manual contains information intended for system or network managers responsible for making server products available on their Ethernets. **System managers** are persons responsible for setting up the host nodes that will load the DECnet Router Server software. The **network manager** is the person responsible for the local area network (LAN) as a whole. Where the DECnet Router Server is to serve as an area router, the network manager is also responsible for the multiple area network.

Structure of this Manual

This manual has six chapters and three appendixes:

Chapter 1 Introduces the DECnet Router Server and describes its various functions, capabilities, and possible hardware and software configurations.

Chapter 2 Explains how to install the DECnet Router Server software on a DECnet host node.

Chapter 3 Provides guidelines for setting up networks, including Ethernet LANs and multiple area networks. It includes guidelines for ensuring that area routing works smoothly.

Chapter 4 Explains how to configure the DECnet Router Server software. It describes the network and routing parameters associated with the DECnet Router Server and how you can modify them to suit your needs. It includes discussion of the area routing parameters you can define to set up the DECnet Router Server as an area router.

Chapter 5 Explains how to load the software from the host into the Communications Server hardware unit. It also explains how to check that the software is operating properly.

Chapter 6 Explains how to troubleshoot certain problems that can occur when attempting to load the server. The troubleshooting procedures can be used by non-technical personnel to isolate faults.

Appendix A Contains a sample line configuration worksheet.

Appendix B Contains sample configuration files and sample installation and loading procedures as performed from a VMS system and from an RSX system.

Appendix C Contains a summary of the network management (Network Control Program – NCP) commands used for loading and maintaining the DECnet Router Server.

How to Use this Manual

Before installing the DECnet Router Server software, first read Chapters 1, 2, 3, and 4, making sure the entire sequence of steps is understood. Before loading the software, you may want to change routing parameters to suit the needs of the network. Chapter 4 describes how to do this.

Use Chapter 3 to help you set up a multiple area network properly.

Other DECnet Router Server Document

- *DECnet Router Software Management Guide*

  This manual explains how to use network management commands to control and monitor the DECnet Router Server. It also describes the tools and facilities available for testing the server and for analyzing and troubleshooting problems.

Associated Documents

You should be familiar with the manuals for each host system used to install or manage the DECnet Router Server software. For manual titles and order numbers, refer to the documentation directory for the operating system.

The Ethernet Communications Server (DECSA) is documented in the following manuals:

- *Ethernet Communications Server Site Preparation and Planning Guide*
- *Ethernet Communications Server Installation Guide*
- *Ethernet Communications Server Operations and Maintenance Guide*

You may need to refer to the following manual which describes the Ethernet H4000 component:

- *H4000 Installation Sheet* (be sure to see the manual that applies to your unit, which can be 115V or 240V)

Conventions Used in this Manual

Conventions	Meaning
`Dot Matrix Type`	Examples of system input and output are printed in dot matrix type.
`Red Print`	User input in examples is printed in red. Black print is used for system prompts and displays.
UPPERCASE	Uppercase letters indicate that the characters must be entered exactly as shown. Command keywords can be abbreviated to the first unique characters.
lowercase italic	Variables in command lines are printed in lowercase italic type. The value is specified by the user.
brackets []	Brackets indicate that the enclosed data is optional. All text not enclosed by brackets is required. Do not type the brackets when you enter a command.
braces {}	Braces indicate that you must choose one (and only one) of the enclosed options. Do not type the braces when you enter a command.
. . . . . .	The use of ellipses means not all the information that the system would display in response to a particular command or for a message is shown, or that not all the information a user would enter is shown.
RET	A symbol with a 1- to 3-character abbreviation indicates that you press a key on the terminal. For example, RET refers to the RETURN (carriage return) key.
CTRL/X	The expression CTRL/X refers to a control character keying sequence. The key labeled CTRL and the appropriate character key should be pressed simultaneously.

1
Introducing the DECnet Router Server and Ethernet

This chapter introduces the DECnet Router Server and explains concepts you need to understand to install the product.

1.1 What Is the DECnet Router Server?

The DECnet Router Server is one of a set of Digital software and hardware products, called **communications servers**, that extend the resource sharing and communications capabilities of the Ethernet LAN. The DECnet Router Server runs in Digital's Ethernet Communications Server hardware unit, which connects directly to the Ethernet. The DECnet Router Server allows communications between nodes on the Ethernet LAN and nodes located off the LAN. It performs DECnet adaptive routing functions for the nodes on the Ethernet.

The DECnet Router Server connects to nodes located off the Ethernet LAN by using synchronous and asynchronous point-to-point lines. It can support up to 16 synchronous lines, or 32 asynchronous lines, or various combinations of the two types of lines. The DECnet Router Server can support routing to 1022 other nodes, routing and/or end nodes. It can support routing to 32 routing nodes on a single Ethernet. The maximum number of nodes addressable by the DECnet Router Server depends on the number of lines that you configure. See Section 1.2.1.

In a multiple area DECnet network, the DECnet Router Server supports routing to 62 other areas, each containing up to 1023 nodes. An **area** is a group of nodes forming a subnetwork. A **multiple area network** is a large network partitioned into areas. The areas are linked by area routers such as the DECnet Router Server. Section 1.5 further discusses area routing and multiple area networks.

The adjacent nodes located off the Ethernet (and with which the server can communicate) may be any of the following:

- DECnet Router Servers or Phase IV DECnet routing nodes on other LANs.

  The DECnet Router Server permits the systems on the Ethernet LAN to access nodes on other Ethernet LANs located in the same vicinity or at a distance (connected by modem). In multiple area networks, the remote routing nodes can be level 1 or level 2 routers. A **level 1 router** routes data within a single area only. A **level 2 router**, such as the DECnet Router Server, can route between areas. In single area networks, all routers are level 1 routers.

- Remote Phase III or Phase IV DECnet routing nodes in a wide area network.

  The DECnet Router Server permits the systems on the Ethernet LAN to access nodes on wide area networks. Again, the remote Phase IV DECnet routing nodes can be level 1 or level 2 routers. If the remote node is in a different area than the DECnet Router Server node, the remote node must be a level 2 router.

- Remote Phase III or Phase IV nonrouting nodes (end nodes), such as DECnet–RT or DECnet/E.

  The DECnet Router Server permits the systems on the Ethernet LAN to access end nodes remote from the LAN (connected by modem).

- Local Phase III nodes

  The DECnet Router Server permits the systems on the Ethernet LAN to access end nodes located in the vicinity of the LAN.

Figure 1–1 shows a DECnet Router Server, RTRDEV, with three point-to-point lines connected to other DECnet Phase IV and Phase III routing nodes and end nodes. The Phase IV DECnet node CENTER is another level 2 router (an "L2" in figures always indicates a level 2 router). RTRDEV and CENTER form a link between areas 2 and 3. Within area 3, RTRDEV routes messages between the host nodes on the Ethernet and nodes ABLE and CANE. To route messages to nodes in area 2, RTRDEV sends them to CENTER. Each node on the local Ethernet can access any nodes on the remote networks.

To enable message routing to nodes located off the Ethernet LAN, end nodes connected directly to the Ethernet must use a DECnet Router Server or another Phase IV routing node connected to the same Ethernet.

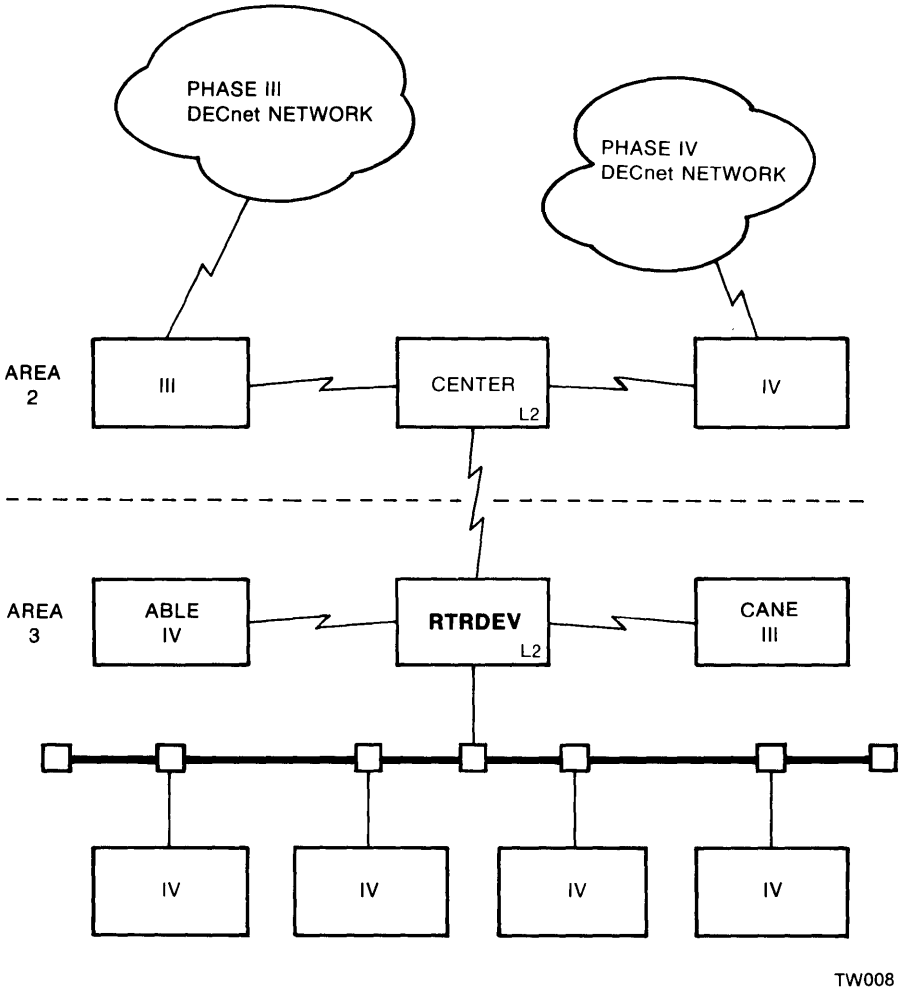

Figure 1–1: A DECnet Router Server with Three Point-to-point Lines

The DECnet Router Server provides Phase IV adaptive routing capabilities. It keeps a **routing database** that contains regularly updated information about the status of all destination nodes in the network and about the status of the communications paths between these nodes and itself. When the DECnet Router Server receives data from a source node, it checks its routing database and forwards the data to the destination node along the least costly path. (The system or network manager sets a cost value for

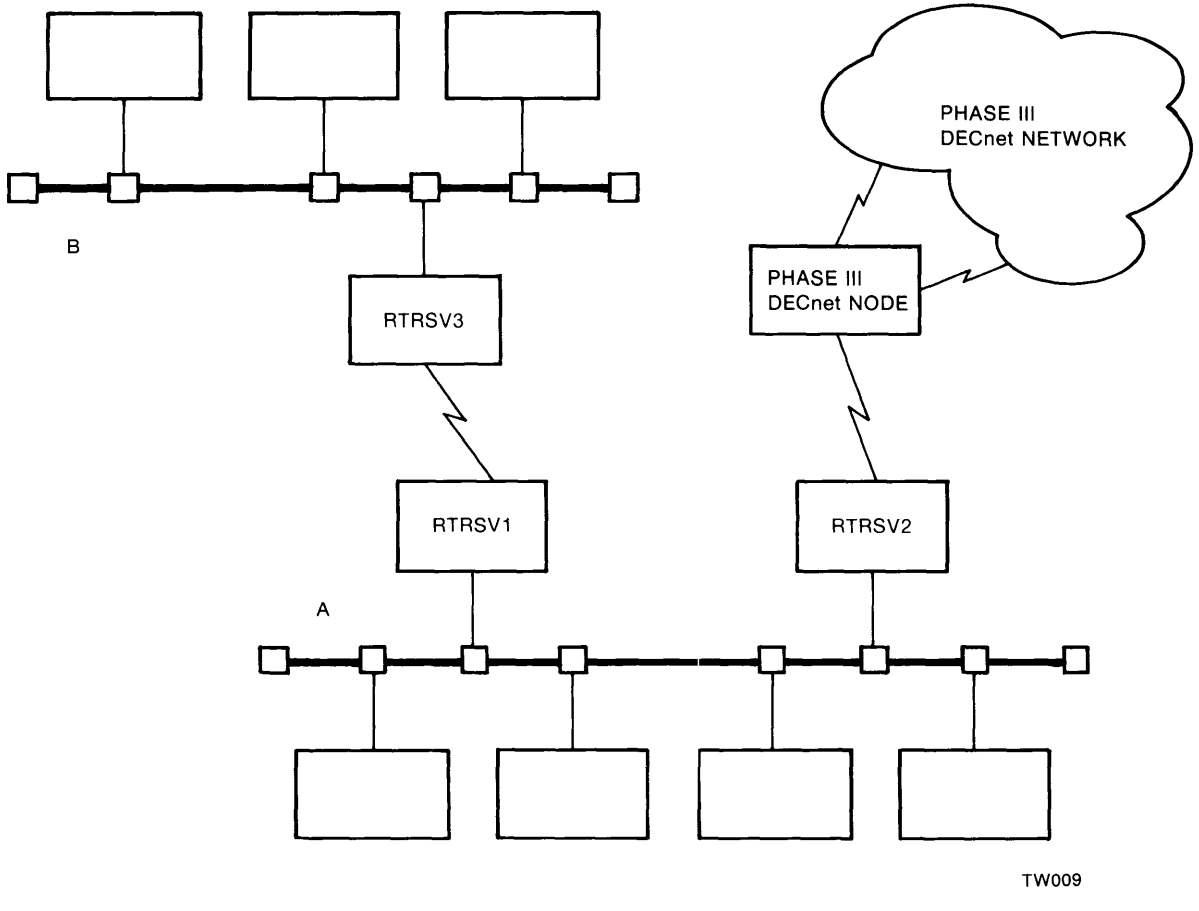

Figure 1–2: Two DECnet Router Servers Used in Conjunction on One Ethernet

each link. The cost of a path between a source and destination node is the total of the costs of the links along the path.) The DECnet Router Server uses the updated information in its routing database to adapt routing paths to changing network conditions. For example, when a node along a path becomes unavailable, the DECnet Router Server will route messages along another path.

Phase IV routing capabilities include all those of Phase III routing (including compatibility with Phase III), plus additional support for RSX and VMS nodes and for other communications server products on the Ethernet, and support for area routing, as described in Section 1.5. Phase IV routing capabilities also allow network management functions to be performed over the Ethernet, as explained in Section 1.3.

In summary, the major benefits of the DECnet Router Server are:

- The DECnet Router Server allows you to configure a large number of nodes on an Ethernet as end nodes. The DECnet Router Server provides the routing functions for these nodes. Thus, these Ethernet nodes can then share communication lines to nodes on and off the Ethernet without burdening intervening host nodes with routing responsibilities. Furthermore, these nodes are not burdened with the logical link connection processing required for remote communications. This also frees up the processing load of the host nodes on the Ethernet.
- Because the connection of the Ethernet nodes to nodes off the Ethernet LAN is through the DECnet Router Server, a unit that is dedicated solely to routing, you can realize greater network access and reliability. When connections must be made through a timesharing system, which is subject to conflicting demands and variable up time, network reliability is not optimal.
- You can increase the size of the network easily because adding new lines does not increase the routing load on other nodes.
- The DECnet Router Server supports area routing. Area routing allows you to configure a very large network and increases the efficiency of a large network.

Thus, the DECnet Router Server is valuable if you have an Ethernet requiring numerous connections to end nodes and routing nodes located off the Ethernet. The routing nodes can be on another Ethernet, in a wide area network, or another area of a multiple area network. If there is heavy network traffic between the Ethernet nodes and remote nodes, you might consider configuring two or more DECnet Router Servers to split the load. For example, if you have 335 nodes on an Ethernet requiring extensive communications with nodes on another Ethernet or on a wide area network, more than one DECnet Router Server may be required to handle the load efficiently, as shown in Figure 1–2, where DECnet Router Servers RTRSV1 and RTRSV2 share routing for Ethernet A.

1.2 The Communications Server Hardware Configuration

Digital provides a general purpose, table top unit that supports the DECnet Router Server software and other Digital server products. This unit, called the Ethernet Communications Server hardware unit, contains a power and cooling system and can be used in any typical office or computer room. The Communications Server is customer-installed and easy to maintain. (See the *Ethernet Communications Server Installation Guide* and the *Ethernet Communications Server Operations and Maintenance Guide.*)

Figure 1–3 shows the Communications Server hardware unit.

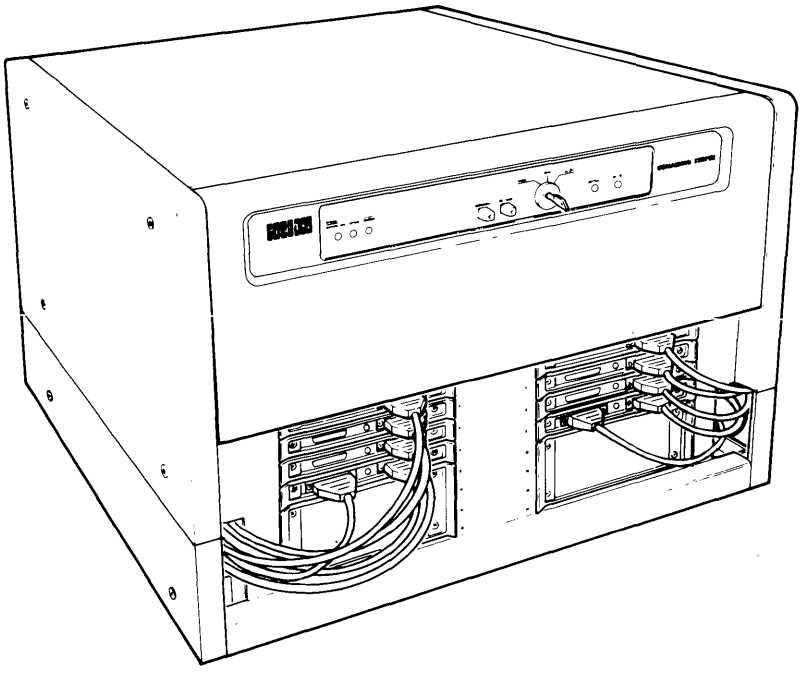

Figure 1–3: An Ethernet Communications Server Hardware Unit

The hardware unit contains an intelligent Ethernet controller, called the Ethernet to Unibus Network Adapter (DEUNA). The DEUNA provides the interface between the Ethernet Communications Server system and the Ethernet. The hardware unit contains **line cards** that provide the interface between the DECnet Router Server and the nodes that are connected by the point-to-point synchronous and asynchronous lines. The line cards connect to an intelligent controller within the hardware unit, called a Protocol Assist Module (PAM), that provides access to server memory and that implements line control and error recovery procedures. The PAM implements the Digital Data Communications Message Protocol (DDCMP) for communications over the point-to-point lines on the DECnet Router Server. The Ethernet Communications Server can have up to two PAMs. Each PAM can support up to 8 line cards.

1.2.1 Line Configurations

The types of line cards supported by the DECnet Router Server product are:

DCSAX–LA (M3100) A one-line synchronous line card that supports full or half duplex transmission at speeds up to 19,200 bits per second over EIA RS–232C/CCITT V.24 lines.

DCSAX–LB (M3101) A one-line synchronous line card that supports full or half duplex transmission at speeds up to 500,000 bits per second over CCITT V.35 lines.

DCSAX–LC (M3102) A two-line asynchronous line card that supports full duplex transmission at up to 19,200 bits per second over RS–232–C/V.24 lines.

Figure 1–3 shows both synchronous and asynchronous line cards.

The Ethernet Communications Server hardware unit supports a variety of line configurations. The aggregate bandwidth of the lines on the unit must be less than 500,000 bits per second for one PAM, or 1,000,000 bits per second for two PAMs. Calculate the aggregate bandwidth by taking the sum of the maximum line speeds. The maximum line speed is defined as the fastest clock rate at which the number of devices specified can be driven under control of the DECnet Router Server. For example, a one-PAM unit can support up to eight high speed synchronous lines (DCSAX–LB) each at a maximum of 56,000 bits per second. Optionally, the unit supports one high speed synchronous line at 500,000 bits per second for interconnection of two Ethernets. It also can support two high speed synchronous lines at 250,000 bits per second.

A two-PAM unit can support up to 32 asynchronous lines or 16 synchronous lines. The maximum configuration assumes each line operates at a maximum of 19,200 bits per second.

You can mix asynchronous and synchronous line cards within the constraints mentioned above. One PAM can handle a maximum of 8 synchronous lines, or 16 asynchronous lines. For a mix of synchronous and asynchronous lines, the PAM can handle a maximum of somewhere between 8 and 16 lines. For every synchronous line (card) on a PAM, the maximum number of asynchronous lines is decreased by two. For example, if you choose to include three synchronous lines on a PAM, then the maximum number of asynchronous lines for the PAM decreases from 16 to 10. The maximum number of lines in this configuration is 13.

Table 1–1 shows the maximum number of communication lines supported by the DECnet Router Server. The aggregate bandwidth is indicated in kilobits per second (Kbps). For more information on configuration and performance of the DECnet Router Server, see the Software Product Description. The Software Product Description also lists the supported devices to which the server line cards can be connected.

Table 1–1: Line Configurations

Line Speed	Number of lines	Aggregate Bandwidth
19.2 Kbps	32 asynch	307.2 Kbps per PAM
19.2 Kbps	16 sync	307.2 Kbps per PAM
56 Kbps	8 sync	448 Kbps
250 Kbps	2 sync	500 Kbps
500 Kbps	1 sync	500 Kbps

Because of routing database restrictions, a server with 16 synchronous lines or 32 asynchronous lines will support routing in an area containing as many as 400 nodes. A server with up to 8 synchronous lines or 16 asynchronous lines supports routing in an area containing 1023 nodes (one of which is the server itself). Because of these limitations, the distribution kit for installation comes with three system images. Based on your installation, the appropriate image will be copied from the kit, as explained in Chapter 2. Table 1–2 summarizes the three software configuration options. Each option supports routing to other areas. The maximum area size includes the server node.

Table 1–2: Software Configuration Options

Maximum Lines	Maximum Area Size
8 synch only	1023
8 synch/16 asynch (or mix)	1023
16 synch/32 asynch (or mix)	400

The Communications Server supports modem control and modem monitoring so that you can include dial-in or leased lines on your server. The *Ethernet Communications Server Site Preparation and Planning Guide* lists the supported modems and couplers. High speed lines require a modem or modem eliminator.

See the Software Product Description for more detail on the hardware options.

While the Communications Server is running, you can remove a line card or replace a line card with an identical line card without disrupting communications on the other lines. However, you cannot add a line card to a slot that was empty during initialization. You must reload the server for the added line to operate. The Software Product Description describes other restrictions for configuring line cards.

1.2.2 Front Panel Switches, Buttons, LEDs and Displays

The front panel of the Communications Server contains a digital display, several fault indicator LEDs (light-emitting diodes), an OFF/ON/LOCK switch, a START button, a TEST button, and POWER and RUN lights, as shown in Figure 1–3. Chapter 5 explains the uses of the front panel LEDs, switch, and buttons for loading the software. When the software is operating normally, the digital display periodically shows the 4-digit DECnet node number associated with the Communications Server and also displays a cyclic pattern indicating that the software is running.

1.2.3 Hardware Self-diagnosis

The Communications Server hardware provides automatic self-diagnosis at startup. Self-tests check the hardware unit's connection to the Ethernet network, making sure there are no hardware faults that can prevent loading of the software from the loading host. The diagnostics use the digital display and LEDs to report the status of any failed hardware.

A longer, more thorough self-test is also available. When the test completes, the Communications Server displays its 12-digit Ethernet hardware address (see the *DECnet Router Software Management Guide*). You can load a diagnostic software system to check thoroughly the integrity of all hardware components and to run repair-level diagnostic tests.

NOTE

The *DECnet Router Software Management Guide* describes these diagnostics. The diagnostics are explained in depth in the *Ethernet Communications Server Operations and Maintenance Guide*.

1.3 Using Hosts to Load and Maintain the DECnet Router Server

You can use host nodes on the Ethernet to perform standard network management functions involving the DECnet Router Server, such as down-line loading the software or performing loopback tests. Most nodes on a LAN can act as a **host node** for the DECnet Router Server. A host node is a multi-function DECnet implementation that has disk storage facilities. You can set up one or more host nodes as **loading hosts**. Loading hosts are nodes you can use to down-line load the software across the Ethernet to the Communications Server hardware unit. You can use any of the following host systems:

- RSX-11M
- RSX-11M-PLUS
- VAX/VMS

Each of these systems must be running Phase IV DECnet and must be located on the same Ethernet as the server. For supported version numbers of host system software and DECnet software, see the Software Product Description for the DECnet Router Server. A host must have a magnetic tape drive or RL02 disk drive to read the distribution media. Also, the host system should have 2700 blocks of disk space to store the DECnet Router Server software for subsequent down-line loading. For installation of the software, VMS hosts should have 5000 blocks of disk space. After installation, 2700 blocks is sufficient. RSX-11M and RSX-11M-PLUS host nodes must support multiuser protection and have access verification support.

Any one of these hosts can be used for receiving up-line dumps of the server's memory after a crash and for receiving event logging messages generated by the server node. (A host should have 1024 disk blocks available for each dump.) The host currently designated for these purposes is called the DECnet Router Server's **maintenance host**. Normally the maintenance host is the host that loads the server software. If the DECnet Router Server is reloaded by another host, then the new loading host becomes the maintenance host. You can choose a host other than the loading host to act as the server's maintenance host, but this is not recommended. In addition, you can set up other hosts, called **backup hosts**, to serve as the maintenance host whenever the initial maintenance host is not available. You designate the maintenance host and backup hosts during installation of the software.

From Phase IV hosts logically connected to the DECnet Router Server, you can issue commands for execution remotely at the server to display status and error information, to control the operation of the server software, and to test network operation. Appendix C contains the command formats. The *DECnet Router Software Management Guide* describes these commands in further detail.

1.4 LAN Addressing

As system or network manager, it is important that you understand how nodes are addressed on an Ethernet. With Phase IV DECnet software, a node on an Ethernet, such as the DECnet Router Server node, can access a very large number of nodes on, and remote from, the same Ethernet. To take advantage of the larger network size and Ethernet's high speed data link, Phase IV DECnet software uses an efficient addressing scheme for sending messages to other nodes. It can address either a specific node or a pre-defined group of nodes on an Ethernet LAN.

An Ethernet node can send a message to a group of nodes on the LAN by using what is called an **Ethernet multicast address**. The message is sent simultaneously, in one transmission, to each node identified by that multicast address. The multicast address is used by the network software for control messages, such as routing control messages. The address is not used for user data. Certain network management operations involving the DECnet Router Server use the Ethernet multicast address. For example, some loopback tests done over the Ethernet send a loop request to the Ethernet multicast address. The first node on the Ethernet to respond will loop the test data back. See the *DECnet Router Software Management Guide* for further details. As another example, the multicast address is used by the DECnet Router Server for requesting potential loading nodes on the Ethernet to down-line load the software, as explained in Chapter 5.

To send a message to a specific node on the Ethernet, the network software uses either the node's Ethernet hardware address or its extended DECnet node address. The network software uses the **Ethernet hardware address** before DECnet software is loaded on the node. The Ethernet hardware address is a unique address permanently associated with each controller hardware interface (Digital or non-Digital) on the Ethernet. The address consists of twelve hexadecimal digits, represented in six pairs that are separated by hyphens (for example, AA-00-03-00-01-23). You need to specify the Ethernet hardware address of the DECnet Router Server when setting up the down-line load database on any host that will load the server, as explained in Chapter 2. To find out the Ethernet hardware address for your server, see Section 2.1.

The network software uses the node's **extended DECnet node address** after DECnet software is loaded on the Ethernet node. The extended DECnet node address is set up by controller software by appending the node's 4-digit (hexadecimal) DECnet node address to a constant 8-digit (hexadecimal) number (AA-00-04-00) that identifies the node as a Digital Ethernet node. For example, if the 4-digit node address is 3B-04 (corresponding to the decimal node number of 59), then the extended DECnet node address becomes AA-00-04-00-3B-04. If area routing is implemented, node addresses must include the area number, a decimal integer indicating the area in

which the node is grouped. For example, if the node with node number 59 is in area 2, its node address would be 2.59. The extended DECnet node address would be AA-00-04-00-3B-08. (The top six bits of the last two hexadecimal digits indicate the area.) Section 1.5 includes more information on addressing nodes in multiple area networks.

NOTE

Single area networks use area 1.

To find out the extended DECnet node address of your server, see the *DECnet Router Software Management Guide.*

The 12-digit Ethernet address that the network software is currently using to address a node is called the node's **Ethernet physical address**. Thus, initially a node's Ethernet physical address is its Ethernet hardware address. After DECnet software is loaded on the node, its physical address becomes the node's extended DECnet node address. The physical address reverts to the hardware address only when the node is powered off and powered up again. In this case, the network software uses the node's hardware address until the DECnet software is reloaded on the node.

When running certain circuit loopback tests, you may have to specify a node's Ethernet physical address, as explained in the *DECnet Router Software Management Guide*. You must use the proper address (hardware or extended DECnet).

However, once an Ethernet node becomes a running DECnet system, you will seldom need to use the node's Ethernet physical address to identify it. When using network management commands, you can identify the node by using the node's DECnet node name (or its DECnet node address), providing the node's Ethernet hardware address is defined in the down-line load database of the node at which you are issuing commands.

1.5 Area Routing

Phase IV DECnet supports an increased network size. In a single area network, Phase IV DECnet increases the maximum size from the 255-node limit of Phase III DECnet to a 1023-node limit. Furthermore, a multiple area network can contain up to 62 areas, each with up to 1023 nodes. The network manager can partition a large network into areas to add a second, higher level of routing to your network. Figure 1-4 shows a multiple area network.

The first level of routing, level 1 routing, is the standard routing within a single area. The second level of routing, level 2 routing, is routing between areas. All routers within a particular area can route data within that area. Level 2 routers, such as the DECnet Router Server, can also route data to and from other areas. Each area must have at least one level 2 router to connect to other areas.

When a level 1 router receives data destined for a node in another area, it uses level 1 routing to send the data to the nearest node within its own area that performs level 2 routing. Referring to Figure 1–4 as an example, suppose node GIANT in area 6 wants to send data to node MOZART in area 5. When the level 1 router node QBACK receives the message, it routes the data to CROWN, the closest level 2 router. In turn, CROWN uses level 2 routing to forward the data to a level 2 router in area 5, which in this case is node TWORT. Then node TWORT routes the data by level 1 routing to node MOZART. Notice the level 2 routers APEX, CROWN, and TWORT, form a subnetwork to link the three areas shown in the figure.

If area routing is not implemented for a network, the whole network is considered a single area with the default area number 1. Thus, in a network not divided into areas, the DECnet Router Server and other routers perform level 1 routing only. Node addresses do not have to include an area number prefix.

The DECnet Router Server automatically takes on the area number of its loading host. You can change the area number at any time. Section 3.3.2.1 explains how to define the area number for the server.

In summary, besides allowing you to configure very large networks, area routing provides the following advantages:

- Increases the efficiency of a large network, even if it contains less than 1023 nodes.

  Setting up a multiple area network reduces routing traffic in the network by restricting routing overhead between areas to the level 2 routers. Level 1 routers only exchange routing information about nodes in their own area.

- Allows different organizations to manage their nodes separately within a large network.

- Makes it easier to merge existing networks.

  The nodes do not have to be renumbered. An area number is added to the number of each node to keep their unique identification.

- If a portion of the network is unstable and generating many routing update messages, then area routing can reduce the routing overhead for the rest of the network.

- If a network has less than 1023 nodes and many of these are Phase III DECnet nodes, which have a maximum address limit of 255, then area routing can increase the efficiency of the network as a whole. The DECnet Router Server and other level 2 routers can support a maximum node number of 1023. Assign to each area those Phase III nodes that need to talk to each other most. Let each area consist of at most 255 nodes so that each Phase III node can address every other node in its area. Section 3.3.2.2 provides further guidelines for setting up networks that include both Phase III and Phase IV nodes.

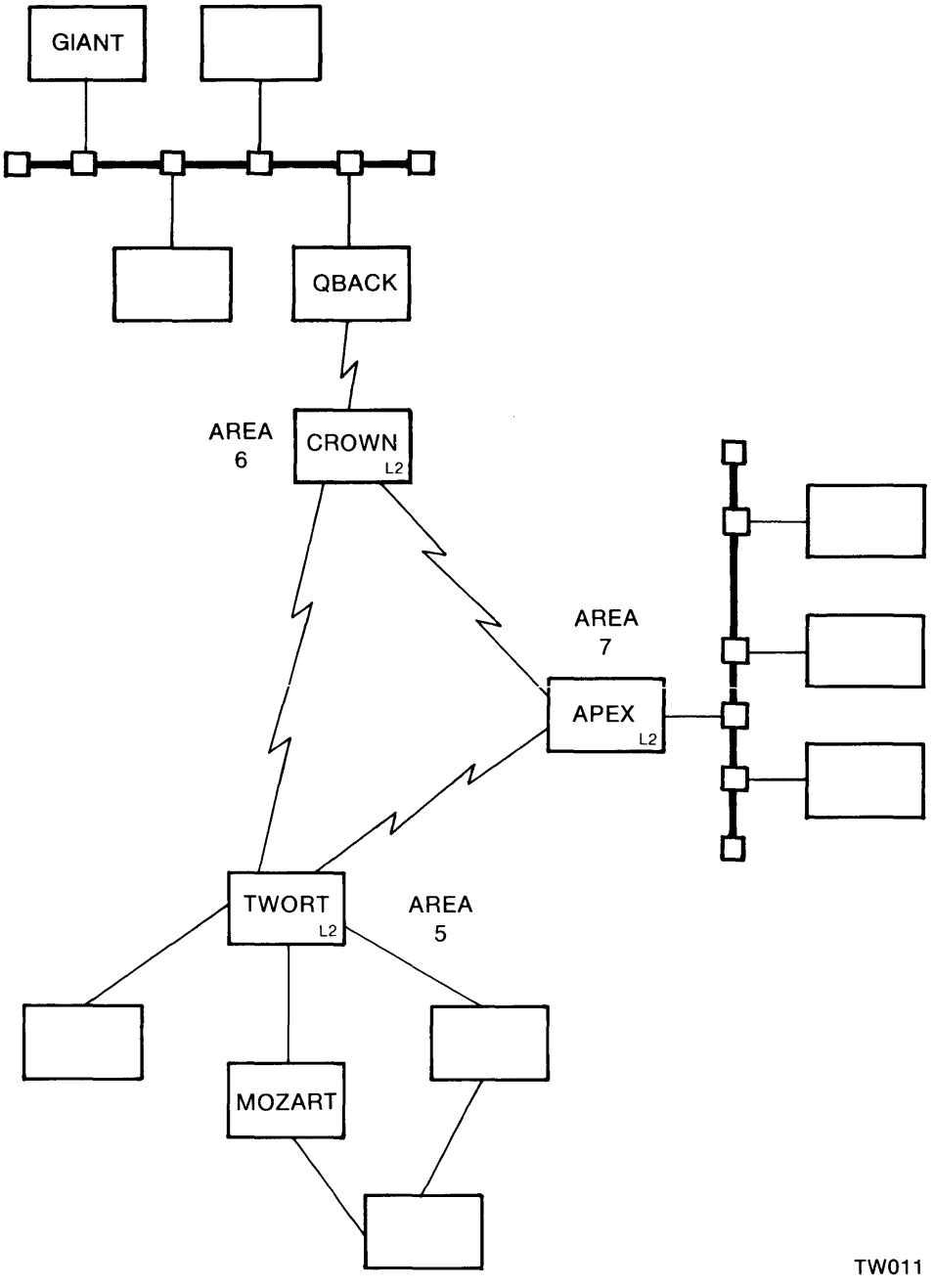

Figure 1–4: A Multiple Area Network

1.6 Ethernet LAN Concepts

This section defines some Ethernet LAN concepts and terms that you need to know for installing the DECnet Router Server. A **LAN** is a high speed data communications network that serves a single building or a limited geographical area, such as an industrial complex or college campus. The Ethernet physical channel is a coaxial cable. Figure 1–5 shows a simple Ethernet LAN configuration and identifies some of the hardware components you may need to work with.

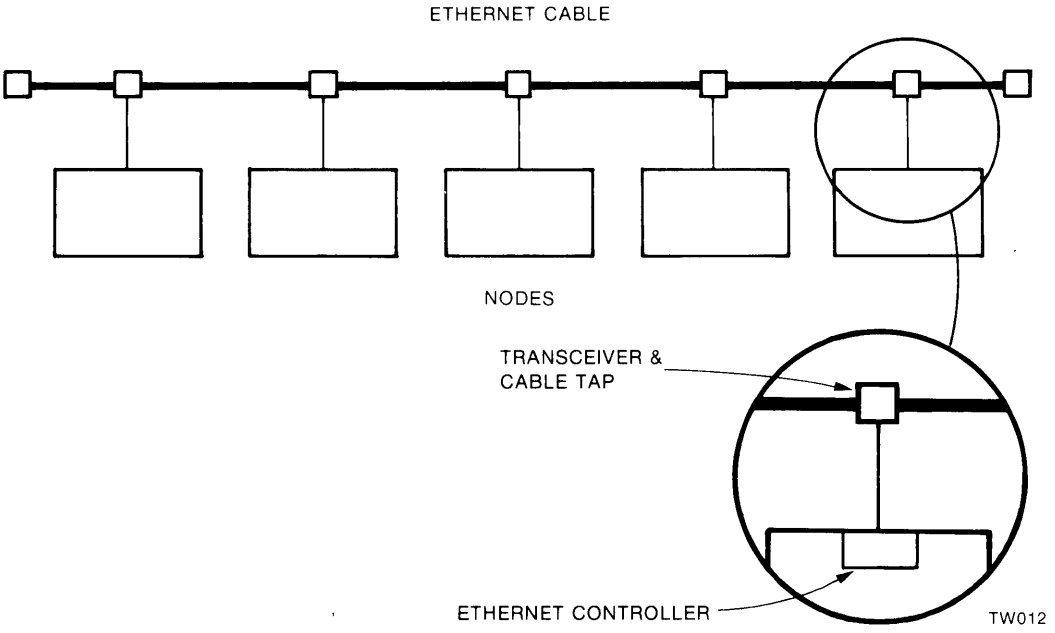

Figure 1–5: Example of an Ethernet Local Area Network Configuration

A node is connected to the cable by a cable tap, transceiver, and an intelligent Ethernet controller; for example, the DEUNA.

Each node on the Ethernet receives only those messages addressed to that node, and does not have to route messages to other nodes. As a result, communications are not hampered by the delay and additional processing that would be needed if messages had to be retransmitted at each intervening node, and all nodes are relieved of network control responsibility at this level.

The way an Ethernet LAN is structured means that network operation remains highly stable and reliable, uninterrupted by any of the following events:

- Node failures (unless the node is a routing node providing the only path between two or more nodes)
- Powering nodes on or off (however, momentary interrupts may occur when transceivers are connected or disconnected)
- Connecting or reconnecting nodes at any point on the Ethernet

The Ethernet LAN structure thus offers great flexibility in a changing work environment.

2

Installing the DECnet Router Server Software

To install the DECnet Router Server, choose a Phase IV DECnet RSX-11M, RSX-11M-PLUS, or VAX/VMS host node directly connected to the Ethernet to serve as the **loading host**. RSX hosts must support multiuser protection in RSX and access verification in DECnet-RSX. In a multiple area network, choose a host node in the same area as the DECnet Router Server.

NOTE

This manual uses the term **server software** to mean the DECnet Router Server software used with the Ethernet Communications Server hardware unit.

The manual also uses the term **server node** to mean the DECnet Router Server node.

The steps for installing the software vary depending on the type of loading host you choose. Section 2.2 explains these steps for a VMS host, and Section 2.3 explains them for an RSX host. Chapter 5 describes how to load the software and check that it works, and how to copy the installation files to another host system.

The procedure for installing the software is automated. Briefly, it does the following:

1 Creates an account and directory on the loading host (if these have not already been created for a previous server node installation).

2 Copies files from the distribution medium into appropriate locations on the host. The configuration files and command files are copied to the newly created account on the host, and all other files are copied to SYS$SYSTEM (SYS$SYSROOT:[SYSEXE]) on a VMS host or to NETUIC (or to any special server UIC you choose) on an RSX host.

3 Sets up the DECnet database relating to the server node on the loading host system. This database describes the parameters necessary to load the software into your Communications Server hardware unit and, in event of a crash, to receive a dump of server memory. (This database is also referred to as the down-line load and up-line dump database.)

4 Sets up the network configuration file. This file sets up software network parameters used by the server. You define a list of **backup hosts** for the DECnet Router Server and passwords used to access the server node from other nodes in the network. A backup host is a substitute for the server's host, used for receiving event messages or up-line dumps whenever the main host is unavailable. Backup hosts can serve as alternate loading hosts, too.

5 Sets up the router configuration file, which defines information for the DECnet Router Server's routing database and network components. A predefined file, supplied with the distribution kit, is used unless you want to tailor it to suit your configuration. Chapter 4 explains how to tailor the file.

After installing the software on the host, you can edit the configuration files at any time. Changes take effect when you reload the server software. You can prevent unauthorized users from changing, deleting, or copying the configuration files, as explained in Section 5.5.

Optionally, you may wish to configure more than one DECnet Router Server in your network. To do so, run a separate, complete installation procedure for each server. With each installation, you will build a unique down-line load database and network configuration file. After installing each server, edit where necessary its router configuration file. Much of the software can be shared on the loading host by all the servers. For example, the loading host needs only one copy of the loadable diagnostics image (LDI).

DECnet Router Servers having different line configurations may need different system images as well as different installation checkout command files. (The installation procedure generates one of three system images, depending on the number of lines on the server.) Those servers with similar line configurations can use the same system image and installation checkout procedure.

2.1 Preparing to Install the DECnet Router Server Software

Before installing your DECnet Router Server, you should know the installation parameters. These parameters should have been established in accordance with the network manager and Digital representatives. These parameters are recorded on a hardware data worksheet provided with the *Ethernet Communications Server Site Preparation and Planning Guide*. This worksheet, called the line configuration worksheet, lists much of the DECnet Router Server information that you will need for installing the software. Appendix A presents a sample line configuration worksheet. Section 4.2.2 explains how to identify server lines.

If the installation parameters have not already been discussed with a Digital representative, then you must:

- Understand the topology of an existing network.

  Adding the DECnet Router Server node to a network affects the routing parameters in other nodes in the network. The system/network manager should know how to modify these routing parameters. The maximum address parameter (defining the largest number of nodes that can be addressed by any node) may need to be increased. Also, if by adding the DECnet Router Server, the maximum number of broadcast routers is exceeded, then the maximum broadcast routers parameter should be increased. (A broadcast router is a routing node on the same Ethernet as the node.)

  If the DECnet Router Server is to support area routing, you should understand the area routing concepts and parameters discussed in Sections 3.3 and 4.3.1.

- Know how to determine a priority list for backup hosts.

  Backup hosts at the top of the list would normally be reliable systems on the network that are usually up and running, not heavily burdened, and having adequate disk space for an up-line dump (about 1100 disk blocks).

- Know how to assign a node name and node address to the server node.

The system/network manager is responsible for coordinating with the system managers of other nodes to ensure that all node addresses are unique and that routing control parameters provide for efficient data flow through the network. The system/network manager should also ensure the uniformity of assumptions about network parameter settings such as circuit cost, buffer sizes, and maximum cost and hops. In multiple area networks, the system/network manager is responsible also for coordinating with the managers of other areas to ensure uniformity among area-related network parameters.

After you meet the conditions described above, do the following before you install the server software:

- Make sure the Communications Server hardware unit has been installed (see the *Ethernet Communications Server Installation Guide*).
- Know the DEUNA 12-digit Ethernet hardware address. This is the unique address associated with the DEUNA that connects your server to the Ethernet. This address uniquely identifies the Communications Server. The installer of the hardware should have recorded the address on back of the front panel cover and on the line configuration worksheet.

  You can make the hardware unit display this address. With the TEST button in the OUT position, push the START button. When the digital display on the front panel starts blinking, push the TEST button. After about five seconds, the 12-digit address will be shown on the display, four digits at a time, left to right, in three phases. The *DECnet Router Software Management Guide* shows how the address is displayed. The address is also displayed when you run the long self-test for the unit.
- Back up the distribution kit before changing any of the configuration files. If problems arise with a modified configuration, you may want to try loading the software with copies of the original configuration files to see if the DECnet Router Server operates successfully that way.

The remainder of this chapter describes how to install the DECnet Router Server.

2.2 Installing the Server Software on a VMS Host

This section describes the automated procedure for installing the DECnet Router Server software on a VMS host. To install the DECnet Router Server, your VMS loading host must have at least 5000 blocks of disk space available. Once the software is loaded and running in the hardware unit, make sure at least 1100 blocks are available on the host for receiving each up-line crash dump.

NOTE

VMSINSTAL automatically purges files on the loading host. If you wish to keep server files that were copied to the host during previous server installations, rename those files before invoking VMSINSTAL.

Invoke VMSINSTAL from the system manager's account or SYS$UPDATE to install the software from the distribution kit into the loading host, to set up the DECnet database for the server on the loading host, and to set up the configuration files.

The automated procedure for installing files on a VMS host requires little involvement beyond answering questions displayed while the procedure (VMSINSTAL) runs. Where applicable, the questions display default answers within brackets; for example, [UNA-0]. To answer a question with the default (for example, to answer UNA-0 where a question displays [UNA-0]), press RET. Ranges of values that you can enter are indicated within parentheses and are separated by a colon. For example, (0:16) indicates you can enter a number between 0 and 16 inclusive.

If you wish to see explanatory text for any question in the procedure, respond with a question mark (?). After the text is displayed, the question will be repeated.

Note that the explanation of VMSINSTAL below deals with the simplest case; it may ask other questions depending on your configuration and the products already installed. Refer to the *Guide to VAX/VMS Software Installation* and the *Guide to Networking on VAX/VMS* for more on how VMSINSTAL works.

To install the distribution kit on your VMS host, log into the SYSTEM account and enter the following command:

$ @SYS$UPDATE:VMSINSTAL CSVRTR *device-id*

where *device-id* identifies the device on which the distribution kit is mounted. CSVRTR is the label of the distribution kit for the DECnet Router Server. The procedure displays the following text (substituting the real date and time for the italics shown below).

```
VAX/VMS Software Product Installation Procedure V4.0

It is date at time.
Enter a question mark (?) at any time for help.
```

The following warning messages might be displayed. You can ignore them. The procedure will prompt you for continuing the installation. Answer Y (yes).

```
%VMSINSTAL-W-DECNET, Your DECnet network is up and running.
%VMSINSTAL-W-ACTIVE, The following processes are still active:

   .
   .
   .
* Do you want to continue anyway [NO]?
```

The procedure will then prompt you for checking your backup. Answer Y (yes) if your backup is in place.

```
* Are you satisfied with the backup of your system disk [YES]?


Please mount the first volume of the set on device-id:.
```

VMSINSTAL displays this request if your distribution kit is on a magnetic tape. Mount the volume on the drive that you specified above. When you have mounted the volume, answer YES to the following question:

```
* Are you ready?
```

The procedure displays:

```
%MOUNT-I-MOUNTED, CSVRTR mounted on device-id:.
The following products will be processed:
    CSVRTR V1.1
        Beginning installation of CSVRTR V1.1 at time
%VMSINSTAL-I-RESTORE, Restoring product saveset A...
Router Server V1.1 installation procedures.
The following set of questions asks you for information used to
set up the account which will be used to install the Router
Server software.
* Device for the account [dev:]:
```

Specify the device where you want the account located. The default device is the running system root device or whatever device you specify as the root for the VMSINSTAL installation.

```
* UIC for account [014,001]:
```

Use a suitable account.

```
* How many synchronous lines will be configured (0:16) [8]:
* How many asynchronous lines will be configured (0:32) [0]:
```

VMSINSTAL uses your answers to these questions to determine which of three system images will be copied to the loading host:

1 CSVRTR.SYS – 8 line maximum configuration

Supports a single-PAM hardware configuration with up to eight synchronous lines. The system image supports routing for a network of up to 1023 nodes. If you respond to the first question above with a number of eight or less, and you respond to the second question with 0 (or a RET), this image will be generated for your server node.

2 CSVRTR16L.SYS – 16 line maximum configuration

Supports a single-PAM hardware configuration with up to 8 synchronous lines, 16 asynchronous lines, or some combination of both. If your configuration includes both synchronous and asynchronous lines, the maximum number of each type of line decreases. The image will support routing for a network of up to 1023 nodes.

3 CSVRTR32L.SYS – 32 line maximum configuration

Supports a dual-PAM hardware configuration with up to 16 synchronous lines or 32 asynchronous lines, or some combination of both. The image supports routing for a network of up to 400 nodes.

After you respond to the two questions, VMSINSTAL displays the text below, repeating the number (*m* and *n*) of each type of line that you specified and indicating the maximum configuration being generated (the maximum is denoted by *p*, which can be either 8 or 16), as based on your responses.

```
You have chosen m synchronous and n asynchronous lines. The system
configuration that will be generated will allow up to p line cards.

There are 2 lines per asynchronous line card or 1 line per synchronous
line card. If you wish to add lines to your Router at some later time,
you should rerun this procedure to generate the appropriate system.

If there is already an account named PLUTO, you will receive a
warning message which you may ignore.

%VMSINSTAL-I-ACCOUNT, This installation creates an account named PLUTO.
user record successfully added
```

VMSINSTAL has added an account with user name PLUTO to the accounting file. The DECnet Router Server's configuration files will reside in this account.

```
Installing Router Server V1.1 files.
Router Server V1.1 files installed.

The images and command files of Router Server V1.1 have been
restored to disk. The next step in the installation is to
set up the host database.
```

The DECnet Router Server software image and other .SYS files have been copied to SYS$SYSTEM (SYS$SYSROOT:[SYSEXE]). Command files and configuration files have been copied to the PLUTO account in the directory (UIC) on the specified device. The command procedure now prompts you for parameters to be used by the loading host to down-line load the software and to receive up-line dumps of the server memory.

```
This command procedure defines the database on your VMS host
which allows you to down-line load the server software and
to receive an up-line dump of the server memory after a
crash.

This procedure can optionally execute the NCP command file.
```

VMSINSTAL uses your answers to the following group of questions to set up a command file that, when executed, creates the permanent DECnet database for the server. The DECnet database for the server is kept on the loading host and contains information that the loading host uses to load the software into the Communications Server hardware unit and to receive an up-line dump if the server crashes. The command file contains NCP DEFINE NODE commands. By default, the NCP command file is named *server-node-id*.COM, where *server-node-id* is the node name that you specify in the first question below. More explanatory text and a sample NCP command file follow this group of questions.

```
* Server node-id     (1-6 chars)      [ ]                    :
```

Answer with the name you have chosen for the server node. A node name is a string of up to six alphanumeric characters, with at least one character being alphabetic.

```
* Server node number     (1 - 1023)   [ ]                    :
```

Answer with the node number you have chosen for the server node. If your server is in a multiple area network, its node address automatically takes on the area number of its maintenance host. You specify the maintenance host below. Section 3.1.1 discusses how nodes are identified in single area and multiple area networks.

```
* Hardware address   (12 hex-digits) [ ]                    :
```

Answer with the 12-digit Ethernet hardware address of the server. This is the permanent, unique address assigned to the Ethernet UNA controller for the server node.

Specify the address as a string of 12 hexadecimal digits, with each pair of digits separated by a hyphen. For example, AA-BB-CC-DD-EE-FF.

```
* Maintenance host   (1-6 chars)      [loading-host-id]              :
```

Answer with the name of the node that will be the maintenance host for the server after it is loaded. If your server is in a multiple area network, the maintenance host should be in the same area as the server. This host collects events generated by the server and receives an up-line dump of server memory if the server crashes. The default host is the loading host. Digital recommends that you use the default initially. You can change the maintenance host at a later time by executing the NCP SET EXECUTOR command at the server, as explained in the *DECnet Router Software Management Guide*. You can also change the host by specifying another host when you load the server with the NCP LOAD command. See Appendix C.

```
* Service circuit    (UNA-n)          [UNA-0]                        :
```

Answer with the UNA circuit used on the host to connect to the server.

```
* Service password   (1-16 hex digits)    [0]                       :
```

This password protects the server from being loaded inadvertently. Anyone wanting to load the server by command must supply this password. It must match the UNA password defined in the server's network configuration file. VMSINSTAL automatically defines a matching UNA password in the file.

NOTE

For security reasons, you may choose not to define the service password in the down-line load database, but to define the UNA password in the network configuration file. In this way, anyone wishing to load the server must specify the password with the LOAD or TRIGGER command, as explained in Chapter 5. To define the UNA password in the network configuration file, edit the file as explained in Chapter 4.

```
* Store file          (YES or NO)      [YES]                         :
```

The NCP configuration file may be stored for later use, executed now, or both. If you want to store the file, answer YES; otherwise, answer NO. If you answer YES, you are asked the following two questions:

```
* File name           (1-12 chars)     [server-node-id.COM]          :
```

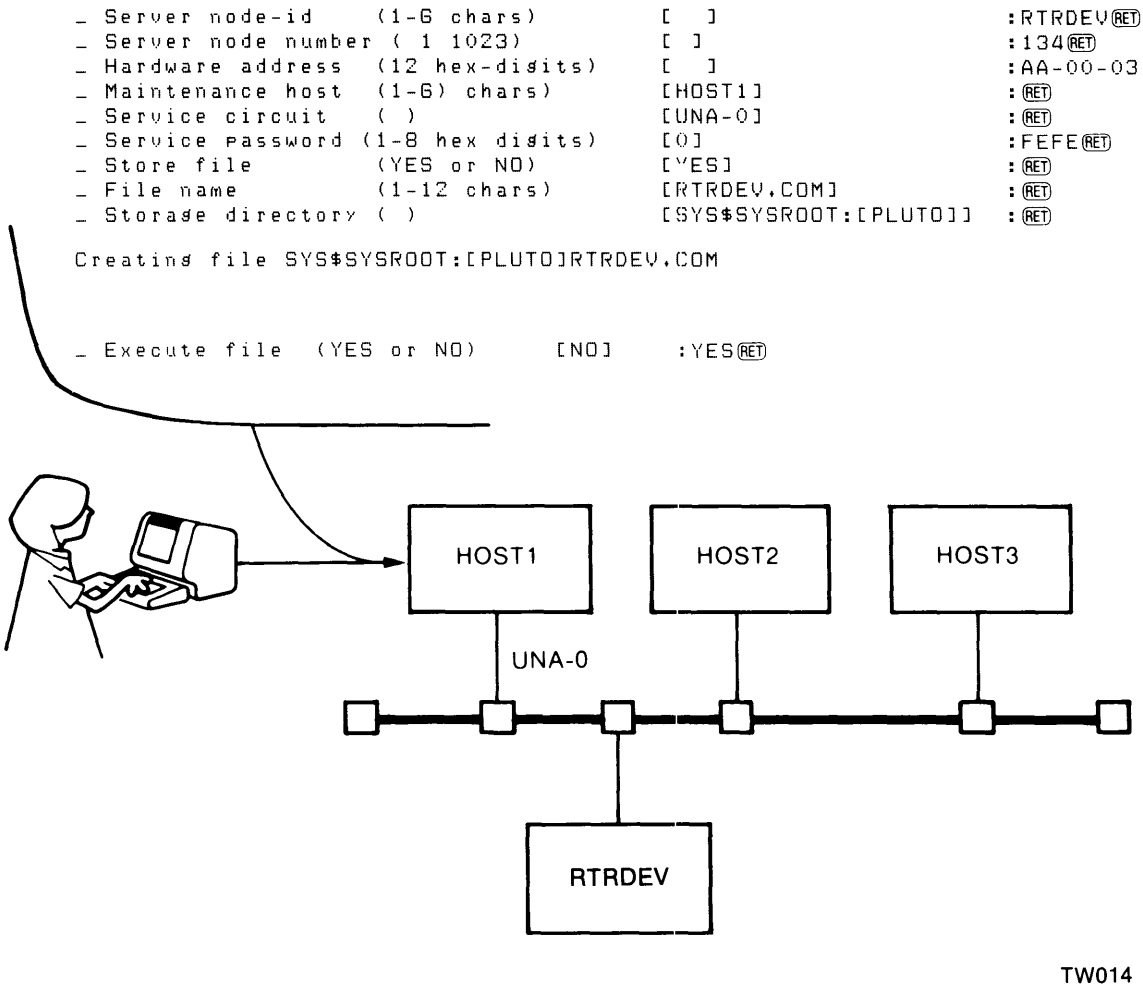

Figure 2–1: Setting up the DECnet Database for the Server on a VMS Host

Answer with the name for the NCP command file.

```
* Storage directory ( )                    [SYS$SYSROOT:[PLUTO]]    :
```

Answer with the name of the directory on which you want the file stored. The default directory is the root into which you are installing the DECnet Router Server software.

The following message is displayed when you store the NCP command file:

```
Creating file dev:[dir.PLUTO]server-node-id.COM
* Execute file        (YES or NO)       [YES]                      :
```

Answer YES if you want to execute the NCP command file now to set up the DECnet database for the server on the loading host. Answer NO if you want to execute the file some other time. Do not answer NO if you have not stored the NCP configuration file. If you answer YES, you will see the following two paragraphs of text and possibly the error messages:

```
NCP will print unrecognized component errors if the node being
defined is not already defined in the permanent database. You
may ignore these errors.

Defining the host database may take anywhere from a few minutes
to 30 minutes depending on system load and size of the host's
node database.

%NCP-I-NMLRSP, listener response - Unrecognized component, Node

%NCP-I-NMLRSP, listener response - Unrecognized component, Node
```

Figure 2–1 shows an example of an installer's responses to the above questions. The installer is at host HOST1. HOST1 will load the DECnet Router Server RTRDEV. The following shows the NCP command file that is set up on HOST1.

```
$! NCP  Configuration file for node rtrdev
$ ncp       purge node RTRDEV all
$ ncp       purge node 134 all
$ ncp       define node 134 name RTRDEV
$ ncp       define node 134 diagnostic file csvldi.sys
$ ncp       define node 134 dump file SYS$SYSROOT:[PLUTO]RTRDEV.DMP
$ ncp       define node 134 hardware address AA-00-03-00-00-86
$ ncp       define node 134 host HOST1
$ ncp       define node 134 service circuit UNA-0
$ ncp       define node 134 service password FEFE
$ ncp       define node 134 load file CSVRTR.SYS
$ ncp       define node 134 secondary loader PLUTO2.SYS
$ ncp       define node 134 tertiary loader PLUTO3.SYS
$ ncp       set node 134 all
```

The server in this example uses the system image for the single-PAM synchronous-only configuration (CSVRTR.SYS). Notice that certain parameters are predefined. Specifically, these are the name and location of the loadable diagnostics image (CSVLDI.SYS), the dump file (*server-node-id*.DMP), and the loader files (PLUTO2.SYS and PLUTO3.SYS). The installation procedure copies all the .SYS files to SYS$SYSTEM (SYS$SYSROOT:[SYSEXE]). However, as discussed at the end of this section, you can move certain .SYS files to special UICs. Accordingly, change the permanent database to reflect the new locations of these files by editing the above file (*server-node-id*.COM) and rerunning it.

Alternatively, to define or change any parameters in the permanent database, use the NCP DEFINE NODE command directly. For example, the following command defines the same parameter values in the database as does the NCP command file, above:

```
DEFINE NODE NODE 134 NAME RTRDEV -
_ DIAGNOSTIC FILE CSVLDI.SYS -
_ DUMP FILE SYS$SYSROOT:[PLUTO]RTRDEV.DMP -
_ HARDWARE ADDRESS AA-00-03-00-00-86 -
_ HOST HOST1 -
_ SERVICE CIRCUIT UNA-0 -
_ SERVICE PASSWORD FEFE -
_ LOAD FILE CSVRTR.SYS -
_ SECONDARY LOADER PLUTO2.SYS -
_ TERTIARY LOADER PLUTO3.SYS
```

The dashes (–) serve as line continuators. NCP begins the next line with the underscore prompt (_). (See Appendix C of this manual for a summary of the DEFINE NODE command and parameters, or see the *VAX/VMS Utilities Reference Volume* for further information on this command.)

```
This procedure will now create the Router Server network
configuration file.

The network configuration file will be named server-node-idSB.CFG
```

The network configuration file contains LAN software network parameters used by the DECnet Router Server. Chapter 4 describes the parameters in detail and explains how to change the parameters. Chapter 4 contains a sample network configuration file.

```
* System password   (1-6 chars)      [null]                :
```

Answer with a string of one to six alphanumeric characters. This will be the network privileged password for the server node. Users must specify this password with privileged network management commands that access the server node.

```
* Clock frequency    (50 or 60)       [60]                    :
```

Answer with the default for installations in the United States or Canada. Answer with 50 if the site of the installation has a 50 Hz supply frequency. (For example, installations in Europe require 50 Hz.).

```
The next set of questions asks for backup hosts.
You may enter a maximum of five (5) backup hosts.
A null entry or five (5) entries will terminate solicitation.

* Backup host        (1-6 chars)      [null]                  :
```

Answer with the name of a node that you will use as a backup host node for the server node. The backup host node is used whenever the server's maintenance host is not available for receiving event messages or an up-line dump. You can specify up to five backup nodes. For this reason, the question will be repeated until either you have named five nodes, or you have pressed RET to show that you have no more backup nodes to specify. If you do not want to specify any backup hosts, press RET when the question first appears.

Specify the most reliable backup hosts first. When the server needs to access a backup host, it requests access to the first backup node that you specify. If that node is not available, the server looks to the next backup specified, and so on.

On each backup host, make sure you set up a DECnet database relating to the server. See the explanatory text, above, which follows the "Execute file" question.

If your server is in a multiple area network, choose backup hosts from the same area as your server.

```
Created the configuration file dev:[dir.PLUTO]server-node-idSB.CFG


When this procedure is complete, check and edit (if necessary) the
router configuration file (server-node-idRTR.CFG).


%VMSINSTAL-I-MOVEFILES, Files will now be moved to their target directories.
Installation of CSVRTR V1.1 completed at time


        VMSINSTAL procedure done at time
```

You have finished installing the software. The files have been moved to their target directories. Before loading the server, you may want to edit the router configuration file. A predefined router configuration file was copied to the newly created directory in the PLUTO account on the loading host. The file is named *server-node-id*RTR.CFG, where *server-node-id* is your server's node name. The router configuration file sets up routing parameters for the DECnet Router Server.

You can use the predefined router configuration file as it is, provided your configuration matches the defaults defined in the file. Otherwise, edit the file to tailor it to your server's line configuration and to define optimal parameter values suitable for your network installation (see Chapter 4).

The predefined file assumes your server has the maximum number of synchronous lines supported by the server software image. (The commands defining parameters for asynchronous lines are disabled; that is, these command lines are preceded by exclamation points (!), causing the commands to be treated as comments). For example, if the software image generated for your server is an image for a single-PAM system, CSVRTR.SYS or CSVRTR16L.SYS, the predefined file assumes your server has 8 synchronous lines. If the image generated for your server is the image for the dual-PAM system, CSVRTR32L.SYS, the file assumes your server has 16 synchronous lines.

Appendix B shows two default files, one that is used for a server system supporting a maximum of 8 synchronous-only lines, and one for a server system supporting a maximum of 8 synchronous or 16 asynchronous lines.

Now, you can load the DECnet Router Server software, as explained in Chapter 5. Section 5.5 explains how to protect the configuration files from being changed, copied, or deleted by unauthorized users.

The VMSINSTAL procedure copies the following system images to the SYS$SYSTEM (SYS$SYSROOT:[SYSEXE]) directory:

PLUTOCC.SYS	This image is used by the Remote Console Facility (RCF, described in the *DECnet Router Software Management Guide*). When you invoke RCF from a host, the image is loaded into the Ethernet UNA controller on the server node.
PLUTOWL.SYS	This loads PLUTOCC.SYS when RCF is invoked.
CSVLDI.SYS	The Communications Server hardware unit loadable diagnostic image.
PLUTO2.SYS	The secondary loader, used for down-line loading the software.
PLUTO3.SYS	The tertiary loader, used for down-line loading the software.
CSVRTR.SYS, CSVRTR16L.SYS or CSVRTR32L.SYS	The DECnet Router Server system image.

The procedure copies the configuration files and the following command files to the directory in the PLUTO account:

CSVRTRICP.COM, Installation checkout procedure command file.
CSVRTR16L.COM,
or
CSVRTR32L.COM

All files and images have world read access.

Note that the configuration files must reside in the PLUTO account (or the general DECnet account on VMS systems). If you move them or edit them, make sure they still have world read access or that their owner is PLUTO and has owner read access.

To test whether the files have sufficient privilege, use the following commands.

From a VMS host:

TYPE *host-id*"PLUTO PLUTO"::*file-id*

From an RSX host:

NFT TI:=*host-id*/PLUTO/PLUTO::*file-id*

You can move the .SYS files to other directories. For example, you can set up a directory for the loader files and system images and another directory for dump files. If you move any .SYS files, you must change accordingly the DECnet database relating to the server. To do so, edit the server's NCP command file. For the changes to take effect in the volatile database of the host, run the command file.

You have finished installing your software on your VMS host. See Chapter 5 for instructions on how to load the server.

2.3 Installing the Server Software on an RSX-11M/M-PLUS Host

This section explains how to install the DECnet Router Server software on an RSX loading host. The RSX system must support multiuser protection and access verification. To accommodate the software installation, your RSX loading host must have at least 2700 blocks of disk space available. Once the software is loaded and running in the hardware units, make sure at least 1100 blocks remain available on the host for receiving an up-line crash dump.

First, you will copy all files on the distribution kit onto any UIC on the loading host. Then, you can run the RSXINSTAL command file for the automated installation procedure. This command file prompts you for the main parameters needed to install your DECnet Router Server. It sets up a special account on the host for storage of the configuration and command files, and moves other files to their respective locations. It also sets up the network configuration file and prompts you for parameters to be used to down-line load the server software or to receive an up-line dump of the server memory. You can use RSXINSTAL to install more than one DECnet Router Server.

If you do not use the RSXINSTAL command file, you must set up a special account and directory for the configuration files and command files, and then move these files to this new directory. The account must have the user name PLUTO. Section 2.3.2.2 explains how to set up this account. (If other servers have been installed on the host, then the account may already exist.) Move the system files (.SYS) to NETUIC or to any other UIC you choose. You must set up a DECnet database for the server on the host. Figure 2–2 shows how to set up the database with the Configuration File Editor (CFE). Appendix C summarizes the CFE DEFINE NODE command and parameters. After using CFE to set up the DECnet database, unload the network and load it again. This brings the CFE changes into effect in the host's volatile database. You also must set up the network configuration and router configuration files for the DECnet Router Server. Chapter 4 explains how to set up these files.

2.3.1 Copying Files from the Distribution Medium

The procedure for copying files from the distribution medium depends on whether the medium is tape or RL02 disk. The following two subsections describe the procedures for each medium. Before proceeding, first move to [40,40] on the host by typing the following two commands:

ASN *dev:*=SY:

SET /UIC=[40,40]

where

dev: is the device to which the tape will be copied.

[40,40] is the UIC to where all files will be copied from the distribution medium.

NOTE

After copying the files, make sure you protect them from accidental deletion.

2.3.1.1 Copying from a Magnetic Tape — Load the tape on any available tape drive. Then mount the tape and copy the files, using the following MCR commands:

ALL *dev1:*

MOU *dev1:*/FOR

BRU

When BRU has been entered, the BRU> prompt will appear. Then enter the following command (shown here with a line continuator):

/DENSITY:1600/REW/VER/NOINI/UFD/OUTVOL:*outvolume-*
/BACKUP_SET:CSVRTR011

where

dev1: identifies the tape drive from which files are copied.

outvolume: identifies the output volume, if mounted.

The BRU utility will display the following prompt:

```
From:
```

Answer again with the tape drive from which the files are copied. Next, BRU displays:

```
To:
```

Answer with the device to which the files are copied.

The BRU utility will display a message at your terminal informing you that all files are copied. Now, all files are in [40,40] on your host. To verify that all files are copied, see Section 2.3.1.3.

2.3.1.2 Copying from an RL02 Disk — As a safety precaution, do not use your distribution kit as a working disk. First, load the disk on the drive and mount the disk, using the following MCR command:

MOU DL*n*:CSVRTR

To copy the files, use the following Peripheral Interchange Program (PIP) command:

PIP /NV=DL*n*:[40,40]*.*

where *n* is the unit number of the RL02 disk drive.

2.3.1.3 Verifying All Files Are Copied — If you list the directory, you should see at least the following files with the number of disk blocks indicated:

CSVRTR.SYS	1016
CSVRTR16L.SYS	1016
CSVRTR32L.SYS	1016
CSVLDI.SYS	1002
PLUTOWL.SYS	5
PLUTOCC.SYS	6
PLUTO2.SYS	5
PLUTO3.SYS	7
SB.CFG	2
RTR8L.CFG	19
RTR16L.CFG	23
RTR32L.CFG	28
CSVRTRICP.CMD	4
CSVRTR16L.CMD	9
CSVRTR32L.CMD	16
CSVRTRICP.COM	5
CSVRTR16L.COM	11
CSVRTR32L.COM	20
RSXINSTAL.CMD	24

All files and images should have world read access.

You are now ready to run RSXINSTAL.

2.3.2 Performing RSXINSTAL

The automated procedure for installing files on an RSX host requires little involvement beyond answering questions displayed while the procedure (RSXINSTAL) runs.

Each question displays within brackets the type of response expected and, if available, the default. Your responses to RSXINSTAL questions will be one of three types:

- YES or NO [Y/N]
- Decimal number [D]
- String [S]

The default is displayed following a "D:". For example, if UNA-0 is the default, it is displayed as follows: D:UNA-0. The default for a yes/no question is NO. To answer a question with the default (for example, to answer UNA-0 where a question displays UNA-0), press RET. Questions expecting a number response show the range of valid values that you can enter, while questions expecting a string response show the range for the string length.

If you want explanatory text for a question, respond by pressing the ESC key. After the text, the question will appear again.

To run RSXINSTAL, type the following:

@RSXINSTAL

The RSXINSTAL procedure displays the following text. This display includes the explanatory text given for each question when you press ESC for help. However, to improve readability of the display that follows, the repetition of the question is omitted after the text.

Example starts on following page.

```
>;
>;=====================================================
>; DECnet Router Server Installation Procedure
>;        Started at time on date
>;=====================================================
>;
>; Copyright (C) 1984 by
>; Digital Equipment Corporation, Maynard, Mass.
>;
>; This installation procedure installs the DECnet Router Server (server)
>; on a RSX-11M/M+ host. This procedure must be run from a privileged
>; account.
>;
>; This procedure will create and copy server files. It will create a
>; network configuration file based on the answers supplied in section 2.
>; A file named CFE<node>.CMD will contain the CFE commands to define the
>; permanent database on this host.
>;
```

In other words, when you are setting up more than one DECnet Router Server, you do not need duplicates of the software images and loader files. The same image and loader files can be used for each server. However, depending on the line configuration supported by the additional server(s), you may need to keep more than one system image. See the explanatory text for questions 2.00 and 2.01, below.

```
>; You may type an escape <ESC> at any question to obtain additional
>; information about the question.
>;
>; <EOS> Do you want to:
>*         <RET>-Continue, E-Exit [S]:
>;
>;
>; = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>; Section 1 - General information
>; = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>;
>; Now you must decide where you would like to put the various DECnet
>; Router Server files. It is suggested that you pick one uic for the
>; configuration files, one uic for the loaders and system images and one
>; uic for the dump images.
>;
>; NOTE: The uic where the configuration files reside must have a user id
>; and password of PLUTO/PLUTO.
>;
>; When answering questions in this section please type the full
>; directory specification. (DEV:[nnn,nnn])
>;
```

The last question of this section gives you the option of running the ACNT program to add new directories.

```
>* 1.00 Where will configuration files reside [S D:"SY:[40,40]"]:
>;
>; This is the uic that is set up as the PLUTO/PLUTO account on the
>; host. Your <server-node-id>SB.CFG and <server-node-id>RTR.CFG
>; configuration files must reside in this uic. These files are
>; read by the DECnet Router Server's initialization tasks from
>; this account. Enter the uic specification in the form:
>;
>;                       DEV:[nnn,nnn]
>;
>* 1.01 Where will system files reside [S D:"SY:[40,40]"]:
>;
>; The system files can reside on any uic on the host system. A
>; separate uic is a neat and convenient method of partitioning host
>; software from server software. Enter the uic specification in the
>; form:
>;
>;                       DEV:[nnn,nnn]
>;
>* 1.02 Where will dump files reside [S D:"SY:[40,40]"]:
>;
>; The dump files can reside on any uic on the host system. A
>; separate uic is a convenient method of insuring disk storage for
>; a dump image. Enter the uic specification in the form:
>;
>;                       DEV:[nnn,nnn]
>;
>* 1.03 Do you need to run the account program? [Y/N]:
>;
>; The uic specification you supplied may not exist on your disk. You
>; can elect to run the accounting program now and add the new uic's
>; to the system. Remember you must also create a PLUTO/PLUTO account
>; for the configuration files.
>;
```

If you answer YES, RSXINSTAL runs the account file maintenance program (ACNT) so that you can add directories. Section 2.3.2.2 explains how to respond to the ACNT program.

```
>;
>; <EOS> Do you want to:
>*         <RET>-Continue, R-Repeat section, E-Exit [S]:
>;
>;
>; = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>; Section 2 - Building the network configuration
>; = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
```

This section allows you to determine the system software and network configurations for your server. The first two questions ask you for the number of synchronous and asynchronous lines on your server. Your responses determine which system image will be copied to the loading host, as explained below. The remaining questions ask you for node identification for your server and for LAN parameter values for the network configuration file used by the server. Chapter 4 describes the parameters in detail and explains how to edit the configuration file to change the parameters. It contains a sample network configuration file.

```
>* 2.00 How many synchronous lines will be configured [D R:0,-16,]:
>* 2.01 How many asynchronous lines will be configured [D R:0,-32,]:
```

RSXINSTAL uses your answers to these questions to determine which of three system images will be copied to the loading host:

1 CSVRTR.SYS - 8 line maximum configuration

Supports a single-PAM hardware configuration with up to 8 synchronous lines. The system image supports routing for a network of up to 1023 nodes. If you respond to the first question above with a number of 8 or less, and you respond to the second question with 0 (or a RET), this image will be generated for your server node.

2 CSVRTR16L.SYS - 16 line maximum configuration

Supports a single-PAM hardware configuration with up to 8 synchronous lines, 16 asynchronous lines, or some combination of both. If your configuration includes both synchronous and asynchronous lines, the maximum number of each type of line decreases. The image will support routing for a network of up to 1023 nodes.

3 CSVRTR32L.SYS - 32 line maximum configuration

Supports a dual-PAM hardware configuration with up to 16 synchronous lines or 32 asynchronous lines, or some combination of both, and supports routing for a network of up to 400 nodes.

After you respond to the two questions, RSXINSTAL displays the text below, repeating the number (*m* and *n*) of each type of line that you specified and indicating the maximum configuration being generated (the maximum is denoted by *p*, which can be either 8 or 16), as based on your responses.

```
>; You have chosen m synchronous and n asynchronous lines. The system
>; configuration that will be generated will allow up to p line cards.

>; There are 2 lines per asynchronous line card or 1 line per synchronous
>; line card. If you wish to add lines to your Router at some later time,
>; you should rerun this procedure to generate the appropriate system.


>* 2.02 What is the node-id of the server [S]:
>;
>; Every DECnet node can be identified by a unique name. You should
>; choose a unique name for each node in the network. A node name is
>; one to six alphanumeric characters. At least one character must be
>; a letter.
>;
>* 2.03 What is the node number [D R:1.-1023.]:
>;
>; Every DECnet node can be identified by a unique number. You
>; should pick a unique number for the DECnet Router Server.
>;
```

If your server is in a multiple area network, its node address automatically takes on the area number of its maintenance host, which by default is the loading host. Section 3.1.1 discusses how nodes are identified in single area and multiple area networks.

```
>* 2.04 What is the UNA-0 password [S R:1,-16, D:"0"]:
>;
>; The UNA-0 password (service password) is used to prevent
>; unauthorized users from triggering or loading the DECnet Router
>; Server. The password is one to sixteen hexadecimal characters.
>;
>* 2.05 What is the network privileged password [S R:0,-8,]:
>;
>; The network privileged password is supplied on network management
>; commands. This is to prevent unauthorized users from issuing
>; privileged commands to the DECnet Router Server.
>;
>* 2.06 What is the system line clock frequency [D R:50,-60, D:60,]:
>;
>; The clock frequency used in the United States is 60 Hz and in
>; Europe is 50 Hz.
>;
>;
>; If you want more than one backup host enter them separated by commas.
>; i.e. HOST1,HOST2,HOST3,HOST4,HOST5
>;
>* 2.07 What are the node-id's of the backup hosts [S]:
>;
>; Backup hosts are needed when the server's maintenance host is out
>; of service. A DECnet Router Server may need to log an event or
>; up-line dump a system image. If the maintenance host is down, a
>; backup host is needed to assist the DECnet Router Server. Be sure
>; to set up the server databases on the backup hosts. Enter the
>; backup hosts as a list. The maximum is five backup hosts. For
>; example:
>;
>;                    HOST1,HOST2,HOST3,HOST4,HOST5
>;
>;
```

On each backup host, make sure you set up a DECnet database relating to the DECnet Router Server.

If your server is in a multiple area network, choose backup hosts from the same area as your server.

```
>; Building the network configuration file.
>;      (dev:[nnn,nnn]server-node-idSB.CFG)
>;
>;
>; NOTE: You must also tailor the router configuration file in
>; dev:[nnn,nnn]server-node-idRTR.CFG after this procedure
>; completes.
>;
```

The router configuration file contains parameters for the routing database used by the DECnet Router Server. A predefined file will be copied to the loading host. Before loading the server, you can tailor the file to fit your server's line configuration. See the explanatory text preceding Section 2.3.2.1.

```
>;
>*         <RET>-Continue, R-Repeat section, E-Exit [S]:
>;
>;
>; = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>;Section 3 - Moving the DECnet Router Server files.
>; = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>;
>;
>; Copying loaders and system files to dev:[nnn,nnn]
>;
>; Copying configuration files
>;     server-node-idSB.CFG and server-node-idRTR.CFG
>;     to dev:[nnn,nnn]
>;
>;
```

```
>; = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>;Section 4 - Building the down-line load database
>; = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>;
```

RSXINSTAL uses your answers to the following two questions to set up a command file that, when executed, creates the permanent DECnet database for the server. The DECnet database for the server is kept on the loading host and contains information that the loading host uses to load the software into the Communications Server hardware unit and to receive an up-line dump if the server crashes. The command file contains Configuration File Editor (CFE) commands. More text explaining how to set up the DECnet database follows these two questions.

```
>* 4.00 What is the loading host's service circuit-id [S D:"UNA-0"]:
>;
>; This host node may have more than one active circuit. You must
>; specify the circuit over which service will be performed.
>;
```

The loading host's service circuit is the UNA circuit over which the down-line load and other service operations will occur.

```
>* 4.01 What is the server's hardware address [S]:
>;
>; Every Ethernet controller has a unique 12-digit address. This
>; hardware address is displayed by running the long diagnostics self
>; test. This address will be used by the host to service the DECnet
>; Router Server. Enter the address as six pairs of digits separated
>; by hyphens (-).
>;
```

Specify 12 hexadecimal digits. This address is the unique address assigned to the server's hardware unit. The address is used to communicate with the server node before the DECnet Router Server software has been loaded.

```
>;
>;
>; You can define these node characteristics in the host's permanent
>; database by running CFE with the command file built in this
>; procedure (dev:[nnn,nnn]CFEserver-node-id.CMD), as follows:
>;
>; >INS DEV:[NETUIC]CFE.TSK
>; >CFE
>; Enter filename: DEV:[NETUIC]CETAB.MAC
>; CFE>@dev:[nnn,nnn]CFEserver-node-id
>; CFE>sho node server-node-id
>;     .... Displays new node characteristics
>; CFE>^Z
>;
>;
>;
>; <EOS> Do you want to:
>*        R-Repeat section, E or <RET>-Exit [S]:
>;
```

After RSXINSTAL completes, you can run the CFE command file to update the permanent database on the host. RSXINSTAL automatically sets up other parameters in the database by using values you specify in Section 2 of RSXINSTAL, such as the server's node name and service password (UNA password). RSXINSTAL sets up the loading host as the server's maintenance host. The system images and loader files have default names. You determine their location in Section 1 of RSXINSTAL. The names and descriptions of each are:

CSVRTR.SYS, CSVRTR16L.SYS, or CSVRTR32L.SYS	The DECnet Router Server system image.
CSVLDI.SYS	The loadable diagnostics image.
PLUTO2.SYS	The secondary loader file used for loading the DECnet Router Server software.
PLUTO3.SYS	The tertiary loader file used for loading the DECnet Router Server software.

NOTE

For security reasons, you may choose not to define the service password in the down-line load database. In this way, anyone wishing to load the server must specify the password with the LOAD or TRIGGER command, as explained in Sections 5.1.1 and 5.1.2.

You can also use the CFE DEFINE NODE command directly to change one or more parameters in the permanent database of the host. Figure 2–2 shows how an installer uses CFE to set up the database on HOST1 for DECnet Router Server RTRDEV. The installer has assigned the system images and files to UIC [100,100] on LB:. By default, the host is HOST1; that is, HOST1 will be RTRDEV's maintenance host. Appendix C includes the DEFINE NODE command and all the possible down-line load and up-line dump parameters. (See the *DECnet–RSX System Manager's Guide* for further information on CFE.) When using CFE directly to set up the database, make sure the UICs you specify for parameters correspond to the UICs where you have stored the files on the host.

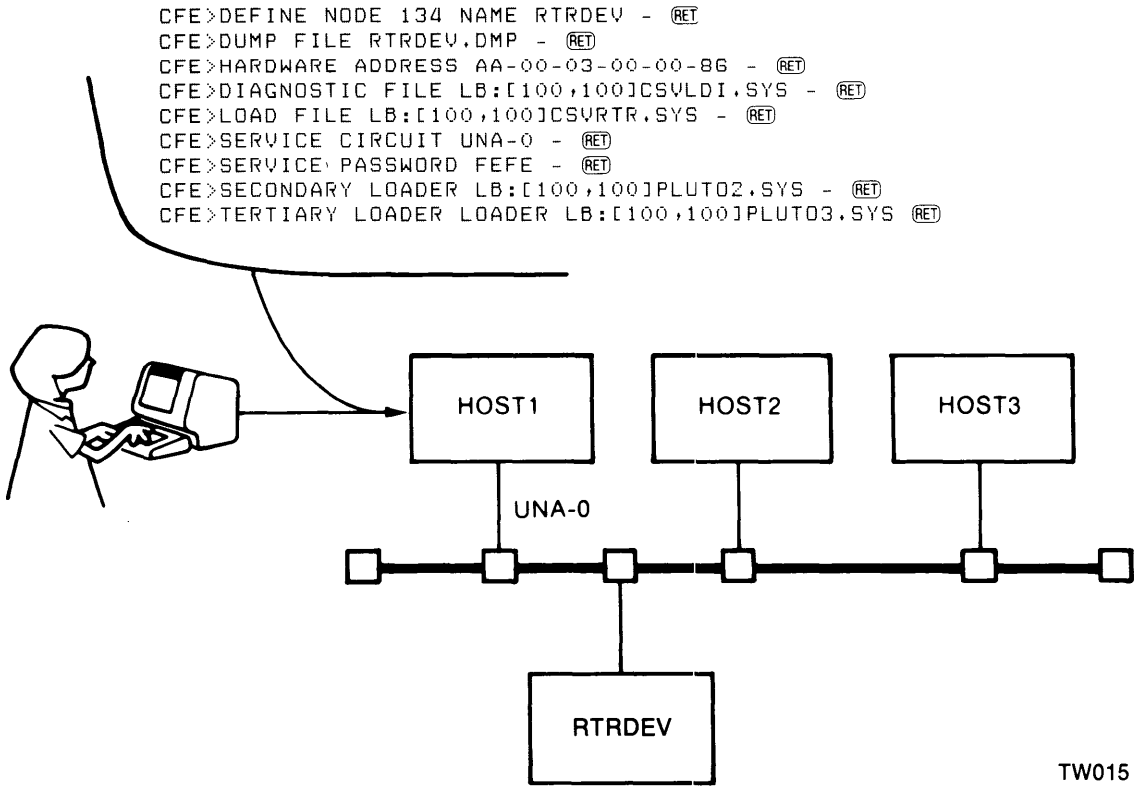

Figure 2–2: Setting up the DECnet Database for the Server on an RSX Host

```
>;
>; Remember to:
>;
>;    1. Edit your router configuration file.
>;
>;    2. Update your permanent database with the newly created CFE command
>;       file. The next time your network is loaded, the volatile database
>;       on the host will be set up.
>;
>;    3. If your volatile database is set up, then you may trigger or
>;       load the server. If the volatile database is not set up, then
>;       down-line load your server with the full NCP command:
>;
>; NCP LOAD NODE server-node-id FROM dev:[nnn,nnn]CSVRTR.SYS SER PASS password
>;
```

If the server image installed by RSXINSTAL was CSVRTR16L.SYS or CSVRTR32L.SYS, specify that instead of CSVRTR.SYS. Also, use the device and UIC that you specified in Section 1 of RSXINSTAL. For the service password, use the password specified in response to question 2.04 in Section 2 of RSXINSTAL.

```
>;    4. If you change the synchronous/asynchronous line configuration,
>;       you should rerun this procedure to ensure you have the correct
>;       software image generated for the new configuration.
>;
>;
>; = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>;DECnet Router Server Installation Procedure
>;         Stopped at time on date
>; = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>;
>@ <EOF>
>
```

You can use the predefined router configuration file as it is, provided your configuration matches the defaults defined in the file. Otherwise, edit the file to tailor it to your server's line configuration and to define optimal parameter values suitable for your network installation (see Chapter 4).

The predefined file assumes your server has the maximum number of synchronous lines supported by the server software image. (The commands defining parameters for asynchronous lines are disabled; that is, these command lines are preceded by semicolons (;), causing the commands to be treated as comments). For example, if the software image generated for your server is an image for a single-PAM system, CSVRTR.SYS or CSVRTR16L.SYS, the predefined file assumes your server has 8 synchronous lines. If the image generated for your server is the image for the dual-PAM system, CSVRTR32L.SYS, the file assumes your server has 16 synchronous lines.

Appendix B shows two default (predefined) files, one that is used for server system supporting a maximum of 8 synchronous-only lines, and one for a server system supporting a maximum of 8 synchronous or 16 asynchronous lines.

If you wish to protect the configuration files from being changed, copied, or deleted by unauthorized users, see Section 5.5.

2.3.2.1 Checking the RSXINSTAL Output — RSXINSTAL moves files to the directories you specify, creates the DECnet Router Server's network configuration file containing the parameter values you specify, and builds a command file on the host that updates the permanent DECnet database relating to the DECnet Router Server.

To check that all the files have been moved to their proper directories, list each target directory. The directory for the system files should contain the following:

CSVRTR.SYS or CSVRTR16L.SYS or CSVRTR32L.SYS
CSVLDI.SYS
PLUTOWL.SYS
PLUTOCC.SYS
PLUTO2.SYS
PLUTO3.SYS

The directory for the configuration and command files should contain the following:

*server-node-id*SB.CFG
*server-node-id*RTR.CFG
CSVRTRICP.CMD or CSVRTR16L.CMD or CSVRTR32L.CMD
CSVRTRICP.COM or CSVRTR16L.COM or CSVRTR32L.COM
RSXINSTAL.CMD

where *server-node-id* is the node name you assigned to the server.

To check the network configuration file, use PIP to type the contents of the file. Identify the file with the directory you created for the PLUTO account. For example, for server RTRDEV, type:

```
>PIP TI:=RTRDEVSB.CFG (RET)
```

In response, PIP displays the file contents, such as:

```
SET LINE UNA-0 PASSWORD FFF300
SET SYSTEM PASSWORD PRIV
SET SYSTEM LINE FREQUENCY 60
SET EXECUTOR BACKUP HOSTS HOST1,HOST2,HOST3
>
```

To check the permanent database command file created by RSXINSTAL, type the contents of CFE*server-node-id*.CMD. For example, for server RTRDEV, type:

```
>TYPE CFERTRDEV.CMD (RET)
```

The following shows a sample display of the command file:

```
DEFINE NODE 300 NAME RTRDEV -
DEFINE NODE RTRDEV -
SERVICE CIRCUIT UNA-0 -
SERVICE DEVICE UNA -
DUMP FILE DB1:[100,100]RTRDEV.DMP -
HARDWARE ADDRESS AA-00-03-00-00-86 -
DIAGNOSTICS FILE DB1:[100,100]CSVLDI.SYS -
LOAD FILE DB1:[100,100]CSVRTR.SYS -
SERVICE PASSWORD FFF300 -
SECONDARY LOADER DB1:[100,100]PLUTO2.SYS -
TERTIARY LOADER DB1:[100,100]PLUTO3.SYS
```

Once the permanent database has been updated, use the CFE SHOW NODE command to list the parameter values in this database.

You have finished installing your software on your RSX host. See Chapter 5 for instructions on how to load the server.

2.3.2.2 Creating an Account and Directory on the RSX Host — This section explains how to use the account file maintenance program (ACNT) to add new accounts and directories on a loading host for storage of server system files, dump files, or configuration files. You must create a special account for the configuration files, if this account has not been created already. The user name for this special account is PLUTO. (The required account and directory may already exist from a previous installation of a server node. If so, you do not need to create the PLUTO account.)

Question 1.03 of RSXINSTAL gives you the option of running the ACNT program to add new directories. See Section 2.3.2 of this manual. Because RSXINSTAL automatically runs the ACNT program, you need not be concerned with the following information that tells how to run ACNT. Skip to the information under the heading "Responding to ACNT Questions".

Running ACNT Independently of RSXINSTAL

To create an account on the host, log on to a privileged account on the host and then run ACNT by typing the following:

```
>RUN $ACNT (RET)
```

If ACNT was built against the file control services resident library (FCSRES) or fast supervisor mode library (FCSFSL), then run ACNT by typing

```
>RUN $ACNTRES (RET)
```

or

```
>RUN $ACNTFSL (RET)
```

accordingly. For more information on ACNT, refer to the appropriate RSX documentation.

Responding to ACNT Questions

The program lists several functions and asks you to select one. Select the Add function (A). As the program prompts you, supply the following information:

1 The identification code (UIC) for the account.

  This serves as the account number. Use a suitable, non-privileged UIC (that is, a UIC with a group number of 10 or more).

2 A password for the account.

  For the directory to hold the configuration files, enter the password PLUTO.

3 The name of the default system device.

  Respond with the name of the device (physical or logical) that will contain the server software files. This must be a device that is always available (usually the system disk). Device LB:, or the disk where the network normally resides, is recommended.

4 A first and last name for the new account.

  For the first name, enter any name you choose (up to 12 characters). The last name for the account created for the configuration files must be PLUTO.

5 The command language interpreter (CLI) to be used.

Answer with MCR. (Note that ACNT does not ask you for the CLI if your system does not support an alternate CLI.)

6 Whether you want your terminal slaved.

Answer YES.

7 On an RSX-11M-PLUS host, ACNT asks for the session identification and account number. Refer to the appropriate RSX documentation.

You have now created an account on the loading host. You can end the ACNT program or create another account and directory.

Set up the PLUTO account so that users cannot log in to it. The following is a sample log-in command file that automatically logs off anyone who tries to log in:

```
.ENABLE QUIET
.OPEN TI:
.ENABLE DATA
For security reasons, you cannot log in to this account.
.DISABLE DATA
.CLOSE
.XQT BYE
```

3
Configuring the Network

Intended for network managers, this chapter gives guidelines for setting up DECnet wide area and local area networks. It also describes how to set up networks to include area routing support. The guidelines fall into three categories:

- General guidelines – for all network nodes (Section 3.1)
- Ethernet guidelines – for all Ethernet nodes (Section 3.2)
- Area guidelines – for all nodes in a multiple area network (Section 3.3)

3.1 General Guidelines for Configuring Networks

The following guidelines describe how you should assign addresses and names to nodes so they can be identified uniquely, and how to set up other parameters that ensure universality in the whole network. The guidelines are:

- **All nodes in the network must have a unique network-wide address** (see Section 3.1.1).
- **All nodes within an area should have the same value specified for the maximum node address parameter** (see Section 3.1.2).
- **All nodes should use the same buffer size** (see Section 3.1.3).

The following sections describe the guidelines in further detail.

3.1.1 Identifying Nodes

Each DECnet node must have a unique node address and, optionally, a unique node name. Node addresses are known network wide by the routing function. Node names are known only to the network software of each node. To avoid potential confusion, give each node a unique name.

3.1.1.1 Node Addresses — Node addresses are used by DECnet software to route messages. Node addresses consist of two parts: the area number and the node number. In networks without area support, the node address must be a number unique within the network. Area numbers are not used. In networks with area support, each area number must be unique within the network and each node number unique within the area. The format of a node address is:

[*area-number.*]*node-number*

where *area-number* must be in the range of 2 to 63 and *node-number* must be in the range of 1 to 1023. You should assign node numbers sequentially, beginning with 1. This reduces the size of the databases on routing nodes. You should assign area numbers sequentially, also.

You define the node number of the DECnet Router Server when you install the software. When you load the software, the server node automatically takes on the default area number of its host, as defined in the down-line load database on the loading host.

You define the node address of VMS or RSX host systems when you configure them.

When adding area routing support to a network, you will need to change node addresses of nodes to reflect their area locations. Section 3.3.2.1 explains how.

When identifying a node, you can omit the area number. By default, the number of the local area is used.

3.1.1.2 Node Names — On each node, assign node names to remote nodes with which the node will communicate. These names must not exceed six alphanumeric characters; at least one of these characters must be alphabetic. You should try to set up the same remote node name list on all nodes. As your network increases in size, the bookkeeping associated with network maintenance is much easier if all nodes reference remote nodes by the same logical name.

Remote node names for the DECnet Router Server are automatically set up at the end of the software initialization. The server software can set up 1023 node names. The software first sets up names for nodes in the same area as the server (called the home area), then the names of any adjacent nodes outside of the home area, and finally as many names of other nodes as will fit in the database.

The server software obtains the node names from the remote node name list on the server's host node. (The software requests the host to do the equivalent of the NCP SHOW KNOWN NODES command.) The node name list on the host is set up when generating the DECnet software on the host system. You can add or change node names and addresses on the host later. Change them in the permanent database of RSX hosts by using the CFE DEFINE NODE command. On VMS hosts, use the NCP DEFINE NODE command. To change them in the volatile database of RSX and VMS hosts, use the NCP SET NODE command.

To change remote node names in the permanent database of the DECnet Router Server, first change them in the host and then reload the server. To change them in the server's volatile database, you can use the NCP SET NODE command, as explained in the *DECnet Router Software Management Guide*.

3.1.2 Maximum Address

All nodes within an area of a multiple area network or within a single area network should have the same value specified for the maximum address (also called maximum node number) parameter. For Phase III nodes, this guideline may be impossible to follow, since Phase IV nodes can address a greater number of nodes. Sections 3.3.2.2 and 3.3.3.2 give more information on how to handle Phase III restrictions.

The value used for the maximum address parameter should be greater than or equal to all other node numbers. If the maximum value defined on a routing node is too small, nodes with numbers exceeding the value will be excluded from the node's routing database.

3.1.3 Buffer Size

All nodes should use the same buffer size. If buffer sizes of nodes differ, parts of messages can be dropped as they are forwarded or received by a node having a smaller buffer size than that of the transmitting node. More information about determining large buffer size and segment buffer size for the DECnet Router Server is given in Section 4.3.1.1.

3.2 Guidelines for Configuring Ethernets

If the end nodes on an Ethernet communicate only with each other, no routing node is required on the Ethernet. However, if the Ethernet is divided into more than one area, an area routing node is required to transport messages between these areas.

When setting up any routing node on an Ethernet, you must follow the guidelines below to ensure proper node operation. These guidelines discuss several parameters that you must define for your node. Chapter 4 discusses parameters you can define for the DECnet Router Server. For information on defining Ethernet-related parameters on other systems, see the appropriate network documentation. The guidelines are:

- **The maximum broadcast nonrouters parameter for any node on an Ethernet should be greater than or equal to the total number of nonrouting nodes on all Ethernet circuits connected directly to the node** (see Section 3.2.1).
- **The maximum broadcast routers parameter for any node on an Ethernet should be greater than or equal to the total number of routing nodes on the Ethernet circuit connected directly to the node** (see Section 3.2.2).
- **The number of routers on an Ethernet should be kept to a minimum** (see Section 3.2.2).

The following sections describe these guidelines.

3.2.1 Maximum Broadcast Nonrouters

Define your routing node's maximum broadcast nonrouters parameter so that it is greater than or equal to the total number of nonrouting (end nodes) on the Ethernet circuit connected to the node. If the parameter is too small, the node may not be able to reach some of the end nodes in one hop. (They will be reachable through other routers on the Ethernet.) Section 4.3.1.6 explains how to define the maximum broadcast nonrouters parameter for the DECnet Router Server.

3.2.2 Maximum Broadcast Routers

Define your routing node's maximum broadcast routers parameter so that it is greater than or equal to the total number of routers on all Ethernet circuits connected to the node. If the parameter is too small, the node may not be able to reach some of the routers in one hop. (They will be reachable through other routers on the Ethernet.)

For the DECnet Router Server, define the maximum broadcast router parameter as explained in Section 4.2.1.

Keep the number of routers on a single Ethernet to a minimum. The larger the number of routers, the greater the overhead for each router. Routers generate traffic among themselves, especially when nodes are becoming unreachable. The traffic increases as the number of routers increases. If possible, keep no more than 10 routers on a single Ethernet. Configure more than one router to split a heavy routing load or to insure that routing remains uninterrupted if one router goes down.

If your Ethernet requires numerous connections to nodes off the Ethernet or on other Ethernets, add one or more DECnet Router Servers to the Ethernet. As a unit dedicated solely to routing, the DECnet Router Server can route without having to attend to other functions that burden conventional routing nodes. This increases the accessibility and reliability of your network. You can configure the other nodes on the Ethernet as end nodes. Leaving routing to the DECnet Router Server, the end nodes can dedicate themselves more fully to applications or other processing functions.

3.2.3 Ethernet Routers and End Nodes

As mentioned previously, all nodes on an Ethernet can communicate directly with each other without depending on intervening routing nodes. Initially, however, end nodes on an Ethernet do not have information about other nodes on the network except for the **designated router** (if there is one) on the Ethernet. An end node uses the designated router when communicating with any node for the first time.

If the destination node is a node on the same Ethernet as the source node, the designated router informs the source node. Then, subsequent communications with this node can be direct. All end nodes keep a cache of nodes which they may address directly on the Ethernet. If the destination node is not on the Ethernet, subsequent communications with this node will occur through the router (on the Ethernet) that is on the optimal path.

If there are two or more routers on the same Ethernet, the network software on all routing nodes on the Ethernet elects one of them as the designated router. The election is made on the basis of the highest numerical priority, a number which is defined on each routing node as an Ethernet circuit parameter. In case of ties, the router with the highest node address is elected. (To define the circuit priority parameter for the DECnet Router Server, see Section 4.3.2.3.)

When there is no router on the Ethernet circuit, the end node wishing to communicate with another node sends the message directly, hoping that the other node is there. If the destination node is on the Ethernet, it informs the source node. The source node then adds the destination node to its cache and sends subsequent messages directly to the destination node. If the destination node is not on the Ethernet, communication will not be possible. End nodes on the Ethernet must use a router to communicate with nodes off the Ethernet.

3.3 Guidelines for Configuring Area Networks

As network manager, you can set up a large network of more than 1023 nodes by dividing it into smaller networks called **areas**. The entire network can consist of up to 62 areas, each containing up to 1023 nodes. Even if your network consists of fewer than 1023 nodes, you can benefit by splitting your network into areas, as explained below. Figure 3–1 shows a multiple area network. You can take an existing large network and partition it into areas, or you can take existing networks, designate them as areas, and combine them to form the larger multiple area network. Section 3.3.2 explains how to configure a multiple area network.

Areas are linked by routers such as the DECnet Router Server that support Phase IV DECnet area routing. These routers are called area routers or **level 2 routers**, and they perform routing on two levels. On one level, they perform the standard routing within their own area, as performed by Phase IV or Phase III DECnet routers. This level of routing is called **level 1 routing**. On a second level, they route data between areas. This level of routing is called **level 2 routing**.

In Figure 3–1, nodes APEX, TWORT, and CROWN are level 2 routers. They link the three areas of the network. Notice that the level 2 routers are connected so that they form a network of their own. (In the figure, the network of level 2 routers is highlighted in red.) Section 3.3.1 includes guidelines for setting up **level 2 routers** in a multiple area network. **Level 1 routers** route data within a single area only. When level 1 routers receive data destined for another area, they route the data to the nearest level 2 router in their own area. In turn, that level 2 router routes the data to the nearest level 2 router in the destination area. In a network that is not a multiple area network, all routers are considered level 1 routers.

Area routing provides several advantages:

1 Allows for larger networks, exceeding 1023 nodes.

2 Minimizes the routing overhead for the network.

3 Management of the network becomes easier.

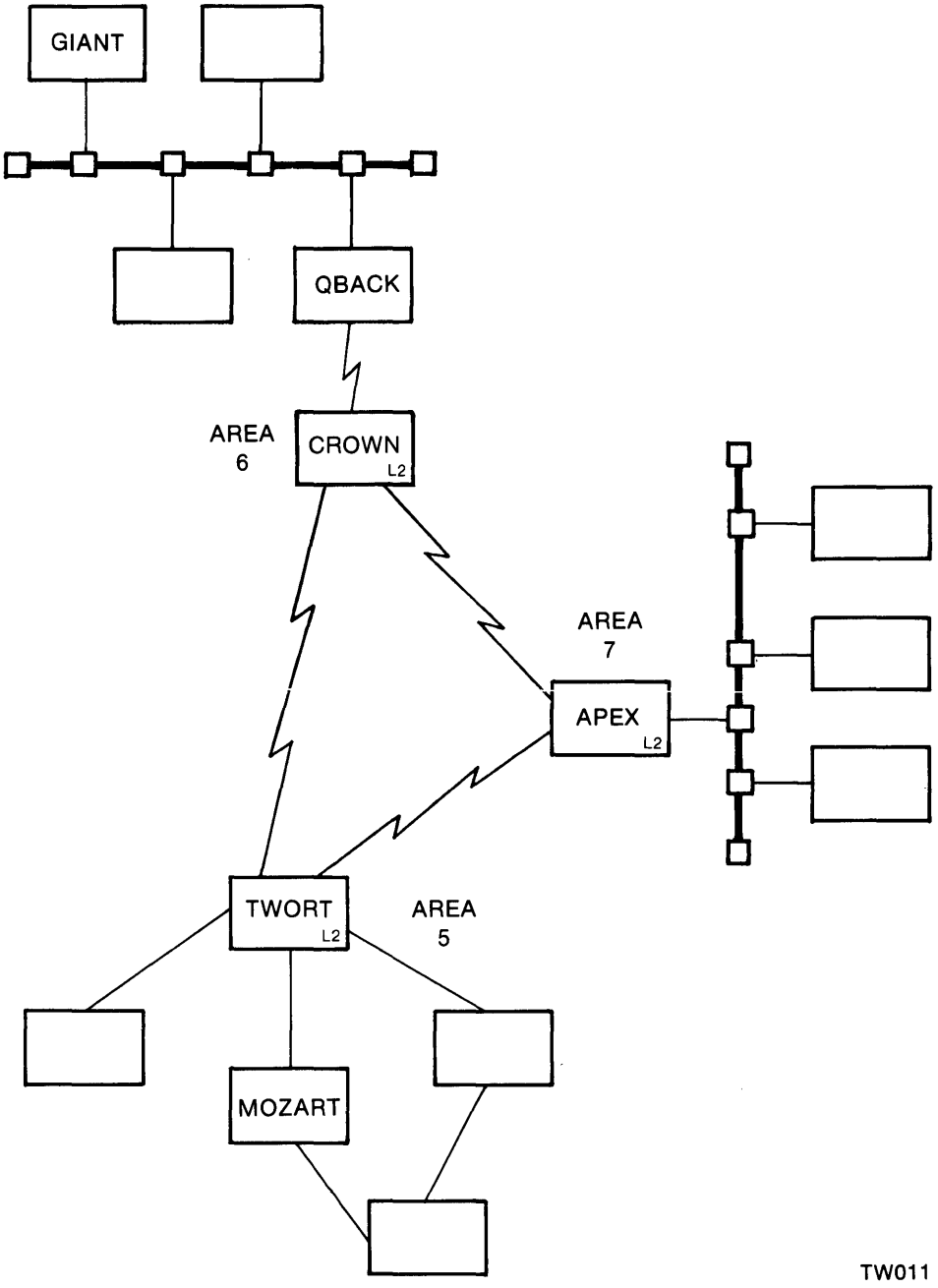

Figure 3–1: A Multiple Area Network

Area routing can benefit a network of fewer than 1023 nodes, too. For example, if you have a network of 1000 nodes, the routing overhead incurred by each routing node can become burdensome. By dividing your network into areas, such as five areas of 200 nodes each, the overhead for routing between areas will be restricted to level 2 routers only. With less routing traffic, your network will gain in efficiency. Also, by dividing your network into areas, it will be easier to manage.

As another example, suppose you have a network of fewer than 1023 nodes and many of these nodes are Phase III DECnet. Because Phase III DECnet nodes have an addressing limit of 255, many nodes will be unable to communicate with each other. You can divide the larger network into groups (areas) of nodes, each group containing fewer than 255 nodes. Keeping in mind that the Phase III nodes can communicate with nodes in the same area only, assign to each area those nodes that need to communicate with each other. To ensure that all the Phase III nodes within an area can communicate with each other, renumber all nodes in the area so that all node numbers are less than 255. Section 3.3.2.2 provides rules you should follow when setting up a multiple area network that includes Phase III nodes.

Other advantages of area routing have been described in previous sections of this manual. The following section describes the properties and functions of level 1 and level 2 routers within a multiple area network.

3.3.1 Level 1 and Level 2 Routers

An area can contain many level 1 routers and end nodes, and must contain at least one level 2 router to provide the connection to other areas. A level 1 router keeps information on the state of nodes within its own area. It cannot have any circuits outside its own area. Level 1 routing nodes and end nodes access nodes in other areas through a level 2 router residing in their own area.

A level 2 router keeps information on the state of nodes in its own area and also information on the cost and hops involved in reaching other areas. The level 2 router always routes data over the least cost path to a destination area. Level 2 routers have the following characteristics:

- Level 2 routers connect areas together.
- Level 2 routers also act as level 1 routers within their own area.
- Each level 2 router in a network must be physically connected to at least one other level 2 router. All level 2 routers must be connected in such a way that they create a network of their own. (See Figure 3–1.) Within an area, there must be a level 2 path between any pair of level 2 routers.

  When a level 2 router finds that it has no links to other level 2 routers, (either in its own area or in other areas), it automatically stops claiming to be a level 2 router. It functions as a level 1 router only. Conversely, when the level 2 router finds that links to other areas are active, it begins to claim to be a level 2 router.
- Level 2 routers exchange level 2 routing messages among themselves.
- In any given area, there can be more than one level 2 router.
- Each level 1 node decides which level 2 router is nearest on the basis of cost.

You should configure several level 2 routers in the same area to provide redundancy. In this way, when one of the routers is unavailable, routing to and from other areas can continue through the other level 2 router(s). Provide for alternate paths between nodes in the same area so that the loss of one path does not prevent the flow of level 2 routing traffic through the area.

Note that if two or more level 2 routers exist in the same area, each level 1 router sends data destined for other areas to the nearest level 2 router. The level 1 router selects the nearest level 2 router on the basis of path cost to the level 2 router, irrespective of which level 2 router is closest to the destination area. The level 1 router has no access to this information.

3.3.2 Configuring a Multiple Area Network

You can divide a network into a maximum of 62 areas, with each area containing up to 1023 nodes. Areas must be distinct: a node cannot belong to more than one area.

Assign an area number (integer) to each area, starting with 2 and incrementing by 1. (Area 1 can be used. However, it is recommended that you do not use area 1 in multiple area networks. Area 1 is reserved for networks without area support or in transition to multiple areas.) Note that the node number must be unique within an area, but may be used again within another area. Thus, node identification within one area is independent of node identification in another area. If you combine two or more networks to form a multiple area network, you do not have to renumber all the nodes to maintain their unique identities. For example, node 211 in area 3 is identified as 3.211, while a node 211 in area 16 is uniquely identified as 16.211.

To add area support to a standard network, follow the steps outlined in Section 3.3.2.1. Section 3.3.2.2 contains guidelines for designing multiple area networks. Follow these guidelines whether you are upgrading a standard network or building a multiple area network from scratch.

3.3.2.1 Upgrading a Single Area Network to a Multiple Area Network — Converting an existing single area network to a multiple area network requires careful planning. Because the network addresses of existing nodes will change, there may be a period of partial connectivity while the conversion is underway. To upgrade a standard network to a multiple area network, follow these three steps:

1 Decide on the new network topology, using all the guidelines in Section 3.3.2.2. Decide which nodes should be level 2 routers, level 1 routers, and end nodes.

2 If the new design entails repositioning nodes, make the required changes before you begin converting node addresses. For example, the redesign may require reconnecting a Phase III node so that it is not in a path between two Phase IV nodes.

3 Create new node databases, reflecting the new layout. The major changes are discussed below. (On VMS nodes, this can be done in a separate directory using logical names so that the current database will not be disturbed until you are ready to replace it.) The major changes to make to the permanent database of each node are:

- Establish area support on each node, starting with the level 2 routers. Establish area support by redefining each node's address to correctly reflect its area. For the DECnet Router Server, you do not have to redefine its node address manually. First, redefine the node address of the server's host in the down-line load database of the loading host, then reload the server. The server's node address automatically takes on the area number of the host. If you want to define your DECnet Router Server as a level 2 router, then before reloading the server software enable the area routing commands in the router configuration file, as explained in Section 4.3.1.

  To redefine the node address of a VMS system to reflect the area in which it resides, use the NCP DEFINE EXECUTOR ADDRESS command. The DEFINE command sets the address in the node's permanent database. For the address to take effect in the volatile database, you must bring the network down and back up again. Use either the SET EXECUTOR STATE SHUT or SET EXECUTOR STATE OFF command to bring the network down. When you use the SET EXECUTOR STATE SHUT command, communications on all currently established links are allowed to complete before the network comes down. The SET EXECUTOR STATE OFF command brings the network down immediately.

  For example, if node 211 is assigned to area 16, redefine the node address by typing the following commands at the node:

```
$ NCP> DEFINE EXECUTOR ADDRESS 16.211 (RET)
$ NCP> SET EXECUTOR STATE SHUT (RET)
```

  Then type the following to bring the network up again:

```
$ @STARTNET (RET)
```

  To redefine the node address of an RSX host node, use the CFE DEFINE EXECUTOR ADDRESS command and reload DECnet on the node.

- Define the level 2 routers. Any DECnet Phase IV routing node can be upgraded to a level 2 router. Level 1 and level 2 routers are distinguished by the TYPE parameter in the node's executor database. The node type of level 1 routers is ROUTING IV. The node type of level 2 routers is AREA. On the DECnet Router Server, the parameter is automatically set up after you load the software. To establish the DECnet Router Server as a level 2 router, enable the area routing commands in the router configuration file before you load the software, as explained in Section 4.3.1.

  To define a VMS host system as a level 2 router, type the following commands:

```
NCP> DEFINE EXECUTOR TYPE AREA (RET)
NCP> SET EXECUTOR STATE SHUT (RET)
NCP> SET EXECUTOR TYPE AREA (RET)
NCP> SET EXECUTOR STATE ON (RET)
```

  The DEFINE EXECUTOR command defines the routing type in the executor's permanent database. The SET EXECUTOR command defines it in the executor's volatile database. As shown, you must bring the network down (SET EXECUTOR STATE SHUT) before using the SET EXECUTOR command, then bring the network back up again afterward.

  To define an RSX host system as a level 2 router, regenerate the node and specify the routing type during the generation procedure.

- On each node, redefine the remote node names, assigning the correct area numbers for the network. This step is unnecessary for the DECnet Router Server node.

- Define transmit passwords for Phase III nodes connected to Phase IV nodes. The transmit password on the Phase III node must match the receive password for the adjacent Phase IV node. See the discussion in item 9 of Section 3.3.2.2

NOTE

For VMS systems, you do not have to reboot the operating system to activate the changes in the permanent database. You merely shut down DECnet and bring it up again. Use the following command to bring down the DECnet:

NCP SET EXECUTOR STATE SHUT

Type the following command to bring it up again:

$@STARTNET

4 If you can take down an entire network or area to upgrade each node, do so. If you cannot shut down all nodes simultaneously, such as in an environment that cannot tolerate massive disruption of the network, some nodes will not be able to interconnect until all nodes have been brought up with the new database.

   Note that if your node is on an Ethernet to which applications other than DECnet are connected, such as the Local Area Transport (LAT) protocol used for communication with Terminal Servers, these applications should also be shut down along with DECnet, and then restarted after DECnet is restarted. This step is necessary because DECnet will be changing the Ethernet physical address of your node to reflect the new executor node address.

5 Use NCP SHOW commands to monitor the reconfigured network. (See Appendix C for command format summaries. For more information, refer to the *DECnet Router Software Management Guide*.)

Depending on the size of the network and the care with which the conversion is done, there may be a period of debugging the network to ensure that the desired level of connectivity has been achieved. You can simplify debugging the conversion if you can run each area separately for a while before connecting them together. You can do this by turning off the circuits between level 2 routers in different areas. Once you are confident that an area is operating to your satisfaction, you can turn on the circuits joining this area to its neighboring areas. Of course, while the interarea circuits are off, nodes in those areas will not be accessible. View this circumstance as a tradeoff to reduce the number of variables during conversion.

3.3.2.2 Designing Multiple Area Networks — Use the following guidelines when designing multiple area networks.

1 First, design the level 2 routers, area by area, into a level 2 subnetwork. Then, in each area, add the level 1 routers. Finally, add the end nodes required to complete each area. Do not connect the areas together until you have configured all areas in the network, as explained previously, and they are running and stable.

2 Each node must belong to one area only. This applies to Phase III and Phase IV nodes alike.

3 Only level 2 routers can be one hop away from a node in another area. That is, only level 2 routers can have a link connecting any two areas.

4 The network of level 2 routers must be physically intact. Paths between any two level 2 routers should include level 2 routers only. If a path includes a level 1 router, the level 2 routers will not be able to exchange level 2 routing information because level 1 routers filter out such information.

5 Configure all level 2 routers as a "backbone" network, then tie all of the areas to it. Remember that the level 2 routers must form a subnetwork so that each level 2 router directly connects to another level 2 router. Level 1 routers or Phase III nodes cannot form a part of the path between two level 2 routers. To ensure reliable area routing, provide more than one path between level 2 routers within the same area. (See Section 3.3.3.1.)

6 Treat each area as a separate network. Connect each node in an area so that it can communicate with all other nodes within the same area. The nodes need not be physically adjacent, but should have at least one physical path that lies totally within the area. Each area must be physically intact. Do not have overlapping areas.

7 Provide enough redundancy in each area to handle failures of links and nodes. As mentioned in Section 3.3.1, it is advisable to set up several level 2 routers in each area to prevent disruption of area routing when a single level 2 router goes down.

8 All Phase III routing nodes are treated as level 1 routing nodes, with some important restrictions:

- All Phase III nodes (both routing and nonrouting) can communicate only with nodes within the same area. Phase III nodes must not have any circuits that cross over to other areas. In other words, a Phase III routing node must not have direct connections to (that is, should not be one hop away from) nodes in other areas.
- All Phase III routing nodes can communicate only with nodes for which they can maintain routing information. Phase III nodes cannot address nodes with a node address greater than 255. Therefore, Phase IV nodes with an address greater than 255 are "invisible" to Phase III nodes in the same area. As explained previously, this is a good reason to break a network into areas (each area not exceeding 255 nodes), even if the network contains fewer than 1023 nodes.
- Place all Phase III nodes on the periphery of the network. Avoid having a Phase III node on a path between two Phase IV nodes with addresses exceeding 255. Phase III nodes cannot be connected directly to an Ethernet.

Section 3.3.3.2 describes in further detail restrictions applying when Phase III nodes are included in a multiple area network.

9 It is possible for communications to occur inadvertently across area boundaries. This can happen when a Phase III node is connected to a node outside its own area. For example, node DAMION in Figure 3–2 is a Phase III node with a link between areas 3 and 4. Because of the way a Phase III link handles an incoming node address (it drops the area number), DAMION will build a routing database containing nodes ABLE, CANE, and EAGLE, including their node addresses minus their area numbers.

DAMION will send routing updates about ABLE and CANE across the area boundary to EAGLE. Because the node addresses of ABLE and CANE sent to EAGLE will not include the area number, EAGLE will think that ABLE and CANE are in its own area. Likewise, ABLE and CANE will think EAGLE is in their own area. In this way, nodes ABLE and CANE will be able to communicate with EAGLE, and vice versa. Though this kind of configuration actually works in some cases, it can pose difficulties to troubleshooters when it does not work. Therefore, *do not configure your network in this way.*

Phase IV DECnet provides a way for you to prevent such interarea leakage as described above. Before a link can be established between a Phase III and Phase IV node, the Phase IV node requires a node level password (transmit password) from the Phase III node. If the Phase IV node does not receive the required password, the link will not be established (the circuit will not come up). The event-logging facility records this as an error message, indicating that a password is required or is mismatched.

This helps you locate interarea links between Phase III and Phase IV nodes. You can learn which Phase III nodes have not been initialized. You can use this information to prevent Phase III nodes from linking to nodes outside their own areas, or to identify which Phase III nodes need to have the transmit password set. Note that this technique will not locate Phase III nodes that are improperly linked to nodes in other areas if the Phase III nodes were configured using node level passwords prior to area conversion.

Thus, when you are sure your network is configured properly, define transmit passwords for all Phase III nodes and receive passwords for Phase IV nodes. Section 4.3.1 explains how to define the receive and transmit passwords for your DECnet Router Server. The server's receive password should match the transmit password of any Phase III node connected to it.

10 Areas should reflect expected traffic flow. That is, assign nodes to areas according to the frequency of their intercommunications or their likeness of logical functions. Although this guideline is not as strict as the previous ones, by following it you will greatly improve overall network performance. Routing within areas is less costly than routing between areas. Thus, areas should reflect not only physical proximity of nodes, but a combination of physical and logical proximity.

11 Do not use areas to enforce protection. Although at first glance the concept of areas seems to offer penetration protection across areas, the DNA architecture does not specify protection guarantees for areas. (See Figure 3–2 and the discussion of area leakage, above). Therefore, do not assume such guarantees when you set up your multiple area network.

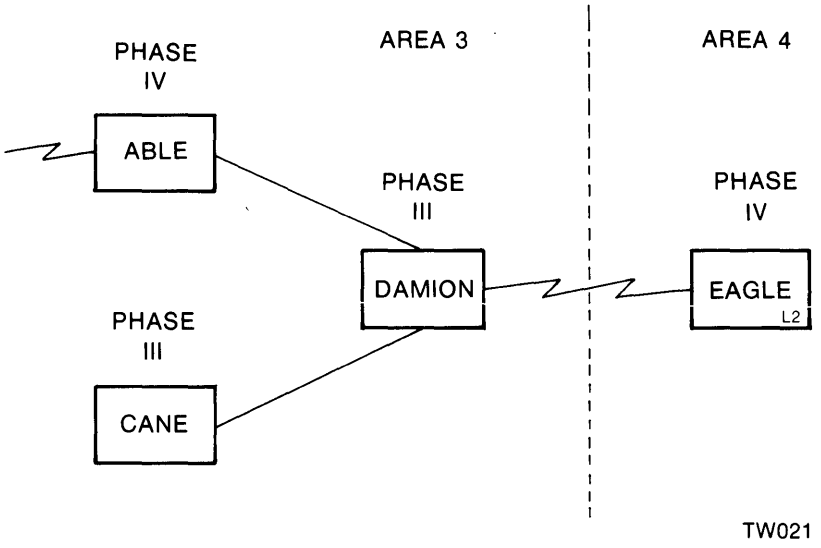

Figure 3–2: Area Leakage

3.3.2.3 Area Routing on an Ethernet — You can set up multiple areas on an Ethernet; all the nodes on a single Ethernet do not have to be in the same area. However, try avoiding such configurations where possible; otherwise, the message overhead for routing nodes on the Ethernet increases significantly. When two end nodes or level 1 routing nodes on an Ethernet are configured in different areas, the nodes do not communicate directly with each other. Each node first communicates with a level 2 router in its own area, which sends the message to a level 2 router in the other area. That level 2 router then transmits the message to the destination node.

3.3.2.4 Area Parameters — The following parameters must be defined on all level 2 routing nodes.

MAXIMUM AREA

This limits the number of areas that the node will recognize.

MAXIMUM AREA COST

The node uses this parameter to control the total path cost between itself and the nearest level 2 router of each area.

MAXIMUM AREA HOPS

This parameter sets the maximum number of hops that a message can make between itself and the nearest level 2 router of each area.

Chapter 4 (Section 4.3.1) explains how to define these parameters for the DECnet Router Server. See the appropriate host system DECnet documentation for information about defining these on VMS or RSX host systems.

Use the NCP SHOW EXECUTOR CHARACTERISTICS command to display the current values of these parameters in the volatile database of a node. You can use the NCP SHOW AREA command to obtain information about areas known to a node. The *DECnet Router Software Management Guide* explains how to use these NCP SHOW commands.

3.3.3 Problems in Configuring Multiple Area Networks

This section includes some typical problems that may arise when configuring a multiple area network and offers some suggestions to help you avoid and fix those problems.

3.3.3.1 Improper Configuration of Routing Nodes within an Area — If a multiple area network is configured improperly, network traffic may be routed incorrectly or lost. Figure 3–3 shows an improperly configured area in which a node can be isolated within an area. This problem is called **area partitioning**, where an area is vulnerable to partitioning as a result of failure of a single line.

Assuming each link cost is 1, then if link c or d is down, the following can happen: Assume we want data sent from node YAP in area 3 to node ZILOG in area 4. The level 2 router in area 3, XYLO, will determine the least cost path to a level 2 router in area 4, which is the path from YAP to XYLO to WHIRL. But, if link c or d is down, then ZILOG will be isolated. On an initial attempt to connect to ZILOG, YAP will receive a "Node unreachable" message. If link c or d breaks after YAP and ZILOG have established a link, a timeout will occur.

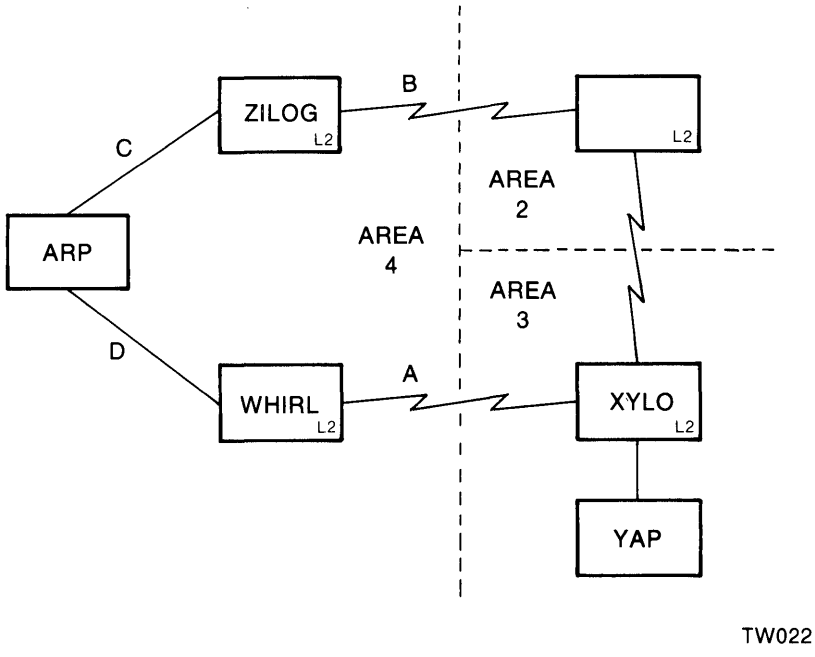

Figure 3–3: Improper Router Configuration within an Area

Another problem can occur with the configuration shown in Figure 3–3. If link d is down and node ZILOG wishes to create a link to node XYLO, node ZILOG will choose a path through area 2 and then to XYLO. However, when XYLO tries to send a return message, the same problem will occur as described above.

To prevent the above problems when configuring your area network, remember to treat each area as a separate network. Where possible, each node should have alternate paths to other nodes, and all level 2 routers in an area should be connected by level 2 paths. In Figure 3–3, the network in area 4 is poorly configured because only one path can be used by each node to reach another node in its area. Also, a level 1 router is on the path between two level 2 routers (ARP is between ZILOG and WHIRL). One way to fix the above problems is to install a link between ZILOG and WHIRL.

3.3.3.2 Phase III and Phase IV Coexistence — As mentioned previously, try to upgrade all Phase III nodes to Phase IV where possible. If you must have Phase III nodes, be careful how you configure them. Section 3.3.2.2 has shown what happens when you set up a Phase III node with a link into another area (Figure 3–2). The following shows the problems that occur when you place a Phase III routing node on a path between two Phase IV nodes. To understand the cause of these problems, you should understand how a Phase III node or link behaves within a network that supports area routing. Phase III nodes do not know anything about areas. Therefore, when data to or from another area is routed through a Phase III node, the consequences can be unpredictable.

Whenever a Phase III node links with a Phase IV node in an area based network, the physical link is initialized with the Phase III protocol and all references to the area number of nodes are dropped. This affects the network in two ways:

1 If the traffic is going from the Phase IV node with area routing to the Phase III node, the area designation is dropped. For example, if the address for node 5.167 is passed to a Phase III node, the address will become node 167 and the Phase III node will pass it on that way.

2 If the traffic is coming from a Phase III node to a Phase IV node, the Phase IV node adds its own area number to the address of the destination node. For example, if the address for destination node 8.167 is passed to a Phase III node, the Phase III node drops the area designation, passing on the node address of 167 to the Phase IV node. If the address of the Phase IV node is 32.2, the node address of the destination node becomes 32.167. Of course, if the destination node is in the same area as the Phase IV node, the traffic would reach its proper destination.

Referring to Figure 3–4, the following shows what may happen when a Phase III node is placed between two Phase IV nodes: If node SALES (node address 4.45) wants to communicate with node ACCNT (node address 4.88), data first goes to the Phase III node CHECK, which has a node address of 22 (no area number for Phase III nodes). Node CHECK drops the area number from the destination address of the data; that is, ACCNT's node address becomes 88. Then CHECK routes the data to ACCNT. ACCNT adds its own area number to the node address. The destination address becomes 4.88. Because the entire path is within the same area, no problem results.

However, if node WAREH (node address 2.72) wants to send data to node SALES (4.45), the following happens: Because these two nodes are in different areas, WAREH sends the data to the nearest level 2 router in the destination area, which is node ACCNT. In turn, ACCNT routes the data to the Phase III node, CHECK, where all references to area addresses are dropped. CHECK sends the data to SALES with no problem. But, the problem arises when SALES tries sending a message back to WAREH: to send the message to WAREH, SALES must locate the nearest level 2 router. SALES depends on node CHECK for information about level 2 routers. But, because CHECK is a PHASE III node, no such information is available. Therefore, SALES will not forward the message to CHECK. Eventually, node WAREH will timeout while waiting for a response from SALES.

To avoid this problem, switch the locations of nodes SALES and CHECK so that CHECK is not between the two Phase IV nodes.

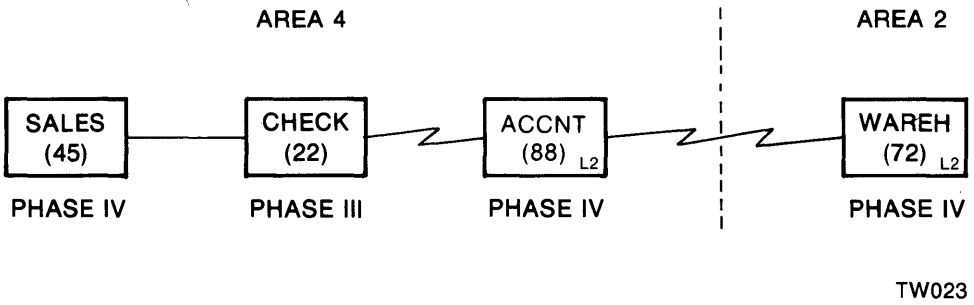

Figure 3–4: Improper Configuration of Phase III and Phase IV Nodes

4
Configuring the DECnet Router Server

When you load the Communications Server hardware unit, DECnet Router Server initialization tasks read the network and router configuration files from the loading host. The tasks use the information contained in these files to set up the DECnet Router Server configuration.

In Chapter 2, you defined parameters contained in these files. Ideally, the parameter values should match the needs of your configuration. If you define values that are too large or too small, you can waste server resources or inhibit server performance. After loading the server, you can change parameter values to fine tune your server and to reflect the changing needs of your configuration. To change parameter values in the configuration files, use any text editor on the host system. After you change values in the files, you must reload the server for the changes to take effect. This chapter describes parameters in each of the configuration files and explains how to edit them. This chapter also describes the parameters that you must define to set up your DECnet Router Server as a level 2 router for routing in a multiple area network. (Chapter 3 explains how to set up a multiple area network.)

Both configuration files consist of commands whose format is similar to that of DECnet network management commands. However, these commands are not network management commands. These commands are interpreted by the initialization tasks, not by network management. Sample files are shown in sections to follow and in Appendix B.

NOTE

After editing configuration files, make sure that the files have world read access. You are advised to protect your configuration files from being changed, deleted, or copied by unauthorized users. See Section 5.5.

During installation, the files are created with the following names and stored on all potential loading hosts. Do not change these names. The files reside in the PLUTO account on these hosts.

Network Configuration File: *server-node-id*SB.CFG

Router Configuration File: *server-node-id*RTR.CFG

where

server-node-id is the node name of the DECnet Router Server.

Section 4.4 explains how the DECnet Router Server software handles errors found in the configuration files.

4.1 Editing the Network Configuration File

The network configuration file contains commands that set up the following parameters:

- The UNA password
- The network privileged password
- The clock frequency for the DECnet Router Server node
- A list of backup hosts

The following subsections describe the commands and parameters contained in the network configuration file and how to change them. Example 4–1, located in Section 4.1.5, shows a sample configuration file. The order in which commands appear in the file is arbitrary.

4.1.1 Defining the UNA Password

The UNA password prevents unauthorized users or nodes from reloading the server software. When the software is loaded, it reads this password from the network configuration file on the loading host. Then it compares the UNA password with the service password specified with the NCP LOAD NODE or NCP TRIGGER NODE command, or if not specified, compares it with the default service password defined in the downline load database on the loading host. If these passwords do not match, the load request is ignored. To define or change the UNA password, use the following command in the network configuration file:

SET LINE UNA-0 PASSWORD *hex-password*

where

hex-password is the password, a hexadecimal number within the range of 0 and FFFFFFFFFFFFFFFF (16-digit maximum). By default, no password is set.

If you do not specify a UNA password, or if the password you specify is invalid, then the default of 0 will be set as the password for the DECnet Router Server and a service password will not be necessary for loading or triggering the server node.

4.1.2 Defining the Network Privileged Password

The network privileged password identifies the password used for access control verification at the server node. Users must specify this password when using privileged network management functions to access the server node.

To define or change the password, use the following command:

SET SYSTEM PASSWORD *password*

where *password* contains up to eight alphanumeric characters.

If you do not specify this password, or if the password you specify is invalid, then a null privileged password will be set for the server. Thus, no password will be necessary when using privileged network management functions.

4.1.3 Specifying Backup Host Nodes

Backup host nodes are nodes that the DECnet Router Server can use for recording event messages or receiving up-line crash dumps whenever its primary maintenance host is unavailable. You can specify a list of up to five backup hosts.

Whenever the DECnet Router Server needs to use a backup host, it requests access to the first backup host specified in this list. If that host is not available, the server requests access to the next node in the list, and so on.

If none of the backup hosts are available to receive an event message, the event message is not recorded. (You can set other nodes to receive event messages generated by the DECnet Router Server. See the *DECnet Router Software Management Guide.*)

If none of the backup hosts are available to receive a crash dump, the DECnet Router Server then sends a request to the multicast address for the Ethernet. The first host to accept the dump will trigger a reload of the server.

To specify the backup nodes, use the following command in the configuration file:

SET EXECUTOR BACKUP HOSTS *name1,name2,...name5*

where

name1,name2,...name5 are the names of up to five backup nodes. In a multiple area network, they should be in the same area as the server. Each node name must consist of one to six alphanumeric characters, with at least one character being alphabetic. List the names by priority, with *name1* being the first backup host that the server will try to access and *name5* being the last. For the first backup host, choose the most reliable node (one that is usually up and running, not heavily loaded). All backup hosts should have adequate disk space for an up-line dump of server memory.

The node names must be known to the DECnet Router Server. As explained in Section 3.1.1.2, the node names known to the server are those known to its host.

The default for the backup host list is the server's host node, as identified in the down-line load database on the loading host.

To display the list of backup hosts for a running server, use the NCP SHOW EXECUTOR CHARACTERISTICS command shown in Appendix C and described in the *DECnet Router Software Management Guide.*

4.1.4 Setting the Clock Frequency

The clock frequency parameter is used by the server's internal clock. The internal clock keeps track of time and is the source for the time recorded on event logging messages. If you specify the wrong clock frequency for your DECnet Router Server, then the time recorded in event messages will be wrong.

The default clock frequency is 60 Hz and is used in the United States. You need not change the clock frequency unless the site of installation has a 50 Hz supply frequency. Installations in Europe, for example, require 50 Hz. To change the clock frequency from 60 to 50 Hz, use the following command:

SET SYSTEM LINE FREQUENCY 50

4.1.5 Sample Network Configuration File

Example 4–1 shows a sample network configuration file used for DECnet Router Server node RTRDEV.

NOTE

The network configuration files generated by the VMSINSTAL and RSXINSTAL procedures do not include comments as does the example below.

```
!        Network Configuration File - RTRDEVSB.CFG
!
!1. Defining the UNA password (viewed by hosts as the service password).
!   Default if invalid or missing: NO PASSWORD SET
        SET LINE UNA-0 PASSWORD AAFF00
!
!2. Defining the Network Privileged password (system password).
!   Default if invalid or missing: NO PASSWORD SET
        SET SYSTEM PASSWORD COME
!
!3. Setting the clock frequency to 50Hz.
!   Default if invalid or missing: 60 Hz.
        SET SYSTEM LINE FREQUENCY 60
!
!4. Backup host node list.
!   Default: server's maintenance host
        SET EXECUTOR BACKUP HOSTS EAST, WEST, NORTH, SOUTH, CENTER
```

Example 4–1: Sample Network Configuration File

4.2 Editing the Router Configuration File

The DECnet Router Server uses the router configuration file to set up the routing parameter values for the network configuration. Section 4.2.1 describes the general procedure for defining and changing parameters in the router configuration file. During installation when you specify the number of synchronous and asynchronous lines on your server, the installation procedure generates the appropriate software and router configuration file. A different configuration file is generated for each of the three possible software system configurations:

- 8-line synchronous only
- 8-synchronous/16-asynchronous
- 16-synchronous/32-asynchronous

You can use the configuration file as is, provided the defaults match your installation. Most likely you will need to tailor the file. (Appendix B includes sample unedited files for the 8-line synchronous only configuration and for the 8-/16-line configuration.) Section 4.3 lists the default values for the parameters defined in each router configuration file.

Edit the file prior to loading the DECnet Router Server so that the routing configuration suits your network installation.

NOTE

Before editing the file, save a copy of the original file. You may need the original file for troubleshooting purposes.

After loading the DECnet Router Server, you can edit the file to reconfigure or fine tune the server system. The changes do not take effect until you reload the server.

You can also use NCP commands to change certain parameters while the server software is running. These changes take effect immediately and stay in effect until the server is reloaded. The parameters you can change in this way are shown in Table 4–1 of Section 4.3. When reloaded, the default parameter values defined in the routing configuration file take effect. Appendix C lists the format for each NCP command available to you. See the *DECnet Router Software Management Guide* for details.

4.2.1 Changing Routing Parameters

The router configuration file uses the following commands to set parameters:

SET CIRCUIT
SET EXECUTOR
SET LINE

Use these commands to make permanent changes to parameter values. Reload the server after editing the file so that the values take effect.

One or more parameter keywords and their values follow each command; for example:

SET EXECUTOR MAXIMUM ADDRESS 1022

You can abbreviate commands and keywords to the first three characters. Do not abbreviate numerical parameter values. For example, abbreviate the preceding command as follows:

SET EXE MAX ADD 1022

Include comments by preceding them with a semicolon (;).

Except for the SET CIRCUIT and SET LINE commands, each command contains one parameter per line. The SET CIRCUIT and SET LINE commands may include several parameters per line, entered in any order. In addition, you can use a wildcard character (*) in SET CIRCUIT or SET LINE commands. The wildcard character allows you to set all circuits or lines to one value without specifying each circuit or line individually. This makes configuration files easier to edit. Also, if you want most of the circuits or lines to have the same value, but you want one or two to have different values, use the wildcard for a command to set the general value and then follow with additional commands for the components to be set differently. The following example shows how to set all circuits on the DECnet Router Server to the ON state, except circuit LC-4:

```
SET CIRCUIT LC-* STATE ON HELLO TIMER 10 COST 5
SET CIRCUIT LC-4 STATE OFF
```

The LC mnemonic identifies the line card on the DECnet Router Server. The next section describes how to identify each of the server lines and circuits. Section 4.3.4 includes more command examples.

Once you load and start your DECnet Router Server, you can use NCP SHOW commands to display the current values for the routing parameters in the server's running database; for example:

TELL *server-node-id* SHOW EXECUTOR

See the *DECnet Router Software Management Guide* for more details of the NCP SHOW commands.

4.2.2 Identifying Server Lines and Circuits

To identify the server's UNA circuit or line, specify UNA–0. To identify the point-to-point lines or circuits, specify the device name for line cards, LC, followed by a hyphen and the number of the slot that the line card occupies. As shown below, asynchronous lines require an additional specifier to distinguish the two lines on the card. The format for identifying lines or circuits is:

LC–*n*[L]
[R]

where

LC Is the device name used for server line cards.

n Is the unique number of the line card slot in the Ethernet Communications Server.

L Identifies the line plugged into the left side of an asynchronous line card. Do not use to identify synchronous lines.

R Identifies the line plugged into the right side of an asynchronous line card. Do not use to identify synchronous lines.

Figure 4–1 shows a Communications Server with eight synchronous lines. The first eight line card slots are numbered in the figure. The slots are numbered left to right, from top to bottom, beginning with 1. Odd-numbered cards are on the left half of the Communications Server and even-numbered are on the right. As shown in the figure, identify the synchronous line connected to the card in slot 2 as LC–2. The figure also shows the numbering scheme for the maximum configuration of 16 synchronous lines.

Figure 4–2 shows a Communications Server with 16 asynchronous lines. As shown, identify the two asynchronous lines connected to the card in slot 2 as LC–2L and LC–2R. The figure shows the numbering scheme for the maximum configuration of 32 asynchronous lines. Remember that your server can have both synchronous and asynchronous line cards, as shown in Figure 1–3.

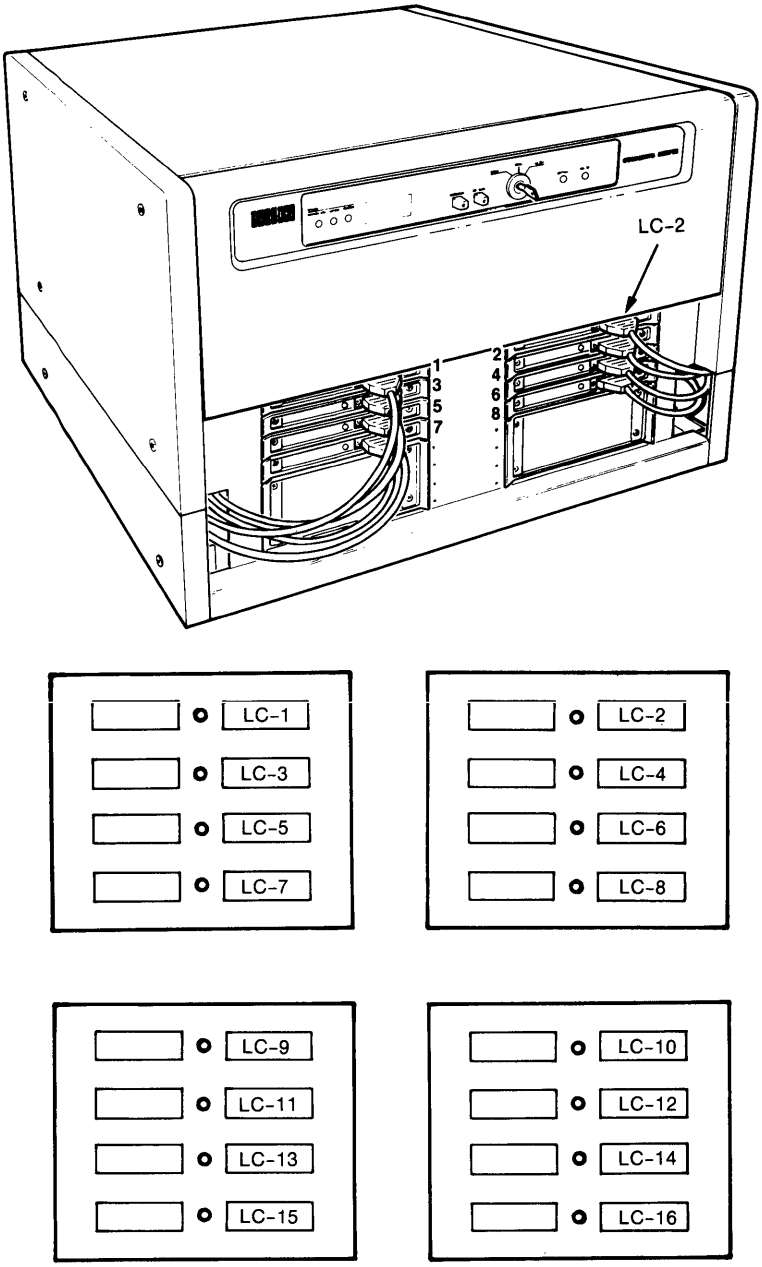

Figure 4–1: Numbering Scheme for Synchronous Lines

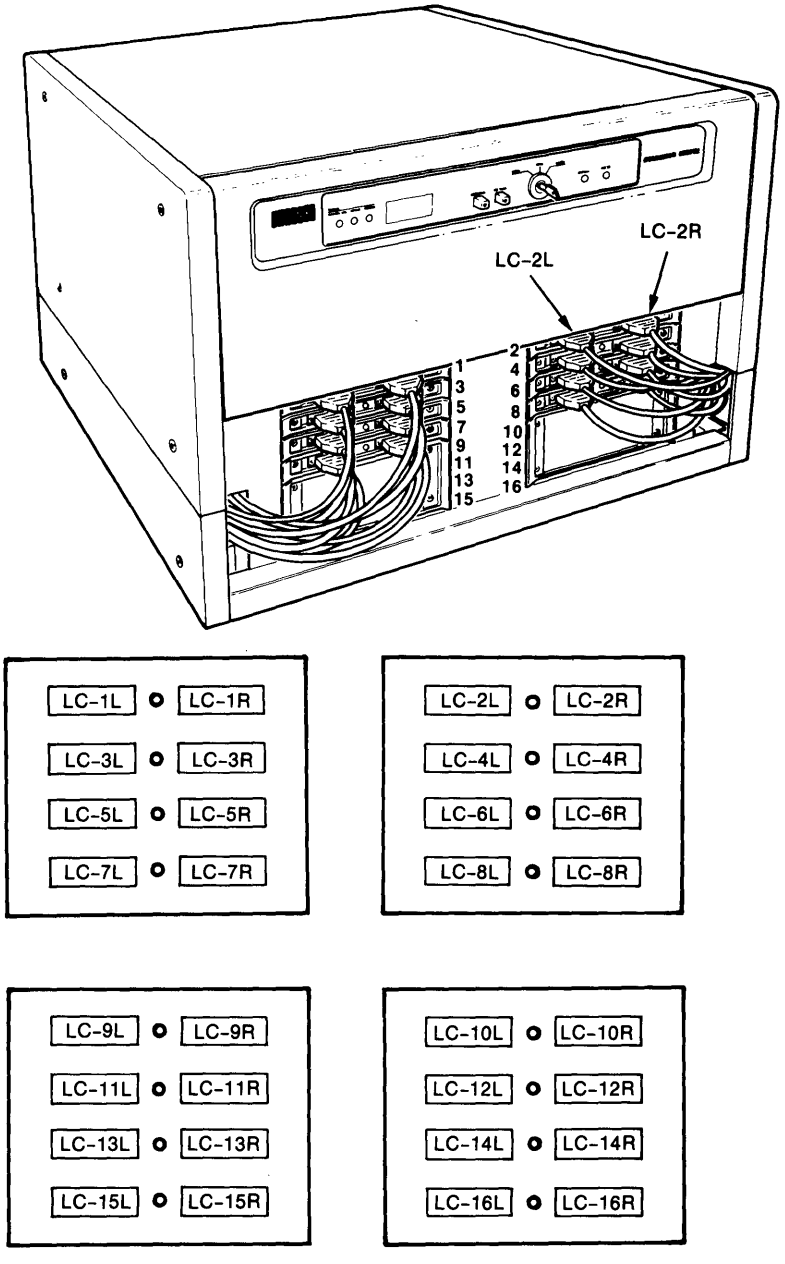

Figure 4–2: Numbering Scheme for Asynchronous Lines

4.3 DECnet Router Server Parameters

The following sections describe the commands and parameters that define the routing configuration for the DECnet Router Server. Each subsection describes the commands and parameters applicable to one of the network components that make up the configuration:

Executor node (the server)	Section 4.3.1
Circuit	Section 4.3.2
Line	Section 4.3.3

Table 4–1 lists the parameters that you can define or change for each component and their defaults. Parameters that you can change while the DECnet Router Server is running are preceded by an asterisk (*). Use the NCP SET commands shown in Appendix C and described in the *DECnet Router Software Management Guide*. Remember that changes made to the running database stay in effect until the server is reloaded. To make the changes permanent, you must edit the configuration file.

Parameters that you use to define the DECnet Router Server as a level 2 router in a multiple area network are preceded by an at sign (@). If you want your DECnet Router Server to be a level 2 router, assign the desired values to these parameters. Activate the command lines that include these parameters by removing the comment specifiers (";") that precede them.

If you use the unedited router configuration file supplied with the distribution kit, the defaults listed in Table 4–1 are the values that will be used by the DECnet Router Server. Appendix B includes two unedited router configuration files, one for the 8-line synchronous only system configuration, and one for the 8-line synchronous/16-line asynchronous system configuration.

4.3.1 Executor (Server) Node Parameters

The following describes the parameters for the server node as the executor.

4.3.1.1 BUFFER SIZE — This parameter specifies the size for buffers used by the DECnet Router Server for intermediate storage of user data being received and forwarded to adjacent nodes. This parameter also controls the maximum segment size of all messages received by the server node. The segment size, minus a 24-byte DECnet header, is the largest block of message data that can be transmitted over a physical line. (Note: This physical limitation does not restrict the size of user messages. If the message being transferred exceeds the segment size, DECnet divides the message into the necessary number of segments. The segments are transmitted to the destination node and the message is reconstructed.)

Table 4–1: Component Parameters

Component	Parameter	Default
EXECUTOR	BUFFER SIZE	576
	MAXIMUM ADDRESS	255
	@ MAXIMUM AREA	63
	@ MAXIMUM AREA COST	1022
	@ MAXIMUM AREA HOPS	20
	MAXIMUM COST	1022
	MAXIMUM HOPS	20
	MAXIMUM BROADCAST NONROUTERS	32
	MAXIMUM BROADCAST ROUTERS	10
	* RECEIVE PASSWORD	null
	SEGMENT BUFFER SIZE	576
	* TRANSMIT PASSWORD	null
CIRCUIT	* COST	1
	HELLO TIMER	15
	ROUTING PRIORITY	100
	* STATE	OFF
LINE	SPEED	9600
	DUPLEX	FULL
	MODEM	YES

Section 4.3.4 includes sample router configuration files.

The buffer size for the DECnet Router Server should be equal to the size used by other nodes in the network. If the buffer size for the server is smaller than that of another node that uses the server to forward messages to a destination node, the server may not forward the entire message. If the buffer size is larger than that of another node, buffer space will be wasted, and processes may have to wait for buffers to become available.

WARNING

All nodes in the network should have the same buffer size.

Trade-offs: Consider the following when selecting the buffer size:

1 The record-blocking factors (transmission segment size) used by application programs.

  Most file transfer operations never send messages greater than 576 bytes. Therefore, a buffer size that exceeds this value would not be useful. If possible, select a buffer size (plus the DECnet header size of 24 bytes) that is an even multiple of the record size used by application programs.

  For example, when application programs block data into 256-byte records, a buffer size of 256 bytes is not appropriate. DECnet adds a 24-byte header to each segment, and thus must split each record into two segments to transmit it. One segment would have 232 bytes of data plus the 24-byte header, and the next segment would have only the remaining 24 bytes of the record data plus the header. This uses segments inefficiently and needs more memory for buffer space. It is better to increase the buffer size to 280 (256 plus 24) bytes, giving a larger segment size so that each record can be accommodated without splitting. You may or may not wish to have a larger buffer size, for the reasons indicated below.

2 The error rate of the communication lines.

  If any lines are prone to errors, specify a smaller buffer size (256 bytes) to reduce the probability and cost of retransmissions over those lines.

3 Your throughput requirements.

  High speed lines perform better with large buffers and large message segments because fewer messages must be processed. (This may not apply to lines that are error prone, as mentioned above.)

  A large buffer size is also good for bulk data transfers. Consider this if your server will be processing a high volume of network file transfers. However, note that a large buffer size reduces the number of buffers available. Consequently, with less buffers, processes may have to wait for buffers to become available.

Format: To specify a buffer size, use the following command in the router configuration file:

SET EXECUTOR BUFFER SIZE *size*

where *size* is the buffer size in bytes, in the range 246 to 1484. The *size* value must be a multiple of four. If the value you specify is not a multiple of four, then the DECnet Router Server will automatically increase the buffer size to the next largest multiple of four. The server logs an event message informing you of this. The default buffer size is 576.

4.3.1.2 MAXIMUM ADDRESS — This parameter defines the largest node address (number) and, consequently, the greatest number of nodes that can be addressed by the DECnet Router Server in its own area. The value defines the size of the routing database. The range of possible values is 2 to 1023. All nodes in the network should have the same maximum address.

Do not specify a maximum address less than the DECnet Router Server's node number or the host node's number. Otherwise, the server automatically sets the maximum address to the default, which is 255, or to the larger of the two numbers if they are greater than 255. If the maximum address is less than the node number of any other nodes, those nodes will be excluded from the routing database. The server will not forward messages to those nodes.

Trade-offs: Choose the lowest address possible that exceeds all other node addresses in the network. To ensure the smallest maximum address, node numbers should be assigned starting with 1 and incremented by 1. The higher the value you choose, the greater will be the routing overhead for the server's memory and central processing unit. The maximum number of nodes in the network depends on the number of broadcasting routers specified in the router configuration file. The values for these are limited by DNA restrictions and by the size restrictions for the DECnet Router Server's routing database. The following formula defines the limits for these entities:

(Max Addr) * ((3.5 + no. of lines) + no. broadcast routers) $\leq$24500

The number of lines can be either 8, 16, or 32, depending on which system image is used. A **broadcast router** is a routing node on the same Ethernet as the server. The formula above assumes the maximum configuration for a maximum node address of 1023, 9 active lines, and 12 broadcast routers. Once your network reaches the maximum configuration, if you increase the number of nodes in the network, you must decrease the number of broadcast routers. Likewise, if you decrease the number of nodes, you can increase the number of broadcast routers.

Format: To set the maximum address, use the following command in the router configuration file:

SET EXECUTOR MAXIMUM ADDRESS *address*

where *address* is in the range of 2 to 1023.

4.3.1.3 MAXIMUM AREA — If you want your DECnet Router Server to be a level 2 router in a multiple area network, use this parameter to limit the number of areas that the server will recognize. The range of possible values is 2 to 63. All level 2 routers in the network should have the same maximum.

Do not specify a maximum area value less than the DECnet Router Server's area number or the host node's area number. Otherwise, the server automatically sets the maximum area to the default, which is 63.

By default, the DECnet Router Server is set for level 1 routing only. The command line in the configuration file that defines the maximum area parameter is preceded by a semicolon (;), which makes the line a comment instead of a command to be processed. To set up the DECnet Router Server as a level 2 router, delete the semicolon. If necessary, change the value of the maximum address parameter to suit your network. (The predefined value is 63.)

Trade-offs: Choose the lowest area number possible that exceeds all other area numbers in the network. To ensure the smallest maximum area, area numbers should be assigned starting with 1 and incremented by 1. The higher the value you choose, the greater will be the routing overhead for the server's memory and central processing unit.

Format: To set the maximum area, use the following command in the router configuration file:

SET EXECUTOR MAXIMUM AREA *number*

where *number* is in the range of 1 to 63.

Remember to delete the semicolon that precedes the command line in the configuration file provided with the distribution kit. If you do not want your DECnet Router Server to be a level 2 router, this command should be preceded by the semicolon. (The server initialization task will see the command as a comment and will not process the command.) Do not delete the command. You may decide to use your DECnet Router Server as a level 2 router at a later time.

4.3.1.4 MAXIMUM AREA COST — If you want your DECnet Router Server to be a level 2 router in a multiple area network, use this parameter to control the total path cost between the server and any other area in the whole network. The total path cost between areas is the sum of the routing path costs along a path between level 2 routers. The DECnet Router Server uses the maximum area cost parameter to find out if an area in the network is reachable. An area is unreachable if the cost to get to the closest level 2 router in that area exceeds the value of this parameter.

Select a maximum path cost that is large enough to include all the areas that you want to be reachable.

By default, the DECnet Router Server is set up as a level 1 router. In the configuration file supplied with your distribution kit, the command line defining the maximum cost parameter is preceded by a semicolon. When the configuration file is processed, the server initialization task will treat this line as a comment. If you wish to set up your DECnet Router Server as a level 2 router, remove the semicolon. Also, if necessary, change the value of the maximum cost parameter to suit your network. The default is 1022.

Trade-offs: This parameter serves to limit the size of the reachable network. If you set a high value, the DECnet Router Server can reach more areas. If you have an extremely large network that includes areas with which communications will be infrequent and unnecessary, use this parameter to exclude these areas from the DECnet Router Server's reachable network. That is, set the parameter to a value that is less than the total path cost required to reach any of the level 2 routers in those areas. There is no drawback if you choose all areas to be reachable.

Format: To set the maximum area cost, use the following command in the router configuration file:

SET EXECUTOR MAXIMUM AREA COST *cost*

where *cost* is in the range of 2 to 1022. The default is 1022. Remember to delete the semicolon that precedes the command line in the configuration file provided with the distribution kit. If you do not want your DECnet Router Server to be a level 2 router, do not delete the semicolon. Do not delete the command. You may decide to use your DECnet Router Server as a level 2 router at a later time.

4.3.1.5 MAXIMUM AREA HOPS — If you want your server to be a level 2 router in a multiple area network, use this parameter to set the maximum number of hops that a message can make between the DECnet Router Server and any other area in the whole network. A hop is the logical distance over a line between two adjacent nodes. The DECnet Router Server uses this parameter to find out if an area in the network is reachable. An area is unreachable if the number of hops needed to get to the closest level 2 router in that area exceeds the value of this parameter.

The value of this parameter should always be large enough to include all the areas that you want to be reachable.

By default, the DECnet Router Server is set up as a level 1 router. In the configuration file supplied with your distribution kit, the command line defining the maximum hops parameter is preceded by a semicolon. When the configuration file is processed, the server initialization task will treat this line as a comment. If you wish to set up your DECnet Router Server as a level 2 router, remove the semicolon. Also, if necessary, change the value of the maximum hops parameter to suit your network. The default is 20.

Trade-offs: This parameter serves to limit the size of the reachable network. If you set a high value, the DECnet Router Server can reach more areas. If you have an extremely large network that includes areas with which communications will be infrequent and unnecessary, use this parameter to exclude these areas from the DECnet Router Server's reachable network. That is, set the parameter to a value that is less than the total number of hops required to reach any of the level 2 routers in those areas. There is no drawback if you choose all level 2 routers to be reachable.

Format: To set the maximum number of area hops, use the following command in the router configuration file:

SET EXECUTOR MAXIMUM AREA HOPS *hops*

where *hops* is in the range of 2 to 30. The default is 20. Remember to delete the semicolon that precedes the command line in the configuration file provided with the distribution kit. If you do not want your DECnet Router Server to be a level 2 router, do not delete the semicolon. Do not delete the command. You may decide to use your server as a level 2 router at a later time.

4.3.1.6 MAXIMUM BROADCAST NONROUTERS — This parameter specifies the maximum number of Ethernet nonrouting nodes (end nodes) that the server's running database can contain at any one time. This applies only to nonrouting nodes on the same Ethernet as the server. Set this parameter large enough to include all nonrouting nodes on the Ethernet.

Trade-offs: The larger the number, the greater the overhead for the server's central processing unit. However, if the number is too small, some nonrouting nodes may be unreachable (directly) due to limits on the size of the server's routing database. They will be reachable through another routing node that includes the nonrouting node in its database.

Format: To set the maximum number of nonrouting nodes, use the following command in the router configuration file:

SET EXECUTOR MAXIMUM BROADCAST NONROUTERS *number*

where *number* is in the range of 0 to 1022. The default value is 32.

The number must be less than the maximum node address minus one. If the number of broadcast nonrouting nodes is greater than the maximum node address minus one, the DECnet Router Server automatically sets the maximum of nonrouters to the maximum node address minus one. For example, if you set the maximum number of nonrouters to 1022, and the maximum node address is 255, then the DECnet Router Server sets the maximum number of nonrouters to 254. The server sends the following message to the event-logging facility on its host:

```
WARNING: MAXIMUM BROADCAST NONROUTERS set to MAXIMUM ADDRESS minus one.
```

4.3.1.7 MAXIMUM BROADCAST ROUTERS — This specifies the maximum number of other Ethernet routing nodes that the DECnet Router Server's running database can contain at any one time. This applies to routing nodes on the same Ethernet as the server. Set this parameter large enough to include all other routing nodes on the Ethernet.

Trade-offs: The larger the number, the greater the overhead on the server's central processing unit. If the number is too small, some routing nodes may be unreachable due to limits on the size of the server's routing database. If you specify a value that is less than the actual number of routers on the Ethernet, then your DECnet Router Server can reach only that many routers in one hop. For example, if your Ethernet has 15 routing nodes and you specify five, then your router will be able to reach in one hop those five routers only. The excluded routing nodes, although directly unreachable, will be reachable through other routing nodes on the Ethernet.

When the number of active routing nodes reaches the limit, router nodes with the lowest routing priority are dropped from the routing database. Section 4.3.2.3 discusses the routing priority parameter.

Format: To set the maximum number of routing nodes, use the following command in the router configuration file:

SET EXECUTOR MAXIMUM BROADCAST ROUTERS *number*

where *number* is in the range of 1 to 33. The default is 10.

4.3.1.8 MAXIMUM COST — The DECnet Router Server uses this parameter to find out whether a destination node in the network is reachable. The parameter specifies the maximum total path cost allowed from the server node to any other node. A remote node is unreachable if the cost to get to the remote node exceeds the value of this parameter. The **path cost** is the sum of the routing circuit costs along a path between two nodes. Section 4.3.2.1 explains how to specify the routing cost for each circuit on the server node. Select a maximum total path cost that is large enough to include all the nodes that you want to be reachable.

Trade-offs: This parameter serves to limit the size of the reachable network. If you set a high value, the DECnet Router Server can reach more nodes. If you have an extremely large network that includes distant nodes with which communications will be infrequent and unnecessary, use this parameter to exclude these nodes from the DECnet Router Server's reachable network. (However, there is no drawback if you choose all nodes to be reachable.)

Format: To set the maximum cost, use the following command in the router configuration file:

SET EXECUTOR MAXIMUM COST *cost*

where *cost* is in the range of 2 to 1022. The default is 1022.

4.3.1.9 MAXIMUM HOPS — The DECnet Router Server uses this parameter to find out whether a destination node is reachable. The parameter specifies the maximum number of routing hops from the server node to any other reachable node. A remote node is unreachable if the number of hops required to get to it exceeds the value set for this parameter. A **hop** is the logical distance over a line between two adjacent nodes. The value of the maximum hops parameter should always be equal to or greater than the longest possible path within the network. The range of valid values is from 2 to 30. The default is 20.

Trade-offs: This parameter limits the size of the reachable network. If you set a high value, the DECnet Router Server can reach more nodes. If you have an extremely large network that includes distant nodes with which communications will be infrequent and unnecessary, use this parameter to exclude these nodes from the DECnet Router Server's reachable network. (However, there is no drawback if you choose all nodes to be reachable.)

Format: To set the maximum hops, use the following command in the router configuration file:

SET EXECUTOR MAXIMUM HOPS *hops*

where *hops* is in the range of 2 and 30. The default is 20.

4.3.1.10 RECEIVE PASSWORD — This parameter specifies a password that the DECnet Router Server uses to control access from adjacent nodes not on the Ethernet. The circuit connecting an adjacent node does not come up unless the password supplied by the adjacent node matches the DECnet Router Server's receive password.

In multiple area networks, this parameter is significant for circuits connecting adjacent DECnet Phase III nodes. Phase III nodes in a multiple area network must have a transmit password. This helps you locate Phase III to Phase IV connections across area boundaries. Such connections should be prevented, as explained in Section 3.3.

If you do not define a receive password, then adjacent nodes can access the DECnet Router Server without supplying a password.

You can change the receive password in the running database of the DECnet Router Server by using the NCP SET EXECUTOR command, as shown in Appendix C.

Trade-offs: If you specify a receive password, you can prevent unauthorized access from remote adjacent nodes.

Format: To set the receive password, use the following command in the router configuration file:

SET EXECUTOR RECEIVE PASSWORD *password*

where *password* is a string of up to 8 ASCII characters. In the configuration file provided with the distribution kit, the command line is preceded by a semicolon so that no password will be set. To define a password, delete the semicolon.

4.3.1.11 SEGMENT BUFFER SIZE — This parameter specifies the size of buffers used to communicate with the DECnet Router Server. This parameter determines the maximum message size that the DECnet Router Server can receive or send. This parameter deals with network management communications to the DECnet Router Server. It has nothing to do with routed messages.

Trade-offs: This parameter should be less than or equal to the buffer size parameter. When you are changing the buffer size throughout the network, make sure the segment buffer remains less than or equal to the buffer size. To increase the network buffer size, first increase the buffer size throughout the network, then the segment buffer size. To decrease the network buffer size, first decrease the segment buffer size throughout the network, then the buffer size. For more information, refer to the appropriate host system DECnet documentation. If you are not changing the buffer size throughout the network, then this should be equal to the buffer size.

If the segment buffers of the server node and a destination or source node differ in size, then the server uses the smaller of the segment buffer sizes for sending or receiving the data.

Format: To set the segment buffer size, use the following command in the router configuration file:

SET EXECUTOR SEGMENT BUFFER SIZE *size*

where *size* is in the range of 246 to 1484 bytes. The default is 576.

4.3.1.12 TRANSMIT PASSWORD — This parameter specifies a password that the DECnet Router Server can supply to allow it to communicate with an adjacent non-Ethernet node. The transmit password must match the adjacent node's receive password. If the passwords match, then the circuit connecting the server and the adjacent node will come up. If the passwords do not match, the circuit will not come up.

If none of the adjacent nodes have set up a receive password, then you need not specify a transmit password for the server.

You can change the transmit password in the running database of the server by using the NCP SET EXECUTOR command, as shown in Appendix C.

Trade-offs: Specify a transmit password if any adjacent non-Ethernet node requires it; otherwise, the server will not be able to access that node.

Format: To set the transmit password, use the following command in the router configuration file:

SET EXECUTOR TRANSMIT PASSWORD *password*

where *password* is a string of up to 8 ASCII characters. In the configuration file provided with the distribution kit, the command line is preceded by a semicolon so that no password will be set. To define a password, delete the semicolon.

4.3.2 Circuit Parameters

Commands for setting circuit parameters can contain more than one parameter per line, in any order. Section 4.2.1 discusses how to change circuit parameters and how to use wildcard characters (*) for setting the same parameter for more than one circuit. Section 4.2.2 explains how to identify circuits on the server.

The router configuration file includes commands for the maximum number of circuits (synchronous and asynchronous) supported by your server's software image. By default, only the commands for synchronous lines are activated. Commands for asynchronous lines are preceded by a semicolon so that the server initialization task will treat these lines as comments. If your server has asynchronous lines, enable the commands defining parameters for the asynchronous lines by deleting the semicolon preceding each of the appropriate commands, and if necessary, change the parameter values to suit your configuration. Insert semicolons before the commands for the unused synchronous lines. For example, if the line in slot 1 is asynchronous, delete the semicolon preceding the lines defining LC-1L and LC-1R, and insert a semicolon before the line defining LC-1 (the synchronous line).

Insert semicolons before any other commands that define lines not used on your server.

Table 4–2 shows the line configurations supported by the server.

Table 4–2: Line Configurations

Line Speed	Number of lines	Aggregate Bandwidth
19.2 Kbps	32 sync/async	307.2 Kbps per PAM
19.2 Kbps	16 sync/async	307.2 Kbps
56 Kbps	8 sync	448 Kbps
250 Kbps	2 sync	500 Kbps
500 Kbps	1 sync	500 Kbps

The total bandwidth must not exceed 500Kbps; otherwise, the DECnet Router Server automatically turns all circuits off.

4.3.2.1 COST — This parameter specifies the routing cost of the circuit. The DECnet Router Server uses the cost value of each circuit to determine which path it will use to route data to the destination node. The DECnet Router Server calculates the path cost for each path to the destination node and chooses the least costly path. The path cost is the sum of the costs of the circuits that make up the path. Messages will travel between nodes along the path with the smallest total cost.

You can change the cost of a circuit in the running database of the DECnet Router Server by using the NCP SET CIRCUIT command, as shown in Appendix C.

Trade-offs: The DECnet Router Server is less likely to route messages along a high cost circuit than a low cost circuit. Therefore, give high speed lines lower cost values and low speed lines higher cost values. In this way, you can force more messages along the high speed lines and thus improve network traffic flow.

Format: To set the cost of a circuit, use the following command in the router configuration file:

SET CIRCUIT *dev* COST *cost*

where *dev* is the identity of a UNA or LC circuit, and *cost* is a decimal integer in the range 1 to 25. The default value is 1.

4.3.2.2 HELLO TIMER — This parameter specifies how often the server sends hello messages to the adjacent node on the specified point-to-point circuit. If the adjacent node does not receive a hello message from the server within a specified time, it considers the server as unreachable. The length of time that can elapse before this happens depends on the value of the listen timer on that node.

The listen timers on all Phase III nodes have the same fixed value. Therefore, if the adjacent node is a Phase III node, set the hello timer to 5 seconds. Phase IV nodes calculate the listen timer from the adjacent node's hello timer.

Trade-offs: If the timer is set too large, then the adjacent node will wait a long time before it detects that the server is not reachable.

Format: To set the hello timer, use the following command in the router configuration file:

SET CIRCUIT *dev* HELLO TIMER *seconds*

where *dev* is the identity of a UNA or LC circuit and *seconds* is a decimal integer in the range 3 to 8191. The default value is 15.

4.3.2.3 ROUTING PRIORITY — This parameter applies only to Ethernet (UNA) circuits and specifies the priority this DECnet Router Server will have in the selection of a designated router for this circuit. (Section 3.2 describes the function of designated routers.)

Trade-offs: If there are two or more routers on the same Ethernet, the designated router provides message routing services for end nodes on the Ethernet. If you specify a high priority for your DECnet Router Server, it is more likely to be chosen as the designated router. If any of the other routers on the Ethernet is a DECnet Router/X.25 Gateway, it is better to give your DECnet Router Server a higher priority and thus increase its workload, leaving the combined Router/Gateway free for other processing.

Also, if another router on the Ethernet has connections to a larger network than does your DECnet Router Server, then specify a lower priority for your router than for the other router. In this way, the other router is more likely to be selected as the designated router. Then, other nodes on the Ethernet can route messages destined for the larger network directly to the router connected to that network, instead of wasting an unnecessary hop to your DECnet Router Server (the messages will go to the designated router anyway). This will improve the throughput of your network.

Format: To set the router priority for the UNA circuit on your server, use the following command in the router configuration file:

SET CIRCUIT UNA-0 ROUTER PRIORITY *number*

where *number* is in the range of 0 to 127. The default is 100.

4.3.2.4 STATE — This parameter specifies the circuit's operational state. There are two possible states applicable to DECnet Router Server circuits.

OFF The circuit is not in use.

ON The circuit is available for normal use or service functions.

You can change the state of a circuit while the DECnet Router Server is running. Use the NCP SET CIRCUIT command, as shown in Appendix C. This change stays in effect until the next time you reload the server. When you reload the server, the state of the circuit will be as defined in the router configuration file.

Format: To set the state of a circuit, use the following command in the router configuration file:

SET CIRCUIT LC-*n* STATE *circuit-state*

where *n* is the number of the circuit and *circuit-state* is OFF or ON. For asynchronous circuits, specify L or R for the position on the line card; for example, LC-3L. The default operational state is OFF.

4.3.3 Line Parameters

As with circuits, commands setting line parameters can include more than one parameter per line, in any order. Section 4.2.1 discusses how to define line and circuit parameters, and how to use wildcards (*) for defining the same parameter for all lines.

Line parameters are: DUPLEX, MODEM, and SPEED. These parameters apply to LC lines only. The settings for these parameters must be consistent with the settings for the adjacent node connected by the line being defined.

You cannot change these parameters dynamically with NCP. If hardware changes are made that affect these parameters, you must change the parameters and reload the server node.

4.3.3.1 DUPLEX — This parameter specifies the hardware duplex mode of the line. There are two possible modes:

FULL full duplex (default)

HALF half duplex

The duplex must be the same as defined on the adjacent node at the other end of the line.

Format: To set the duplex parameter for a line, use the following command in the router configuration file:

SET LINE LC-*n* DUPLEX {FULL / HALF}

where *n* is the number of the circuit. For asynchronous circuits, specify L or R for the position on the line card; for example, LC-3L.

4.3.3.2 MODEM — This parameter specifies whether the line is connected by an external modem. (Null modems or null modem cables are considered as a modem.) Modems are required for all high speed lines (M3101), for all leased lines, and for any low speed lines connected to devices other than LCs (such as DMCs or DMRs). Specify MODEM YES for such lines. Specify MODEM NO only for low speed lines (M3100) connecting your server to a line card on another local server, such as a line that connects your server to another DECnet Router Server, forming a connection between two Ethernets. If you have such a configuration, make sure the router configuration files for both servers have the corresponding lines set up in the same way.

NOTE

For interconnection of two Ethernets requiring heavy traffic, use high speed lines (M3101).

Some modems have dual rates. The DECnet Router Server forces the modem to work at the highest of the two rates.

Trade-offs: If this parameter is set wrong, the line will not work.

Format: SET LINE LC-*n* MODEM {YES / NO}

where *n* is the line number. For asynchronous circuits, specify L or R for the position on the line card; for example, LC-3L. Specify YES if the line has a modem, and specify NO if the line does not have a modem. The default is MODEM YES.

4.3.3.3 SPEED — This parameter specifies the receive and transmit speed for the line. If you specify an invalid line speed, the DECnet Router Server uses the next greater valid speed. The maximum line speed for DCSAX-LA (M3100) line cards is 19,200 bits per second. The maximum for DCSAX-LB (M3101) line cards is 500,000 bits per second. For M3101 line cards, the speed you choose is determined by the clocking speed of the modems on the line. The default speed for both types of line cards is 9600.

Remember that the sum of the speeds for all the LC lines on your server must be less than 500,000 bps.

Format: To set the speed of an LC line, use the following command in the router configuration file:

SET LINE LC-*n* SPEED *speed*

where *speed* is an integer greater than zero. Observe the maximum speeds allowed for each line card type. For asynchronous circuits, specify L or R for the position on the line card; for example, LC-3L.

4.3.4 Sample Router Configuration Files

Sections 4.3.4.1 and 4.3.4.2 each contain an example of a customized router configuration file. Section 4.3.4.1 contains a customized router configuration file for a DECnet Router Server in a single area network and having four synchronous lines (the software supports a maximum of eight synchronous lines). Section 4.3.4.2 contains a customized file for a DECnet Router Server with both synchronous and asynchronous lines. The server is set up as a level 2 router in a multiple area network. Appendix B includes two unedited router configuration files which show how the customized router configuration files (Examples 4–2 and 4–3) appear before editing.

4.3.4.1 Sample Customized File for Server with Four Lines — The following file is set up for the DECnet Router Server RTRDEV, with four synchronous lines. Figure 4–3 shows the physical network configuration for RTRDEV. Example 4–2 contains the router configuration file. There are 40 end nodes and 14 routing nodes or DECnet Router Servers on RTRDEV's Ethernet (LAN1).

The greatest number of nodes in the area that RTRDEV can address is 500, the value set to the maximum address parameter in the configuration file. All the nodes shown in Figure 4–3 have a buffer size of 800 bytes. Thus, the buffer size parameter in the file is set to 800 bytes. The file limits the reachable network for the DECnet Router Server to all nodes at a distance of 10 hops or less (maximum hops parameter).

Line LC-1 links two DECnet Router Servers and is a high speed line. Therefore, it needs a modem. Lines LC-2, LC-3, and LC-4 need modems because they connect to devices other than LCs. In this configuration, the traffic on LC-1 should not be heavy. Therefore, RTRDEV can handle other lines. LC-1 is a high speed line (56,000 bps).

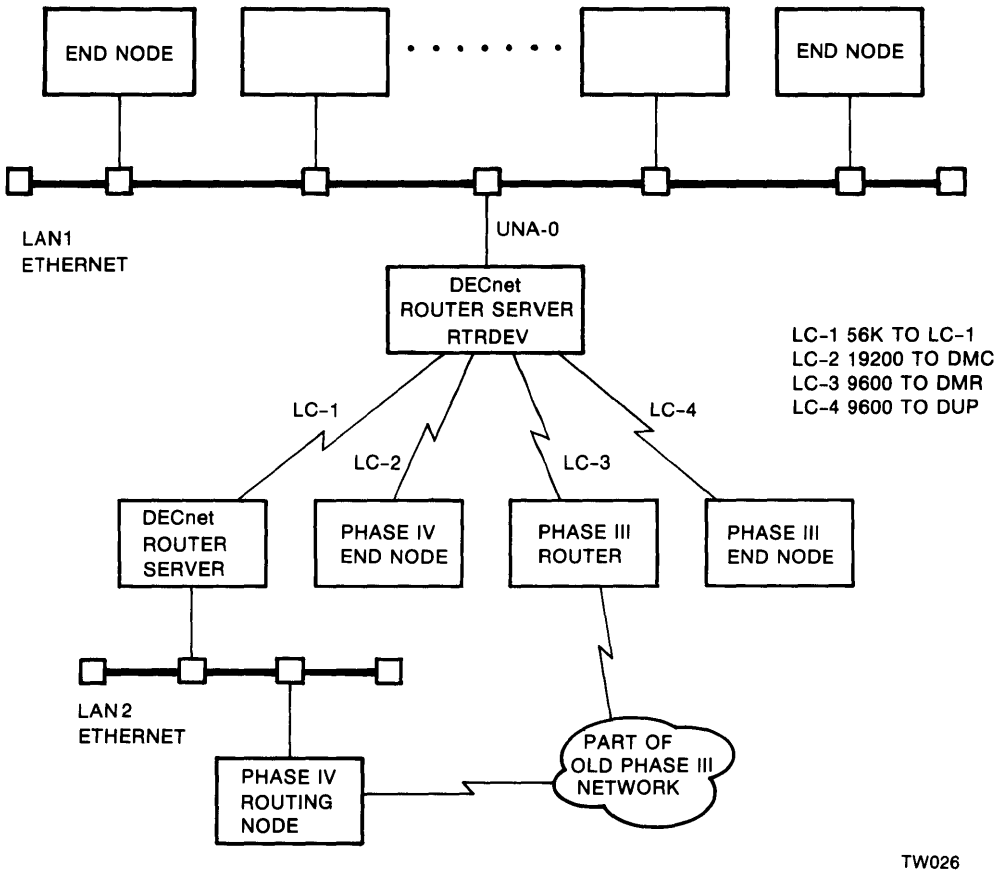

Figure 4–3: Configuration for Sample Customized Routing Configuration File

The cost on LC–3 is set at a higher value than the cost of LC–1 so that the high speed line will be used more often for communications to LAN2. Notice messages can take either of two paths from RTRDEV to the Phase III network: one through LC–3 and the other through LC–1 to the line connecting LAN2 and the Phase III network.

Note that the SET CIRCUIT commands have been edited so that the circuits are turned to the ON state.

The routing priority for RTRDEV is higher than the default (110 instead of 100). This helps ensure that RTRDEV will be the designated router for LAN1. Also, the hello timer for UNA–0 is set to a higher value than the default (25 instead of 15). Thus, fewer hello messages will be sent; this minimizes message traffic over the UNA.

Both the transmit and receive passwords for all adjacent nodes connected by LC lines are ETHER. Thus, the transmit and receive passwords for RTRDEV are defined as ETHER. To enable the command lines defining these passwords, the semicolons preceding the lines have been deleted.

Notice that semicolons precede the lines defining area parameters (lines 13, 14, and 15). This sets up RTRDEV as a level 1 router.

```
;
; DECnet Router Server Initialization File
;
; Copyright (c) 1984 by
; Digital Equipment Corporation, Maynard, Mass.
;
; File name = "Server's node name"RTR.CFG
;
; This configuration file resides on the PLUTO/PLUTO account or
; General DECnet account of the down-line loading host system. This
; file uses all the default values for configuring a DECnet Router
; Server node. Note all values are in decimal.
;
;
;       1.  Set the MAXIMUM ADDRESS in the DECnet network. The legal
;           range for this parameter is 2 to 1023 inclusive. The
;           default value for the MAXIMUM ADDRESS parameter is 255.

          SET EXECUTOR MAXIMUM ADDRESS 500

;       2.  Set the maximum number of routing nodes (excluding this
;           node) on the Ethernet simultaneously. The legal range for
;           the BROADCAST ROUTERS parameter is 1 to 33 inclusive. The
;           default value for this parameter is 10.

          SET EXECUTOR MAXIMUM BROADCAST ROUTERS 15

;       3.  Set the maximum number of nonrouting nodes on the Ethernet
;           simultaneously. The legal range for the BROADCAST
;           NONROUTERS parameter is 0 to 1022 inclusive. The default
;           value for this parameter is 32. The number of nonrouters
;           will be set to the maximum address minus one if the number
;           of nonrouters is greater than the maximum address minus
;           one.
```

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Example 4–2: Router Configuration File for Server with Four Synchronous Lines

```
SET EXECUTOR MAXIMUM BROADCAST NONROUTERS 40

;       4.  Set the total number of hops from the DECnet Router Server
;           to any other reachable node in the network. A remote node
;           is unreachable over a path if the number of hops required
;           to get to it exceeds the value set for this parameter. The
;           legal range for the HOPS parameter is 2 to 30 inclusive.
;           The default value for this parameter is 20.

SET EXECUTOR MAXIMUM HOPS 10

;       5.  Set the total cost from the DECnet Router Server to any
;           other reachable node in the network. A remote node is
;           unreachable over a path if the cost required to get to it
;           exceeds the value set for this parameter. The legal range
;           for the COST parameter is 2 to 1022 inclusive. The default
;           value for this parameter is 1022.

SET EXECUTOR MAXIMUM COST 40

;       6.  Set the BUFFER SIZE for the DECnet Router Server. These
;           buffers are used for the intermediate storage of all user
;           data being transmitted or received. Legal range for the
;           BUFFER SIZE parameter is 246 to 1484 inclusive. The
;           default value for this parameter is 576.
```

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Example 4–2 (cont.): Router Configuration File for Server with Four Synchronous Lines

```
          SET EXECUTOR BUFFER SIZE 800

;       7.  Set the SEGMENT BUFFER SIZE. This parameter allows nodes
;           with different buffer sizes to communicate efficiently.
;           The legal range for the SEGMENT BUFFER SIZE parameter is
;           246 to 1484 inclusive. The default value for this
;           parameter is 576.

          SET EXECUTOR SEGMENT BUFFER SIZE 800

;       8.  Set the line characteristics (SPEED, DUPLEX, MODEM control)
;           for each point-to-point connection from the DECnet Router
;           Server. The options for each parameter are the following:
;
;           The speed range varies depending on your configuration.
;           Check the DECnet Router Software Installation Guide for the
;           proper values. The total bandwidth for the point-to-point
;           lines must not exceed 500 kilobaud.
;
;           The duplex parameter for the line can be DUPLEX FULL or
;           DUPLEX HALF.
;
;           The modem control parameter can be MODEM YES or MODEM NO.
;
;           The default values for these parameters are SPEED 9600,
;           DUPLEX FULL and MODEM YES. The legal devices are LC-1
;           through LC-8.
;
          SET LINE LC-1 SPEED 56000 DUPLEX FULL MODEM YES
          SET LINE LC-2 SPEED 19200 DUPLEX FULL MODEM YES
          SET LINE LC-3 SPEED 9600 DUPLEX FULL MODEM YES
          SET LINE LC-4 SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-5 SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-6 SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-7 SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-8 SPEED 9600 DUPLEX FULL MODEM YES
```

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Example 4–2 (cont.): Router Configuration File for Server with Four Synchronous Lines

```
;       9.  Set the circuit characteristics (COST, HELLO TIMER, STATE)
;           for the point-to-point circuits from the DECnet Router
;           Server. The legal range for the cost parameter is 1 to 25
;           inclusive. This sets the path cost between the DECnet
;           Router and the adjacent node on the circuit. The legal
;           range for the HELLO TIMER parameter is 3 to 8191. The
;           HELLO TIMER is the rate in seconds that idle transport
;           messages are sent to maintain reachability. The options for
;           the state parameter are STATE ON or STATE OFF. The default
;           values for COST, HELLO TIMER and STATE are 1, 15 seconds
;           and off respectively.

             SET CIRCUIT LC-* COST 1 HELLO TIMER 15 STATE ON
             SET CIRCUIT LC-1 COST 1 HELLO TIMER 15 STATE ON
             SET CIRCUIT LC-2 COST 5 HELLO TIMER 15 STATE ON
             SET CIRCUIT LC-3 COST 4 HELLO TIMER 15 STATE ON
             SET CIRCUIT LC-4 COST 3 HELLO TIMER 15 STATE ON


;       10. Set the circuit UNA-0 parameters (COST, ROUTING PRIORITY,
;           HELLO TIMER). The COST and HELLO TIMER parameters have the
;           same attributes and defaults as described above for LC
;           circuits. The ROUTING PRIORITY parameter designates which
;           router will serve the Ethernet. If two routing nodes have
;           the same priority, then the node with the higher node
;           address will be the designated router for the Ethernet.
;           The legal range for the ROUTING PRIORITY parameter is 0 to
;           127 inclusive. The default for this parameter is 100.
;
             SET CIRCUIT UNA-0 COST 1 ROUTING PRIORITY 110 HELLO TIMER 25
;
;       11. Set the TRANSMIT PASSWORD, which the executor node must
;           transmit to an adjacent node during a node initialization
;           sequence. The password is one to eight ASCII characters.
;           The default for this parameter is no password.
```

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Example 4–2 (cont.): Router Configuration File for Server with Four Synchronous Lines

```
SET EXECUTOR TRANSMIT PASSWORD ETHER

;
;       12. Set the RECEIVE PASSWORD, which the executor node expects
;           to receive from an adjacent node during a node
;           initialization sequence. The password is one to eight
;           ASCII characters. The default for this parameter is no
;           password.

  SET EXECUTOR RECEIVE PASSWORD ETHER

;
;       13. Set the MAXIMUM AREA number in the DECnet network. The
;           legal range for this parameter is 2 to 63 inclusive. If
;           this parameter is specified, the DECnet Router will become
;           an area router. The default value for the MAXIMUM AREA
;           parameter is level 1 routing only. Refer to the
;           documentation when configuring areas.
;
;         SET EXECUTOR MAXIMUM AREA 63

;
;       14. Set the total number of area hops from the DECnet Router
;           Server's area to any other reachable area in the network.
;           A remote area is unreachable over a path if the number of
;           hops required to get to it exceeds the value set for this
;           parameter. The legal range for the AREA HOPS parameter is
;           2 to 30 inclusive. If this parameter is specified, the
;           DECnet Router will become an area router. The default
;           value for the AREA HOPS parameter is level 1 routing only.
;           Refer to the documentation when configuring areas.
;
;         SET EXECUTOR MAXIMUM AREA HOPS 20
```

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Example 4–2 (cont.): Router Configuration File for Server with Four Synchronous Lines

```
;
;       15. Set the total cost from the DECnet Router Server's area to
;           any other reachable area in the network. A remote area is
;           unreachable over a path if the cost required to get to it
;           exceeds the value set for this parameter. The legal range
;           for the AREA COST parameter is 2 to 1022 inclusive. If
;           this parameter is specified, the DECnet Router will become
;           an area router. The default value for this parameter is
;           level 1 routing only. Refer to the documentation when
;           configuring areas.
;
;         SET EXECUTOR MAXIMUM AREA COST 1022
```

Example 4–2 (cont.): Router Configuration File for Server with Four Synchronous Lines

4.3.4.2 Sample Customized File for Server with Synchronous and Asynchronous Lines — The next sample configuration file, shown in Example 4–3, is for DECnet Router Server RTRD2, a level 2 router with six synchronous lines and four asynchronous lines. This file, too, has been edited. The original file copied from the distribution kit during installation comes with the DECnet Router Server system image supporting up to eight synchronous or 16 asynchronous lines. Appendix B includes a sample of the unedited file for such software configurations.

In Example 4–3, commands for unused lines are preceded by a semicolon. In the original file, all commands defining parameters for asynchronous lines were preceded by a semicolon. Because RTRD2 has four asynchronous lines, LC–7L through LC–8R, you have to enable the commands for these lines by deleting the semicolons preceding them. Also, you have to insert semicolons before the commands defining parameters for synchronous lines LC–7 and LC–8.

To set up the DECnet Router Server as a level 2 router, the area routing commands (13, 14, and 15 in the sample file) are enabled.

Notice that the SET CIRCUIT command lines have been edited so that the circuits are turned to the ON state. Except for using asynchronous lines and area routing, RTRD2 uses all the defaults. No receive or transmit passwords are set.

```
;
; DECnet Router Server Initialization File
;
; Copyright (c) 1984 by
; Digital Equipment Corporation, Maynard, Mass.
;
; File name = "Server's node name"RTR.CFG
;

;
; This configuration file resides on the PLUTO/PLUTO account or
; General DECnet account of the down-line loading host system. This
; file uses all the default values for configuring a DECnet Router
; Server node. Note all values are in decimal.
;

;
;       1.  Set the MAXIMUM ADDRESS in the DECnet network. The legal
;           range for this parameter is 2 to 1023 inclusive. The
;           default value for the MAXIMUM ADDRESS parameter is 255.
;

          SET EXECUTOR MAXIMUM ADDRESS 255

;
;       2.  Set the maximum number of routing nodes (excluding this
;           node) on the Ethernet simultaneously. The legal range for
;           the BROADCAST ROUTERS parameter is 1 to 33 inclusive. The
;           default value for this parameter is 10.
;

          SET EXECUTOR MAXIMUM BROADCAST ROUTERS 10
```

(continued on next page)

Example 4–3: Configuration File for Server with Synchronous and Asynchronous Lines

```
;
;       3.  Set the maximum number of nonrouting nodes on the Ethernet
;           simultaneously. The legal range for the BROADCAST
;           NONROUTERS parameter is 0 to 1022 inclusive. The default
;           value for this parameter is 32. The number of nonrouters
;           will be set to the maximum address minus one if the number
;           of nonrouters is greater than the maximum address minus
;           one.

             SET EXECUTOR MAXIMUM BROADCAST NONROUTERS 32

;
;       4.  Set the total number of hops from the DECnet Router Server
;           to any other reachable node in the network. A remote node
;           is unreachable over a path if the number of hops required
;           to get to it exceeds the value set for this parameter. The
;           legal range for the HOPS parameter is 2 to 30 inclusive.
;           The default value for this parameter is 20.
;

             SET EXECUTOR MAXIMUM HOPS 20

;
;       5.  Set the total cost from the DECnet Router Server to any
;           other reachable node in the network. A remote node is
;           unreachable over a path if the cost required to get to it
;           exceeds the value set for this parameter. The legal range
;           for the COST parameter is 2 to 1022 inclusive. The default
;           value for this parameter is 1022.
;

             SET EXECUTOR MAXIMUM COST 1022
```

(continued on next page)

Example 4–3 (cont.): Configuration File for Server with Synchronous and Asynchronous Lines

```
;
;       6.  Set the BUFFER SIZE for the DECnet Router Server. These
;           buffers are used for the intermediate storage of all user
;           data being transmitted or received. Legal range for the
;           BUFFER SIZE parameter is 246 to 1484 inclusive. The
;           default value for this parameter is 576.
;

             SET EXECUTOR BUFFER SIZE 576

;
;       7.  Set the SEGMENT BUFFER SIZE. This parameter allows nodes
;           with different buffer sizes to communicate efficiently.
;           The legal range for the SEGMENT BUFFER SIZE parameter is
;           246 to 1466 inclusive. The default value for this
;           parameter is 576.
;
;

             SET EXECUTOR SEGMENT BUFFER SIZE 576

;
;       8.  Set the line characteristics (SPEED, DUPLEX, MODEM control)
;           for each point-to-point connection from the DECnet Router
;           Server. The options for each parameter are the following:
;
;           The speed range varies depending on your configuration.
;           Check the DECnet Router Server Installation Guide for the
;           proper values. The total bandwidth for the point-to-point
;           lines must not exceed 500 Kilobaud.
;
;           The duplex parameter for the line can be DUPLEX FULL or
;           DUPLEX HALF.
;
;           The modem control parameter can be MODEM YES or MODEM NO.
```

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Example 4–3 (cont.): Configuration File for Server with Synchronous and Asynchronous Lines

```
;
;          The default values for these parameters are SPEED 9600,
;          DUPLEX FULL and MODEM YES. The legal devices are LC-1
;          through LC-8 and LC-*. If the lines are asynchronous,
;          specify L or R following the line number to indicate the
;          left and right part of the line card. The default is
;          synchronous.
;
;          Synchronous
          SET LINE LC-1 SPEED 9600 DUPLEX FULL MODEM YES
          SET LINE LC-2 SPEED 9600 DUPLEX FULL MODEM YES
          SET LINE LC-3 SPEED 9600 DUPLEX FULL MODEM YES
          SET LINE LC-4 SPEED 9600 DUPLEX FULL MODEM YES
          SET LINE LC-5 SPEED 9600 DUPLEX FULL MODEM YES
          SET LINE LC-6 SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-7 SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-8 SPEED 9600 DUPLEX FULL MODEM YES

;          Asynchronous
;         SET LINE LC-1L SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-1R SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-2L SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-2R SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-3L SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-3R SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-4L SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-4R SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-5L SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-5R SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-6L SPEED 9600 DUPLEX FULL MODEM YES
;         SET LINE LC-6R SPEED 9600 DUPLEX FULL MODEM YES
          SET LINE LC-7L SPEED 9600 DUPLEX FULL MODEM YES
          SET LINE LC-7R SPEED 9600 DUPLEX FULL MODEM YES
          SET LINE LC-8L SPEED 9600 DUPLEX FULL MODEM YES
          SET LINE LC-8R SPEED 9600 DUPLEX FULL MODEM YES
```

(continued on next page)

Example 4–3 (cont.): Configuration File for Server with Synchronous and Asynchronous Lines

```
;
;       9.  Set the circuit characteristics (COST, HELLO TIMER, STATE)
;           for the point-to-point circuits from the DECnet Router
;           Server. The legal range for the cost parameter is 1 to 25
;           inclusive. This sets the path cost between the DECnet
;           Router and the adjacent node on the circuit. The legal
;           range for the HELLO TIMER parameter is 3 to 8191. The
;           HELLO TIMER is the rate in seconds that idle transport
;           messages are sent to maintain reachability. The options for
;           the state parameter are STATE ON or STATE OFF. The default
;           values for COST, HELLO TIMER and STATE are 1, 15 seconds
;           and off respectively.
;
;             Synchronous
            SET CIRCUIT LC-1 COST 1 HELLO TIMER 15 STATE ON
            SET CIRCUIT LC-2 COST 1 HELLO TIMER 15 STATE ON
            SET CIRCUIT LC-3 COST 1 HELLO TIMER 15 STATE ON
            SET CIRCUIT LC-4 COST 1 HELLO TIMER 15 STATE ON
            SET CIRCUIT LC-5 COST 1 HELLO TIMER 15 STATE ON
            SET CIRCUIT LC-6 COST 1 HELLO TIMER 15 STATE ON
;           SET CIRCUIT LC-7 COST 1 HELLO TIMER 15 STATE OFF
;           SET CIRCUIT LC-8 COST 1 HELLO TIMER 15 STATE OFF

;             Asynchronous
;           SET CIRCUIT LC-1L COST 1 HELLO TIMER 15 STATE OFF
;           SET CIRCUIT LC-1R COST 1 HELLO TIMER 15 STATE OFF
;           SET CIRCUIT LC-2L COST 1 HELLO TIMER 15 STATE OFF
;           SET CIRCUIT LC-2R COST 1 HELLO TIMER 15 STATE OFF
;           SET CIRCUIT LC-3L COST 1 HELLO TIMER 15 STATE OFF
;           SET CIRCUIT LC-3R COST 1 HELLO TIMER 15 STATE OFF
;           SET CIRCUIT LC-4L COST 1 HELLO TIMER 15 STATE OFF
;           SET CIRCUIT LC-4R COST 1 HELLO TIMER 15 STATE OFF
;           SET CIRCUIT LC-5L COST 1 HELLO TIMER 15 STATE OFF
;           SET CIRCUIT LC-5R COST 1 HELLO TIMER 15 STATE OFF
```

(continued on next page)

Example 4–3 (cont.): Configuration File for Server with Synchronous and Asynchronous Lines

```
;         SET CIRCUIT LC-6L COST 1 HELLO TIMER 15 STATE OFF
;         SET CIRCUIT LC-6R COST 1 HELLO TIMER 15 STATE OFF
          SET CIRCUIT LC-7L COST 1 HELLO TIMER 15 STATE ON
          SET CIRCUIT LC-7R COST 1 HELLO TIMER 15 STATE ON
          SET CIRCUIT LC-8L COST 1 HELLO TIMER 15 STATE ON
          SET CIRCUIT LC-8R COST 1 HELLO TIMER 15 STATE ON
;
;       10. Set the circuit UNA-0 parameters (COST, ROUTING PRIORITY,
;           HELLO TIMER). The COST and HELLO TIMER parameters have the
;           same attributes and defaults as described above for LC
;           circuits. The ROUTING PRIORITY parameter designates which
;           router will serve the Ethernet. If two routing nodes have
;           the same priority, then the node with the higher node
;           address will be the designated router for the Ethernet.
;           The legal range for the ROUTING PRIORITY parameter is 0 to
;           127 inclusive. The default for this parameter is 100.
;
          SET CIRCUIT UNA-0 COST 1 ROUTING PRIORITY 100 HELLO TIMER 15
;
;       11. Set the TRANSMIT PASSWORD, which the executor node must
;           transmit to an adjacent node during a node initialization
;           sequence. The password is one to eight ASCII characters.
;           The default for this parameter is no password.
;
;         SET EXECUTOR TRANSMIT PASSWORD DECNET
;
;       12. Set the RECEIVE PASSWORD, which the executor node expects
;           to receive from an adjacent node during a node
;           initialization sequence. The password is one to eight
;           ASCII characters. The default for this parameter is no
;           password.
;
;           SET EXECUTOR RECEIVE PASSWORD DECNET
```

(continued on next page)

Example 4–3 (cont.): Configuration File for Server with Synchronous and Asynchronous Lines

```
;
;       13. Set the MAXIMUM AREA number in the DECnet network. The
;           legal range for this parameter is 2 to 63 inclusive. If
;           this parameter is specified, the DECnet Router will become
;           an area router. The default value for the MAXIMUM AREA
;           parameter is level 1 routing only. Refer to the
;           documentation when configuring areas.
;
            SET EXECUTOR MAXIMUM AREA 63

;
;       14. Set the total number of area hops from the DECnet Router
;           Server's area to any other reachable area in the network.
;           A remote area is unreachable over a path if the number of
;           hops required to get to it exceeds the value set for this
;           parameter. The legal range for the AREA HOPS parameter is
;           2 to 30 inclusive. If this parameter is specified, the
;           DECnet Router will become an area router. The default
;           value for the AREA HOPS parameter is level 1 routing only.
;           Refer to the documentation when configuring areas.
;
            SET EXECUTOR MAXIMUM AREA HOPS 20

;
;       15. Set the total cost from the DECnet Router Server's area to
;           any other reachable area in the network. A remote area is
;           unreachable over a path if the cost required to get to it
;           exceeds the value set for this parameter. The legal range
;           for the AREA COST parameter is 2 to 1022 inclusive. If
;           this parameter is specified, the DECnet Router will become
;           an area router. The default value for this parameter is
;           level 1 routing only. Refer to the documentation when
;           configuring areas.
;
            SET EXECUTOR MAXIMUM AREA COST 1022
```

Example 4–3 (cont.): Configuration File for Server with Synchronous and Asynchronous Lines

4.4 How the DECnet Router Server Handles Configuration File Errors

When you load the DECnet Router Server, the software checks the syntax of the commands in the configuration files and checks that all parameter values are valid. The DECnet Router Server checks the network configuration file first, then the router configuration file. If you do not specify a parameter value to a command in either of these files, or if the command syntax or a parameter value in either file is invalid, the software uses the default value. The software reports all errors to the event logger on the DECnet Router Server's maintenance host (which normally is the loading host). The event logger displays the event messages on the host's console or monitor (on a VMS host). The software will not stop processing the configuration files or crash the node, regardless of the errors detected, unless a halt error condition occurs. A halt error condition occurs when a serious error cannot be corrected by reloading the software. The *DECnet Router Software Management Guide* lists all halt error messages and event messages generated by the DECnet Router Server. The network configuration file event error messages are of the class 225. Following is an example of an event error message reported on an RSX host during a syntax check of the network configuration file:

```
 Event Type 225.0
Occurred 1-Jul-83 09:00:17 on node 271 (RTR32)
 SET EXECUTOR BACKUP HOSTS MAX1, MAX2, MAX3, MAX4, MAX5, >> MAX6
 Too many BACKUP HOSTS specified
```

This message informs you that you specified too many backup hosts. The limit is five.

The router configuration file event error messages are of the class 226. Following is an example of an event error message reported on an RSX host during a syntax check of that file:

```
 Event Type 226.0
Occurred 1-Nov-83 09:10:00 on node 271 (RTR32)
 SET EXECUTOR MAXIMUM ADDRESS >> 2000, MAXIMUM ADDRESS out of
range.
```

This message informs you that you specified an invalid maximum address. The maximum is 1023. The default maximum address of 255 will be used.

The software also reports any errors that occur when attempting to process the configuration file commands. When you load the software, note any errors logged at the maintenance host system's console. Correct the errors by editing the appropriate configuration files, then reload the software.

5

Loading the Server Software and Checking the Installation

This chapter explains how to load the DECnet Router Server software and check that it works, and how to copy server files to other hosts that might be called on to load the server software.

5.1 Loading the DECnet Router Server Software

You load the DECnet Router Server by having the software down-line loaded from the loading host to the server hardware unit. You can do this in any of the three ways listed below and described in Sections 5.1.1 through 5.1.3.

Before trying to load the DECnet Router Server, make sure that:

- Installation is complete and the down-line load database is set up on the loading host.
- The UNA line is loaded on the host (the UNA line over which the host will down-line load the software). Use the following NCP command:

  SET LINE UNA-*n* ALL

  where *n* identifies the UNA circuit on the host.
- The UNA circuit at the host is set to the ON state. Use the following NCP command:

  SET CIRCUIT UNA-*n* STATE ON

  The line must be loaded before you can turn on the circuits.

- The UNA circuit at the host is enabled for service operations. (Service operations include down-line loading, up-line dumping, and loopback testing.) Use the following NCP command:

  SET CIRCUIT UNA-*n* SERVICE ENABLED

  On VMS hosts, the circuit must be off before you can enable it for service. To turn off the circuit and then enable the circuit for service, use the following NCP commands:

  SET CIRCUIT UNA-*n* STATE OFF
  SET CIRCUIT UNA-*n* SERVICE ENABLED STATE ON

- The server hardware unit is turned on. If not, turn the OFF/ON/LOCK switch to the ON position. This will automatically start the load process.

- Event logging is enabled at any host that might load the server. The server logs events at the maintenance host, which by default is the loading host.

  To enable event logging at the host, use the following NCP command:

  SET LOGGING CONSOLE STATE ON

  On VMS hosts, you can also enable logging at the system monitor as follows:

  SET LOGGING MONITOR STATE ON

  When you load the DECnet Router Server, it generates several event messages to inform you of stages of the loading process and the success or failure of the loading processes, as described in Section 5.1.4. These messages can help you troubleshoot any problems that might arise.

  The *DECnet Router Software Management Guide* explains how to set up and change event logging for events generated by the server node. You can also have events logged at other nodes.

The three ways to load the DECnet Router Server are:

1 Use the NCP LOAD NODE command at a terminal connected to the loading host, as explained in Section 5.1.1. With this command, the load occurs from the host at which you execute the command. Also, you can specify additional parameters to override parameter values set in the down-line load database on the host. See Appendix C.

2 Use the NCP TRIGGER NODE command at a terminal connected to any DECnet host on the Ethernet, as explained in Section 5.1.2. The TRIGGER command produces similar results as the LOAD command, but any suitable host can load the server. You cannot be sure what host will load the server, but an event message will inform you after the load.

  You can specify additional parameters to override parameter values set in the down-line load database on the host.

  The TRIGGER command has the same effect as does loading the software by pressing the START button on the hardware unit.

3 Press the START button on the front panel of the Communications Server hardware unit, as explained in Section 5.1.3. Using the START button on the server is the fastest method of loading the server.

All three methods produce the same results when loading the server for the first time.

Section 5.1.4 describes the various phases of the loading process and the event messages you should see at the loading host (or maintenance host).

NOTE

You can prevent a specific node from down-line loading the software or from receiving an up-line dump from the server node and specify an alternate node to provide the service. You may want to do this if the loading node is not available or if you want to prevent unauthorized reloads of the software from certain remote nodes. To stop a node from down-line loading or receiving up-line dumps, use the NCP CLEAR NODE *server-node-id* NAME command on this node, where *server-node-id* identifies the server node.

5.1.1 Using the LOAD Command

Issue the NCP LOAD command using the following format:

LOAD NODE *server-node-id*

where *server-node-id* identifies the server node.

If for security reasons you have set up all down-line load parameters on the host except the service password, the password must be specified with the LOAD command as follows:

LOAD NODE *server-node-id* SERVICE PASSWORD *hex-password*

where *hex-password* specifies the hexadecimal password, in the range of 0 to FFFFFFFFFFFFFFFF. This must match the UNA password defined in the DECnet Router Server's network configuration file.

Figure 5–1 shows the LOAD command being used on HOST1 for down-line loading server node RTRDEV over the Ethernet, on circuit UNA–0. The arrow shows the path that HOST1 uses to down-line load the software onto the server node.

NOTE

If you issue the NCP LOAD command while the TEST button on the server hardware unit is in, then NCP ignores the state of the TEST button and sends the server system image, not the diagnostic image.

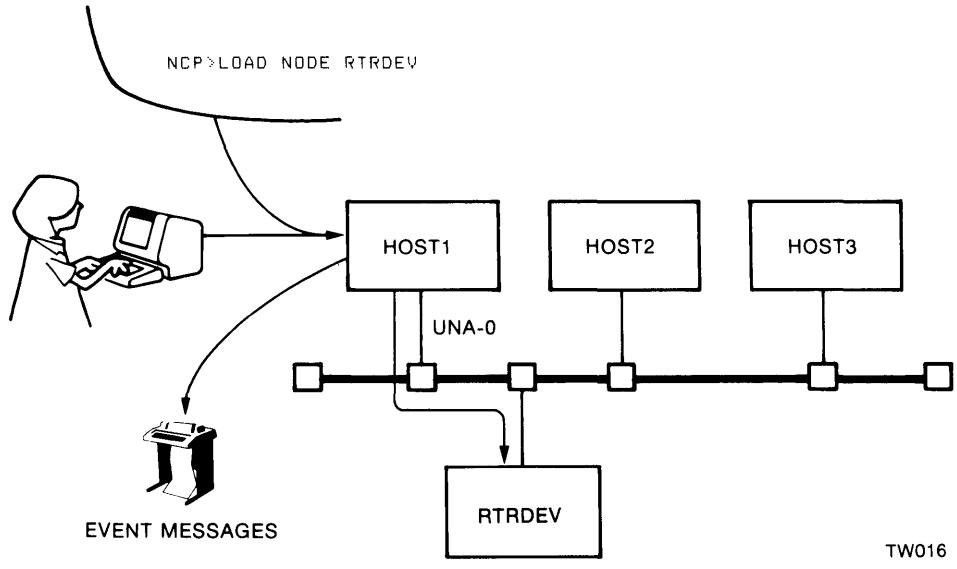

Figure 5–1: Using the LOAD Command

5.1.2 Using the TRIGGER Command

Issue the NCP TRIGGER command using the following format:

TRIGGER NODE *server-node-id*

where *server-node-id* identifies the server node.

If for security reasons you have set up all down-line load parameters on the host except the service password, the password must be specified with the TRIGGER command as follows:

TRIGGER NODE *server-node-id* SERVICE PASSWORD *hex-password*

where *hex-password* specifies the hexadecimal password, in the range of 0 to FFFFFFFFFFFFFFFF. This must match the UNA password defined in the DECnet Router Server's network configuration file.

Use the TRIGGER VIA command, in the format shown in Appendix C, to specify the circuit over which the software is loaded. Figures 5–2 through 5–4 show the three phases that occur after you use the TRIGGER command to down-line load the server node RTRDEV over the Ethernet.

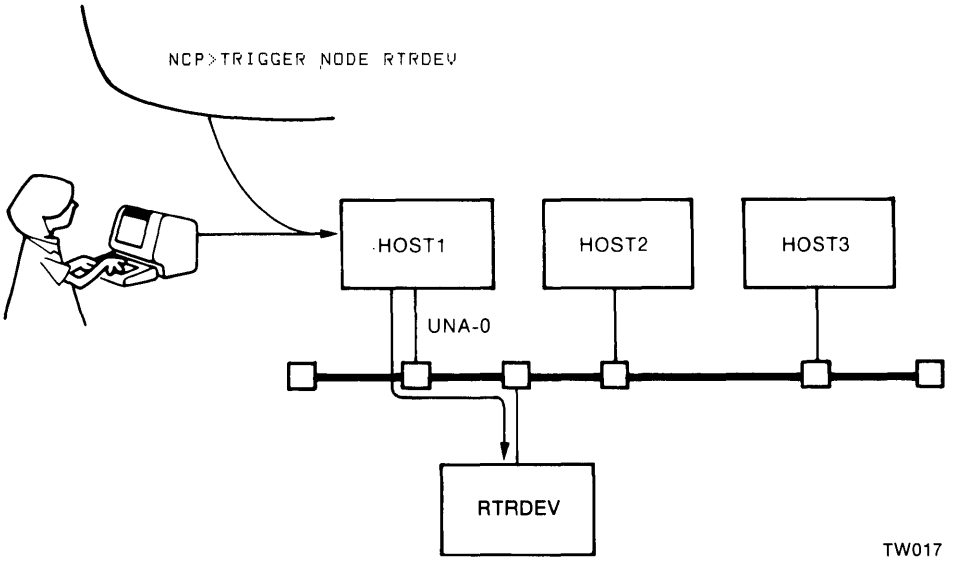

Figure 5–2: The TRIGGER Command: (1) Trigger Is Sent to the Server

1 First, as shown in Figure 5–2, the host where the command is issued will send the trigger to RTRDEV over circuit UNA-0. (Before the host can send the trigger, it first checks its database for node RTRDEV to find the physical address of the server. The down-line load database for node RTRDEV was set up on each potential loading host, as shown in Figures 2–1 and 2–2.) The arrow shows the path that HOST1 uses to send the trigger message to the server node.

2 Next, the Communications Server hardware unit responds to the trigger by sending a request-to-load message to all DECnet host nodes on the Ethernet, as shown by the arrows in Figure 5–3.

3 As shown in Figure 5–4, the host that loads the server is the first host to respond that has the down-line load information for that server. Event messages that record the sequence of events during the load process are logged at the loading host's logging console (or logging monitor on VMS systems).

If you want the host from which you are issuing the TRIGGER command to be able to do the load, make sure the UNA circuit has been service enabled before issuing the TRIGGER command. Use the following NCP command:

SET CIRCUIT UNA-0 SERVICE ENABLED

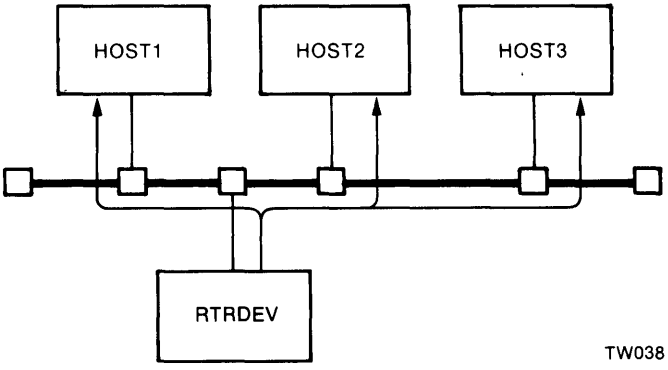

Figure 5–3: The TRIGGER Command: (2) Multicast Request-to-load Message

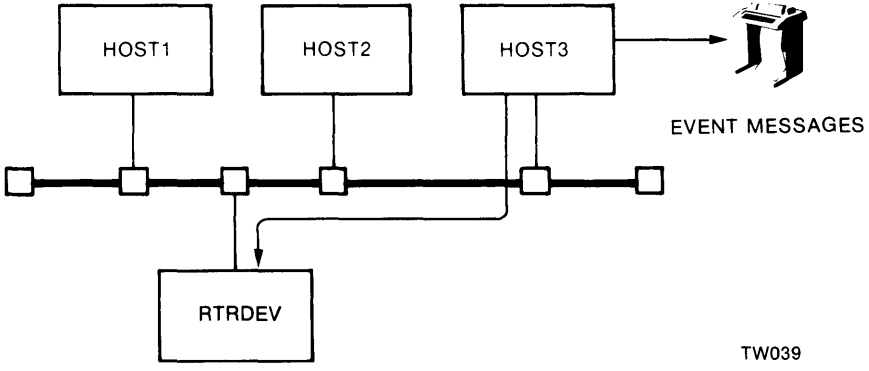

Figure 5–4: The TRIGGER Command: (3) First Host to Respond Loads the Server

NOTE

If you issue the TRIGGER command while the TEST button on the server hardware unit is pushed in, then the unit will load the loadable diagnostics image (LDI) instead of the DECnet Router Server system image. See the *DECnet Router Software Management Guide.*

5.1.3 Starting the Load at the Server Hardware Unit

At the Ethernet Communications Server hardware unit, start the load of the software by first checking that the POWER switch is ON, and then pressing the START button on the front panel of the unit, as shown in Figure 5–5. The inset shows the front panel of the unit. (Turn the switch to the LOCK position to prevent unauthorized or inadvertent reloads. In the LOCK position, the START button is disabled. The LOCK position also prevents someone from forcing a crash of the server from a host.)

Figures 5–5 and 5–6 show what happens when you initiate the load at the hardware unit.

1 First, as shown in Figure 5–5, the Communications Server hardware unit responds by sending a request-to-load message to all DECnet host nodes on the Ethernet.

2 Then, the first host to respond (the first available host that has the down-line load information for that server) is the host that loads the server. Figure 5–6 shows that the loading host is HOST1.

During a successful load, you will first see the unit's digital display blinking, then you will see:

L 30

This can last up to 30 seconds. After this, you will see:

L 5*n*

where *n* is a digit that cycles from 0 to 7 repeatedly, indicating that the software image is being loaded. This can last a couple of minutes. When the server node comes up and the server has initialized all lines, a cyclic pattern shows on the server hardware unit's digital display, as shown in figure 5–6. Intermittently, the display shows the server's DECnet node number. The DECnet node number distinguishes communications servers located in the same vicinity. This node number is defined in the databases on each host node in the LAN and on other nodes that will communicate with the server node. (As system or network manager, you must make sure that the server's node number is known to all these nodes.) You can use the node number to identify the server node when issuing network management commands. (Normally you use the server's node name.)

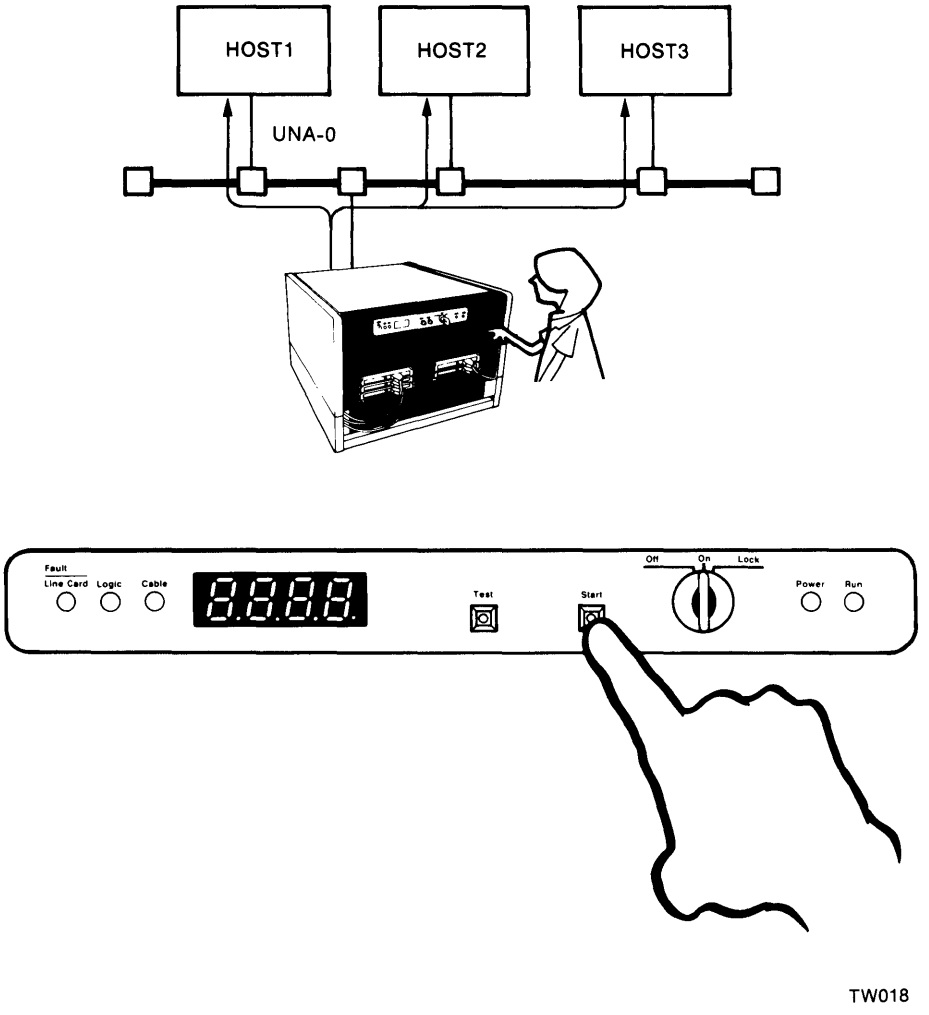

Figure 5–5: Load Started at the Hardware Unit: (1) Multicast Request-to-load Message

If an error occurs during or after the load, one of the fault indicators may light up and the digital display will show error information. Refer to the *DECnet Router Software Management Guide* for a listing and the meaning of all codes that can be displayed.

When the server node comes up, you are ready to run the installation checkout procedure described in Section 5.2.

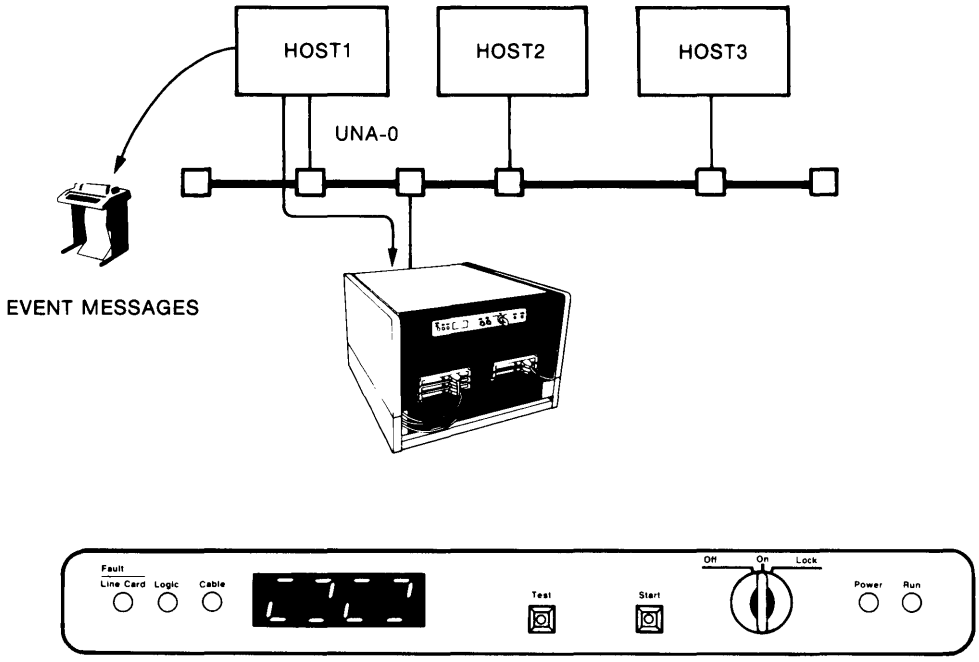

Figure 5–6: Load Started at the Hardware Unit: (2) First Host to Respond Loads the Server

5.1.4 The Loading Process and Event Messages

The loading process, which takes several minutes, goes through the following three phases:

1 A primary loader, contained in the server's Ethernet controller, loads the secondary loader (PLUTO2.SYS) into the controller and starts the secondary loader.

2 In turn, the secondary loader loads the tertiary loader (PLUTO3.SYS) into server memory and starts the tertiary loader.

3 The tertiary loader loads the system image (CSVRTR.SYS, CSVRTR16L.SYS, or CSVRTR32L.SYS) into server memory. This can last a couple of minutes, after which the tertiary loader also passes host-supplied parameters to the system image, such as the server's node name and number, and the host's node number. Finally, the tertiary loader starts the system image.

During each phase of the load, the host issues two DECnet event messages. The first of each pair of events indicates the load phase has been requested. The second indicates whether the load was successful. Other messages follow. The event messages may vary slightly on different host systems. Sections 5.1.4.1 and 5.1.4.2 show the event messages seen from VMS and RSX loading hosts. (Also, during the load, the codes described in Section 5.1.3 are displayed on the front panel of the Ethernet Communications Server hardware unit. These codes are displayed whether the load is invoked at the hardware unit or by command at a host.)

Event messages of type 225 are for events that occur before and during the initialization of the network configuration file. Event messages of type 226 are for errors that occur during initialization of the router configuration file, and for any subsequent errors. Event messages of types 225 and 226 also record status changes, such as the "Server initializing" and "Server up" events. No errors during these phases are fatal, but the server can halt. The server attempts a reload after crash dumps; however, the server halts on errors for which a reload would not be of any avail. See the *DECnet Router Software Management Guide.*

When the software finds errors in the configuration files, the event message shows which command is in error and the nature of the error. The software scans the remainder of the configuration file so that all possible syntax and invalid parameter values are detected and reported at one pass. You should correct these reported configuration file errors and then load the software again.

NOTE

Syntax errors or invalid parameter values in the network configuration file will not prevent the server from loading. (The server will use default values for the affected parameters.)

If you start the load at a terminal, and the server fails to come up for reasons other than software errors, you may have to try starting the load at the hardware unit, as described later.

Once the software is loaded without error and the server comes up, you are ready to perform the installation checkout procedure as described in Section 5.2.

5.1.4.1 Events During a Load from VMS Host — Assuming the loading host is VMCENT, a VMS system, and the server node is RTRDEV with three point-to-point lines connecting nodes ELROND (50), HAZEL (45), and AARON (275), the following are the events normally seen during the load of the DECnet Router Server software.

NOTE

Because many events occur in a short time, certain event messages may not be logged. The following event message warns you of this:

```
            DECnet event 0.0, Event records lost
            From node 134 (RTRDEV), 25-AUG-84 16:00:01
%%%%%%%%%%%  OPCOM    25-AUG-84 16:41:04.42
Message from user DECnet on VMCENT
DECnet event 0.3, automatic line service
From node 120 (VMCENT), 25-AUG-84 16:41:03.53
Circuit UNA-0, Load, Requested, Node = 134 (RTRDEV)
File = PLUTO2.SYS, Secondary loader
%%%%%%%%%%%  OPCOM    25-AUG-84 16:41:04.59
Message from user DECnet on VMCENT
DECnet event 0.3, automatic line service
From node 120 (VMCENT), 25-AUG-84 16:41:
Circuit UNA-0, Load, Successful, Node = 134 (RTRDEV)
File = PLUTO2.SYS, Secondary loader
%%%%%%%%%%%  OPCOM    25-AUG-84 16:41:05.01
Message from user DECnet on VMCENT
DECnet event 0.3, automatic line service
From node 120 (VMCENT), 25-AUG-84 16:41:05.00
Circuit UNA-0, Load, Requested, Node = 134 (RTRDEV)
File = PLUTO3.SYS, Tertiary loader
%%%%%%%%%%%  OPCOM    25-AUG-84 16:41:05.58
Message from user DECnet on VMCENT
DECnet event 0.3, automatic line service
From node 120 (VMCENT), 25-AUG-84 16:41:05.38
Circuit UNA-0, Load, Successful, Node = 134 (RTRDEV)
File = PLUTO3.SYS, Tertiary loader
%%%%%%%%%%%  OPCOM    25-AUG-84 16:41:06.00
Message from user DECnet on VMCENT
DECnet event 0.3, automatic line service
From node 120 (VMCENT), 25-AUG-84 16:41:05.88
Circuit UNA-0, Load, Requested, Node = 134 (RTRDEV)
File = CSVRTR.SYS, Operating system
%%%%%%%%%%%  OPCOM    25-AUG-84 16:41:06.91
Message from user DECnet on VMCENT
DECnet event 0.3, automatic line service
From node 120 (VMCENT), 25-AUG-84 16:42:06.21
Circuit UNA-0, Load, Successful, Node = 134 (RTRDEV)
File = CSVRTR.SYS, Operating system
```

The following message shows that the server has come up as a DECnet node. The configuration files have been read, and the server is reconfiguring, using the information supplied by the configuration files. The message identifies the software version of the DECnet Router Server and the system image (8L denotes the 8 synchronous line configuration, 16L the 16 line maximum configuration, 32L for the 32 line maximum configuration).

```
DECnet event 225.0
From node 134 (RTRDEV), 25-AUG-84 16:43:19.29
Parameter #0 = Server initializing,
Identification = DECnet Router Server V1.1 8L
```

The following event messages show that the server now sees the loading host (VMCENT) and other nodes on the Ethernet as active adjacent nodes.

```
DECnet event 4.15, adjacency up
From node 134 (RTRDEV), 25-AUG-84 16:43:49.89
Circuit UNA-0, Adjacent node = 120 (VMCENT)

DECnet event 4.15, adjacency up
From node 134 (RTRDEV), 25-AUG-84 16:43:55.32
Circuit UNA-0, Adjacent node = 340 (BACH)

DECnet event 4.15, adjacency up
From node 134 (RTRDEV), 25-AUG-84 16:43:56.09
Circuit UNA-0, Adjacent node = 41 (MOZART)

DECnet event 4.15, adjacency up
From node 134 (RTRDEV), 25-AUG-84 16:43:56.34
Circuit UNA-0, Adjacent node = 10 (BRAHMS)
                .
                .
                .
```

You will also see sometimes the following messages showing that the point-to-point (LC) circuits have come up:

```
DECnet event 4.10, Circuit up
From node 134 (RTRDEV), 25-AUG-84 16:44:02.43
Circuit LC-1
Node address = 50 (ELROND)

DECnet event 4.10, Circuit up
From node 134 (RTRDEV), 25-AUG-84 16:44:05.36
Circuit LC-2
Node address = 45 (HAZEL)

DECnet event 4.10, Circuit up
From node 134 (RTRDEV), 25-AUG-84 16:45:01:01
Circuit LC-3
Node address = 275 (AARON)
                .
                .
                .
```

When configuration completes without error, the DECnet Router Server's remote event logging facility sends the following event message which shows that the system is now running.

```
DECnet event 226.0
From node 134 (RTRDEV), 25-AUG-84 16:45:02.21
Server up, Identification = DECnet Router Server V1.1 8L
```

5.1.4.2 Events during a Load from an RSX Host — The following are events normally seen on an RSX loading host. The loading host is HOST1, and the DECnet Router Server is RTRDEV. (The down-line load database on HOST1 is the one set up in Figure 2–2.) RTRDEV has three point-to-point lines connecting nodes ELROND (50), HAZEL (45), AARON (275).

NOTE

Because many events occur in a short time, certain event messages may not be logged. The following event message will warn you of this:

```
        Event type 0.0, Event records lost
      Occurred AUG-25-84 16:40:04 on node 134 (RTRDEV)

 Event type 0.3, Automatic service
Occurred AUG-25-84 16:41:04 on node 245 (HOST1)
Circuit UNA-0
Service type = Load
Status = Requested
Node = 134 (RTRDEV), File = DL0:[100,100]PLUTO2.SYS
Software type = Secondary loader

 Event type 0.3, Automatic service
Occurred AUG-25-84 16:41:04 on node 245 (HOST1)
Circuit UNA-0
Service type = Load
Status = Successful
Node = 134 (RTRDEV), File = DL0:[100,100]PLUTO2.SYS
Software type = Secondary loader

 Event type 0.3, Automatic service
Occurred AUG-25-84 16:41:05 on node 245 (HOST1)
Circuit UNA-0
Service type = Load
Status = Requested
Node = 134 (RTRDEV), File = DL0:[100,100]PLUTO3.SYS
Software type = Tertiary loader

 Event type 0.3, Automatic service
Occurred AUG-25-84 16:41:06 on node 245 (HOST1)
Circuit UNA-0
Service type = Load
Status = Successful
Node = 134 (RTRDEV), File = DL0:[100,100]PLUTO3.SYS
Software type = Tertiary loader
```

(continued on next page)

```
 Event type 0.3, Automatic service
Occurred AUG-25-84 16:41:07 on node 245 (HOST1)
Circuit UNA-0
Service type = Load
Status = Requested
Node = 134 (RTRDEV), File = DL0:[100,100]CSVRTR.SYS
Software type = System

 Event type 0.3, Automatic service
Occurred AUG-25-84 16:41:58 on node 245 (HOST1)
Circuit UNA-0
Service type = Load
Status = Successful
Node = 134 (RTRDEV), File = DL0:[100,100]CSVRTR.SYS
Software type = System
```

The next message indicates that the server has come up as a DECnet node. The configuration files have been read, and the server is reconfiguring, using the information supplied by the configuration files. The message identifies the software version of the DECnet Router Server and the system image (8L denotes the 8 synchronous line configuration, 16L the 16 line maximum configuration, 32L for the 32 line maximum configuration).

```
 Event type 225.0
Occurred AUG-25-84 16:42:35 on node 134 (RTRDEV)
Server initializing, Identification = DECnet Router Server V1.1 8L
```

Next, the server sends the following messages showing that it now sees the loading host (node 245, HOST1) and other nodes on the Ethernet as active adjacent nodes.

```
 Event type 4.15, Adjacency up
Occurred AUG-25-84 16:43:09 on node 134 (RTRDEV)
Circuit UNA-0
Adjacent node = 245 (HOST1)

 Event type 4.15, Adjacency up
Occurred AUG-25-84 16:43:11 on node 134 (RTRDEV)
Circuit UNA-0
Adjacent node = 340 (BACH)

 Event type 4.15, Adjacency up
Occurred AUG-25-84 16:43:11 on node 134 (RTRDEV)
Circuit UNA-0
Adjacent node = 41 (MOZART)

 Event type 4.15, Adjacency up
Occurred AUG-25-84 16:43:13 on node 134 (RTRDEV)
Circuit UNA-0
Adjacent node = 10 (BRAHMS)
                      .
                      .
                      .
```

You will also see the following messages showing that the point-to-point (LC) circuits have come up:

```
 Event type 4.10, Circuit up
Occurred AUG-25-84 16:44:03 on node 134 (RTRDEV)
Circuit LC-1
Node address = 50 (ELROND)

 Event type 4.10, Circuit up
Occurred AUG-25-84 16:44:04 node 134 (RTRDEV)
Circuit LC-2
Node address = 45 (HAZEL)

 Event type 4.10, Circuit up
Occurred AUG-25-84 16:44:23 node 134 (RTRDEV)
Circuit LC-3
Node address = 275 (AARON)
                        .
                        .
                        .
```

When configuration completes without error, the DECnet Router Server's remote event logging facility sends the following event message which shows that the system is running.

```
 Event type 226.0
Occurred AUG-25-84 16:43:51 on node 134 (RTRDEV)
Server up, Identification = DECnet Router Server V1.1 8L
```

5.2 Checking out the Installation from VMS and RSX Hosts

To verify that your DECnet Router Server has been installed correctly, use the installation checkout procedure (ICP) at a terminal on any host system. This procedure checks the connectivity of your DECnet Router Server with all adjacent remote nodes. Before invoking this procedure, have a firm understanding of the current network configuration. If the procedure reveals that something is not working, you must correct the source of the problem.

You will invoke one of three ICP command files, depending on your DECnet Router Server configuration:

CSVRTRICP — The ICP command file for the 8-line synchronous-only configuration (CSVRTR.SYS)

CSVRTR16L — The ICP command file for the single-PAM synchronous/asynchronous configuration (CSVRTR16L.SYS), 16 line maximum.

CSVRTR32L — The ICP command file for the dual-PAM synchronous/asynchronous configuration (CSVRTR32L.SYS), 32 line maximum.

5.2.1 Before Starting ICP

Before starting, edit the appropriate command file to enable the commands that test the communications lines installed on your server. (All commands in the ICP file are set up as comments.) On a VMS host, edit the file with the .COM extension, enabling the commands by removing the exclamation point (!) that precedes each command. On an RSX host, edit the file with the .CMD extension, enabling the commands by removing the semicolon (;) that precedes each command.

For example, assume you are going to check out the DECnet Router Server RTRDEV from a VMS host VMHOST. RTRDEV has five synchronous lines on a single-PAM system supporting synchronous lines only (CSVRTR.SYS). Therefore, you will use the command file CSVRTRICP.COM.

First, enable the commands for lines LC-1 through LC-5, as shown below. The exclamation marks for the three unused lines (LC-6 through LC-8) are left intact.

```
                .
                .
                .
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC1 CIR LC-1
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC1
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC1 CIR
$
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC2 CIR LC-2
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC2
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC2 CIR
$
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC3 CIR LC-3
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC3
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC3 CIR
$
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC4 CIR LC-4
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC4
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC4 CIR
$
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC5 CIR LC-5
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC5
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC5 CIR
$!
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC6 CIR LC-6
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC6
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC6 CIR
$!
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC7 CIR LC-7
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC7
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC7 CIR
$!
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC8 CIR LC-8
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC8
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC8 CIR
$ SET NOVERIFY
$ EXIT
```

As another example, the following shows a portion of an ICP command file for a DECnet Router Server system supporting both synchronous and asynchronous lines (either CSVRTR16L or CSVRTR32L). The line card in slot 1 has a synchronous line and the line card in slot 2 has two asynchronous lines. Therefore, you would enable the commands for LC-1, LC-2L, and LC-2R. As shown, the exclamation marks are removed from these command lines.

```
                .
                .
                .
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC1 CIR LC-1
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC1
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC1 CIR
$!
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC1 CIR LC-1L
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC1
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC1 CIR
$!
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC1 CIR LC-1R
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC1
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC1 CIR
$!
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC2 CIR LC-2
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC2
$! NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC2 CIR
$!
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC2 CIR LC-2L
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC2
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC2 CIR
$!
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' SET NODE LC2 CIR LC-2R
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' LOOP NODE LC2
$ NCP TELL 'NODE' USER [1,1] PASS 'PASS' CLE NODE LC2 CIR
$!
                .
                .
                .
```

5.2.2 Starting the Procedure

Start the installation checkout procedure by typing:

$ @[*UIC*]*filename*

where *UIC* is the UIC in which you have installed the command file (the UIC for the PLUTO account), and *filename* is one of the following:

CSVRTRICP

CSVRTR16L

CSVRTR32L

When you invoke the command file, you will be prompted through the following steps:

1 You are asked for the server's node name.

2 You are asked for the server's network privileged password. The command file uses this and the node name for accessing the server node to execute the NCP LOOP NODE commands. The LOOP NODE commands test the connections to the adjacent node on each of the server's point-to-point lines. The loopback tests start from the DECnet Router Server.

   The command file sets up a loop node name for each circuit. A **loop node name** is a temporary node name associated with a specific circuit. Section 3.3.2.2 of the *DECnet Router Software Management Guide* further explains how to set up and use loop nodes for loopback testing.

NOTE

> If one or more circuits are inactive, and they should be active, then check the router configuration file to see that all circuits are set to the ON state.

If no error messages are reported at your console, then the test succeeded and your server software is working properly. If errors are reported, make the necessary corrections.

The command file clears all temporary node names that you use during the checkout procedure.

The following is a sample command procedure invoked on VMS host node VMHOST to test the five synchronous lines on DECnet Router Server RTRDEV, which is shown in Figure 5–7. The arrows in the figure show the flow of test data to each node connected by the five lines.

```
$ @CSVRTRICP (RET)

Please enter the DECnet Router Server name: RTRDEV(RET)
Please enter RTRDEV password: ORANGE(RET)
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE SET NODE LC1 CIR LC-1
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE LOOP NODE LC1
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE CLE NODE LC1 CIR
$
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE SET NODE LC2 CIR LC-2
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE LOOP NODE LC2
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE CLE NODE LC2 CIR
$
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE SET NODE LC3 CIR LC-3
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE LOOP NODE LC3
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE CLE NODE LC3 CIR
$
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE SET NODE LC4 CIR LC-4
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE LOOP NODE LC4
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE CLE NODE LC4 CIR
$
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE SET NODE LC5 CIR LC-5
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE LOOP NODE LC5
$ NCP TELL RTRDEV USER [1,1] PASS ORANGE CLE NODE LC5 CIR
$!
$! NCP TELL RTRDEV USER [1,1] PASS ORANGE SET NODE LC6 CIR LC-6
$! NCP TELL RTRDEV USER [1,1] PASS ORANGE LOOP NODE LC6
$! NCP TELL RTRDEV USER [1,1] PASS ORANGE CLE NODE LC6 CIR
$!
$! NCP TELL RTRDEV USER [1,1] PASS ORANGE SET NODE LC7 CIR LC-7
$! NCP TELL RTRDEV USER [1,1] PASS ORANGE LOOP NODE LC7
$! NCP TELL RTRDEV USER [1,1] PASS ORANGE CLE NODE LC7 CIR
$!
$! NCP TELL RTRDEV USER [1,1] PASS ORANGE SET NODE LC8 CIR LC-8
$! NCP TELL RTRDEV USER [1,1] PASS ORANGE LOOP NODE LC8
$! NCP TELL RTRDEV USER [1,1] PASS ORANGE CLE NODE LC8 CIR
$ EXIT
$
```

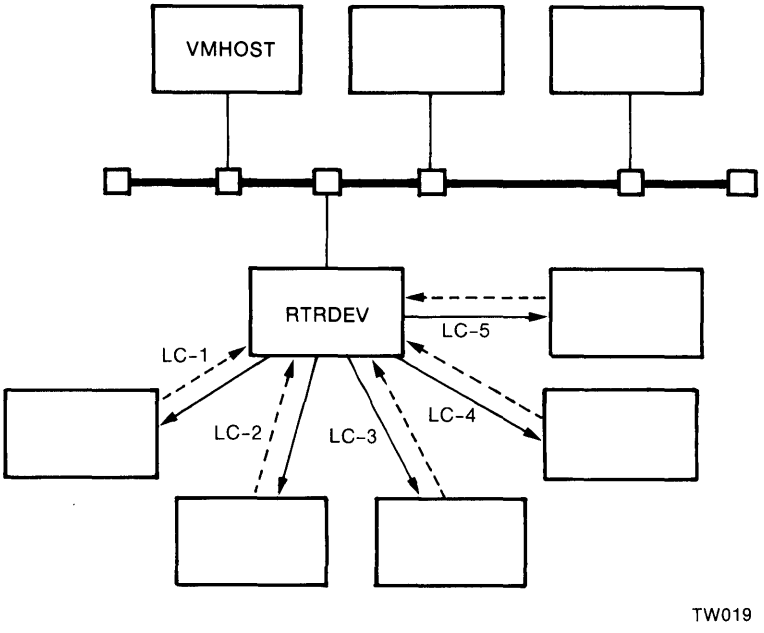

Figure 5–7: Configuration Tested by Sample ICP

5.3 Copying Files to Alternate Loading Hosts

After checking that the software is working properly, copy the software images and files from the loading host to all nodes that you wish to use as alternate loading hosts, such as the backup hosts. Any backup host can be called upon to down-line load the software or receive an up-line dump of server memory. Make sure you copy the files into the appropriate place on each host.

On RSX hosts, the server system image, diagnostics system image, and the loader files reside in NETUIC or a special UIC selected for this software. The configuration files and ICP command file reside in the PLUTO account, if such an account exists. If the PLUTO account does not exist, create it as explained in Section 2.3.2.2.

On VMS hosts, the server system image, diagnostics system image, and the loader files reside in SYS$SYSTEM (SYS$SYSROOT[SYSEXE]). The configuration files and the ICP command file reside in the PLUTO account, if such an account exists. If the account does not exist, create it as explained in Section 2.2.

5.3.1 Copying Files to RSX Alternate Loading Hosts

To copy files to an alternate RSX loading host node, log in to an account on that host and issue the following two Network File Transfer utility (NFT) commands. These commands copy the configuration files and ICP command file to the PLUTO directory on the alternate loading host. (The PLUTO account must be set up on that host first.)

NFT *alt-host-id*/PLUTO/PLUTO::=*loadhost-id*/PLUTO/PLUTO::*.CFG

NFT *alt-host-id*/PLUTO/PLUTO::=*loadhost-id*/PLUTO/PLUTO::CSVRTRICP.CMD

where

alt-host-id is the name of the alternate loading host.

loadhost-id is the name of the loading host.

After copying the files, edit the network configuration file on each host, as explained in Section 5.3.4. Then, use NFT to copy the .SYS files to the NETUIC or special server UIC. To find out what the NETUIC is on the alternate host, type:

SET /NETUIC

The UIC will be displayed as in the following example:

```
NETUIC = [101,54]
```

(If you do not know the NETUIC on the loading host, do the same on the loading host.)

Now use NFT as follows:

NFT *alt-host-id/acc/pass*::[*netuic*] = *loadhost-id/acc/pass*::[*netuic*]*.SYS

where *acc* and *pass* are the respective account and password for each of the hosts.

Make sure the DECnet database for the server node is set up on each alternate loading host. Use the CFE LIST NODE command to display the parameters set for the server node. If needed, create on the host a DECnet database for the server node. See Section 2.3.2. Also, you need to edit the network configuration file on the host to which it is copied, as explained in Section 5.3.4.

Check the appropriate directories on the alternate loading host to see that the files listed in Section 2.3.2.1 have been copied.

5.3.2 Copying Files to VMS Alternate Loading Hosts

To copy files to a VMS alternate loading host, log in to an account on the host node and use the COPY command. To load the configuration files, use this command:

COPY *loadhost-id*"PLUTO PLUTO"::*.CFG

The following prompt will then appear:

```
To:
```

Type the following:

alt-host-id"*priv-acct password*"::SYS$SYSROOT:[PLUTO]*

where

loadhost-id	is the name of the loading host.
alt-host-id	is the name of the alternate host.
priv-acct	is a privileged account on the alternate host, into which files can be copied.
password	is the password for the privileged account.
SYS$SYSROOT:	is the default logical name for the device where the files will be copied.
[PLUTO]	is the directory on the alternate host, where the files will be copied.

Also, copy CSVRTRICP.COM in the same way.

NOTE

The privileged account must be set up on the alternate host before copying the files. Make sure the files have world-read access or are owned by PLUTO with owner-read access.

Now, use the COPY command to copy the .SYS files, as follows:

COPY *loadhost-id*"*acc pass*"::SYS$SYSTEM:*.SYS

The following prompt will appear:

```
To:
```

Type the following:

alt-host-id"*acc pass*"::SYS$SYSTEM:*

where *acc* and *pass* are the privileged accounts and passwords for the respective hosts.

NOTE

Make sure you have the privileges to write in SYS$SYSTEM.

Make sure the DECnet database for the server node is set up on each alternate loading host. Use the NCP LIST NODE command to display the parameters for the server node. If needed, create on the alternate loading host the DECnet database for the server node. See Section 2.2. Also, you need to edit the network configuration file on the host to which it is copied, as explained in Section 5.3.4.

Check the appropriate directories on the alternate loading host to see that the files listed in Section 2.2 have been copied.

Instead of using the above method, you can do the following to make a VMS alternate host capable of down-line loading the software: VMS software products, including the server software, feature kits containing "savesets" as backup copies of the software. You can copy a saveset from the primary loading host to an alternate loading host and then run VMSINSTAL. Refer to the *Guide to Networking on VAX/VMS* and the *Guide to VAX/VMS Software Installation* for more details.

5.3.3 Verifying that All Files Have Been Copied

Make sure the following files have been copied to each host:

File Name	Directory or account	
	VMS	**RSX**
PLUTO2.SYS	SYS$SYSTEM	NETUIC or special server UIC *
PLUTO3.SYS	SYS$SYSTEM	NETUIC or special server UIC *
CSVRTR.SYS, CSVRTR16L.SYS, or CSVRTR32L.SYS	SYS$SYSTEM	NETUIC or special server UIC
CSVLDI.SYS	SYS$SYSTEM	NETUIC or special server UIC
PLUTOCC.SYS	SYS$SYSTEM	NETUIC or special server UIC
PLUTOWL.SYS	SYS$SYSTEM	NETUIC or special server UIC
*server-node-id*SB.CFG	PLUTO	PLUTO
*server-node-id*RTR.CFG	PLUTO	PLUTO
CSVRTRICP.COM	PLUTO	PLUTO
CSVRTRICP.CMD	PLUTO	PLUTO

* NETUIC is the default. The location of the files depends on what you specify in the down-line load database on the host.

5.3.4 Editing the Backup Host List

You need not edit any of the files copied to the alternate loading host nodes. However, you can edit the network configuration file at each node to make sure the backup host list contains the appropriate number of backup host nodes. On each node, the backup host list should be unique. For example, suppose the backup host list on node A contains nodes B, C, and D. When you copy files from node A to nodes B, C, and D, the backup host lists for each node will be as follows:

	Backup Hosts
Node A:	B, C, D
Node B:	B, C, D
Node C:	B, C, D
Node D:	B, C, D

On node B, the backup host list includes node B. This means that if node B is called on to load the server, the server will have only two nodes available for backups, nodes C and D. Therefore, you should substitute another node for node B in the backup list on that node, and do similarly for each of the other nodes. For example, after making appropriate edits, the backup lists on the nodes could be:

	Backup Hosts
Node A:	B, C, D
Node B:	A, C, D
Node C:	A, B, D
Node D:	A, C, B

5.4 Editing Configuration Files after Loading

After installing the DECnet Router Server, you may want to edit the configuration files to correct errors you made or to fine tune the routing database. Chapter 4 explains how to edit these files. After editing the files, load the server again, check out the software, and copy the files to backup hosts as done previously.

5.5 Protecting the Configuration Files

Once you have successfully installed your server and it is running to your satisfaction, you are advised to protect your server configuration files. This will prevent them from being changed, deleted, or copied by unauthorized users. Follow the steps described in the following sections. To protect the files stored on a VMS loading host, read Section 5.5.1. To protect the files stored on an RSX loading host, read Section 5.5.2.

5.5.1 Protecting Configuration Files on VMS Loading Hosts

When you install the server, VMSINSTAL sets the DISUSER and CAPTIVE flags to protect the PLUTO account. Make sure these flags are not changed. To further protect the configuration files,

1 Set the ownership of the configuration files to that of the PLUTO directory and set their protection as read-only by owner. To set the ownership of the configuration files to the PLUTO directory, type the following command for each file:

SET FILE/OWNER=[PLUTO] *filespec*.CFG

Type the following command to set the protection of the configuration files so that the owner has read-only access and all other users are restricted from all types of access:

SET PROTECTION=(OWNER:R,SYSTEM,WORLD,GROUP) *filespec*.CFG

2 Set up a log-in command file for the PLUTO account, such as the one shown below. The following file insures that only certain nodes can log in to the account. Normally, the CAPTIVE and DISUSER flags prevent users from logging in to this account. However, network processes such as the File Access Listener (FAL) can still access the account. The command file shown here makes sure any access requests made by FAL are from a known server. If the request is not from a known server, the request is rejected. Specifically, the file senses the name of the remote node requesting access, assigning the name to the symbol "remote_node". Then it checks this name against a list of known server node names. If it finds a match, the command file exits to allow the requesting node to continue. If no match is found, the file executes the log-out command, thereby denying access to the requesting node. In the command file below, replace the "SERVER_NODE_N" symbols with server node names. You can extend the list if more than three servers use the same system as their host.

```
$ !
$ !  File: LOGIN.COM (from PLUTO account)
$ !
$ on error then logout
$ on warning then logout
$ !
$ remote_user = f$logical("sys$net")
$ node_length = f$locate(":",remote_user)
$ remote_node = f$extract(0,node_length,remote_user)
$ !
$ if remote_node .eqs. "SERVER_NODE_1" then exit
$    ! '"'s are required
$ if remote_node .eqs. "SERVER_NODE_2" then exit
$    ! Include as many server nodes as you have
$ if remote_node .eqs. "SERVER_NODE_X" then exit
$ logout
```

3 Write protect the directory in which the configuration files will be stored. This prevents anyone from modifying the files or copying new versions of the file into the directory. Type the following command:

SET PROTECTION=(SYSTEM:RED,OWNER:RED,GROUP:RE,WORLD:RE) -RET
_*dev:*[*dir*]PLUTO.DIR RET

where

dev: is the device on which the PLUTO directory resides. The default is SYS$SYSDEVICE[SYS0]:PLUTO.DIR.

dir is the directory in which the files will be stored.

5.5.2 Protecting Configuration Files on RSX Loading Hosts

On RSX loading hosts, do the following to protect your configuration files:

1 Use the ACNT program to modify the account for PLUTO. Specifically, set up the account as nonprivileged by choosing a group number of 10 or greater (for example, [310,2]). Set up the account as slaved by answering yes to the following question: "Slave terminal?".

2 Create a login.cmd file for the account that prevents users from logging into the account. Specify the version number of the file as 77777 (login.cmd;77777). This prevents anyone from writing a new version of the file. Within the command file, include the following command to log off anyone who tries to log in interactively:

.XQT BYE

Using PIP, protect the command file as follows:

```
>PIP LOGIN.CMD/PR/WO/GR/OW:R/SY RET
```

This command restricts all users except the owner from all types of access to the file. The owner has read access only.

3 Set the protection of the files so that the owner has only read-only access and all other users are restricted from all types of access. Also, give the files the version number of 77777.

PIP *server-node-id*SB.CFG/PR/WO/GR/OW:R/SY

PIP *server-node-id*RTR.CFG/PR/WO/GR/OW:R/SY

PIP *server-node-id*SB.CFG;77777/RE=*server-node-id*SB.CFG

PIP *server-node-id*RTR.CFG;77777/RE=*server-node-id*RTR.CFG

4 Write protect the directory in which the configuration files are to be stored, as follows:

PIP [0,0]*nnnnnn*.DIR/PR/SY:RWED/OW:R

where *nnnnnn* is the UIC, zero-filled. For example, specify the following for UIC [310,2]:

```
>PIP [0,0]310002.DIR/PR/SY:RWED/OW=R RET
```

6
Troubleshooting

This chapter includes troubleshooting procedures for the problems most likely to occur when you attempt to load the server software.

6.1 Server Does Not Load

Before trying to reload the server, check that the following loading conditions are correct. Section 5.1 explains how to set up the proper loading conditions.

1 Power is on at the server hardware unit. The ON/OFF/LOCK switch must be ON and the green POWER light should be ON.

  If the ON/OFF/LOCK switch is ON but the POWER light is OFF, check the circuit breaker on the back of the unit. The bar should be up. If it is not, the circuit breaker tripped. Reset the breaker and check the POWER light. If the light is not ON, check the digital display and other lights on the front panel. If they are lit, the POWER light is faulty. Call for service.

2 Check the UNA lines on all potential loading hosts. The UNA lines must be loaded (use the NCP SET LINE UNA-0 ALL command to load the line).

3 Check the UNA circuits on all potential loading hosts. The circuit state should be ON. Also, the circuit should be enabled for service.

4 Check that event logging is enabled at the loading host and any other potential loading host.

Once all loading conditions are satisfied, try reloading the server. If the reload fails (that is, the software does not start running, as indicated by the cyclic pattern on the front of the hardware unit), your next step depends on how you tried to start the load. If you tried to load the server locally (at the hardware unit), go to Section 6.1.1. If you tried to load the server remotely (using NCP LOAD or TRIGGER commands from a host), go to Section 6.1.2.

6.1.1 Server Cannot Be Loaded Locally

If you try loading the server by pushing the START button on the hardware unit and nothing happens after the initial self-test (the lights blink and the digital display is cleared, no "L" indicating the load is taking place), check that:

1 The down-line load database on the loading hosts are set up properly. If none of the potential loading hosts have the database defined for the server, the server's request-to-load message sent to the hosts will be left unanswered.

  Type the following NCP command at the host to display the database:

  SHOW NODE *server-node-id* CHARACTERISTICS

  If the database has not been defined, execute the database command file on the loading host. On a VMS host, the file is an NCP command file named *server-node-id*.COM. On an RSX host, it is a CFE command file named CFE*server-node-id*.CMD. You may have installed the server software without executing the command file.

2 The Ethernet hardware address defined in the database is correct.

3 The system load files are in the correct directory. Also, check that they are world readable.

Also, check for event messages at the loading host. The event messages can point to the cause of the problem.

If all of the above are verified, run LDI to check the hardware components. The *DECnet Router Software Management Guide* explains how to run LDI. Also, see the *Ethernet Communications Server Operations and Maintenance Manual* for complete coverage of the hardware diagnostics available. If hardware faults are found, correct them or have them corrected, and try to load the server again.

6.1.2 Server Cannot Be Loaded by Command

If you cannot get the server to load by using the NCP LOAD command, try using the command at another loading host. If the server loads successfully from there, then the down-line load database might be set up improperly on the host from which the command has failed. Check all the conditions mentioned in Section 6.1.1. Also, check that all required files have been installed on the host and that the parameters are correct for your installation. (Refer to Chapter 2.) If the files are not correct, correct them. Then try loading the server.

If the server does not load from another loading host, then try the NCP TRIGGER command at any DECnet host. If the TRIGGER command works, then the DECnet databases on the hosts from which you tried the LOAD command were not set up properly.

If the TRIGGER command does not get the server to load, then try manual loading. If manual loading works, perhaps the server's service password is not correct (that is, the service password defined in the DECnet database for the server does not match the UNA password defined in the server's network configuration file).

If manual loading does not work, the reason might be that none of the hosts on the Ethernet have the proper DECnet database for loading the server. Another reason might be that the down-line load files are in the wrong directory. On VMS hosts, they should be in SYS$SYSTEM. On RSX hosts, they should be in NETUIC or whatever directory is listed when you issue the following NCP command:

SHOW NODE *server-node-id* CHARACTERISTICS

This command displays the volatile DECnet database parameters used for loading the server. If the parameters have not been set up, then shut down the network and reload it.

If necessary, run LDI to check the hardware components. The *DECnet Router Software Management Guide* explains how to run LDI. Also, see the *Ethernet Communications Server Operations and Maintenance Manual* for complete coverage of the hardware diagnostics available. If hardware faults are found, correct them or have them corrected, and try to load the server again.

If the above steps do not isolate the problem source, call for service.

6.2 Server Loads – LC Circuits Not Turned On

If after successfully loading the software you notice that the state of the LC circuits is OFF (you tried accessing an adjacent node on one of the point-to-point lines and access failed, or you typed the NCP SHOW KNOWN CIRCUITS command for execution at the server and the display showed the circuit states as OFF), then the circuits might still be initializing. Wait a minute or two and see if the circuits turn on.

If the circuits are still off, check for event messages. They may help you find the cause of the problem.

Possibly, the error lies in the router configuration file. (Event error messages could pinpoint the errors.) For example, if the total bandwidth for the circuits is too high (the total of the line speeds exceeds the maximum bandwidth shown in Chapter 4), the server turns off all the circuits. Or, one of the router initialization files might be unreadable. They should have world read access. Use the following commands to check that the files are readable:

From a VMS host:

TYPE *host-id*"PLUTO PLUTO"::*file-id*

From an RSX host:

NFT TI:=*host-id*/PLUTO/PLUTO::*file-id*

6.3 Server Loads – Lines Are On-starting

If the lines are not on, but are in the on-starting substate, check the following:

1 The router configuration file parameters. Check in particular that the MAXIMUM ADDRESS is large enough (see Section 4.3). Also, check that the receive and transmit passwords are defined properly. On a link that crosses an area boundary, make sure that the server and the adjacent node are both level 2 routers.

2 Event messages at the loading host or at adjacent hosts trying to access the server.

3 The fault LED on the line card. This LED should be off. If it is still on, the line card might be at fault. Run LDI to be sure.

4 If LC lines are connected by modem, check that the line parameters defined in the router configuration file match the settings for the modem. Test the modem hardware.

6.4 Server Crashes

If the server crashes, check for event messages at the loading host or a backup host. Also, check for a halt code displayed on the hardware unit. Take the appropriate corrective action based on the event messages or code. If the problem happens again, check for a dump file in the server account on the loading host or backup hosts. Have the dump file analyzed by Digital specialists. If you do not find a dump file, force a crash dump as explained in the *DECnet Router Software Management Guide.*

Try reproducing the problem. Collect more environmental data while doing so by answering the following questions. The data can help you or Digital specialists to isolate the cause of the problem.

1 What is the network configuration and what is the application?

2 What are the version numbers of the affected software?

3 Describe the problem.

4 How long has the problem been observed?

5 What was happening when the problem occurred?

6 Can you reproduce the problem?

7 What must you do to reproduce the problem?

8 What was expected to happen that did not happen?

9 What event messages did you receive?

10 What effect does the problem have on the application?

11 Did the crash result in a dump or did you force a dump?

A
Sample Line Configuration Worksheet

Figure A–1 shows a sample line configuration worksheet. This worksheet includes information used for installing the DECnet Router Server software. It identifies each line card and its termination. The worksheet is filled out before installation by the system manager (or customer) and Digital software specialists or sales personnel.

See next page for sample line configuration worksheet.

Line Configuration Worksheet

Left Linecard Slots

Slot	Module	Connector	Cable ID	Line Assignment
1		Left		
		Right		
3		Left		
		Right		
5		Left		
		Right		
7		Left		
		Right		
9		Left		
		Right		
11		Left		
		Right		
13		Left		
		Right		
15		Left		
		Right		

Right Linecard Slots

Slot	Module	Connector	Cable ID	Line Assignment
2		Left		
		Right		
4		Left		
		Right		
6		Left		
		Right		
8		Left		
		Right		
10		Left		
		Right		
12		Left		
		Right		
14		Left		
		Right		
16		Left		
		Right		

TW037

Figure A–1: Sample Line Configuration Worksheet

B
Sample Configuration Files and Procedures

Section B.1 contains an example of a network configuration file. Section B.2 contains two examples of prototype router configuration files that can be installed from the distribution kit. Chapter 4 explains how to edit these files to customize the configuration to your needs. Refer to Chapters 3 and 4 for instructions on how to set up the server as an area router. Section B.3 contains sample installation, configuration, and loading procedures for a DECnet Router Server as performed on a VMS node (Section B.3.1) and as performed from an RSX node (Section B.3.2). Chapter 2 explains how to install and load the server. Section B.4 contains sample installation checkout procedure (ICP) files.

B.1 Sample Network Configuration File

The following is a sample network configuration file for server node RTRDEV. You can edit the file by modifying the parameters in each command.

```
!            Configuration File - RTRDEVSB.CFG
!
!1. Defining the UNA password (viewed by hosts as the service password).
!   Default if invalid or missing: NO PASSWORD SET
        SET LINE UNA-0 PASSWORD FFFF134
!
!2. Defining the Network Verification password.
!   Default if invalid or missing: NO PASSWORD SET
        SET SYSTEM PASSWORD PRIV
!
!3. Setting the clock frequency to 50 Hz.
!   Default if invalid or missing: 60 Hz.
        SET SYSTEM LINE FREQUENCY 60
!
!4. Backup host node list.
!   Default: server's maintenance host
        SET EXECUTOR BACKUP HOSTS HOST1,HOST2,HOST3,HOST4,HOST5
```

B.2 Sample Router Configuration Files

Following are examples of prototype (unedited) router configuration files. Section B.2.1 contains a file generated for a server software configuration supporting a maximum of eight synchronous lines (CSVRTR.SYS). Section B.2.2 contains a file generated for server software supporting a maximum of eight synchronous or 16 asynchronous lines (CSVRTR16L.SYS). See Chapter 4 for further explanation of the commands and parameters in the file.

B.2.1 Unedited Router Configuration File for 8 Synchronous Lines

The following file accompanies the server software configuration that supports up to 8 lines, synchronous only.

```
;
; DECnet Router Server Initialization File
;
; Copyright (c) 1984 by
; Digital Equipment Corporation, Maynard, Mass.
;
; File name = "Server's node name"RTR.CFG
;
; This configuration file resides on the PLUTO/PLUTO account or
; General DECnet account of the down-line loading host system. This
; file uses all the default values for configuring a DECnet Router
; Server node. Note all values are in decimal.
;
;
;       1.  Set the MAXIMUM ADDRESS in the DECnet network. The legal
;           range for this parameter is 2 to 1023 inclusive. The
;           default value for the MAXIMUM ADDRESS parameter is 255.
;

        SET EXECUTOR MAXIMUM ADDRESS 255

;
;       2.  Set the maximum number of routing nodes (excluding this
;           node) on the Ethernet simultaneously. The legal range for
;           the BROADCAST ROUTERS parameter is 1 to 33 inclusive. The
;           default value for this parameter is 10.
;

        SET EXECUTOR MAXIMUM BROADCAST ROUTERS 10

;
;       3.  Set the maximum number of nonrouting nodes on the Ethernet
;           simultaneously. The legal range for the BROADCAST
;           NONROUTERS parameter is 0 to 1022 inclusive. The default
;           value for this parameter is 32. The number of nonrouters
;           will be set to the maximum address minus one if the number
;           of nonrouters is greater than the maximum address minus
;           one.

        SET EXECUTOR MAXIMUM BROADCAST NONROUTERS 32
```

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```
;
;       4.  Set the total number of hops from the DECnet Router Server
;           to any other reachable node in the network. A remote node
;           is unreachable over a path if the number of hops required
;           to get to it exceeds the value set for this parameter. The
;           legal range for the HOPS parameter is 2 to 30 inclusive.
;           The default value for this parameter is 20.
;

            SET EXECUTOR MAXIMUM HOPS 20

;
;       5.  Set the total cost from the DECnet Router Server to any
;           other reachable node in the network. A remote node is
;           unreachable over a path if the cost required to get to it
;           exceeds the value set for this parameter. The legal range
;           for the COST parameter is 2 to 1022 inclusive. The default
;           value for this parameter is 1022.
;

            SET EXECUTOR MAXIMUM COST 1022

;
;       6.  Set the BUFFER SIZE for the DECnet Router Server. These
;           buffers are used for the intermediate storage of all user
;           data being transmitted or received. Legal range for the
;           BUFFER SIZE parameter is 246 to 1484 inclusive. The
;           default value for this parameter is 576.
;

            SET EXECUTOR BUFFER SIZE 576

;
;       7.  Set the SEGMENT BUFFER SIZE. This parameter allows nodes
;           with different buffer sizes to communicate efficiently.
;           The legal range for the SEGMENT BUFFER SIZE parameter is
;           246 to 1484 inclusive. The default value for this
;           parameter is 576.
;

            SET EXECUTOR SEGMENT BUFFER SIZE 576
```

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```
;
;       8.  Set the line characteristics (SPEED, DUPLEX, MODEM control)
;           for each point-to-point connection from the DECnet Router
;           Server. The options for each parameter are the following:
;
;           The speed range varies depending on your configuration.
;           Check the DECnet Router Software Installation Guide for the
;           proper values. The total bandwidth for the point-to-point
;           lines must not exceed 500 kilobauds.
;
;           The duplex parameter for the line can be DUPLEX FULL or
;           DUPLEX HALF.
;
;           The modem control parameter can be MODEM YES or MODEM NO.
;
;           The default values for these parameters are SPEED 9600,
;           DUPLEX FULL and MODEM YES. The legal devices are LC-1
;           through LC-8 and LC-*.
;

SET LINE LC-1 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-2 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-3 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-4 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-5 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-6 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-7 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-8 SPEED 9600 DUPLEX FULL MODEM YES

;
;       9.  Set the circuit characteristics (COST, HELLO TIMER, STATE)
;           for the point-to-point circuits from the DECnet Router
;           Server. The legal range for the cost parameter is 1 to 25
;           inclusive. This sets the path cost between the DECnet
;           Router and the adjacent node on the circuit. The legal
;           range for the HELLO TIMER parameter is 3 to 8191. The
;           HELLO TIMER is the rate in seconds that idle transport
;           messages are sent to maintain reachability. The options for
;           the state parameter are STATE ON or STATE OFF. The default
```

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```
;           values for COST, HELLO TIMER and STATE are 1, 15 seconds
;           and off respectively.
;

SET CIRCUIT LC-1 COST 1 HELLO TIMER 15 STATE OFF
SET CIRCUIT LC-2 COST 1 HELLO TIMER 15 STATE OFF
SET CIRCUIT LC-3 COST 1 HELLO TIMER 15 STATE OFF
SET CIRCUIT LC-4 COST 1 HELLO TIMER 15 STATE OFF
SET CIRCUIT LC-5 COST 1 HELLO TIMER 15 STATE OFF
SET CIRCUIT LC-6 COST 1 HELLO TIMER 15 STATE OFF
SET CIRCUIT LC-7 COST 1 HELLO TIMER 15 STATE OFF
SET CIRCUIT LC-8 COST 1 HELLO TIMER 15 STATE OFF

;
;       10. Set the circuit UNA-0 parameters (COST, ROUTING PRIORITY,
;           HELLO TIMER). The COST and HELLO TIMER parameters have the
;           same attributes and defaults as described above for LC
;           circuits. The ROUTING PRIORITY parameter designates which
;           router will serve the Ethernet. If two routing nodes have
;           the same priority, then the node with the higher node
;           address will be the designated router for the Ethernet.
;           The legal range for the ROUTING PRIORITY parameter is 0 to
;           127 inclusive. The default for this parameter is 100.
;

SET CIRCUIT UNA-0 COST 1 ROUTING PRIORITY 100 HELLO TIMER 15

;
;       11. Set the TRANSMIT PASSWORD, which the executor node must
;           transmit to an adjacent node during a node initialization
;           sequence. The password is one to eight ASCII characters.
;           The default for this parameter is no password.

;       SET EXECUTOR TRANSMIT PASSWORD DECNET
```

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```
;
;       12. Set the RECEIVE PASSWORD, which the executor node expects
;           to receive from an adjacent node during a node
;           initialization sequence. The password is one to eight
;           ASCII characters. The default for this parameter is no
;           password.
;
;        SET EXECUTOR RECEIVE PASSWORD DECNET
;
;       13. Set the MAXIMUM AREA number in the DECnet network. The
;           legal range for this parameter is 2 to 63 inclusive. If
;           this parameter is specified, the DECnet Router will become
;           an area router. The default value for the MAXIMUM AREA
;           parameter is level 1 routing only. Refer to the
;           documentation when configuring areas.
;
;        SET EXECUTOR MAXIMUM AREA 63
;
;       14. Set the total number of area hops from the DECnet Router
;           Server's area to any other reachable area in the network.
;           A remote area is unreachable over a path if the number of
;           hops required to get to it exceeds the value set for this
;           parameter. The legal range for the AREA HOPS parameter is
;           2 to 30 inclusive. If this parameter is specified, the
;           DECnet Router will become an area router. The default
;           value for the AREA HOPS parameter is level 1 routing only.
;           Refer to the documentation when configuring areas.
;
;        SET EXECUTOR MAXIMUM AREA HOPS 20
```


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```
;
;       15. Set the total cost from the DECnet Router Server's area to
;           any other reachable area in the network. A remote area is
;           unreachable over a path if the cost required to get to it
;           exceeds the value set for this parameter. The legal range
;           for the AREA COST parameter is 2 to 1022 inclusive. If
;           this parameter is specified, the DECnet Router will become
;           an area router. The default value for this parameter is
;           level 1 routing only. Refer to the documentation when
;           configuring areas.
;
;        SET EXECUTOR MAXIMUM AREA COST 1022
```

B.2.2 Unedited File for 8 Synchronous/16 Asynchronous Lines

The following file accompanies the server software configuration supporting up to 8 synchronous or 16 asynchronous lines.

Example starts on following page.

```
;
; DECnet Router Server Initialization File
;
; Copyright (c) 1984 by
; Digital Equipment Corporation, Maynard, Mass.
;
; File name = "Server's node name"RTR.CFG
;
;
; This configuration file resides on the PLUTO/PLUTO account or
; General DECnet account of the down-line loading host system. This
; file uses all the default values for configuring a DECnet Router
; Server node. Note all values are in decimal.
;
;
;       1.  Set the MAXIMUM ADDRESS in the DECnet network. The legal
;           range for this parameter is 2 to 1023 inclusive. The
;           default value for the MAXIMUM ADDRESS parameter is 255.
;
        SET EXECUTOR MAXIMUM ADDRESS 255
;
;       2.  Set the maximum number of routing nodes (excluding this
;           node) on the Ethernet simultaneously. The legal range for
;           the BROADCAST ROUTERS parameter is 1 to 33 inclusive. The
;           default value for this parameter is 10.
;
        SET EXECUTOR MAXIMUM BROADCAST ROUTERS 10
;
;       3.  Set the maximum number of nonrouting nodes on the Ethernet
;           simultaneously. The legal range for the BROADCAST
;           NONROUTERS parameter is 0 to 1022 inclusive. The default
;           value for this parameter is 32. The number of nonrouters
;           will be set to the maximum address minus one if the number
;           of nonrouters is greater than the maximum address minus
;           one.
        SET EXECUTOR MAXIMUM BROADCAST NONROUTERS 32
```

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```
;
;       4.  Set the total number of hops from the DECnet Router Server
;           to any other reachable node in the network. A remote node
;           is unreachable over a path if the number of hops required
;           to get to it exceeds the value set for this parameter. The
;           legal range for the HOPS parameter is 2 to 30 inclusive.
;           The default value for this parameter is 20.
;
            SET EXECUTOR MAXIMUM HOPS 20

;
;       5.  Set the total cost from the DECnet Router Server to any
;           other reachable node in the network. A remote node is
;           unreachable over a path if the cost required to get to it
;           exceeds the value set for this parameter. The legal range
;           for the COST parameter is 2 to 1022 inclusive. The default
;           value for this parameter is 1022.
;
            SET EXECUTOR MAXIMUM COST 1022

;
;       6.  Set the BUFFER SIZE for the DECnet Router Server. These
;           buffers are used for the intermediate storage of all user
;           data being transmitted or received. Legal range for the
;           BUFFER SIZE parameter is 246 to 1484 inclusive. The
;           default value for this parameter is 576.
;
            SET EXECUTOR BUFFER SIZE 576

;
;       7.  Set the SEGMENT BUFFER SIZE. This parameter allows nodes
;           with different buffer sizes to communicate efficiently.
;           The legal range for the SEGMENT BUFFER SIZE parameter is
;           246 to 1466 inclusive. The default value for this
;           parameter is 576.
;
            SET EXECUTOR SEGMENT BUFFER SIZE 576
```

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```
;
;       8.  Set the line characteristics (SPEED, DUPLEX, MODEM control)
;           for each point-to-point connection from the DECnet Router
;           Server. The options for each parameter are the following:
;
;           The speed range varies depending on your configuration.
;           Check the DECnet Router Software Installation Guide for the
;           proper values. The total bandwidth for the point-to-point
;           lines must not exceed 500 kilobauds.
;
;           The duplex parameter for the line can be DUPLEX FULL or
;           DUPLEX HALF.
;
;           The modem control parameter can be MODEM YES or MODEM NO.
;
;           The default values for these parameters are SPEED 9600,
;           DUPLEX FULL and MODEM YES. The legal devices are LC-1
;           through LC-8 and LC-*. If the lines are asynchronous,
;           specify L or R following the line number to indicate the
;           left and right part of the line card. The default is
;           synchronous.
;
;           Synchronous
SET LINE LC-1 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-2 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-3 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-4 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-5 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-6 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-7 SPEED 9600 DUPLEX FULL MODEM YES
SET LINE LC-8 SPEED 9600 DUPLEX FULL MODEM YES
```

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```
;
;          Asynchronous
;       SET LINE LC-1L SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-1R SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-2L SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-2R SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-3L SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-3R SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-4L SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-4R SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-5L SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-5R SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-6L SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-6R SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-7L SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-7R SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-8L SPEED 9600 DUPLEX FULL MODEM YES
;       SET LINE LC-8R SPEED 9600 DUPLEX FULL MODEM YES
;
;    9. Set the circuit characteristics (COST, HELLO TIMER, STATE)
;       for the point-to-point circuits from the DECnet Router
;       Server. The legal range for the cost parameter is 1 to 25
;       inclusive. This sets the path cost between the DECnet
;       Router and the adjacent node on the circuit. The legal
;       range for the HELLO TIMER parameter is 3 to 8191. The
;       HELLO TIMER is the rate in seconds that idle transport
;       messages are sent to maintain reachability. The options for
;       the state parameter are STATE ON or STATE OFF. The default
;       values for COST, HELLO TIMER and STATE are 1, 15 seconds
;       and off respectively.
;
;          Synchronous
;       SET CIRCUIT LC-1 COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-2 COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-3 COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-4 COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-5 COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-6 COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-7 COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-8 COST 1 HELLO TIMER 15 STATE OFF
```

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```
;          Asynchronous
;       SET CIRCUIT LC-1L COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-1R COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-2L COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-2R COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-3L COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-3R COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-4L COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-4R COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-5L COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-5R COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-6L COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-6R COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-7L COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-7R COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-8L COST 1 HELLO TIMER 15 STATE OFF
;       SET CIRCUIT LC-8R COST 1 HELLO TIMER 15 STATE OFF
;
;     10. Set the circuit UNA-0 parameters (COST, ROUTING PRIORITY,
;         HELLO TIMER). The COST and HELLO TIMER parameters have the
;         same attributes and defaults as described above for LC
;         circuits. The ROUTING PRIORITY parameter designates which
;         router will serve the Ethernet. If two routing nodes have
;         the same priority, then the node with the higher node
;         address will be the designated router for the Ethernet.
;         The legal range for the ROUTING PRIORITY parameter is 0 to
;         127 inclusive. The default for this parameter is 100.
;
      SET CIRCUIT UNA-0 COST 1 ROUTING PRIORITY 100 HELLO TIMER 15
;
;     11. Set the TRANSMIT PASSWORD, which the executor node must
;         transmit to an adjacent node during a node initialization
;         sequence. The password is one to eight ASCII characters.
;         The default for this parameter is no password.
;
;       SET EXECUTOR TRANSMIT PASSWORD DECNET
```

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```
;
;       12. Set the RECEIVE PASSWORD, which the executor node expects
;           to receive from an adjacent node during a node
;           initialization sequence. The password is one to eight
;           ASCII characters. The default for this parameter is no
;           password.
;
;        SET EXECUTOR RECEIVE PASSWORD DECNET
;
;       13. Set the MAXIMUM AREA number in the DECnet network. The
;           legal range for this parameter is 2 to 63 inclusive. If
;           this parameter is specified, the DECnet Router will become
;           an area router. The default value for the MAXIMUM AREA
;           parameter is level 1 routing only. Refer to the
;           documentation when configuring areas.
;
;        SET EXECUTOR MAXIMUM AREA 63
;
;       14. Set the total number of area hops from the DECnet Router
;           Server's area to any other reachable area in the network.
;           A remote area is unreachable over a path if the number of
;           hops required to get to it exceeds the value set for this
;           parameter. The legal range for the AREA HOPS parameter is
;           2 to 30 inclusive. If this parameter is specified, the
;           DECnet Router will become an area router. The default
;           value for the AREA HOPS parameter is level 1 routing only.
;           Refer to the documentation when configuring areas.
;
;        SET EXECUTOR MAXIMUM AREA HOPS 20
```


(continued on next page)

```
;
;       15. Set the total cost from the DECnet Router Server's area to
;           any other reachable area in the network. A remote area is
;           unreachable over a path if the cost required to get to it
;           exceeds the value set for this parameter. The legal range
;           for the AREA COST parameter is 2 to 1022 inclusive. If
;           this parameter is specified, the DECnet Router will become
;           an area router. The default value for this parameter is
;           level 1 routing only. Refer to the documentation when
;           configuring areas.
;
;           SET EXECUTOR MAXIMUM AREA COST 1022
```

B.3 Examples of DECnet Router Server Installation and Loading Procedure

Section B.3.1 shows a sample installation and loading procedure from a VMS host. Section B.3.2 shows one from an RSX host.

B.3.1 Installing and Loading Procedure from a VMS Host

The following is an example showing the installation of software for a DECnet Router Server named RTRDEV on a VMS host, VMCENT, followed by an example of the down-line loading of the server. First, log into the SYSTEM account and enter the following command. Then respond to the questions in the procedure.

Example starts on following page.

```
$ @SYS$UPDATE:VMSINSTAL CSVRTR MTA0:(RET)

        VAX/VMS Software Product Installation Procedure V4.0

It is 23-AUG-1984 at 16:19
Enter a question mark (?) at any time for help.

%VMSINSTAL-W-DECNET, Your DECnet network is up and running.
%VMSINSTAL-W-ACTIVE, The following processes are still active:
        BERGER
        MAIL_71
        _JOB5792
        SMITH
* Do you want to continue anyway [NO]? Y (RET)
* Are you satisfied with the backup of your system disk [YES]? (RET)

Please mount the first volume of the set on MTA0:.
* Are you ready? Y (RET)
%MOUNT-I-MOUNTED, CSVRTR mounted on _MTA0:.

  The following products will be installed:

    CSVRTR V1.1

        Beginning installation of CSVRTR V1.1 at 16:19

%VMSINSTAL-I-RESTORE, Restoring product saveset A...

Router Server V1.1 installation procedures.

The following set of questions asks you for information used to
set up the account which will be used to install the Router
Server software.

* Device for the account [SYS$SYSROOT:]: (RET)
* UIC for account [014,001]: (RET)

* How many synchronous lines will be configured (0:16) [8]: (RET)
* How many asynchronous lines will be configured (0:32) [0]: (RET)
You have chosen 8 synchronous and 0 asynchronous lines. The system
configuration that will be generated will allow up to 8 line cards.
```

(continued on next page)

```
There are 2 lines per asynchronous line card or 1 line per synchronous
line card. If you wish to add lines to your Router at some later time,
you should rerun this procedure to generate the appropriate system.

If there is already an account named PLUTO, you will receive a
warning message which you may ignore.

%VMSINSTAL-I-ACCOUNT, This installation creates an account named PLUTO.
user record successfully added

Installing Router Server V1.1 files.
Router Server V1.1 files installed.

The images and command files of the Router Server V1.1 have been
restored to disk. The next step in the installation is to
set up the host database.

This command procedure defines the database on your VMS host
which allows you to down-line load the server software and
to receive an up-line dump of the server memory after a
crash.


This procedure can optionally execute the NCP command file.

* Server node-id      (1-6 chars)        [ ]                 :RTRDEV<RET>
* Server node number  (1 - 1023)         [ ]                 :134<RET>
* Hardware address    (12 hex-digits)    [ ]                 :AA-00-03-00-00-86<RET>
* Maintenance host    (1-6 chars)        [VMCENT]            :VMCENT<RET>
* Service circuit     ( )                [UNA-0]             :<RET>
* Service password    (1-16 hex digits)  [0]                 :11FF<RET>
* Store file          (YES or NO)        [YES]               :<RET>
* File name           (1-12 chars)       [RTRDEV.COM]        :<RET>
* Storage directory   ( )                [SYS$SYSROOT:[PLUTO]]  :<RET>
```


(continued on next page)

```
Creating file SYS$SYSROOT:[PLUTO]RTRDEV.COM

* Execute File        (YES or NO)       [YES]              :RET

NCP will print unrecognized component errors if the node being
defined is not already defined in the permanent database. You
may ignore these errors.

Defining the host database may take anywhere from a few minutes
to 30 minutes depending on system load and size of the host's
node database.
%NCP-I-NMLRSP, listener response - Unrecognized component, Node

%NCP-I-NMLRSP, listener response - Unrecognized component, Node

This procedure will now create the DECnet Router Server network
configuration file.

The network configuration file will be named RTRDEVSB.CFG.

* System password     (1-6 chars)       [null]             : METRET
* Clock frequency     (50 or 60)        [60]               : RET

The next set of questions asks for backup hosts.
You may enter a maximum of five (5) backup hosts.
A null entry or five (5) entries will terminate solicitation.

* Backup host         (1-6 chars)       [null]             : HOSTA RET
* Backup host         (1-6 chars)       [null]             : HOSTB RET
* Backup host         (1-6 chars)       [null]             : HOSTC RET
* Backup host         (1-6 chars)       [null]             : HOSTF RET
* Backup host         (1-6 chars)       [null]             : RET
Created the configuration file SYS$SYSROOT:[PLUTO]RTRDEVSB.CFG

When the procedure is complete, check and edit (if necessary) the
router configuration file (RTRDEVRTR.CFG).

VMSINSTAL-I-MOVEFILES, Files will now be moved to their target directories...
       Successful installation of CSVRTR V1.1 at 16:25
        VMSINSTAL procedure done at 16:35
$
```

Assuming you are using the predefined DECnet Router Server configuration file, you are now ready to load the DECnet Router Server. Before using the NCP LOAD command, you must prepare the UNA–0 line and circuit for down-line loading, as shown:

```
$ NCP> SET LINE UNA-0 ALL (RET)
$ NCP> SET CIRCUIT UNA-0 SERVICE ENABLED STATE ON(RET)
$ NCP> LOAD NODE RTRDEV (RET)
```

The following events are seen at the logging console or logging monitor of the loading host:

```
%%%%%%%%%%%  OPCOM   26-AUG-84 14:22:10.76
Message from user DECnet on VMCENT
DECnet event 0.3, automatic line service
From node 120 (VMCENT), 26-AUG-84 14:22:09.86
Circuit UNA-0, Load, Requested, Node = 134 (RTRDEV)
File = PLUTO2.SYS, Secondary loader

%%%%%%%%%%%  OPCOM   26-AUG-84 14:22:10.85
Message from user DECnet on VMCENT
DECnet event 0.3, automatic line service
From node 120 (VMCENT), 26-AUG-84 14:22:10.66
Circuit UNA-0, Load, Successful, Node = 134 (RTRDEV)
File = PLUTO2.SYS, Secondary loader

%%%%%%%%%%%  OPCOM   26-AUG-84 14:22:11.32
Message from user DECnet on VMCENT
DECnet event 0.3, automatic line service
From node 120 (VMCENT), 26-AUG-84 14:22:11.06
Circuit UNA-0, Load, Requested, Node = 134 (RTRDEV)
File = PLUTO3.SYS, Tertiary loader

%%%%%%%%%%%  OPCOM   26-AUG-84 14:22:11.76
Message from user DECnet on VMCENT
DECnet event 0.3, automatic line service
From node 120 (VMCENT), 26-AUG-84 14:22:11.66
Circuit UNA-0, Load, Successful, Node = 134 (RTRDEV)
File = PLUTO3.SYS, Tertiary loader

%%%%%%%%%%%  OPCOM   26-AUG-84 14:22:12.03
Message from user DECnet on VMCENT
DECnet event 0.3, automatic line service
From node 120 (VMCENT), 26-AUG-84 14:22:11.79
Circuit UNA-0, Load, Requested, Node = 134 (RTRDEV)
File = CSVRTR.SYS, Operating system

%%%%%%%%%%%  OPCOM   26-AUG-84 14:22:13.06
Message from user DECnet on VMCENT
DECnet event 0.3, automatic line service
From node 120 (VMCENT), 26-AUG-84 14:23:10.76
Circuit UNA-0, Load, Successful, Node = 134 (RTRDEV)
File = CSVRTR.SYS, Operating system
```

```
DECnet event 225.0
From node 134 (RTRDEV), 26-AUG-84 14:24:21.37
Parameter #0 = Server initializing,
Identification = DECnet Router Server V1.1 8L

DECnet event 4.15, adjacency up
From node 120 (VMCENT), 26-AUG-84 14:25:00.63
Circuit UNA-0, Adjacent node = 134 (RTRDEV)

DECnet event 4.15, adjacency up
From node 134 (RTRDEV), 26-AUG-84 14:25:10.56
Circuit UNA-0, Adjacent node = 245 (HOSTA)

DECnet event 4.15, adjacency up
From node 134 (RTRDEV), 26-AUG-84 14:26:00.60
Circuit UNA-0, Adjacent node = 450 (HOSTB)
                      .
                      .
                      .
DECnet event 4.15, adjacency up
From node 134 (RTRDEV), 26-AUG-84 14:26:50.76
Circuit UNA-0, Adjacent node = 124 (HOSTC)

DECnet event 4.10, circuit up
From node 134 (RTRDEV), 26-AUG-84 14:26:53.44
Circuit LC-1, Adjacent node = 211 (HELTER)

DECnet event 4.10, circuit up
From node 134 (RTRDEV), 26-AUG-84 14:26:56.78
Circuit LC-2, Adjacent node = 418 (MELTER)
                      .
                      .
                      .
DECnet event 226.0
From node 134 (RTRDEV), 26-AUG-84 14:26:59.16
Server up, Identification = DECnet Router Server V1.1 8L
```

B.3.2 Installing and Loading Procedure from an RSX Host

The following commands unload the server files from an RL02 distribution disk to the loading host RSXCEN.

```
>MOU DL1:CSVRTR(RET)
>PIP /NV=DL1:[40,40]*.*(RET)
```

After the files are copied, the installer performs RSXINSTAL:

Example starts on following page.

```
>SET /UIC=[40,40](RET)
>ASN DL1:=SY:(RET)
>@RSXINSTAL(RET)
>;
>;==================================================================
>;DECnet Router Server Installation Procedure
>;        Started at 13:08:34 on 03-AUG-84
>;==================================================================
>;
>; Copyright (C) 1984 by
>; Digital Equipment Corporation, Maynard, Mass.
>;
>; This installation procedure installs the DECnet Router Server (server)
>; on a RSX-11M/M+ host. This procedure must be run from a privileged
>; account.
>;
>; This procedure will create and copy server files. It will create a
>; network configuration file based on the answers supplied in section 2.
>; A file named CFE<node>.CMD will contain the CFE commands to define the
>; permanent database on this host.
>;
>; You may type an escape <ESC> at any question to obtain additional
>; information about the question.
>;
>; <EOS> Do you want to:
>*        <RET>-Continue, E-Exit [S]:(RET)
>;
>;
>;==================================================================
>;Section 1 - General information
>;==================================================================
>;
>; Now you must decide where you would like to put the various DECnet
>; Router Server files. It is suggested that you pick one uic for the
>; configuration files, one uic for the loaders and system images and one
>; uic for the dump images.
>;
>; NOTE: The uic where the configuration files reside must have a user id
>; and password of PLUTO/PLUTO.
```

(continued on next page)

```
>;
>; When answering questions in this section please type the full
>; directory specification. (DEV:[nnn,nnn])
>;
>* 1.00 Where will configuration files reside [S D:"SY:[40,40]"]: RET
>* 1.01 Where will system files reside [S D:"SY:[40,40]"]: DL0:[100,54]RET
>* 1.02 Where will dump files reside [S D:"DL0:[100,54]"]: RET
>* 1.03 Do you need to run the account program? [Y/N]: RET
>;
>; <EOS> Do you want to:
>*        <RET>-Continue, R-Repeat section, E-Exit [S]: RET
>;
>;
>;= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>;Section 2 - Building the network configuration
>;= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>;
>* 2.00 How many synchronous lines will be configured (0:16) [8]: RET
>* 2.01 How many asynchronous lines will be configured (0:32) [0]: RET
>;
>; You have chosen 8 synchronous and 0 asynchronous lines. The system
>; configuration that will be generated will allow up to 8 line cards.
>; NO ASYNCHRONOUS LINES WILL BE GENERATED.
>;
>;
>; There are 2 lines per asynchronous line card or 1 line per synchronous
>; line card. If you wish to add lines to your Router at some later time,
>; you should rerun this procedure to generate the appropriate system.
>;
>* 2.02 What is the node-id of the server [S]: RTRDEVRET
>* 2.03 What is the node-address [D R:1.-1023.]: 134RET
>* 2.04 What is the UNA-0 password [S R:1.-16. D:"0"]: FFFF134RET
>* 2.05 What is the network privileged password [S R:0.-8.]: PRIVRET
>* 2.06 What is the system line clock frequency [D R:50.-60. D:60.]: RET
>;
>; If you want more than one backup host enter them separated by commas.
>; i.e. HOST1,HOST2,HOST3
>;
```

(continued on next page)

```
>* 2.07 What are the node-id's of the backup hosts [S]: ESC
>; Backup hosts are needed when the server's maintenance host is out
>; of service. A DECnet Router Server may need to log an event or
>; up-line dump a system image. If the maintenance host is down, a
>; backup host is needed to assist the DECnet Router Server. Be sure
>; to set up the server databases on the backup hosts. Enter the
>; backup hosts as a list. The maximum is five backup hosts. For
>; example:
>;
>;          HOST1,HOST2,HOST3,HOST4,HOST5
>;
>* 2.07 What are the node-id's of the backup hosts [S]: SHIV,CENTR,ALOE RET
>;
>;
>; Building the network configuration file.
>;      (SY:[40,40]RTRDEVSB.CFG)
>;
>;
>; NOTE: You must also tailor the router configuration file in
>; dev:[nnn,nnn]RTRDEVRTR.CFG after this procedure
>; completes.
>;
>*         <RET>-Continue, R-Repeat section, E-Exit [S]: RET
>;
>;
>;= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>;Section 3 - Moving the DECnet Router Server files.
>;= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>;
>;
>; Copying loaders and system files to DL0:[100,54]
>;
>; Copying configuration files
>;    RTRDEVSB.CFG and RTR.CFG
>;    to SY:[40,40]
>;
```

(continued on next page)

```
>;=============================================================
>;Section 4 - Building the down-line load database
>;=============================================================
>;
>* 4.00 What is the loading host's service circuit-id [S D:"UNA-0"]: RET
>* 4.01 What is the server's hardware address [S]: AA-00-03-00-00-86RET
>;
>;
>;
>; You can define these node characteristics in the host's permanent
>; database by running CFE with the command file built in this
>; procedure (DL0:[100,54]CFERTRDEV.CMD), as follows:
>;
>; INS DEV:[NETUIC]CFE.TSK
>; >CFE
>; Enter filename: DEV:[NETUIC]CETAB.MAC
>; CFE>@DL0:[100,54]CFERTRDEV
>; CFE>sho node RTRDEV
>;     .... Displays new node characteristics
>; CFE>^Z
>;
>;
>;
>; <EOS> Do you want to:
>*        R-Repeat section, E or <RET>-Exit [S]: RET
>;
>;
>; Remember to:
>;
>;   1. Edit your router configuration file.
>;
>;   2. Update your permanent database with the newly created CFE command
>;      file. The next time your network is loaded, the volatile database
>;      on the host will be set up.
```

(continued on next page)

```
>;
>;    3. If your volatile database is set up, then you may trigger or
>;       load the server. If the volatile database is not set up, then
>;       down-line load your server with the full NCP command:
>;
>;       NCP LOAD NODE RTRDEV FROM DLO:[100,54]CSVRTR.SYS SER PASS PRIV
>;
>;    4. If you change the synchronous/asynchronous line configuration,
>;       you should rerun this procedure to ensure you have the correct
>;       software image generated for the new configuration.
>;
>;= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>;DECnet Router Server Installation Procedure
>;         Stopped at 13:11:03 on 03-AUG-84
>;= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
>;
>@ <EOF>
>
```

Assuming you are using the predefined DECnet Router Server configuration file, you are now ready to load the DECnet Router Server. Before using the NCP LOAD command, you must prepare the UNA-0 line and circuit for down-line loading, as shown:

```
$ NCP> SET LINE UNA-0 ALL (RET)
$ NCP> SET CIRCUIT UNA-0 SERVICE ENABLED STATE ON(RET)
$ NCP> LOAD NODE RTRDEV (RET)
```

The following are events normally seen on an RSX loading host. The loading host is RSXCEN:

```
 Event type 0.3, Automatic service
Occurred 26-AUG-84 16:41:04 on node 245 (RSXCEN)
Circuit UNA-0
Service type = Load
Status = Requested
Node = 134 (RTRDEV), File = DL0:[100,54]PLUTO2.SYS
Software type = Secondary loader

 Event type 0.3, Automatic service
Occurred 26-AUG-84 16:41:04 on node 245 (RSXCEN)
Circuit UNA-0
Service type = Load
Status = Successful
Node = 134 (RTRDEV), File = DL0:[100,54]PLUTO2.SYS
Software type = Secondary loader

 Event type 0.3, Automatic service
Occurred 26-AUG-84 16:41:05 on node 245 (RSXCEN)
Circuit UNA-0
Service type = Load
Status = Requested
Node = 134 (RTRDEV), File = DL0:[100,54]PLUTO3.SYS
Software type = Tertiary loader

 Event type 0.3, Automatic service
Occurred 26-AUG-84 16:41:06 on node 245 (RSXCEN)
Circuit UNA-0
Service type = Load
Status = Successful
Node = 134 (RTRDEV), File = DL0:[100,54]PLUTO3.SYS
Software type = Tertiary loader

 Event type 0.3, Automatic service
Occurred 26-AUG-84 16:41:07 on node 245 (RSXCEN)
Circuit UNA-0
Service type = Load
Status = Requested
Node = 134 (RTRDEV), File = DL0:[100,54]CSVRTR.SYS
Software type = System
```

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```
 Event type 0.3, Automatic service
Occurred 26-AUG-84 16:42:04 on node 245 (RSXCEN)
Circuit UNA-0
Service type = Load
Status = Successful
Node = 134 (RTRDEV), File = DL0:[100,54]CSVRTR.SYS
Software type = System

 Event type 225.0
Occurred 26-AUG-84 16:43:00 on node 134 (RTRDEV)
Server initializing, Identification = DECnet Router Server V1.1 8L

 Event type 4.15, Adjacency up
Occurred 26-AUG-84 16:43:06 on node 245 (RSXCEN)
Circuit UNA-0
Adjacent node = 134 (RTRDEV)

 Event type 4.15, Adjacency up
Occurred 26-AUG-84 16:43:08 on node 134 (RTRDEV)
Circuit UNA-0
Adjacent node = 245

 Event type 4.15, Adjacency up
Occurred 26-AUG-84 16:43:54 on node 134 (RTRDEV)
Circuit UNA-0
Adjacent node = SHIV
                     .
                     .
                     .
 Event type 4.15, Adjacency up
Occurred 26-AUG-84 16:44:14 on node 134 (RTRDEV)
Circuit UNA-0
Adjacent node = 124 (CENTR)

 Event type 4.10, Circuit up
Occurred 26-AUG-84 16:44:34 on node 134 (RTRDEV)
Circuit LC-1
Node address = 211 (HELTER)

 Event type 4.10, Circuit up
Occurred 26-AUG-84 16:44:52 on node 134 (RTRDEV)
Circuit LC-2
Node address = 418 (MELTER)
                     .
                     .
                     .
 Event type 226.0
Occurred 26-AUG-84 16:45:21 on node 134 (RTRDEV)
Server up, Identification = DECnet Router Server V1.1 8L
```

B.4 Sample Installation Checkout Procedures

Section B.4.1 contains a sample installation checkout procedure done on VMS hosts. Section B.4.2 contains a sample procedure done on RSX hosts. Both procedures assume a fully configured server for eight synchronous lines. If you have fewer lines, disable command lines that test the unused LCs. On VMS hosts, precede such command lines with an exclamation mark (!). On RSX hosts, precede them with a semicolon (;). (This turns the command lines into comments.)

Section B.4.3 contains a sample procedure done on a VMS host to test a DECnet Router Server with both synchronous and asynchronous lines.

B.4.1 Sample VMS Installation Checkout Procedure

Following is a sample installation checkout procedure used on a VMS host to test eight circuits on RTRDEV. RTRDEV's system image is CSVRTR.SYS, which supports synchronous lines only.

```
$ @CSVRTRICP(RET)

Please enter the DECnet Router Server name: RTRDEV(RET)
Please enter RTRDEV password: PRIV(RET)
$ NCP TELL RTRDEV USER [1,1] PASS PRIV SET NODE LC1 CIR LC-1
$ NCP TELL RTRDEV USER [1,1] PASS PRIV LOOP NODE LC1
$ NCP TELL RTRDEV USER [1,1] PASS PRIV CLE NODE LC1 CIR
$
$ NCP TELL RTRDEV USER [1,1] PASS PRIV SET NODE LC2 CIR LC-2
$ NCP TELL RTRDEV USER [1,1] PASS PRIV LOOP NODE LC2
$ NCP TELL RTRDEV USER [1,1] PASS PRIV CLE NODE LC2 CIR
$
$ NCP TELL RTRDEV USER [1,1] PASS PRIV SET NODE LC3 CIR LC-3
$ NCP TELL RTRDEV USER [1,1] PASS PRIV LOOP NODE LC3
$ NCP TELL RTRDEV USER [1,1] PASS PRIV CLE NODE LC3 CIR
$
$ NCP TELL RTRDEV USER [1,1] PASS PRIV SET NODE LC4 CIR LC-4
$ NCP TELL RTRDEV USER [1,1] PASS PRIV LOOP NODE LC4
$ NCP TELL RTRDEV USER [1,1] PASS PRIV CLE NODE LC4 CIR
$
$ NCP TELL RTRDEV USER [1,1] PASS PRIV SET NODE LC5 CIR LC-5
$ NCP TELL RTRDEV USER [1,1] PASS PRIV LOOP NODE LC5
$ NCP TELL RTRDEV USER [1,1] PASS PRIV CLE NODE LC5 CIR
$
$ NCP TELL RTRDEV USER [1,1] PASS PRIV SET NODE LC6 CIR LC-6
$ NCP TELL RTRDEV USER [1,1] PASS PRIV LOOP NODE LC6
$ NCP TELL RTRDEV USER [1,1] PASS PRIV CLE NODE LC6 CIR
$
$ NCP TELL RTRDEV USER [1,1] PASS PRIV SET NODE LC7 CIR LC-7
$ NCP TELL RTRDEV USER [1,1] PASS PRIV LOOP NODE LC7
$ NCP TELL RTRDEV USER [1,1] PASS PRIV NODE LC7 CIR
$
$ NCP TELL RTRDEV USER [1,1] PASS PRIV SET NODE LC8 CIR LC-8
$ NCP TELL RTRDEV USER [1,1] PASS PRIV LOOP NODE LC8
$ NCP TELL RTRDEV USER [1,1] PASS PRIV CLE NODE LC8 CIR
$ EXIT
$
```

B.4.2 Sample RSX Installation Checkout Procedure

The following is a sample installation checkout procedure used on an RSX host to check the eight circuits on RTRDEV. RTRDEV's system image is CSVRTR.SYS, which supports synchronous lines only.

```
>@CSVRTRICP
>* Please enter the DECnet Router Server name [S]: RTRDEV(RET)
>* Please enter RTRDEV password [S]: PRIV(RET)
>NCP TELL RTRDEV PASS PRIV SET NODE LC1 CIR LC-1
>NCP TELL RTRDEV PASS PRIV LOOP NODE LC1
>NCP TELL RTRDEV PASS PRIV CLE NODE LC1 CIR
>NCP TELL RTRDEV PASS PRIV SET NODE LC2 CIR LC-2
>NCP TELL RTRDEV PASS PRIV LOOP NODE LC2
>NCP TELL RTRDEV PASS PRIV CLE NODE LC2 CIR
>NCP TELL RTRDEV PASS PRIV SET NODE LC3 CIR LC-3
>NCP TELL RTRDEV PASS PRIV LOOP NODE LC3
>NCP TELL RTRDEV PASS PRIV CLE NODE LC3 CIR
>NCP TELL RTRDEV PASS PRIV SET NODE LC4 CIR LC-4
>NCP TELL RTRDEV PASS PRIV LOOP NODE LC4
>NCP TELL RTRDEV PASS PRIV CLE NODE LC4 CIR
>NCP TELL RTRDEV PASS PRIV SET NODE LC5 CIR LC-5
>NCP TELL RTRDEV PASS PRIV LOOP NODE LC5
>NCP TELL RTRDEV PASS PRIV CLE NODE LC5 CIR
>NCP TELL RTRDEV PASS PRIV SET NODE LC6 CIR LC-6
>NCP TELL RTRDEV PASS PRIV LOOP NODE LC6
>NCP TELL RTRDEV PASS PRIV CLE NODE LC6 CIR
>NCP TELL RTRDEV PASS PRIV SET NODE LC7 CIR LC-7
>NCP TELL RTRDEV PASS PRIV LOOP NODE LC7
>NCP TELL RTRDEV PASS PRIV CLE NODE LC7 CIR
>NCP TELL RTRDEV PASS PRIV SET NODE LC8 CIR LC-8
>NCP TELL RTRDEV PASS PRIV LOOP NODE LC8
>NCP TELL RTRDEV PASS PRIV CLE NODE LC8 CIR
@ <EOF>
>
```

B.4.3 Sample for Synchronous/Asynchronous Line Configuration

The following is a sample installation checkout procedure run on a VMS host to check the lines on a server with both synchronous and asynchronous lines. The server being checked, node RTR16L, has software that supports the 16-line maximum (CSVRTR16L.SYS). RTR16L has one synchronous line in line card slot 1. The remaining seven slots contain two asynchronous lines each.

```
$ @CSVRTR16L(RET)

Please enter the DECnet Router Server name: RTR16L(RET)
Please enter RTR16L password: PRIV(RET)
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC1 CIR LC-1
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC1
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC1 CIR
$
$! NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC1 CIR LC-1L
$! NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC1
$! NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC1 CIR
$!
$! NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC1 CIR LC-1R
$! NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC1
$! NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC1 CIR
$!
$! NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC2 CIR LC-2
$! NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC2
$! NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC2 CIR
$
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC2 CIR LC-2L
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC2
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC2 CIR
$
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC2 CIR LC-2R
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC2
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC2 CIR
$
$! NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC3 CIR LC-3
$! NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC3
$! NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC3 CIR
$!
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC3 CIR LC-3L
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC3
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC3 CIR
$
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC3 CIR LC-3R
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC3
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC3 CIR
$!
$! NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC4 CIR LC-4
$! NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC4
$! NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC4 CIR
$
```

```
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC4 CIR LC-4L
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC4
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC4 CIR
$
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC4 CIR LC-4R
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC4
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC4 CIR
$!
$! NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC5 CIR LC-5
$! NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC5
$! NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC5 CIR
$
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC5 CIR LC-5L
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC5
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC5 CIR
$
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC5 CIR LC-5R
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC5
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC5 CIR
$!
$! NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC6 CIR LC-6
$! NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC6
$! NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC6 CIR
$
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC6 CIR LC-6L
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC6
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC6 CIR
$
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC6 CIR LC-6R
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC6
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC6 CIR
$!
$! NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC7 CIR LC-7
$! NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC7
$! NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC7 CIR
$
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC7 CIR LC-7L
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC7
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC7 CIR
$
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC7 CIR LC-7R
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC7
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC7 CIR
$!
$! NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC8 CIR LC-8
$! NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC8
$! NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC8 CIR
$
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC8 CIR LC-8L
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC8
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC8 CIR
$
$ NCP TELL RTR16L USER [1,1] PASS PRIV SET NODE LC8 CIR LC-8R
$ NCP TELL RTR16L USER [1,1] PASS PRIV LOOP NODE LC8
$ NCP TELL RTR16L USER [1,1] PASS PRIV CLE NODE LC8 CIR
$
$ EXIT
```

C
Summary of NCP Commands

The following is a summary of all NCP commands that are useful for managing the DECnet Router Server. The SET NODE and DEFINE NODE commands are discussed in Chapter 2. The LOAD NODE and TRIGGER NODE commands are discussed in Chapter 5. For a discussion of the other commands, see the *DECnet Router Software Management Guide*.

C.1 Setting up the Down-line Load and Up-line Dump Database on the Host

Use the following privileged command to set up or modify the down-line load database on a loading host. On VMS hosts, use NCP. On RSX hosts, use CFE.

NOTE

When installing the server software on a loading host, you can use the installation command procedure (VMSINSTAL on VMS hosts or RSXINSTAL on RSX hosts) to automatically set up the database, as explained in Chapter 2.

DEFINE NODE *server-node-id*	NAME *server-name* DUMP FILE [*uic*]:*server-node-id*.DMP HARDWARE ADDRESS *hex-address* DIAGNOSTIC FILE [*uic*]:CSVLDI.SYS LOAD FILE [*uic*]:CSVRTR.SYS SERVICE CIRCUIT *circuit-id* SERVICE PASSWORD *hex-password* SECONDARY LOADER [*uic*]:PLUTO2.SYS TERTIARY LOADER [*uic*]:PLUTO3.SYS

The *uic* is SYS$SYSTEM on VMS hosts and NETUIC on RSX hosts.

C.2 Loading the Server Software

Issue any of the following privileged commands at a host node for execution at the loading host.

LOAD NODE *server-node-id* [FROM *server-image-file*
HOST *host-id*
SECONDARY LOADER *file-id*
SERVICE PASSWORD *hex-password*
TERTIARY LOADER *file-id*]

LOAD VIA *circuit-id* [FROM *server-image-file*
HOST *host-id*
PHYSICAL ADDRESS *hex-address*
SECONDARY LOADER *file-id*
SERVICE PASSWORD *hex-password*
TERTIARY LOADER *file-id*]

TRIGGER NODE *server-node-id* [VIA *circuit-id*
PHYSICAL ADDRESS *E-address*
SERVICE PASSWORD *hex-password*]

TRIGGER VIA *circuit-id* PHYSICAL ADDRESS *E-address*
[SERVICE PASSWORD *hex-password*]

C.3 Remote Command Execution

Use the following commands to cause commands to be executed remotely at the DECnet Router Server:

SET EXECUTOR NODE *server-node-id* [PASSWORD *password*]

TELL *server-node-id ncp-command* [PASSWORD *password*]

Supply the network privileged password if the server requires it; that is, if the password has been defined in the server's network configuration file.

Use the following command to return NCP command execution to the local node. Use this command subsequent to issuing the SET EXECUTOR NODE command.

CLEAR EXECUTOR NODE

C.4 Loopback Testing

Use the following commands to test server and network components. You can execute them locally at the host or remotely at the server node.

LOOP NODE *node-id* [COUNT *count* | LENGTH *length* | WITH *block-type*]

LOOP CIRCUIT *circuit-id* [ASSISTANT NODE *node-id* | ASSISTANT PHYSICAL ADDRESS *hex-address* | COUNT *count* | HELP *assistance-type* | LENGTH *length* | NODE *destination-node-id* | PHYSICAL ADDRESS *destination-hex-address* | WITH *block-type*]

Use the following command to associate a node name with a circuit for loop node testing:

SET NODE *node-name* CIRCUIT *circuit-id*

C.5 Configuring and Controlling the DECnet Router Server

Use the following privileged commands to change the operational state and cost of circuits on the DECnet Router Server. The KNOWN CIRCUITS keyword affects all circuits, including the UNA circuit. Therefore, be careful when using this keyword. If you turn off the UNA circuit, the server will be disconnected from the Ethernet. Issue the SET CIRCUIT command for remote execution at the server.

SET {CIRCUIT *circuit-id* | KNOWN CIRCUITS} STATE *state*
COST *cost*

Use the following to change the host (maintenance host) and receive and transmit passwords for the DECnet Router Server. (On VMS hosts, you cannot use the SET EXECUTOR command to change the passwords. Go to an RSX host.) Issue the command for remote execution at the server.

SET EXECUTOR HOST *node-id*
RECEIVE PASSWORD *password*
TRANSMIT PASSWORD *password*

Use the following command to change or define node names for nodes known to the server:

SET NODE *node-id* NAME *node-name*

C.6 Monitoring the DECnet Router Server

Use the following commands for monitoring purposes. Use the SET LOGGING and CLEAR LOGGING commands to change logging parameters. Use the SHOW commands to display information on command. Issue the commands for remote execution at the server.

```
CLEAR  { KNOWN LOGGING    }  { EVENTS events  }  [ { CIRCUIT circuit-id  } ]
       { LOGGING CONSOLE  }  { KNOWN EVENTS  }  [ { LINE line-id       } ]
       { LOGGING MONITOR  }  { ALL EVENTS    }  [ { NODE node-id       } ]
                                                [ { SINK NODE node-id } ]

SET    { KNOWN LOGGING    }  { EVENTS events  }  [ { CIRCUIT circuit-id  } ]
       { LOGGING CONSOLE  }  { KNOWN EVENTS  }  [ { LINE line-id       } ]
       { LOGGING MONITOR  }                     [ { NODE node-id       } ]
                                                [ { SINK NODE node-id } ]

SHOW   { AREA area-no     }  [ { CHARACTERISTICS } ]
       { ACTIVE AREAS     }  [ { STATUS          } ]
       { KNOWN AREAS      }  [ { SUMMARY         } ]

SHOW   { ACTIVE CIRCUITS  }  [ { CHARACTERISTICS } ]  [TO file-id]
       { CIRCUIT circuit-id }[ { COUNTERS        } ]
       { KNOWN CIRCUITS   }  [ { STATUS          } ]
                             [ { SUMMARY         } ]
```

(On RSX hosts, you can use the SHOW SIGNIFICANT CIRCUITS command.)

```
SHOW EXECUTOR  [ { CHARACTERISTICS } ]  [TO file-id]
               [ { COUNTERS        } ]
               [ { STATUS          } ]
               [ { SUMMARY         } ]

SHOW   { LINE line-id      }  [ { CHARACTERISTICS } ]  [TO file-id]
       { ACTIVE LINES      }  [ { COUNTERS        } ]
       { KNOWN LINES       }  [ { STATUS          } ]
                              [ { SUMMARY         } ]
```

(On RSX hosts, you can use the SHOW SIGNIFICANT LINES command.)

```
SHOW   { ACTIVE LOGGING    }  [ { CHARACTERISTICS } ]  [TO file-id]
       { KNOWN LOGGING     }  [ { EVENTS          } ]  { SINK NODE node-id }
       { LOGGING CONSOLE   }  [ { STATUS          } ]  { KNOWN SINKS       }
       { LOGGING MONITOR   }  [ { SUMMARY         } ]
```

(On RSX hosts, you can use the SHOW SIGNIFICANT LOGGING command.)

SHOW { ACTIVE NODES / ADJACENT NODES / KNOWN NODES / LOOP NODES / NODE *node-id* } { [CHARACTERISTICS / COUNTERS / STATUS / SUMMARY] } [TO *file-id*]

(On RSX hosts, you can use the SHOW SIGNIFICANT NODES command.)

Use the following privileged commands to clear counters kept for DECnet Router Server components.

ZERO { CIRCUIT *circuit-id* / KNOWN CIRCUITS } [COUNTERS]

ZERO EXECUTOR [COUNTERS]

ZERO { KNOWN LINES / LINE *line-id* } [COUNTERS]

ZERO { NODE *node-id* / KNOWN NODES } [COUNTERS]

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