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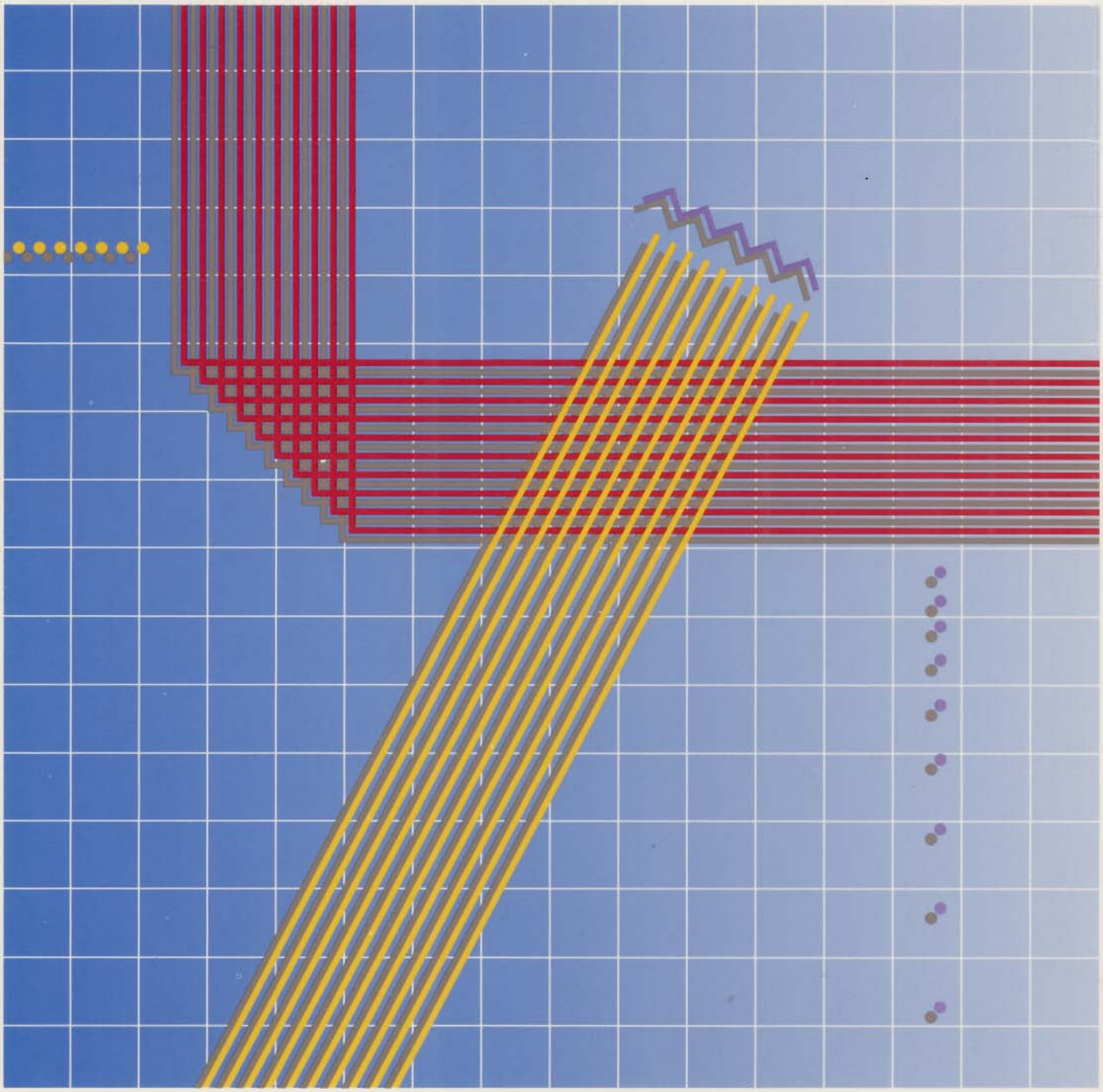
HEWLETT PACKARD

# NS3000/XL

## Configuration Planning and Design Guide



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# NS3000/XL

## Configuration Planning and Design Guide

HEWLETT PACKARD

Hewlett-Packard Company
Business Networks Division
19420 Homestead Road
Cupertino, California 95014

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The List of Effective Pages gives the date of the current edition and of any pages changed in updates to that edition. Within the manual, any page changed since the last edition is indicated by printing the date the changes were made on the bottom of the page. Changes are marked with a vertical bar in the margin. If an update is incorporated when an edition is reprinted, these bars are removed but the dates remain. No information is incorporated into a reprinting unless it appears as a prior update. To verify that your manual contains the most current information, check that the date printed at the bottom of the page matches the date listed below for that page.

| Effective Pages | Date |
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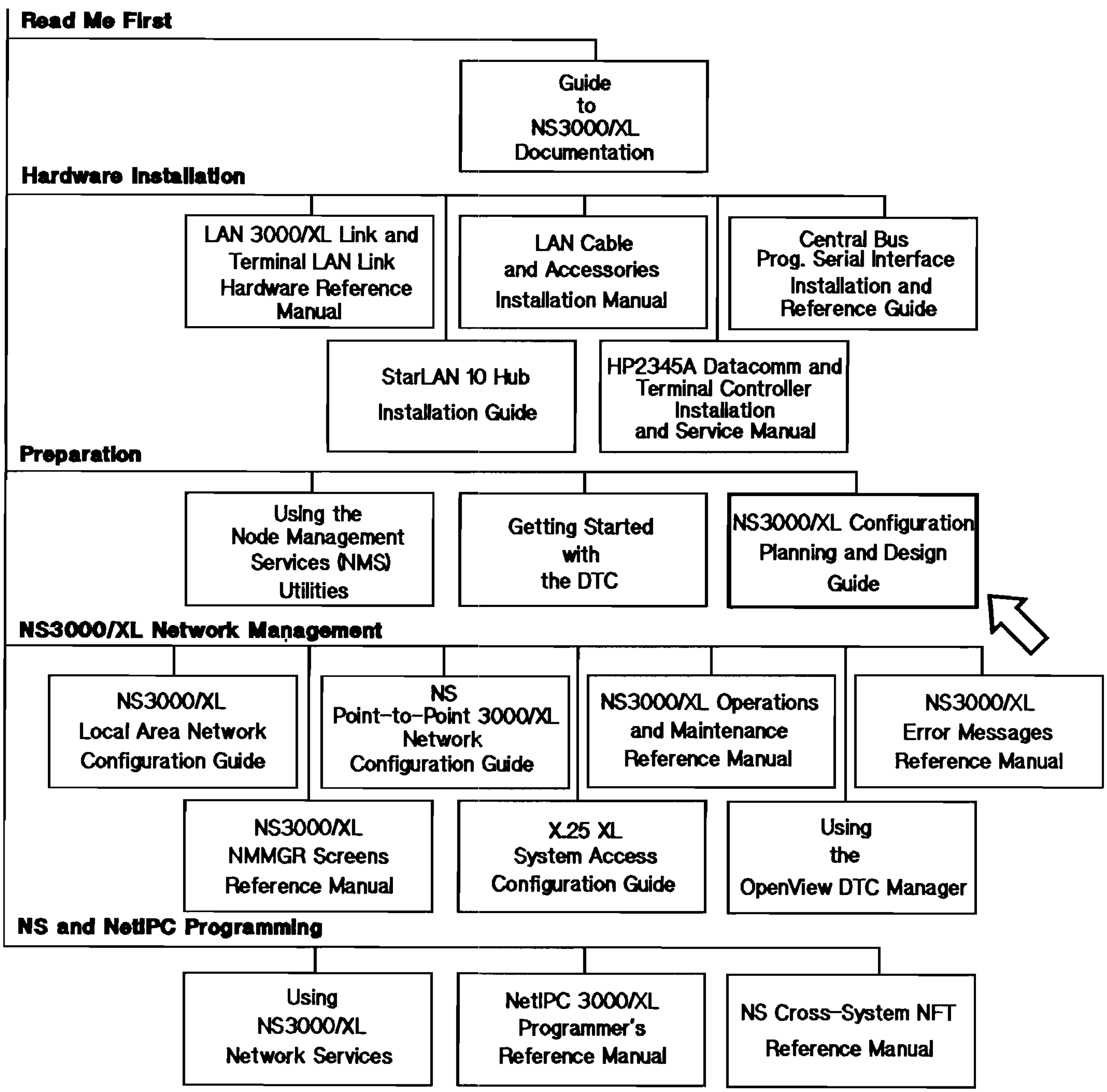
| All | October 1989 |

# Documentation Map

The following documentation map is intended to be a general guideline to the manuals containing information related to the product described in this manual. You may need information from one or all the manuals listed here.



# Documentation Cross-Reference List

The list below provides a cross-reference between manuals shown on the documentation map and their associated part numbers and, where applicable, kit numbers. When kit numbers exist, use those numbers for direct orders.

| Manual Name | Manual Part Number | Kit Number (for Direct Orders) |
|---|---|---|
| *Guide to NS3000/XL Documentation* | 5959-2837 | 36923-61001 |
| *HP 36923A LAN 3000/XL Link and Terminal LAN Link Hardware Reference Manual* | 36923-90001 | |
| *LAN Cable and Accessories Installation Manual* | 5955-7680 | |
| *Central Bus Programmable Serial Interface Installation and Reference Guide* | 30263-90001 | |
| *HP 28663A StarLAN 10 Hub Installation Guide* | 28663-90001 | |
| *HP2345A Datacommunications and Terminal Controller Installation and Service Manual* | 02345-90021 | |
| *Using the Node Management Services (NMS) Utilities* | 5959-2805 | 32022-61005 |
| *Getting Started with the DTC* | 32098-90010 | 32098-61000 |
| *NS3000/XL Configuration Planning and Design Guide* | 36922-90007 | 36922-61002 |
| *NS3000/XL Local Area Network Configuration Guide* | 36922-90005 | 36922-61000 |
| *NS Point-to-Point 3000/XL Network Configuration Guide* | 36922-90006 | 36922-61001 |
| *NS3000/XL Operations and Maintenance Reference Manual* | 36922-90010 | 36922-61005 |
| *NS3000/XL Error Messages Reference Manual* | 5959-2836 | 36923-61000 |
| *NS3000/XL Screens Reference Manual* | 36922-90008 | 36922-61003 |
| *X.25 XL System Access Configuration Guide* | 36939-90001 | 36939-61001 |
| *Using the OpenView DTC Manager* | D2355-90001 | |
| *Using NS3000/XL Network Services* | 36920-90001 | 36920-61000 |
| *NetIPC 3000/XL Programmer's Reference Manual* | 5958-8600 | 36920-61005 |
| *NS Cross-System NFT Reference Manual* | 5958-8563 | 36920-61003 |

# Preface

## Purpose of This Manual

This manual describes the concepts and terminology needed to design an NS3000/XL network and to plan the configuration process for that network. It also provides worksheets designed to help you lay out the network and record information needed for network configuration and maintenance. You should use these worksheets as a practical means of documenting your network installation.

This guide is intended to be used as you make decisions regarding how NS3000/XL will be configured at your installation. It assumes that all hardware has been installed and that the Distributed Terminal Subsystem (DTS) has been configured at each MPE XL node according to the instructions in *Configuring Systems for Terminals, Printers, and Other Serial Devices.*

## Audience

This manual is intended for network managers and planners whose responsibility it is to set up and configure a communications network. To make the best use of this guide you should be familiar with basic MPE XL commands, as well as with the NS3000/XL product and the configuration tools. You will find a basic introduction to NS3000/XL in the *Guide to NS3000/XL Documentation*. Information on the configuration tools is provided in *Using the Node Management Services (NMS) Utilities*.

General users of the network may also find the information contained in this manual of value in understanding network architecture and topologies in general, and how NS3000/XL networks implement standard protocols.

## Organization of This Manual

The following summarizes the material contained in this manual:

**Chapter 1**

**Introduction.** Provides an overview of the network architecture and protocols of NS3000/XL. Also describes the network links and services available with NS3000/XL.

**Chapter 2** **Network Management.** Describes network management tasks. Provides background information as needed in addition to explaining each major functional area and the corresponding commands or utilities that make up the network manager's job.

**Chapter 3** **Network Planning and Configuration.** Explains the concepts needed to plan and install an NS3000/XL network or internetwork, including software components, configuration concepts, network and internetwork configuration and administration tasks, and network design.

**Chapter 4** **Internetwork Worksheets.** Provides information and worksheets specifically intended for use in planning and configuring an internetwork.

**Chapter 5** **Network Examples and Records.** Contains configuration worksheets for use in planning and configuring a network. Includes examples of the various types of networks you might need to configure.

**Chapter 6** **Node Examples and Records.** Provides node worksheets to help you determine ahead of time the information you will need to configure during NMMGR's Guided Configuration.

**Appendix A** **Supported Modems.** Lists the modems supported for NS Point-to-Point 3000/XL links.

**Appendix B** **PC-to-HP 3000 Communication.** Summarizes the tasks required for connecting personal computers to HP 3000 Series 900 computers over ThinLAN 3000/XL or StarLAN 10 3000/XL network links.

**Appendix C** **MPE/V to MPE XL Migration.** Provides a quick overview of the planning and tasks needed to migrate an NS3000 network from an MPE/V system to an MPE XL system.

# Related Publications

The following manuals are referenced in this manual, or may be of use to you as you plan and configure your network.

## Hardware

- *HP36923A LAN 3000/XL Link and Terminal LAN Link Hardware Reference Manual* (36923-90001)
- *LAN Cable and Accessories Installation Manual* (5955-7680)
- *LAN Link Hardware Troubleshooting Manual* (5955-7681)
- *StarLAN 10 3000/XL Link Installation and Service Manual* (28663-90001)
- *Central Bus Programmable Serial Interface Installation and Reference Manual* (30263-90001)
- *Online Diagnostic Subsystem Utilities* (09740-90021)

## General Information

- *System Configuration* (32650-60005)
- *MPE XL Commands Reference Manual* (32650-60002)
- *MPE XL Documentation guide and Glossary of Terms* (32650-60003)
- *MPE XL Account Structure and Security Manual* (32650-60006)
- *Resource Sharing: System Management* (32597-90001)
- *Resource Sharing: Utilities* (32597-90002)
- *MPE XL Asynchronous Serial Communications System Administrator's Reference Manual* (32022-61000)

## Networking

- *Guide to NS3000/XL Documentation* (36923-61001)
- *Using the Node Management Services Utilities* (32022-61005)
- *NS3000/XL Local Area Network Configuration Guide* (36922-61000)
- *NS Point-to-Point 3000/XL Network Configuration Guide* (36922-61001)
- *X.25 XL System Access Configuration Guide* (36939-61001)

- *NS3000/XL Screens Reference Manual* (36922-61003)
- *NS3000/XL Operations and Maintenance Reference Manual* (36922-61005)
- *NS3000/XL Error Messages Reference Manual* (36923-61000)
- *NS Cross-System Network Manager's Reference Manual* (36920-61004)
- *Using NS3000/XL Network Services* (36920-61000)
- *NetIPC 3000/XL Programmer's Reference Manual* (36920-61005)
- *NS Cross-System NFT Reference Manual* (36920-61003)

## PC Networking

- *PC Workstation Configuration Guide for LANs - HP OfficeShare Network* (50929-90001)
- *Planning Guide for LANs - HP OfficeSharing Network* (50929-90000)

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## Chapter 4 Internetwork Worksheets



## Chapter 5 Network Examples and Records



## Chapter 6 Node Examples and Records

## Appendix A Supported Modems

## Appendix B PC-TO-HP 3000 Communication



## Appendix C MPE/V to MPE XL Migration



## Glossary

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# Conventions

| NOTATION | DESCRIPTION |
|---|---|
| **nonitalics** | Words in syntax statements which are not in italics must be entered exactly as shown. Punctuation characters other than brackets, braces and ellipses must also be entered exactly as shown. For example: `EXIT;` |
| **italics** | Words in syntax statements which are in italics denote a parameter which must be replaced by a user-supplied variable. For example: CLOSE *filename* |
| **[ ]** | An element inside brackets in a syntax statement is optional. Several elements stacked inside brackets means the user may select any one or none of these elements. For example: [A] [B] [C] User may select A or B or C or none. |
| **{ }** | When several elements are stacked within braces in a syntax statement, the user must select one of those elements. For example: {A} {B} {C} User must select A or B or C. |
| **...** | A horizontal ellipsis in a syntax statement indicates that a previous element may be repeated. For example: [,*itemname*]...; |
| **Δ** | When necessary for clarity, the symbol Δ may be used in a syntax statement to indicate a required blank or an exact number of blanks. For example: SET[*modifier*]Δ(*variable*) |

# Conventions (continued)

**underlining**

Underlining is used for four different purposes as follows:

1. Brackets, braces or ellipses appearing in syntax or format statements which must be entered as shown will be underlined. For example:

```
LET var[[subscript]] = value
```

2. An underlined delimiter preceding a parameter in a syntax statement indicates that the delimiter must be supplied whenever (a) that parameter is included or (b) that parameter is omitted and any other parameter which follows is included. For example:

```
itema[,itemb][,itemc]
```

   means that the following are allowed:

```
itema
itema,itemb
itema,itemb,itemc
itema,,itemc
```

3. Output and input/output parameters are underlined. A notation in the description of each parameter distinguishes input/output from output parameters. For example:

```
CREATE (parm1,parm2,flags,error)
```

4. Underlining may also be used in some cases to distinguish user input from the output on the terminal's screen. For example:

```
NEW NAME?    ALPHA
```

**[Key Cap]**

A string in bold font enclosed by brackets may be used to indicate a key on the terminal's keyboard. For example, **[Enter]** indicates the carriage return key.

**[CTRL]-char**

Control characters are indicated by **[CTRL]** followed by the character. For example, **[CTRL] y** means the user presses the control key and the character **y** simultaneously.

# Introduction to NS3000/XL

HP Network Services and links for MPE XL Based Systems (NS3000/XL) are HP data communications products that provide networking capabilities to interactive users and application programs on HP 3000s running the MPE XL operating system. Through the use of NS3000/XL, these HP 3000s can be connected to other HP computer systems in a distributed network.

NS3000/XL consists of two parts: NS3000/XL Services and NS3000/XL links. NS3000/XL Network Services consist of software that enables users to access data, initiate processes, and exchange information among all the systems on a network. NS3000/XL links provide connections among systems (either HP 3000s or personal computers) in the same network. To use NS3000/XL Services, the systems must be connected by an NS3000/XL network link.

A variety of network link products are available with NS3000/XL. The link product that connects individual systems in an NS3000/XL network can be any of the following:

- ThinLAN 3000/XL Link (includes ThickLAN option for thick coaxial cable, described below, and StarLAN 10 3000/XL Link option for twisted-pair wiring).
- NS Point-to-Point 3000/XL
- DTC/X.25 XL Network Link

The link products listed above can all be used to connect HP 3000s to each other.

Additionally, the ThinLAN 3000/XL Link, including the ThickLAN option, can connect HP 3000s with HP 1000s and HP 9000s. The ThinLAN 3000/XL link and StarLAN 10 3000/XL link can also connect HP 3000s to personal computers.

ThinLAN 3000/XL Link connections are usually made with thin (.18 inch) coaxial cable; however, you can also use thicker (.4 inch diameter) coaxial cable, available by ordering the ThickLAN option of ThinLAN 3000/XL.

The DTC/X.25 XL Network Link is used to connect HP 3000s to an X.25 network, through which many different types of computers are accessible.

Although NS3000/XL Services all require a network link to operate, network links can be purchased without the concurrent purchase of NS3000/XL Services.

Network links differ in their supporting hardware, software and, in some cases, function. Later subsections of this chapter describe these links and the differences among them.

## System Requirements

NS3000/XL is supported on the HP 3000 Series 900 executing the MPE XL operating system, V.U.F. A.01.00 or later versions. The system must have a minimum of 16 megabytes of memory (24 megabytes or more are highly recommended).

## Network Architecture

Before you understand the details of NS3000/XL links and services, you should understand some general concepts about network architecture and NS3000/XL. This chapter will familiarize you with concepts and terms you will encounter later in this manual.

A **network** is a group of computer systems connected in such a way that they can exchange information and share resources. In a **distributed network**, as opposed to a centralized one, the connected systems are independent and equal. One system does not control another system.

NS3000/XL networks are distributed networks. Systems that are configured into an NS 3000 network are called **nodes**. Through participation in a distributed network, users on your system, or **local node**, can use the processing and storage facilities of another system, or **remote node**; users at remote nodes can take advantage of the resources of your local node.

A *group* of networks that are connected to each other is called an **internetwork**. One network is connected to another by means of a node called a **gateway** node.

The plan that defines the characteristics and interactions of the hardware and software used to connect nodes into a network is called a **network architecture**. Typically, the software is organized as a series of layers. The user interface is integrated into the top layer and the hardware is integrated into the lowest layer. Therefore, a message, composed of data and information necessary to transmit the data to its destination, is sent from the user down through the layers and out onto the network; when the message is received at the remote node, it is passed up through the layers to the remote user.

**Protocols** define the functions of each architectural layer and the format of messages. Individual layers can be designed, implemented, changed, or updated in any way, as long as they provide data according to the protocol. Because each layer has a specific task, this also makes it easier to pinpoint and correct errors. An internationally accepted set of standards has been developed based on a layered architecture known as the model for Open Systems Interconnection.

## The OSI Model

The **International Standards Organization** (ISO), an agency of the United Nations, developed the first step in the standardization of network architectures by defining the Open Systems Interconnection (OSI) Reference Model. The OSI model defines seven architectural layers and specifies the function of each. Figure 1-1 illustrates the OSI model.

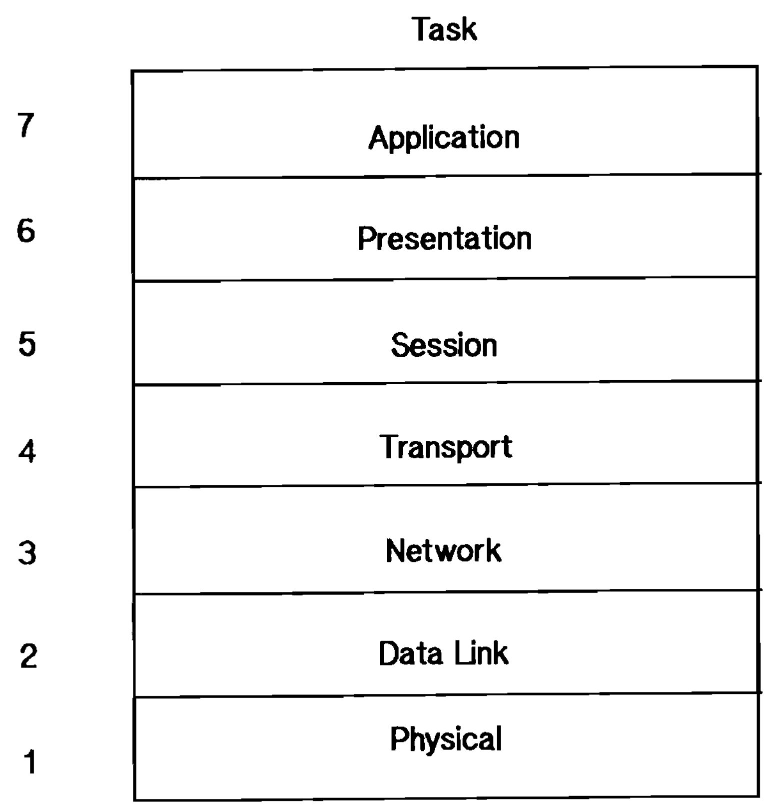



**Figure 1-1. The Seven Layers of the OSI Model**

- **Layer 7 (Application)** provides various remote services which provide the end user with access to the network.
- **Layer 6 (Presentation)** manipulates user data, such as in data compression and encryption.
- **Layer 5 (Session)** negotiates connection establishment at remote nodes.
- **Layer 4 (Transport)** is responsible for **end-to-end** data integrity. This means that the Transport Layer is responsible for ensuring that the message arrives at the correct remote node, without errors, even if the message had to pass through any intermediate nodes.

  Layers 5 - 7 also provide end-to-end services, while Layers 1 - 3 are responsible only for data integrity between each node.

  Layer 4 protocols can provide the following services to upper layers: in-order message delivery, retransmission of lost messages, suppression of duplicate messages and flow control.
- **Layer 3 (Network)** determines the routes messages take to get from one node to another. This layer can be split into two sub-layers: **3i** and **3s**. Layer 3i handles routing between networks (**internetwork**), and 3s handles routing within a network (**intranetwork**).
- **Layer 2 (Data Link)** checks for and corrects transmission errors over the physical link.
- **Layer 1 (Physical)** transmits the electrical signals over the link.

The functions of each layer are performed by software that adheres to established protocols. The protocols used by NS3000/XL are described later in this chapter.

## Types of Networks

Computer networks can be broadly classed as one of three types: broadcast networks, point-to-point networks and packet switched networks. Nodes on a **broadcast network** share the same communications channel, over which data is transmitted to all the nodes in the network. Networks using HP ThinLAN, including the ThickLAN and StarLAN 10 options, are broadcast networks; the protocol that they use *broadcasts* messages to all the systems on the LAN (local area network).

Point-to-point networks, on the other hand, are networks in which data is transmitted from node to node in a network over a defined route until it reaches a specific destination. Because data is passed from one node to another, one node at a time, the means of transmitting data over point-to-point networks is called the **store and forward** technique. When a message is received at an intermediate node, it is forwarded to either another intermediate node or to its final destination. Point-to-point networks are sometimes referred to as **router** networks. The term router is used within this manual to refer to point-to-point networks. The Point-to-Point 3000/XL Link can be used to connect nodes in a router network. Another type of network is a **packet switched network (PSN)**. In a packet switched network, data is passed from node to node as in a point-to-point network. Nodes are logically connected to other nodes on the same network by multiple logical connection paths (called virtual circuits). Using an appropriate connection path, data is sent to a destination node--not as a contiguous block, but divided into units called **packets**. X.25 protocol defines the standard method of access to packet switched networks. The route taken by each packet through the network is transparent to the user making the request. Therefore, a common representation of a packet switched network is one in which only the connected nodes are specifically identified--the rest of the network is seen as a cloud.

Packet switched networks, like other kinds of networks, can be privately owned and operated with access available only to private users. Additionally, most countries have public packet switched networks that are also called **public data networks (PDNs)**. Subscribers to a PDN can access the network via telephone lines.

The DTC/X.25 XL Network Link allows your computer to connect remote computers to public or private packet switched networks.

## NS3000/XL Network Types

An NS3000/XL network can be one of three types:

- **An IEEE 802.3 local area network**
- **A router network**
- **An X.25 network**

These types correspond to the types of networks--broadcast, point-to-point and packet switched--previously described. The NS3000/XL IEEE 802.3 local area network is a broadcast network based on standards published by the Institute of Electrical and Electronics Engineers (IEEE). The standards are called "IEEE 802.3" (and a related standard is called IEEE 802.2); therefore, the kind of network it specifies is called an "IEEE 802.3 network."

The NS3000/XL router network is a point-to-point network that uses the store-and-forward technique. The DTC/X.25 XL Network Link provides access to public or private packet switched networks which implement X.25 protocol as defined by the CCITT (International Consultative Committee on Telephone and Telegraph).

Certain NS3000/XL link types can be used for each network type, as shown in Table 1-1:

**Table 1-1. Network and Link Types**

| NS3000/XL Network Type | NS3000/XL Link Type |
|---|---|
| Router | NS Point-to-Point 3000/XL Link |
| IEEE802.3 | ThinLAN 3000/XL Link (including ThickLAN and StarLAN 10 options) |
| X.25 | DTC/X.25 XL Network Link |

As Table 1-1 shows, NS3000/XL router networks use the NS Point-to-Point 3000/XL link to connect nodes. IEEE 802.3 networks use ThinLAN 3000/XL link (or its ThickLAN or StarLAN 10 options). X.25 networks use the DTC/X.25 XL Network Link to connect nodes.

## Network Topology

The **topology** of a network refers to the physical arrangement of its nodes. For example, one type of common topology is a **bus topology**, in which all nodes are directly linked. Another type is a **star** topology, in which all nodes are linked in a radiating fashion to a central node or switching device.

The possible topologies for a given network are determined by the type of link used to connect the network's nodes.

For example, a bus topology can be used only for a broadcast network, such as an IEEE 802.3 network.

Figure 1-2 shows a bus topology, in which network nodes (represented by numbered circles) are joined to a common bus.

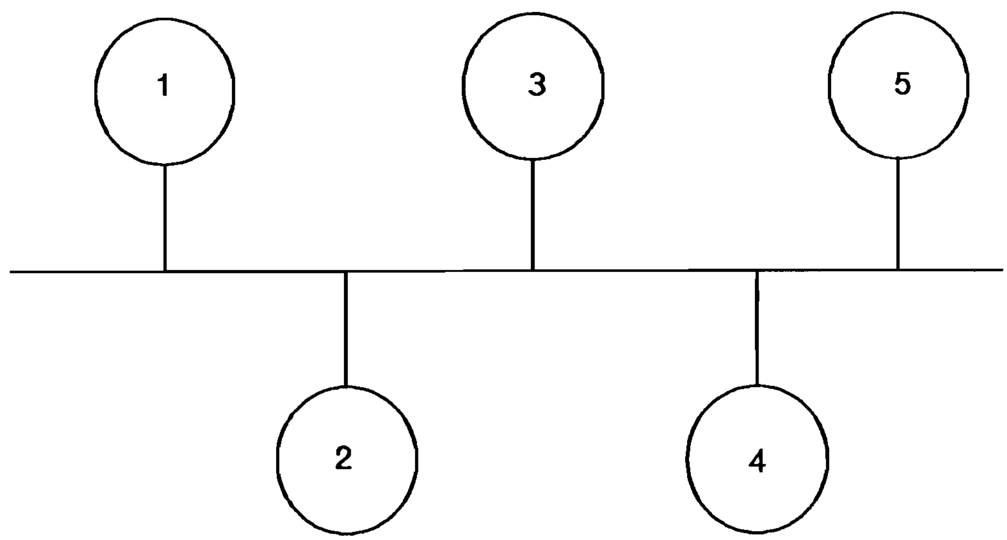



**Figure 1-2. Bus Topology**

Point-to-point networks cannot use a bus topology. Instead, point-to-point networks must use a topology in which each network node is connected to at least one other node. Data is passed from one node to another, including through any intermediate nodes, until it reaches its destination. NS Point-to-Point 3000/XL Links can be used to create point-to-point or router networks.

The actual topologies that can be used for point-to-point networks are widely varying; possibilities include star, ring, hierarchical (sometimes referred to as a tree topology) and string. Any arrangement of nodes will work as long as each node is connected to at least one other node in the same network. Figure 1-3 illustrates several possible topologies for point-to-point networks.

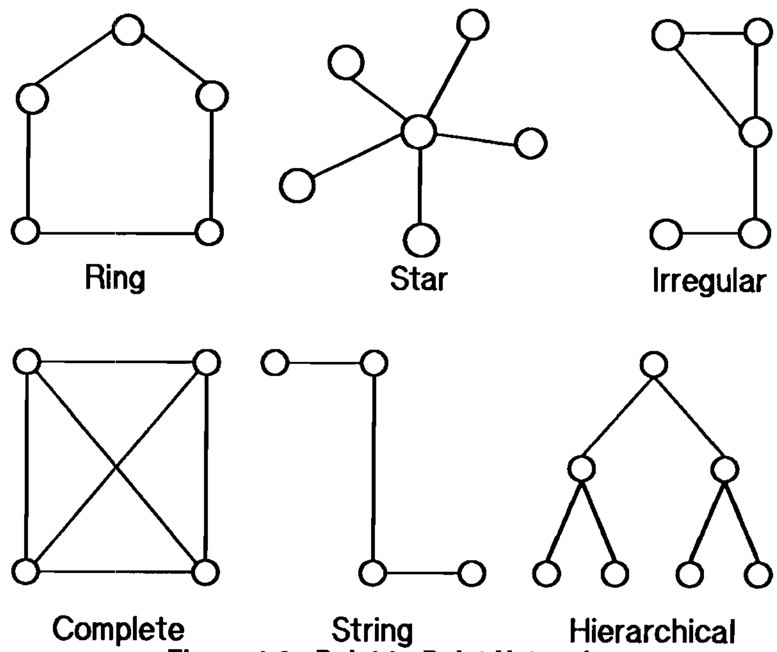



**Figure 1-3. Point-to-Point Networks**

Nodes that are directly connected to only one other node in point-to-point networks are referred to as leaf nodes. In the illustration above, each of the endpoints of the star topology are leaf nodes, as are some of the nodes in string, hierarchical, and irregular topologies.

## Internetworks

Two or more networks can be linked together to form an **internetwork.** For example, if you wanted to connect the nodes in a router network with the nodes in an IEEE 802.3 network, the combination of the two networks would be called an internetwork. Creation of an internetwork allows any node on one network to communicate with any node on another network that is part of the same internetwork. Up to 256 individual networks can belong to the same NS3000/XL internetwork.

The divisions between the networks in an internetwork are called **network boundaries**. Figure 1-4 shows an internetwork, with the network boundary indicated by a line through Node 11.

## Gateway Nodes

Networks in the same internetwork are joined together by **gateway nodes.** A gateway node can be a **full gateway** or a **gateway half.** A full gateway is a node that is a member of two or more networks and allows communication between the networks to which it belongs. Communication between networks is also called **internetwork communication.** For example, in Figure 1-4, Node 11 belongs to Network C and to Network D; it serves as a gateway between Networks C and D. Internetwork protocols determine how data and associated messages are routed through multiple networks. In the example (Figure 1-4), the internet protocol used determines how data and associated messages are routed from one network to the other. NS3000/XL's **Internet Protocol** (IP) is implemented according to the **DARPA** (Defense Advanced Research Projects Agency) standard for an internetwork protocol.

If Node 7 in Network C wants to send a message to Node 14 in Network D, Node 7's message would be sent to Node 11. Node 11 would then send the message to Node 14. All traffic from Network C to Network D must go through Node 11, the gateway to Network D.

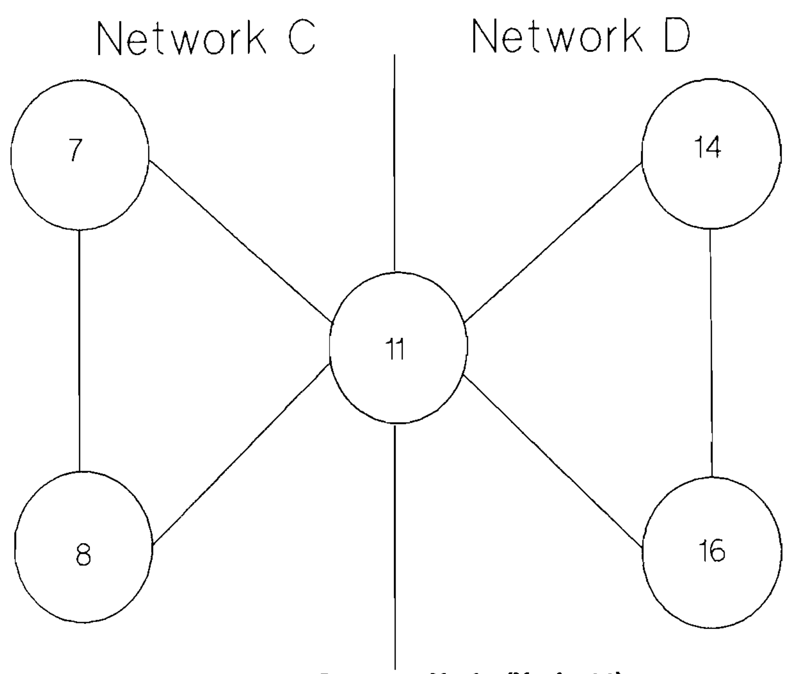



**Figure 1-4. Gateway Node (Node 11)**

Networks can also communicate via **gateway halves.** A gateway half is a degenerate case of a gateway; instead of one gateway node providing internetwork communication, two gateway halves are needed. Each gateway half belongs to only one of the networks that it links; each has a **Gateway Half link** over which it is connected to the other gateway.

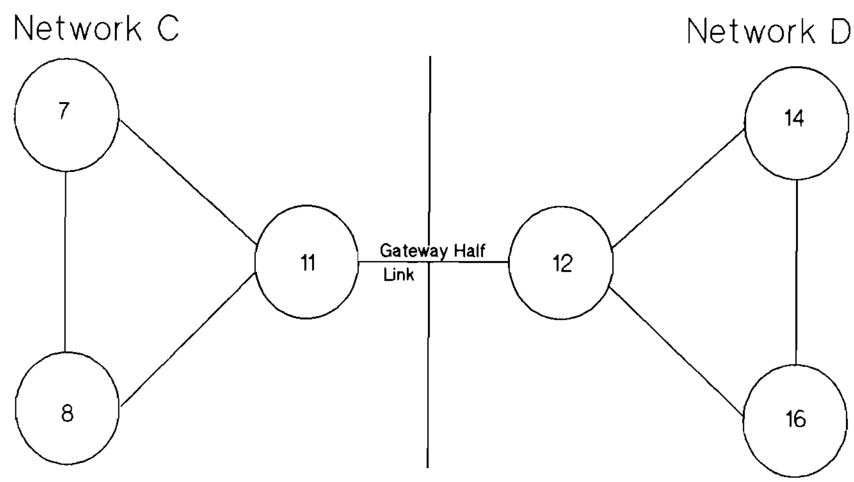



**Figure 1-5. Gateway Halves (Nodes 11 and 12)**

For example, in Figure 1-5, Node 11 is a gateway half that belongs to Network C, and Node 12 is a gateway half that belongs to Network D. The link between Nodes 11 and 12 is a Gateway Half link. Messages from Network C destined for Network D are first sent to Node 11, the gateway half for Network C. Node 11 sends the message to Node 12, which is Network D's gateway half. Node 12 then routes the message to the appropriate node in Network D.

A node can be a full gateway and a gateway half. For example, if a node has three links and belongs to two networks, it could act as a full gateway for the two networks to which it belongs, but would be a gateway half to the network to which it did not belong. In Figure 1-6, Node 5 is a member of Networks A and B, and is a gateway between them. Although Node 5 has a link to Network C, it does not belong to Network C and so is a gateway *half* to that network.

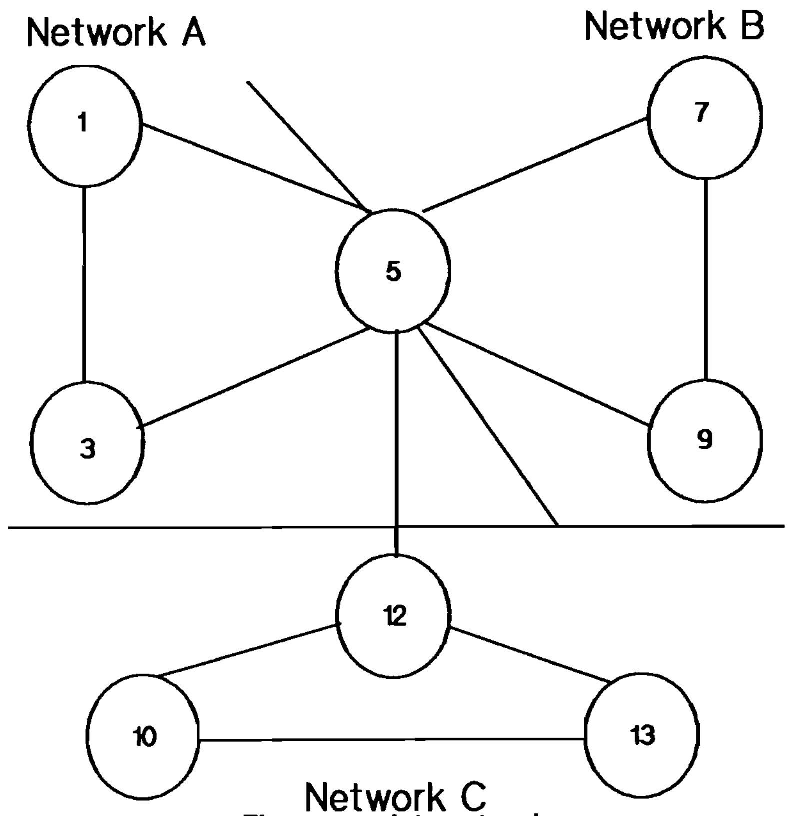



Figure 1-6. Internetwork

## NS3000/XL Architecture

NS3000/XL is composed of two parts: NS3000/XL Services and NS3000/XL links. NS3000 Services perform functions of layer 5 (Session layer), layer 6 (Presentation layer), and layer 7 (application layer) of the OSI model. Each of the available NS3000/XL links performs the functions of layers 1 through 4 of the OSI model. Figure 1-7 shows the relationship of NS3000/XL Services and links to the OSI model.

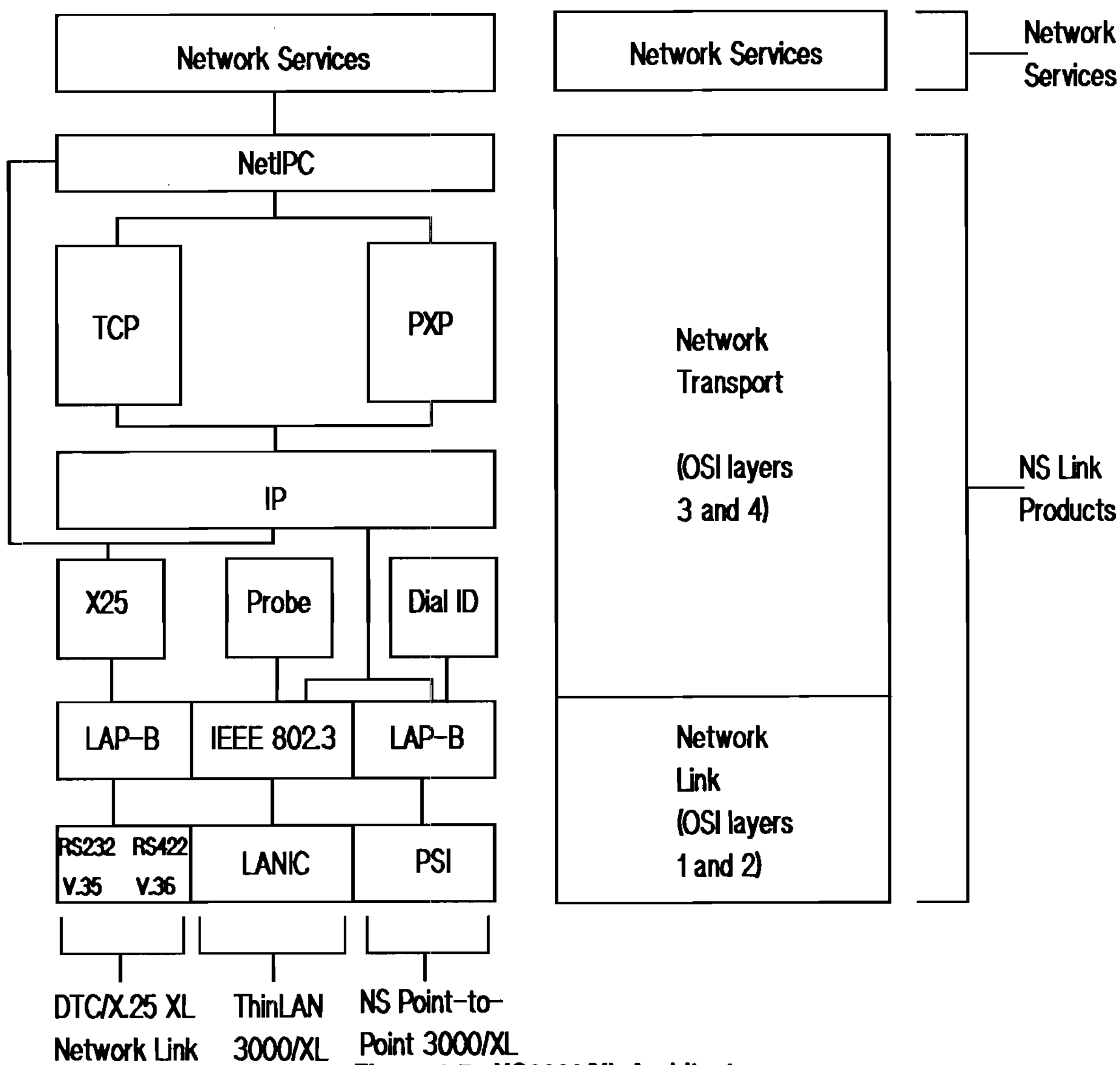



**Figure 1-7. NS3000/XL Architecture**

## Protocols

The protocols, or rules that specify the format of each NS3000/XL architectural layer, ensure that NS3000/XL communication occurs successfully. Some protocols, such as the protocols for layers 3 and 4 (the Network and Transport Layers, respectively) are used by all network nodes, regardless of the type of links that connect them. Other protocols, such as those for layers 1 and 2 (the Physical and Data Link Layers, respectively), differ depending on what kind of link and network are being used.

This section briefly describes the protocols used by NS3000/XL for various network layers, and explains the variations associated with different network link types. Figure 1-7 shows the protocols used for each type of network link. Figure 1-7 also shows the composition of NS3000/XL link products. Each link product consists of software and hardware that performs the functions of layers 1 through 4 of the OSI model. NS3000/XL Network Services consists of software that performs the functions of layers 5 through 7 of the OSI model.

As Figure 1-7 also shows, the software and hardware comprising each NS3000/XL link product can be divided into two main portions: the Network Transport and the Network Link. The Network Transport software performs the functions of layers 3 and 4 of the OSI model. The Network Link hardware and software performs the functions of layers 1 and 2 of the OSI model.

### OSI Layer 4 (Transport Layer) Protocols

NS3000/XL communication has two protocols for the Transport Layer-- the network layer that is responsible for ensuring that a message arrives at the correct remote node.

One protocol is TCP (**Transmission Control Protocol**). TCP is a reliable, end-to-end, connection-oriented protocol. This means that the protocol recovers from transmission errors and delivers packets of data to their final destination in the correct sequence. It also means that when data is being sent from one node to another, the TCP modules residing on the source and destination nodes maintain status information about the transmission of that data. The combination of information maintained at each endpoint is called a **connection**. TCP is also flow-controlled, which means that it regulates the flow of data, breaking messages into fragments if necessary, and reassembling them correctly at their destination.

TCP, which is the Defense Advanced Research Projects Agency (DARPA) standard for a Transport Layer protocol, is used by NS3000/XL services and can be accessed directly by programs that use NetIPC intrinsics. The use of these intrinsics is described in the *NetIPC 3000/XL Programmer's Reference Manual.*

The other Transport Layer protocol used by NS3000/XL is called PXP, for **Packet Exchange Protocol**. PXP is a request/reply datagram protocol used indirectly by programs using the socket registry mechanism of

NetIPC ( `IPCLOOKUP` intrinsic). PXP is an HP-proprietary protocol that cannot be directly accessed by user programs.

## OSI Layer 3 (Network Layer) Protocols

The Network Layer of the OSI model is divided into two sublayers: 3i, which routes messages between networks (internetwork), and 3s, which provides routing within a network. The routing provided by level 3s is often called intranetwork or subnet routing.

**Internet Protocol (IP).** The NS3000/XL protocol used for layer 3i (the internetwork layer) and for layer 3s (the intranetwork layer) in router networks is called the **Internet Protocol (IP)**. Just as TCP is the DARPA standard for a Transport Layer protocol, IP is the DARPA standard for an internetwork protocol.

The purpose of the IP protocol is to route data from source nodes to destination nodes throughout the internetwork. IP determines the route that a packet of data should take through the internetwork based on addresses. Each node in the internetwork is assigned a unique address. Each data packet also includes a destination address, which is compared with the addresses of the nodes the data passes through. When the addresses match, it means that the data has reached its destination. NS3000/XL uses IP for internet routing (routing between networks in the internetwork) and for intranet routing in router networks.

Chapter 3 of this manual discusses IP routing and addressing in more detail.

Although NS3000/XL uses IP to provide routing information for nodes within the same router network, additional protocols must be used to provide intranet routing for other network types. These protocols are described below:

**IEEE 802.3 Local Area Network Protocols.** The ThinLAN 3000/XL Link and its ThickLAN and StarLAN 10 options all use protocols defined in the IEEE 802.3 standard for layer 3s, as well as for layers 1 and 2.

**X.25 Protocol.** The DTC/X.25 XL Network Link uses the X.25 protocol defined in the (1984) CCITT X.25 Recommendation for layer 3s, as well as for layers 1 and 2 of the OSI model. X.25 (layer 3) software is capable of both originating calls to, and receiving calls from, other hosts implementing X.25 over switched or permanent virtual circuits.

For X.25, programs that use the NetIPC intrinsics can directly access the X.25 software (layer 3s) that is part of the DTC/X.25 XL Network Link. Refer to the *NetIPC 3000/XL Programmer's Reference Manual.*

## OSI Layer 2 (Data Link Layer) Protocols

The layer 2 (link-level) protocol used for NS Point-To-Point 3000/XL links (dial up and non-dial leased lines) and DTC/X.25 XL Network Links is called LAP-B, for Link Access Procedure, Balanced. LAP-B is a bitoriented, full-duplex protocol. LANs use the IEEE 802.3 link layer protocol.

## OSI Layer 1 (Physical Layer) Standards

As with data link layer standards, standards for the OSI physical layer vary, and depend on the type of NS3000/XL link in use. Figure 1-7 shows the Hewlett-Packard hardware interface cards that implement physical layer protocols: the DTC/X.25 Network Access Card for the DTC/X.25 XL Network Link, the Programmable Serial Interface (PSI) for the NS Point-to-Point 3000/XL Links, and the Local Area Network Interface Controller (LANIC) for ThinLAN 3000/XL and the ThickLAN and StarLAN 10 options.

Table 1-2 lists the standards supported by each interface card that can be used for NS3000/XL links:

**Table 1-2. Interface Cards and Connection Standards**

| Card | Connection Standards |
|---|---|
| PSI | EIA RS-232-C<br>EIA RS-366A<br>EIA RS-422<br>EIA RS-423<br>EIA RS-449<br>CCITT V.35 |
| LANIC | IEEE 802.3 |
| DTC card | EIA RS-232-C<br>EIA RS-422<br>CCITT V.35<br>CCITT V.36 |

**Note**

The DTC/X.25 Network Access Card resides on the Datacommunications and Terminal Controller (DTC), which is a required hardware device for X.25/XL links. In addition to the DTC card, the DTC contains the X.25 packet layer and the LAP-B data link layer.

## Auxiliary Protocols

Two additional protocols are used by NS3000/XL link products. These are the **Probe protocol** and the **Dial ID protocol.**

**Probe Protocol.** The Probe protocol is a proprietary Hewlett-Packard protocol used by IEEE 802.3 links. It is a connectionless protocol that provides name-to-address resolution and information about which networking protocols are used on a given remote node. The Probe protocol multicasts a request to all the nodes on the network, and the correct node responds. Depending on the request, the response provides either the IP address that corresponds to a given node name or the IEEE 802.3 address that corresponds to a particular IP address.

**Dial ID Protocol.** The NS Point-to-Point 3000/XL Link is used over leased (non-dial) or dial-up telephone lines. When used over dial-up telephone lines (dial links), a Hewlett-Packard protocol called the Dial ID protocol provides security checking and IP address exchange.

# Network Links

As noted previously, NS3000/XL operates over the following network links:

- ThinLAN 3000/XL Link, including the thicker cable ThickLAN option and the StarLAN 10 option
- NS Point-to-Point 3000/XL Link
- DTC/X.25 XL Network Link

Each link product consists of both hardware and software components. Later sections of this chapter describe the software and hardware that is specific to each link product. However, some of the software comprising each link is common to all link products. This software is described below.

## Common Link Software

The following software is common to all NS3000/XL link products:

- **Network Interprocess Communication** (NetIPC) is a peer-to-peer communications interface. NetIPC allows programs, running concurrently, to exchange information and synchronize actions.
- **The Network Transport** provides the functionality of the network and transport layers (OSI Layers 3 and 4), respectively. The Network Transport moves the data from a user's application out to the communications link and receives data from the communications link, routing it to the appropriate user. It implements the specifications of the Transmission Control Protocol (TCP) and Internet Protocol (IP).
- **Node Management Services** provide configuration file version checking and logging. Logging enables network transactions to be "logged," or recorded, in a disk file. Such a record can be used to assist in network troubleshooting.
- The **Node Management Configurator** subsystem provides NMMGR, the Node Management Configurator program that allows you to configure each node on the network.
- The **Link Support Services** subsystem contains software that opens, closes, and otherwise controls physical links.

## IEEE 802.3 Links

**Note**

The information contained in this subsection is divided into three headings--ThickLAN, ThinLAN 3000/XL Link and StarLAN 10 3000/XL Link. Note that this chapter discusses the use of ThinLAN 3000/XL to connect multiple HP 3000s; it *does not* describe the use of HP ThinLAN for PCs. This product can be used to connect personal computers in a network. Refer to the HP ThinLAN publications listed in the Preface for complete information about HP ThinLAN for PCs.

**ThickLAN.** The ThickLAN option of ThinLAN 3000/XL includes all the components to connect an HP 3000 to a coaxial cable based on the Institute of Electrical and Electronics Engineers (IEEE) 802.3 standard. This standard specifies a 10 million bits per second (Mbps) baseband local area network (LAN) with a bus topology. The LAN uses a shielded 0.4 inch diameter coaxial cable as the data transmission medium and the Carrier Sense, Multiple Access with Collision Detect (CSMA/CD) medium access method.

Figure 1-8 shows the hardware components (described later in this section) that the ThickLAN provides to connect an HP 3000 to an IEEE 802.3 coaxial cable.

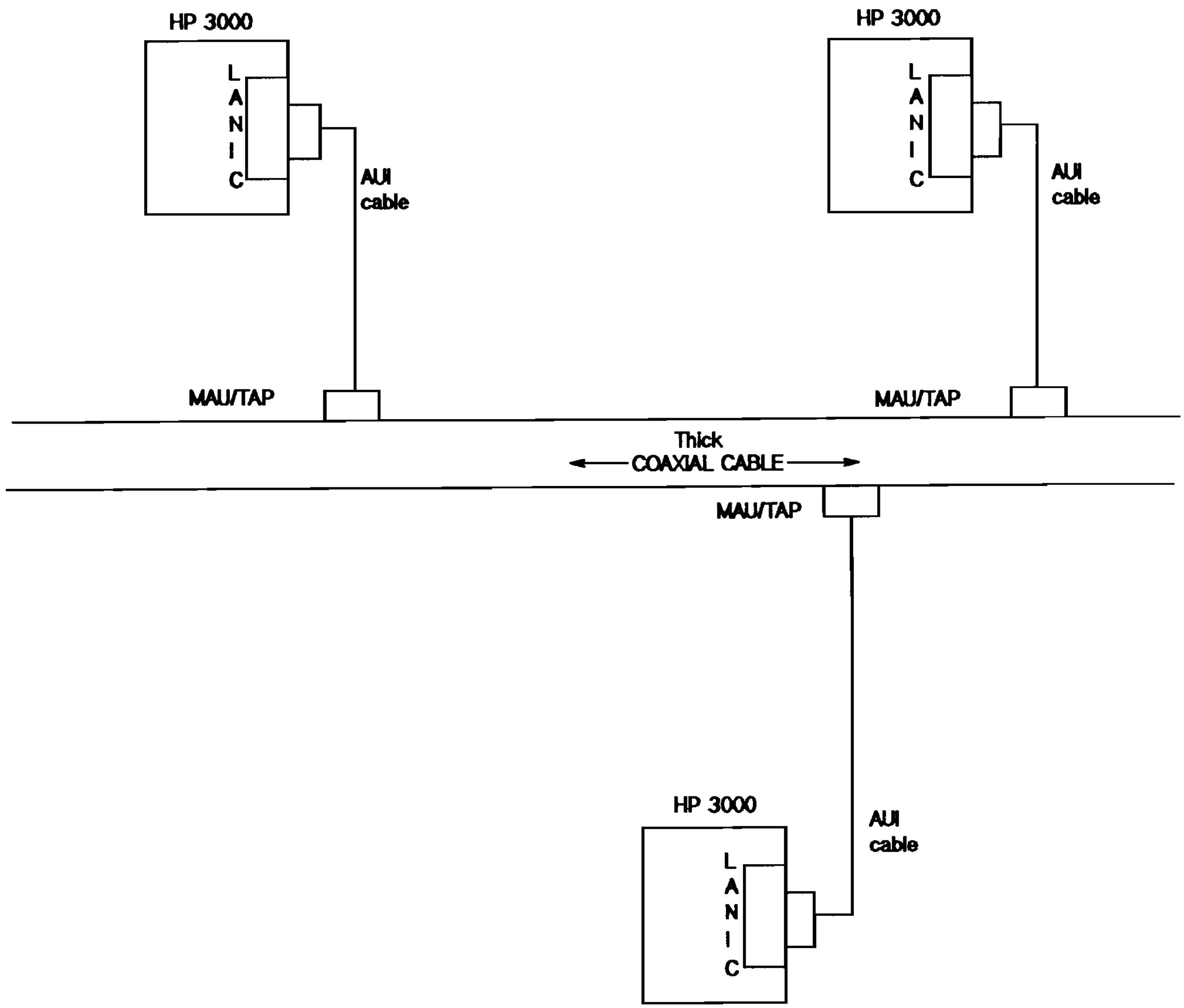



**Figure 1-8. ThickLAN Hardware Components**

**ThinLAN 3000/XL Link.** Same as ThickLAN except that ThinLAN 3000/XL Link uses a 0.18-inch diameter coaxial cable.

**StarLAN 10 3000/XL Link.** This link allows personal computer and HP 3000 Series 900 users to access a 10 Mpbs IEEE 802.3 local area network using twisted-pair wiring.

Figure 1-9 shows a StarLAN 10 network that is attached to a ThinLAN 3000/XL Link.

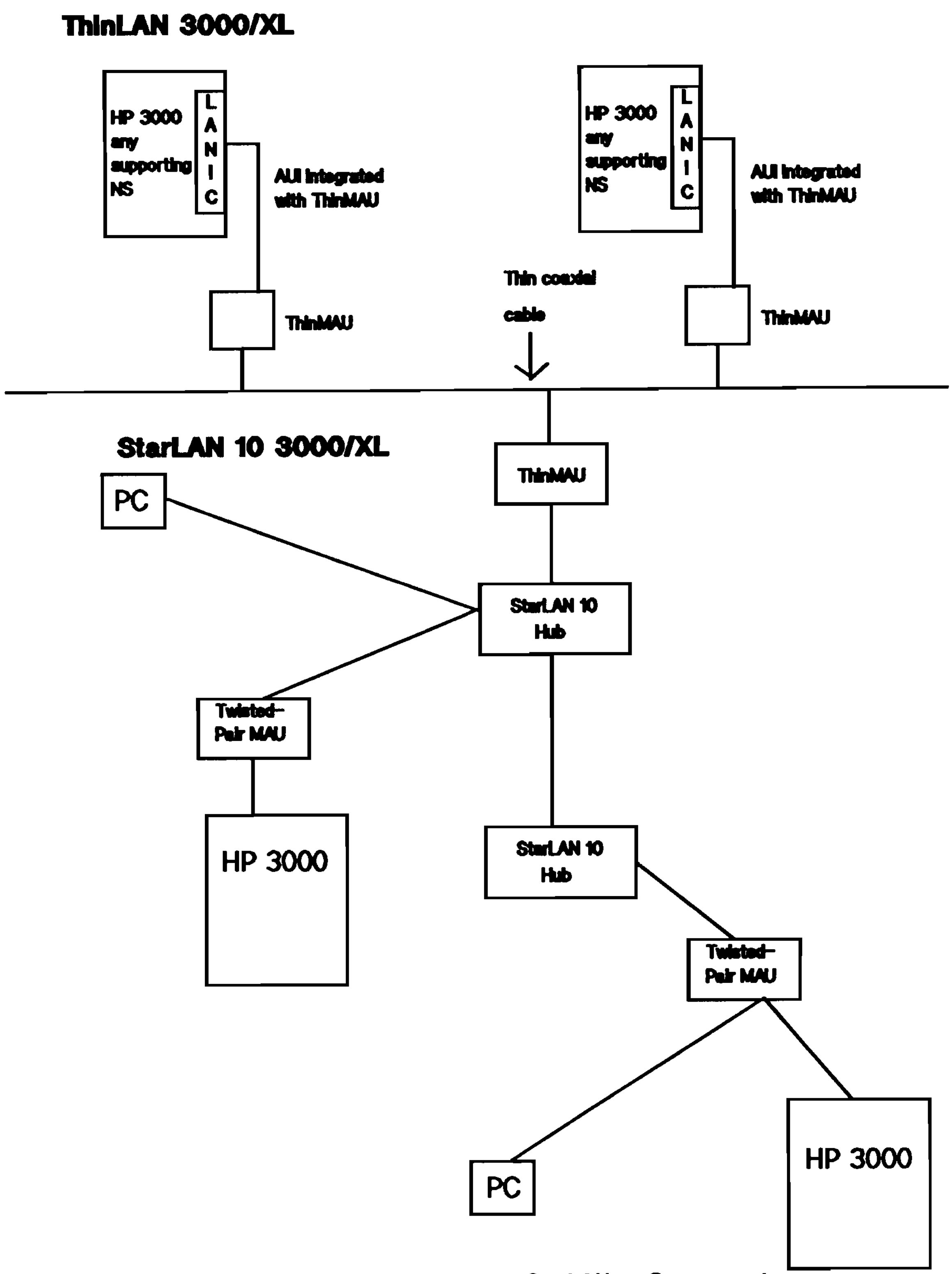



Figure 1-9. ThinLAN 3000/XL and StarLAN 10 Components

## Medium Access Method for IEEE 802.3 Links

The IEEE 802.3 standard specifies the **Carrier Sense, Multiple Access with Collision Detect (CSMA/CD)** medium access method. This method provides an ideal means of transmitting bursts of data at high speeds between nodes on a LAN. With CSMA/CD, all nodes have equal access to the network (Multiple Access); there is no central control node. Before transmitting data, a node monitors the network to verify that no other node is transmitting data (Carrier Sense). If a signal is sensed, the node desiring access defers its transmission. Although the carrier sense makes collisions unlikely, they can occur when two nodes sense that no other carriers are on the network and begin transmitting simultaneously. To deal with this possibility, nodes listen for collisions while transmitting (Collision Detect). If one is detected, the node will initiate a jam signal to warn the entire network. All nodes must then cease their transmission. Each delays for a random period of time and then restarts its transmission. This means that each node eventually is able to transmit its data.

Although nodes in an Ethernet network also use CSMA/CD, a node based on IEEE 802.2/802.3 cannot communicate with an Ethernet node. Nevertheless, both nodes may coexist on the same network cable. This is because there is an incompatibility in the frame format at the data link level (OSI Layer 2) that interferes with communications but not with transmissions. The frame format specified by IEEE 802.2/802.3 provides for higher network reliability.

## Hardware Components

**ThickLAN**. There are three major hardware components of ThickLAN. These are:

- **Local Area Network Interface Controller** (LANIC). The LANIC is a microprocessor-based communication controller that plugs into the HP 3000 backplane. It handles link-level buffering, error checking, the IEEE 802.2 and 802.3 protocols, and includes a built-in self-test. When addressed by another node on the network, the LANIC receives the frames of information and checks them for accuracy before passing them to the HP 3000. When transmitting, an addressed frame is passed to the LANIC where error checking information is added. The LANIC then tests to see if the cable is busy and, if not, transmits the frame.

- Medium Attachment Unit (MAU). The MAU provides the physical and electrical connection to the coaxial cable; it is powered by the LANIC through the AUI (Attachment Unit Interface) cable. The MAU receives signals from and sends signals to the coaxial cable. It also detects collisions resulting from two nodes starting to transmit simultaneously. A MAU is attached to the coaxial cable with a cable tap and can remain permanently attached to the cable. A MAU can be attached on an active network without interrupting network traffic.

- **Attachment Unit Interface** (AUI) Cable. The AUI cable and two-meter internal LANIC cable attach the LANIC to the MAU. The

AUI cable can be up to 48 meters in length. It is available with either FEP coating for installation in passages restricted for breathable air or with PVC coating for installation in less-restricted spaces.

**ThinLAN 3000/XL Link.** There are two major hardware components of ThinLAN 3000/XL Link, as follows:

- **Local Area Network Interface Controller (LANIC)**--same as for ThickLAN.
- **Thin Medium Attachment Unit (ThinMAU).** The ThinMAU provides the connection from the LAN hardware to the thin coaxial cable. The ThinMAU connects to the LANIC with an AUI cable. The AUI cable is one meter in length and is integrated with the ThinMAU. Additional or alternate cables are not supported. The AUI cable attaches to a two-meter internal LANIC cable.

**StarLAN 10 3000/XL Link.** There are three major hardware components of this link, as follows:

- **StarLAN 10 3000/XL Interface Card.**
- Twisted-pair **Medium Attachment Unit (MAU).** The MAU connects the StarLAN card to the twisted-pair cable.
- **StarLAN 10 3000/XL Hub,** which functions as a multi-port repeater. This component provides connections for up to 12 separate twisted-pair segments. It also has one AUI port for possible connection to a backbone cable.

## Link Level Software

**ThickLAN.** The link level software implements the specifications of IEEE 802.2 and 802.3, the protocols used for OSI layers 1 and 2, the physical and data link layers, respectively.

**ThinLAN 3000/XL.** Same as for ThickLAN, plus software that provides PC access to most HP 3000 applications.

**StarLAN 10 3000/XL.** Same as for ThinLAN 3000/XL, but using twisted pair wiring.

# NS Point-to-Point 3000/XL Link

The Point-to-Point 3000/XL Link is, as its name implies, a point-to-point link. Point-to-point links transfer data by sending it from one node in a network to another until it reaches its destination.

Two types of Point-to-Point 3000/XL Links are available; they are distinguished by the kind of physical connections that exist between nodes on the network:

- **Dial links**, in which a modem attached to a node is used to transmit and receive data carried across telephone wires. Dial links are also referred to as switched lines.

- **Leased lines**, in which data is sent over data-grade lines leased from a private carrier.

Figure 1-10 shows a router network consisting of some NS Point-to-Point 3000/XL Links.

NS Point-to-Point 3000/XL links use an **HP 3000 Programmable Serial Interface (PSI)** to perform link-level communications protocol management. The PSI is a hardware card that fits into the backplane of the HP 3000. Software that implements a particular link-level protocol is downloaded from the HP 3000 when the system is being installed as part of the network. Each HP 3000 with a Point-to-Point 3000/XL link must have a PSI installed.

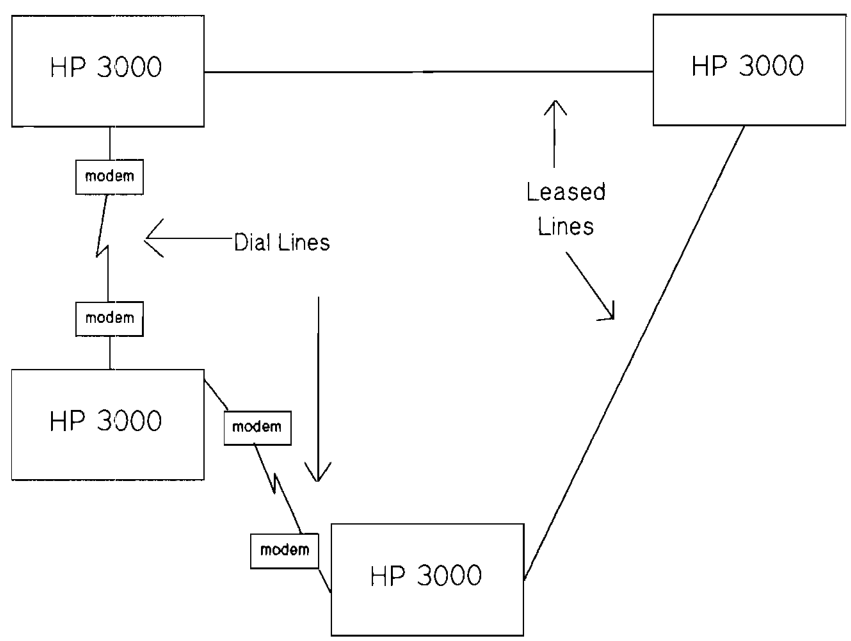



**Figure 1-10. Router Network with Point-to-Point Links**

**Caution**

Special provisions are required to ensure reliable communication between an NS Point-to-Point 3000/XL Link using a PSI card and an NS Point-to-Point 3000/V Link using an Intelligent Network Processor (INP). The INP must use download software version V.02.30 (or later), available through your Hewlett-Packard Support Representative.

## Dial Links

Dial links are implemented using autodial modems. The telephone number of a connected node is configured into NS3000/XL network management software. Manual dial is not supported.

LAP-B is the link-level protocol that supports NS Point-to-Point 3000/XL dial links.

LAP-B is a full-duplex protocol. Because data can be transmitted in two directions at once using a full-duplex protocol, and in only one direction at a time using a half-duplex protocol, better throughput is achieved using the LAP-B protocol. Full-duplex modems are required when using LAP-B.

See Appendix A for a list of the modems supported for each link-level protocol.

## Leased Lines

The company that owns a leased line allocates use of the line specifically for a subscriber's data communication needs. A cable from the PSI to a modem that is attached directly to the leased line connects the HP 3000 to the leased line.

HP supports the use of only the LAP-B protocol over leased lines for NS Point-to-Point 3000/XL Links.

LAP-B requires the use of full-duplex modems. See Appendix A for a list of the modems supported for LAP-B.

## Hardware and Cables for Dial Links and Leased Lines

As previously noted, each HP 3000 with an NS Point-to-Point 3000/XL link, including those using switched (dial links) or leased lines, requires its own PSI. In addition, each HP 3000 connected via a modem link requires a modem and cable connecting the modem to the PSI. These cables are direct connect and are terminated by connectors adhering to the EIA RS-232-C standard. Autodial and leased line modem links require only a modem. Refer to Appendix A of this manual for a list of supported modems.

**Note**

A node initiating a connection across a dial link MUST use a modem with an **autodialer**; otherwise, a dial-up connection cannot be established. If an autodialer is not used on one end of a connection, the connection may time out and become unavailable. Therefore, Hewlett-Packard strongly advocates using modems with autodialers for both the initiating and receiving ends of a dial-up connection.

### Personal Computer Interface

Unlike HP 3000s, PCs cannot provide transparent internet or intranet point-to-point communication. Instead, a PC must be directly connected through an Asynchronous Serial Network Link (ASNL) to an adjacent, MPE/V based HP 3000.

In addition, PCs do not accept inbound communication. As a result, PC users must log on to the adjacent MPE/V based HP 3000 from the PC (using the `DSLINE` command); HP 3000 users cannot log on to the PC from an HP 3000 terminal. Once the PC user has logged on to the HP 3000, other nodes in the network can be accessed by using commands initiated at the HP 3000. Refer to Appendix B for information on how to configure the HP 3000 Series 900 to communicate with PCs.

## DTC/X.25 XL Network Link

The DTC/X.25 XL Network Link includes the hardware and software components required to connect an HP 3000 Series 900 to a public or private X.25 packet switched network. To connect to an X.25 network, NS3000/XL systems must be connected to a Datacomm and Terminal Controller (DTC) on a LAN. An example of X.25 system connections can be seen in Figure 4-1. Sections 4-6, devoted to configuration planning, include sample worksheets.

The DTC/X.25 XL Network Link can be used in conjunction with leased lines (leased data grade telephone lines) or over normal voice-grade telephone lines. A synchronous modem is required for every connection to a Public Data Network (PDN).

The DTC/X.25 XL Network Link includes an interface to the DTC/X.25 Network Access Card on the Datacommunications and Terminal Controller (DTC). The DTC card implements levels 1 to 3 of the CCITT X.25 Recommendation (1984) for synchronous host-to-network connections.

### Certified Public Networks

The DTC/X.25 XL Network Link is certified for use on a variety of Public Data Networks (PDNs). Consult your HP representative for a list of currently supported PDNs.

### Private X.25 Networks

By installing a private X.25 network, your company can establish a wide-area network (WAN) that is operated and maintained by the company. Such a network can provide greater security than that provided by a public network, and it gives the company complete control over network operation and growth.

In a private network, a device called an X.25 switch is needed to route network traffic among the network's nodes. Hewlett-Packard, in conjunction with other vendors, offers a number of X.25 switches. Consult your Hewlett-Packard sales representative for complete information about X.25 switch products.

## X.25 Direct Access

As with other NS3000/XL Links, you can purchase the DTC/X.25 XL Network Link without Network Services. Programs that are written using the NetIPC intrinsics can directly access the X.25 (OSI layer 3s) software that is part of the X.25 XL System Access. NetIPC intrinsics also allow access to the TCP/IP transport protocols (OSI layer 4) over X.25. Refer to the *NetIPC3000/XL Programmer's Reference Manual* for information on using NetIPC. Hewlett Packard's AdvanceNet Architecture includes HP data communications products based on the principles of the OSI model, as well as extensions for the AdvanceNet predecessor, DSN. Data communications products can communicate only with products that are using the same architecture. Therefore, it is important to know which architecture is used for a product.

# NS3000/XL Network Services

NS3000/XL Network Services extend the capabilities of the HP 3000 operating system (MPE) and permit users to share information, programs, processing capabilities, storage facilities, and other resources provided by the various nodes of the distributed network.

## Services Available

The following services are provided by NS3000/XL over NS3000/XL links:

- **Remote Process Management (RPM).** Allows a process to programmatically initiate and terminate other processes throughout a network from any node on the network. RPM is normally used in conjunction with NetIPC.
- **Virtual Terminal (VT and VTR).** Gives the user interactive capabilities on the remote node, even though the user's terminal is physically connected to the local node. Reverse VT (VTR) gives programmatic access to remote terminals.
- **Remote File Access (RFA).** Allows a user to access files and devices on remote nodes.
- **Remote Data Base Access (RDBA).** Allows a user to access data bases on remote nodes. The same security protection used for data bases on the local node applies to remote access.
- **Network File Transfer (NFT).** Allows a user to efficiently transfers disc files between nodes on the network.

These services enable users and programmers to perform essential functions in a network- and internetwork-wide context. For details on using these services, refer to *Using NS3000/XL Network Services*.

2

# Network Management

The advantages of a distributed network are accompanied by the responsibilities of network management, the management of systems in a distributed network. These responsibilities are assigned to the user identified as the **network manager**, whose role is to oversee the configuration and daily operation of the network. The network manager's role can be further subdivided by delegating certain tasks to additional users:

- Users called **node managers** can be assigned to perform network management tasks required for each node on the network.
- If the network is part of an internetwork, tasks related to coordinating individual network operation with the operation of the internetwork can be assigned to an **internetwork administrator.**
- If a personal computer network uses an HP 3000 Series 900 as a server, the management of the PC network can be assigned to a **PC network manager.**

These collective network management responsibilities can be distributed among several individuals, as described above, with coordination among them provided by the network manager, or they can be given to one person. Since the system management of a single HP 3000 Series 900 is assigned to a user identified as the system manager and the system supervisor/operator, it may be appropriate to assign one of these users the role of node manager for an individual system. All of these system management and network management role assignments are based on the MPE XL capabilities they require to perform their functions:

- system manager (SM) capability for system manager
- Operator (OP) capability for system supervisor/operator
- node manager (NM) capability for node manager
- network administrator (NA) capability for network manager

**Note**

Although this manual refers to the person responsible for managing the network as the network manager, this title and other titles defined in this section are used only for convenience. The person responsible for maintaining the operation of the network, the PC network, or the internetwork needs no particular title, as long as it is clearly defined who is responsible for various parts of the network's operation.

Node manager (NM) and network administrator (NA) capabilities currently provide almost identical access rights. The single difference is that NA capability is required to access and update the network directory, part of the NMMGR utility. Therefore, the node manager should be assigned NM capability; the network manager should be assigned NA capability. In this manual, it is assumed that one person, the network manager, will be completing the tasks required to establish a working NS3000/XL network.

As previously noted, these responsibilities may be distributed among several individuals or may be assigned to one person at your installation.

Later portions of this chapter describe the tasks required of the network manager and cover the following topics:

- The Network Management Lifecycle
- Network Management Tools
- Configuration and Initialization Overview

In addition to explaining each major functional area and the corresponding commands or utilities that make up the network manager's job, this section explains background information as needed. Other complex subjects can only be introduced here. In such cases, you will be referred to appropriate additional sources.

# Network Management Tasks

As the network manager, you are directly responsible for executing the utilities and commands needed for the operation of NS3000/XL services and link products for all the nodes directly connected to your network. In addition, your network may be linked (via gateway nodes) to other networks in the same internetwork. The internetwork administrator is responsible for the coordination of tasks among all networks to ensure the complete operation of the entire internetwork.

As the network manager, you are also responsible for coordination with any network, possibly through the internetwork administrator, with which your local network can communicate.

Although network managers do not have full responsibility for the other networks with which the local network can communicate, they need to be aware of the requirements of establishing connections, such as the naming or addressing conventions used by each type of network.

## The Network and Internetwork Management Lifecycle

To understand the responsibilities of network and internetwork management, it is helpful to examine the major stages of development in a typical network or internetwork, generalized into the network/internetwork life cycle shown in Figure 2-1.

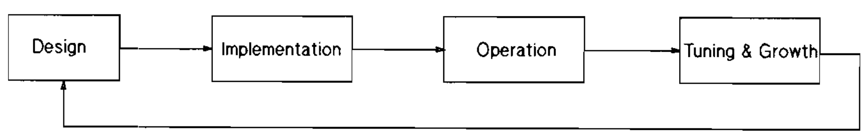



**Figure 2-1. The Network/Internetwork Life Cycle**

Both networks and internetworks evolve in much the same way as is illustrated in Figure 2-1. First is the design stage, a time of defining requirements and designing a network to meet those requirements. This stage is followed by the implementation stage. During the implementation stage, each network manager is responsible for managing the installation, configuration, and initialization of all the nodes in the network. The internetwork administrator is responsible for managing the overall installation, configuration, and initialization of all networks in the internetwork. This includes informing all network managers of configuration information that must be coordinated to achieve internetwork communication. Once the network or internetwork is established, management consists of two main tasks:

- Ensuring network availability. Each network manager is responsible for changing configurations, controlling the operation of the data communications products on each node, and resolving any problems.

- Maintaining performance levels. The network manager monitors performance to ensure consistent response time. The internetwork administrator can monitor performance of internetwork traffic. Eventually, in response to the requirements of these tasks, the network manager determines the need for growth or tuning of a particular network, returns to the design stage, and the cycle begins again. Similarly, the internetwork administrator must determine the need for growth, tuning, or other alteration of the internetwork, and must as a result return to the design stage and begin the cycle again.

Thus, network and internetwork management requirements change over time, depending on where your network or internetwork is in the network life cycle.

## Network Management Tools

The responsibilities of managing a node in a network and coordinating with remote nodes and networks may require the network manager to use a combination of software utilities, data communications test equipment, and network support services. The network manager has a variety of tools and utilities available to supervise the operation of NS3000/XL services and link products. Some are provided with the data communications products and some are provided with the HP 3000 Series 900.

### MPE XL Commands and Utilities

The responsibilities of the network manager, node manager and the system supervisor/operator tend to overlap because of the similarities of their roles. NA, NM, and OP capabilities allow users to issue MPE XL commands and interact with the system to fulfill designated responsibilities.

A variety of utilities and commands used by the system supervisor/operator are also available to the network manager (and/or node manager, network administrator, or internetwork administrator) for use in managing NS3000/XL networks. These include:

- SYSGEN--the system I/O configuration utility. Refer to the *System Configuration Manual* in the System Administrator's Series, which provides detailed instructions on how to use SYSGEN.

- MPE XL Networking Commands. There are MPE XL commands specifically designed for starting and stopping NS3000/XL link products, and for specifying the operation of certain components.

Table 2-1 lists these networking commands. They are described in the *NS3000/XL Operations and Maintenance Manual.*

Additional MPE XL commands, such as SHOWDEV and ALLOW, may also be helpful in managing NS3000/XL services and link products. Refer to the *MPE XL Commands Reference Manual* for information about commands not explained in the *NS3000/XL Operations and Maintenance Manual.*

- Dump Analysis Tool (DAT). DAT is a utility for analyzing MPE XL system events such as process hangs, operating system failures, and hardware failures. DAT extracts dump tape data and stores it in disc files, where it can be read and analyzed interactively.
- LOGTOOL. This utility analyzes files in the MPE XL system log files. An MPE XL log file records events such as session or job initiation and termination, process termination, file closure, I/O errors, and system shutdown.

**Table 2-1. NS3000/XL Networking Commands**

| Command Name | Description |
|---|---|
| LINKCONTROL | Activates or deactivates link level tracing on the specified communications line. The line must already be initialized. |
| NETCONTROL | Initiates, terminates, and controls the operation of the Network Transport subsystem of NS3000/XL. |
| NSCONTROL | Initiates, terminates, and controls the operation of the Network Services subsystem of NS3000/XL. |
| RESUMENMLOG | Resumes NMS logging after a recoverable error. |
| SHOWNMLOG | Displays the identification number and available space for the NMS log file. |
| SWITCHNMLOG | Closes the current NMS log file and creates and opens a new one. |

## Node Management Services

Node Management Services (NMS), used by the network manager to configure, initialize, and maintain NS3000/XL services and link products, are used in much the same way that MPE XL operating system utilities are used by the system supervisor for similar tasks. For example, the SYSGEN utility is used to configure system hardware into MPE XL; the network equivalent is the Node Management Configurator, abbreviated NMMGR, which is used for network configuration. The utilities and commands combined as Node Management Services include:

- The Node Management Configurator (NMMGR). NMMGR is a menu-driven configuration utility that is used to create and enter information into a configuration file. The information in a configuration file is used by the data communications product, **when it is active**, to determine its operating characteristics.

- The NMS Conversion Utility (NMMGRVER). NMMGRVER converts a configuration file created with earlier versions of NMMGR to the format required by NMMGR.

- The NMS Trace/Log Formatter (NMDUMP). The diagnostic functions of logging events and tracing messages are handled by NMS using a common set of internal intrinsics. NMS provides the NMDUMP formatting utility to format the files created by logging or tracing operations.

- The NMS Maintenance Utility (NMMAINT). This utility provides a list of software module version numbers and verifies that all modules are current and compatible.

## Link Level Tools and Utilities

This manual covers those aspects of network management used by the network manager on a day-to-day basis. There are also a variety of link-specific troubleshooting tools that are beyond the scope of this manual. However, because it may be helpful to know what is available, the link-level tools are listed here, with references to the appropriate manuals.

**IEEE 802.3 Links.** For IEEE 802.3 links, the following tools are available:

- **LANIC Self Test.** This test exercises the major portion of the LANIC hardware and reports status.

- **LAN Node Diagnostic** (LANDAD). This utility is an interactive on-line program designed to help identify any malfunctioning hardware units of the LAN/XL Link.

- **Time Domain Reflectometer** (TDR). The TDR that HP recommends is the TEKTRONIX 1503 Cable Fault Locator.

Refer to the *LAN Link Hardware Troubleshooting Manual* for more information on these tools.

**Links Using a Central Bus PSI.** The NS Point-to-Point 3000/XL Link uses the Central Bus Programmable Serial Interface (PSI) card to perform lower-level data communication functions. The following utilities are available for Central Bus PSI troubleshooting:

- **PSI Self Test.** This test exercises the PSI hardware and reports the status through an LED display on the card, or to the user terminal if run as part of the on-line diagnostic.
- **PSIDAD.** This utility is an interactive, on-line program designed to identify any malfunctioning hardware units of the Point-to-Point link.

For more information refer to the *On-Line Diagnostic Subsystem Manual.*

**DTC/X.25 XL Network Link.** The DTC/X.25 Network Access card can be tested from the OpenView DTC Manager. Refer to *Using the OpenView DTC Manager.*

## Installing NS3000/XL Links

The installation procedure for each NS3000/XL link product specifies responsibilities of the customer and of HP.

### Customer Installation Tasks for All NS3000/XL Links

You must complete the tasks listed in Table 2-2 before your HP representative begins to install any NS3000/XL link product:

**Table 2-2. Customer Installation Tasks**

| Required Steps | References |
|---|---|
| Install modems and phone lines for remote NS3000/XL links, if any. | Refer to the appropriate cabling, modem, or auto-dial unit or reference guide. |
| Install external interconnect cable between HP 3000 systems for NS Point-to-Point 3000/XL connections, if any. | *Central Bus Programmable Serial Interface Installation and Reference Guide* |
| Perform a system backup (including MPE XL and @.PUB.SYS) and make the system available for installation of the data communications software, interface card(s), and cable. | *LANIC Installation and Service Manual Option 100*; *LANIC Installation and Service Manual* |

In addition, if any NS3000/XL links will be used to connect personal computers to an HP 3000, the customer is responsible for installing the personal computers.

It is also the customer's responsibility to install some hardware and cables for IEEE 802.3 links, as described below.

## Additional Tasks for IEEE 802.3 Links

Table 2-3 lists the steps you must complete before beginning to install the software for ThinLAN 3000/XL (or the ThickLAN or StarLAN 10 options):

**Table 2-3. IEEE 802.3 Link: Customer Installation Tasks**

| Required Steps | References |
|---|---|
| **ThinLAN 3000/XL**: Install the thin coaxial cable and ThinMAU. Test that the line is functioning correctly. | *LAN Cable and Accessories Installation Manual*<br>*LANIC Installation and Service Manual* |
| **ThickLAN** option: Install the coaxial cable, MAU/tap, and AUI cables. Test that the line is functioning correctly. | *LAN Link Hardware Troubleshooting Manual* |
| **StarLAN 10** option: Install the Hubs and unshielded twisted-pair cable. Test that the line is functioning correctly. | *StarLAN 10 3000/XL Link Installation and Service Manual* |

After the hardware described in Table 2-3 has been installed, you must perform a system backup, as described in Table 2-2.

## HP Installation Tasks

During the installation of NS3000/XL links, HP is responsible for:

- Taking the system down and performing a system update to add the product software modules to the system if the system is on the current release; otherwise a full system update will be performed.
- Verifying that the correct number and version of the software modules have been installed.
- Installing the link product hardware (with the exception of the IEEE 802.3 link hardware described in Table 2-3), modems and phone lines, and external interconnect cable between hardwired HP 3000 Series 900s.
- Adding the link product hardware into the I/O software configuration and configuring it in accordance with the customer's intended use.

- Initially configuring the software in accordance with the network links used.
- Connecting the network link to the communication line (only if the line is available).
- Verifying that a link properly connects a personal computer to the HP 3000 Series 900. HP can verify this only if all hardware connections have been made to the HP 3000 Series 900 and if the personal computer is available for testing.
- Verifying that the product properly opens the line when started by command.

You may encounter a situation where you have ThinLAN 3000/XL Link with incoming VT as your only service, and then you decide to purchase all services for system-to-system communications. To revert from having a VT-only service to having all services, restore `@.NET.SYS`, and then perform `STREAM CONFJOB.NET.SYS`.

## Configuration and Initialization Overview

Configuration of an NS3000/XL network is performed through the use of NMMGR, a utility that enables you to interactively enter configuration information. Once each node in the network has been correctly configured, the network can be initialized. Initialization is accomplished through the use of MPE XL network commands.

Configuring and initializing an NS3000/XL network includes the following major steps:

- Network and configuration planning.
- System Configuration.
- Configuring the network with NMMGR.
- Verifying network configuration with software utilities and tests.
- Maintaining an up-to-date network directory through the use of the NS3000/XL network directory utility.

Table 2-4 summarizes the required configuration and initialization steps. Table 2-4 also lists the appropriate sections of this manual where you will find the information required to complete each step. In addition, for each step there is a list of the additional references that you can consult for more or related information. The sections of this manual are arranged in an order that closely corresponds to the steps required to configure and operate NS3000/XL.

**Table 2-4. Configuration and Initialization Summary**

| Required Steps | References |
|---|---|
| Create the configuration file required for initiating purchased services. | "Installing Network Services," earlier in this chapter. |
| Prepare for network configuration using worksheets and network/internetwork maps. | Chapter 3, Network Planning and Configuration |
| Configure the link hardware devices into the HP 3000 operating system. | Individual network configuration guides. |
| Study the use of the Node Management Configurator, NMMGR. | *Using the Node Management Services Utilities* |
| Using NMMGR, prepare the configuration files required for NS3000/XL service and link operation. | For guided configuration, see the individual network configuration guides.<br>For non-guided configuration, see the *NS3000/XL Screens Reference Manual.* |
| Create a network directory for nodes requiring one; synchronize network directories among all nodes in network and internetwork. | *Using the Node Management Services (NMS) Utilities* or Chapter 3, Network Planning and Configuration. |
| Initialize the Network Transport with `NETCONTROL`, then the Network Services with `NSCONTROL`. | Individual network configuration guides or the *NS3000/XL Operations and Maintenance Reference Manual.* |

3

# Network Planning and Configuration

This section explains concepts you will need to understand before you plan and install an NS3000/XL network or internetwork.

This section will introduce and describe the following topics:

- **Software Components**, including NS3000/XL software subsystems and configuration files.
- **Configuration concepts**, including internet and intranet routing, and the relationship of symbolic names to network addresses.
- **Network and internetwork configuration and administration tasks.** Configuration tasks include the procedures required to configure software on each network node, verify that the network is functioning correctly, and start the network. Administration tasks include making sure that changes to network nodes are recorded and that changes are coordinated among all network nodes, when necessary.
- **Network design**, including guidelines to follow when designing a network or internetwork.

The latter chapters in this manual contain worksheets that can assist you in designing a network or internetwork, and that you can use to prepare for configuration with the configuration program NMMGR. The worksheet process includes the creation of a network or internetwork map that shows the placement of nodes and connecting links.

# Software Components

The following subsection describes the software components that make up NS3000/XL services and link products.

## NS3000/XL Software Subsystems

The software and associated protocols that enable an NS3000 network to operate are divided into units referred to as subsystems. Separate copies of these subsystems reside on each node in the network. The following subsystems make up NS3000/XL services and links:

- **Network Services.** The Network Services subsystem provides services that include Network File Transfer (NFT) and Remote File Access (RFA). The Network Services subsystem will be present on a node only if Network Services have been purchased (separately from the link) for that node.

- **Network Transport.** The Network Transport subsystem contains the protocol modules corresponding to layers 1 through 4 of the OSI model. Network Interprocess Communication (NetIPC) is part of the Network Transport subsystem.

- **Node Management Services.** The Node Management Services subsystem provides configuration file version checking, logging, and tracing. Logging enables network transactions to be "logged," or recorded, in a disk file. The recorded information can be used to assist in network troubleshooting.

- **Node Management Configurator.** The Node Management Configurator subsystem provides the software that enables you to configure an HP3000 Series 900 as a network node.

- **Link Support Services.** The Link Support Services subsystem contains two software modules: the Link Manager and the PC Link Manager. Both of these modules open, close, and otherwise control physical links.

## Configuration Files

Part of the network installation process involves configuring the network using NMMGR interactive configuration software. Through the use of NMMGR, several files containing information about the node and the rest of the network to which it belongs will be created on each node. The information in these files is accessed by various network subsystems while the network is operating. It is the information provided by the configuration files that enables the network software to send and receive data in a suitable form for each node and network link, and to direct data to the correct destination nodes.

Two files can be created on each network node: NMCONFIG.PUB.SYS and NSDIR.NET.SYS. Each of the files is described below:

NSDIR.NET.SYS. This file, also called a network directory, contains information that enables network software to translate node names (a node name is a symbolic ASCII-character name given to each system in the network that identifies it to the rest of the network and to network users) into protocol and address information. NSDIR.NET.SYS is actually the data file of a KSAM data file and key file pair. The key file that will be created at the same time as the data file will be named using the first six characters of the data file, appended with the character K. For example, if the default data file name is used, the key file will be named NSDIRK.

NMCONFIG.PUB.SYS. This file contains information needed for link and network transport configuration and for logging. Parameters such as what network activities to record and where to record them are provided by this file.

# Configuration Concepts

Before beginning network planning and configuration, you must understand certain terms and concepts that may influence your network design and the values you enter for various configuration parameters. This subsection describes the most important of these terms and concepts and those that you should understand in order to fully understand NS3000/XL networks.

## NS Routing

**Routing** refers to the process used to determine the path that packets, or fragments of a message, take through a network or internetwork to reach a destination node. Routing between multiple networks in the same internetwork is referred to as internet routing; routing between nodes in the same network is referred to as intranet routing. The routing mechanism used by a particular network is based on its network type.

The NS Network Transport subsystem provides intranet and internet routing. However, a message's complete source-to-destination route is not determined at the source node (unless the destination is a logically adjacent node), because each node possesses information about only the path that should be taken to the *next* node on the way to a destination.

The information about which node a packet should be directed to next is obtained by the Network Transport from the `NMCONFIG.PUB.SYS` configuration file. The information in this file is derived from values configured using NMMGR. The values entered must therefore reflect the physical design of your network. (Network design is further discussed later in this chapter.)

### Intranet Routing

**Intranet routing** involves all the processes required to route a packet from one node in a network to another node in the same network. Intranet routing can be very simple, as for an IEEE 802.3 network, or potentially very complex, as for a point-to-point router network.

For an IEEE 802.3 network, in which each node is attached to a common bus (the cable) that is shared by all the nodes, routing occurs as follows: Each node that has data to send acquires control of the bus, adds a subnet address identifying the node (called a station address) to the packet, and sends it on the bus. After the packet has been sent, the sending node relinquishes control of the bus. Each node will check every packet that is sent on the bus for a station address that matches its own, and will receive only those destined for it. Figure 3-1 illustrates an IEEE 802.3 network; note that the nodes on the network are all logically adjacent to one another.

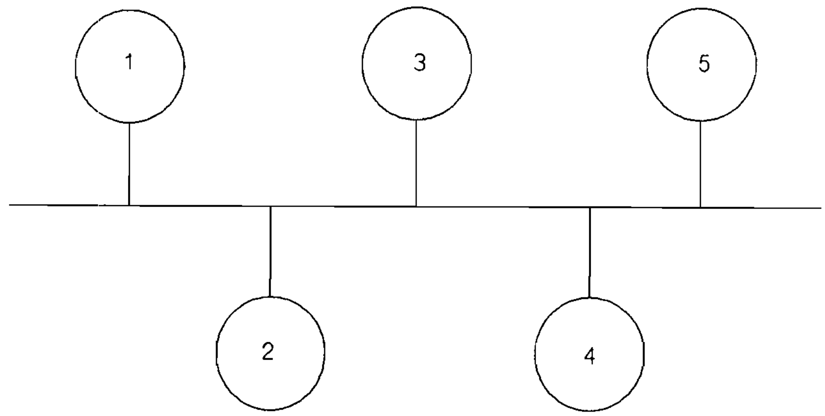



**Figure 3-1. IEEE 802.3 Network**

For point-to-point networks, nodes are connected to other nodes in the network via one or more point-to-point links. A route may therefore include one or more intermediate nodes through which a packet must pass on its way to its destination. The routes to various remote nodes are configured into nodal routing tables at each node. At an intermediate node, a packet will be received and forwarded to the next node in the network based on the routing information configured at that intermediate node for the destination node. Information about more than one route to the same destination node can be configured into a node's routing table. If so, an internal algorithm selects the best possible route to the destination node. Figure 3-2 shows an example point-to-point network. Note that more than one possible route exists between nodes.

At each node on a point-to-point network, you configure the name of the link that a packet should take to get to a given remote node. By configuring multiple alternative links to reach the same destination, you can provide several routes for packets to take to reach a destination. NMMGR allows you to specify an "entry priority" for each link to indicate the order of preference for configured outbound links to the same destination. Alternate routes can be useful if a link on the network becomes non-operational because of an intentional shut down. The user must perform a NETCONTROL DELLINK on both ends of the link for the alternate routing to take effect.

For X.25 networks, nodes are connected to other nodes on the same X.25 network via multiple logical connection paths (Virtual Circuits). X.25 protocol defines the method of access to packet switched networks, using either switched or permanent virtual circuits. X.25 parameters are configured into nodal routing tables at each node. The route a packet actually takes between two nodes is transparent to the user.

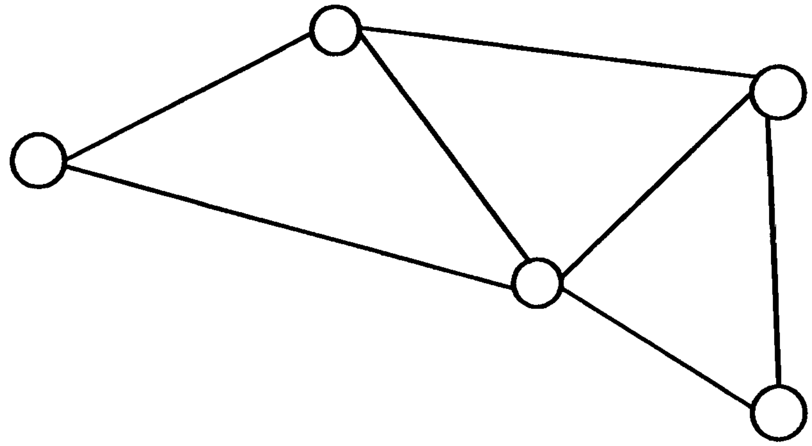


**Figure 3-2. Point-to-Point Router Network**

## Internet Routing

Internet routing involves all the processes required to route a packet from a node on one network to a destination node on another network. Networks are connected to other networks via gateway nodes, which are nodes that are configured either as a member of multiple networks or as a gateway half in addition to a network. To act as a gateway, the node must also be specified as such by at least one other node during the other node's configuration. Internet routing is therefore concerned with which gateways and which networks a packet will pass through to reach its final destination.

Internet routing decisions are made at both the node that originates the packet and at intermediate gateways. The destination network address is checked against a table that contains an entry for each remote network in the internetwork and specifies the gateway(s) on the network that can reach each remote network. Because the purpose of internet routing is to get the packet to the correct destination network, the packet will be forwarded to the appropriate gateway. This will be repeated, if necessary, until the packet reaches the gateway that is a member of the destination network. At this point, intranet routing takes over to get the packet to the correct (and final) destination node.

# Symbolic Names

A **name**, when used in the context of NS3000/XL networks, is a character string which identifies some portion or component of a network or internetwork. Names, because they can be defined by the user (in this case, the node or network manager), can be chosen to represent some meaningful and easily recognizable concept. For example, if you had three networks in an internetwork, you could name them NET1, NET2, and NET3. Or, perhaps, in your installation three nodes "belonged" to the marketing, finance, and manufacturing departments, respectively. You might choose to name them NODEMKTG, NODEFIN, and NODEMFG.

Configuration of NS3000/XL networks requires that you use NMMGR to configure each node. Many of the items to be entered via the interactive user interface of NMMGR (discussed in detail in the *Using the Node Management Services (NMS) Utilities* manual) are names. The following subsections describe the names that NMMGR will require you to configure.

## Node Names

The **node name** is used to identify each system that is a node in the network or internetwork. Each node name used to designate a computer in the network or internetwork must be unique, although a single node can be identified by multiple names. Besides being used for configuration, node names are used in Network Services commands (for example, the `DSLINE` command) and intrinsics to designate upon which node a particular networking activity is to occur. A complete node name consists of three parts, which together can be no more than 50 characters, as described in detail in the following subsection.

**Note**

Other Hewlett-Packard networking documentation may use the term "computer name" instead of "node name." A computer name is the same as a node name.

### Node Name Format and Assignment

Each node in the network must be assigned at least one unique node name. A fully qualified node name consists of three fields, each separated by a period:

*nodename.domain.organization*

When specifying node names, you must enter the delimiting periods. Each field can be up to 16 characters (alphanumeric, underscore or hyphens); the first character must be alphabetic. Just as an MPE XL filename has a singular name, *filename*, and a fully qualified name, *filename.groupname.acctname*, a nodename also has a singular name, *nodename*, and a fully qualified name, *nodename.domain.organization*.

The *nodename* must be unique for each node on the network. The *domain* and *organization* do not need to be unique. You might choose a unique *domain* name for each network in the internetwork. Note that if the default *domain* and *organization* of all the nodes match they do not need to be specified in commands and intrinsic calls originating from nodes with the same *domain* and *organization* names. If a user does not supply domain and organization fields the fields will default to the local node's assigned domain and organization. This allows users to issue commands or intrinsics with just the single portion of the nodename, *nodename*.

Hewlett-Packard recommends that you use some convention when assigning names; for example, all nodes in the same network could have the same domain name and all nodes in the same internetwork could have the same organization name.

**Multiple Node Names.** A single node can be assigned more than one node name by specifying two (or more) node names in the network directory. Although the node may have multiple node names, it can have only one IP address (described in "Network Addresses" later in this section) unless it is a full gateway, which will have one IP address configured for each network it belongs to. Using more than one node name may be useful if you need to isolate sets of network traffic received or generated by the same node. For example, if you previously had two HP3000 Series 900s but have consolidated their activities on a single, more powerful HP3000 Series 900, you might have application software that uses two node names that correspond to node names of your previous two computers. By using two node names for the single new system, you could avoid having to modify existing software to accommodate the change.

## Other Names

During configuration with NMMGR, you will be asked for several other names in addition to a node name. The node name is the only name that is exchanged between nodes and used by software on remote systems; these additional names are required by only the software within the system being configured. The names described below must be composed of up to eight alphanumeric characters, and must begin with a letter.

**Network Interface** Name. The **network interface name** is used to identify the software on a node that provides an interface to a particular network. A useful convention is to name a network interface for the network to which it provides an interface. For example, if you are configuring a node as a member of a network named NET1, the name of the network interface to that network should be NET1. The network interface name is used during configuration and as part of some commands that control network operation. A node requires one network interface for each network to which it belongs, and one network interface corresponding to the software loopback function. A node's multiple interfaces are distinguishable by the use of a different network interface name for each.

During configuration, you may also be required to enter a **home network name**, which is simply the name of one of the node's network interfaces. One of the networks to which a gateway half belongs must be designated the home network to establish a source network address for packets originating from the gateway half.

**Link Name.** A **link name** is given to each of the links connecting a node to other nodes on the same network. Links should be named according to some convention you have defined. For example, for a relatively simple network, you might choose to use the same name on different connected nodes to refer to the link which connects them.

**Router Node Name, Static Neighbor Node Name, and Gateway Name.** Configuration sometimes requires that you specify the name of a node that belongs to a particular category. For example, a **router node name** is the name of a node that can be reached via one or more router links from the node being configured. A **static neighbor node name** is the name of a node that is on the same IEEE 802.3 network as the node being configured. A **gateway name** is a name that refers to a node acting as a gateway for the node being configured. These names need not be identical with the node name configured for a node; these names identify subsets of configuration data related to a particular node.

## Network Addresses

An **address**, in the networking sense, is a numerical identifier defined and used by a particular protocol and associated software to distinguish one node from another. Addresses of different kinds can vary in complexity depending on the need. For example, two of the protocols used by NS require addresses: the IP protocol and the IEEE 802.3 protocol. The address used by the IP protocol is hierarchical; it identifies both individual nodes and the network to which each belongs. The address used by the IEEE 802.3 protocol is not hierarchical; it provides information only about nodes in a particular IEEE 802.3 network.

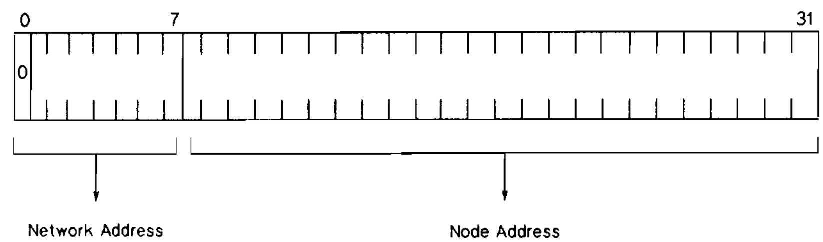
Another type of address is an X.25 address, which can be configured in the network configuration files of nodes with DTC/X.25 XL Network Links. An X.25 address is the address of a remote node on an X.25 public data network or X.25 private network with which your node expects to communicate. The X.25 address may contain as many as 15 digits. The X.25 address is required if you have defined the corresponding address key in the SVC path screen of your configuration. An address key allows you to associate a virtual circuit with a specific facility set. If you are configuring the POOL address key to accept calls from a system not configured in the local system, then no X.25 address needs to be configured because the address would be meaningless. Also, for communication with DDN networks, to configure an X.25 address would be meaningless because the X.25 address is derived from the IP address. For more information on X.25 addresses and X.25 address keys, refer to the *X.25 XL System Access Configuration Guide*.

## IP Address Format and Assignment

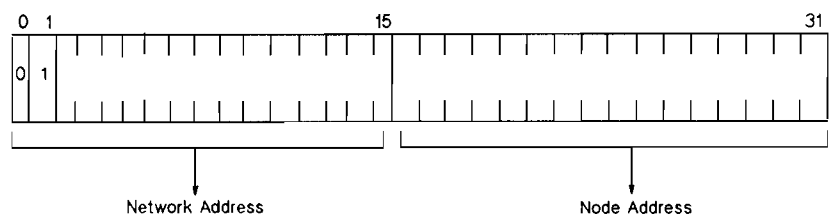
An IP address consists of two components: a network portion, which identifies the network, and a node portion, which identifies a node within a network. The terms **network address** and **node address** are commonly used to describe these two components of the IP address. Together, they uniquely identify a node within an internetwork.

**Address Classes.** There are three IP address classes, each accommodating a different number of network and node addresses. The address classes are defined by the most significant bits of the address, as follows:

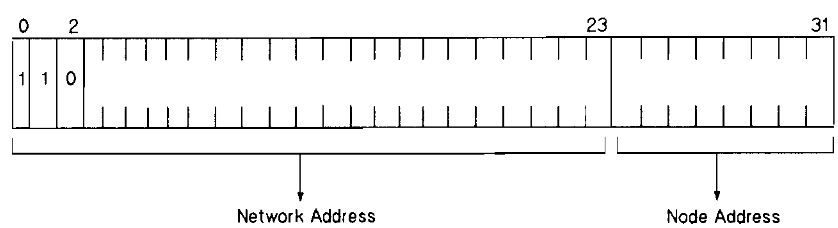
**Class A - -**




**Class B - -**




**Class C - -**




The address classes can also be broken down by address ranges. IP addresses are represented in NS3000/XL software by converting the bits to decimal values one octet at a time and separating each octet's decimal value by a period ( . ) except between the node and network portions, which are separated by a space.

Table 3-1 lists the number of networks and nodes and the address ranges for each address class:

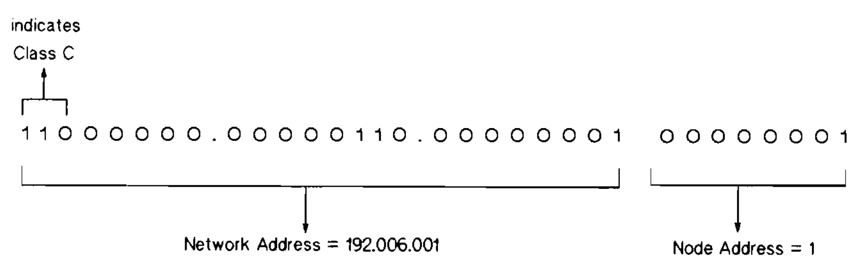
**Table 3-1. IP Address Classess**

| Class | Number of Networks | Number of Nodes | Address Range |
|---|---|---|---|
| A | 127 | 16777215 | 000 000.000.000 - 127 255.255.255 |
| B | 16383 | 65535 | 128.000 000.000 - 191.255 255.255 |
| C | 2097151 | 255 | 192.000.000 000 - 223.255.255 255 |
| Reserved | -- | -- | 244.000.000.000 - 255.255.255.255* |

**Note**

The address 255.255.255.255 is reserved for NS3000/XL loopback. Loopback is described in the *NS3000/XL Screens Reference Manual.*

To determine a network address and node address from an IP address, you must separate the network and node address fields. For example, the bit representation of IP address 192.006.001 001 is separated as follows:




**Assigning IP Addresses.** You must assign an IP address for each node on the internetwork. To assign IP addresses, you must determine network and node addresses. To determine network addresses for each network, you must first determine how many networks your internetwork contains and where your network boundaries are. Each network must be assigned a unique network address. All nodes in the same network must be assigned the same network address.

HP has obtained a block of Class C addresses from the Defense Advanced Research Projects Agency (DARPA). Even if you do not anticipate connection to DARPA's ARPANET (Advanced Research

Projects Agency Network), HP recommends that you obtain IP network addresses from the **HP Network Administration Office** (NAO) to guarantee unique network addresses. To do this, contact your HP representative or write to the NAO at the following address:

Network Administration Office,
Department NET Information Networks Group
Hewlett-Packard Company
19420 Homestead Road MS 43UC
Cupertino, California U.S.A. 95014
(408) 725-8111

Do not assign any network and node addresses consisting of all 1s or all 0s. In NS3000/XL software, the node address 0 is reserved for messages that are broadcast to all nodes; the address of all 1s is reserved for loopback. (Note that the 3-digit decimal address of 255 represents a byte of all 1s.) ARPA standards also reserve these addresses: all 1s signifies messages for all nodes on the network, and all 0s signifies messages for the same node that originated the message or the same network as the originating node.

Node addresses must be unique only within each network. For example, you could have a node with node address 5 in network 1 and another node with node address 5 in network 2. You can assign node addresses according to your own needs, but they must be within the ranges for the IP address class that you are using.

## IEEE 802.3 Station Address Format and Assignment

An **IEEE 802.3 station address** is assigned to every node on an IEEE 802.3 network. When a packet is sent on the network, only the node whose station address matches the destination address in the packet receives the packet. Hewlett Packard assigns a **station address** to each IEEE 802.3 interface card during manufacturing. The station address is used for network addressing on the IEEE 802.3 network bus, and has the following format:

*hh-hh-hh-hh-hh-hh*

where *h* is a hexadecimal digit (0 - 9, A - F).

For HP3000 Series 900s, this factory-configured station address is in ROM on the LANIC interface card. You have the option of specifying a different station address by using NMMGR. Refer to the *NS3000/XL Screens Reference Manual* for details. Each time the card is initialized, either the factory-supplied station address or the NMMGR-configured address is activated for use on the IEEE 802.3 network.

**Assigning Station Addresses.** HP recommends that you use the factory-configured station address assigned to the LAN interface card. If you decide to assign your own address contact your HP representative for more information.

## Address Resolution

**Address resolution** in NS networks refers to the mapping of node names to IP addresses and the mapping of IP addresses to subnet addresses. Two kinds of address resolution can occur on a node in an NS network: First, the destination node's nodename must be mapped to the node's IP address. Second, for some types of networks, the IP address must be mapped to a subnet address that identifies a node for the protocols used by the subnet.

### Node Name to IP Address Resolution

NS3000/XL routes packets throughout internetworks and networks based on the internet and intranet addresses of each message's destination node. However, network users and application programs use node names to designate the destination of a message. As a result, a method is required to map node names to their corresponding addresses.

The Network Transport determines the addresses that correspond to a node name through one of the following methods:

1. By accessing the network directory (`NSDIR.NET.SYS` file) that resides on the node from which communication originates. Every node with a point-to-point link must have a network directory. This includes all nodes on router networks and any node functioning as a gateway half. Also, a node with an X.25 network interface configured must have a network directory, except for DDN networks and SNA over X.25.

2. By the use of the Probe protocol. The Probe protocol can be used only on IEEE 802.3 networks.

3. By the use of a Probe proxy server. This method combines methods 1 and 2 listed above. A Probe proxy server is a node on an IEEE 802.3 network that possesses a network directory and is designated a Probe proxy server during configuration. Other nodes on the IEEE 802.3 network can use Probe proxy requests to obtain information contained in the network directory that may not be available elsewhere.

For each node, a choice from the above methods and the preferred order that they will be used can be configured with NMMGR.

Name-to-address information for each node is contained in a data structure called a **path report**. In addition to a node's addressing information, each path report specifies the networking protocols used on the node. When a connection is established between two nodes, the destination node's path report is obtained by one of the three methods listed above. Once a node has received another node's path report, the node receiving the information retains it so that a path report does not have to be obtained every time a connection is established with the same destination node.

**The Network Directory**. The network directory file `NSDIR.NET.SYS`, which you can initially create with NMMGR, contains a node's network directory. The network directory contains entries for remote nodes that each include a remote node's node name and its path report. The first time a connection is initiated from a node that has a network directory, the Network Transport software searches the NSDIR.NET.SYS file for the destination node's node name and associated path report. The path report contains the IP address(es) associated with the destination node name. Every node having a point-to-point link or X.25 link (except for DDN networks and SNA over X.25) must possess a network directory. However, nodes on IEEE 802.3 networks do not each require network directories. Instead, they can use the Probe protocol or a Probe proxy server to obtain path reports.

**The Probe Protocol.** IEEE 802.3 nodes can use the Probe protocol to obtain path reports specifying the names and corresponding addresses of other nodes on the network. When a node configured to use the Probe protocol needs to establish a connection, it first multicasts a query to all the nodes on the network, requesting a response from the node whose name matches the name in the message to be sent. (Multicasting is similar to broadcasting, except that a message is sent to only a subset of nodes instead of all nodes on the network.) If the name of a node on the IEEE 802.3 network matches the destination node name, it responds to the query by sending back its path report. The node sending the message then uses this information to resolve the destination node's address, ensuring that messages arrive at the correct destination.

**Probe Proxy Server Nodes.** By itself, the Probe protocol can obtain information only about nodes on the same IEEE 802.3 network; to obtain information about nodes on other networks in the same internetwork requires additional help from a network directory. Therefore, if an IEEE 802.3 network is part of an internetwork, a network directory must reside on at least one of the IEEE 802.3 network's nodes for messages to be sent to nodes in other networks. If another node on the IEEE 802.3 network needs to establish a connection with a destination node that belongs to a different network on the internetwork, the node with the network directory can provide the sending node with addressing information about the destination node. The node on the IEEE 802.3 network that performs this function is called a **Probe proxy server**. In addition to possessing a network directory, the Probe proxy server must be designated as such during configuration. HP recommends that the IEEE 802.3 network's gateway node be used as the Probe proxy server. HP also recommends that you create more than one Probe proxy server on each IEEE 802.3 network so that if one of them is shut down, network directory information will still be available.

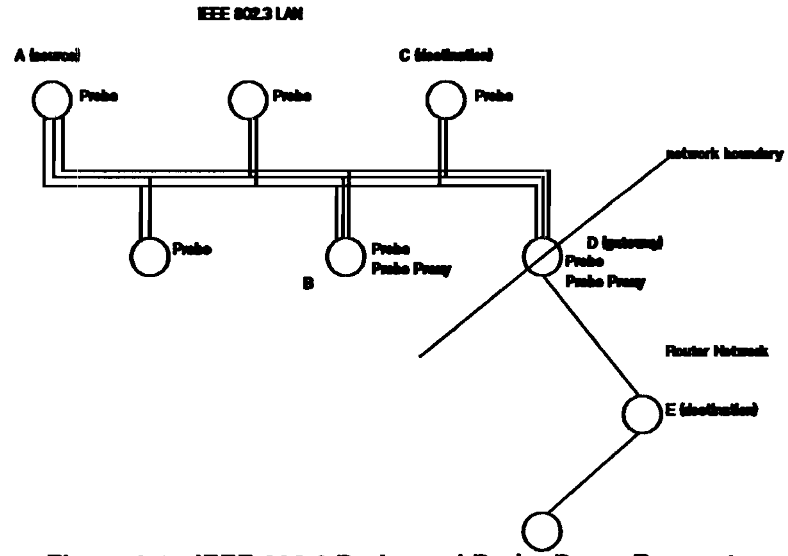



**Figure 3-3. IEEE 802.3 Probe and Probe Proxy Requests**

Figure 3-3 shows an IEEE 802.3 network with two Probe proxy nodes. Probe requests are sent to nodes that are configured to use the Probe protocol. Probe proxy requests are sent to nodes that are configured as Probe proxy servers. Node A can obtain a path report about node E, on another network, from nodes B or D. To send a message to node C, information is obtained from node C itself; the use of a Probe proxy server is not needed.

### IP to Subnet Address Resolution

Once a packet is routed to the correct destination network, it needs to be directed to the correct destination node within that network. For router networks, the IP address is the only address needed to route the message within the router subnet. However, in IEEE 802.3 networks, the destination node's IP address must be mapped to its IEEE 802.3 address. For connections to X.25 networks, the destination node's IP address must be mapped to its X.25 address.

**IEEE 802.3 Address Resolution with Probe Protocol.** In addition to providing node name to IP address resolution, the Probe protocol provides IP to IEEE 802.3 address resolution. The mapping of a given IP address to an IEEE 802.3 address occurs as a result of a Probe request for address information.

**IEEE 802.3 Address Resolution for Non-HP Systems.** To communicate with a non-HP node on an IEEE 802.3 network, information about the non-HP node must be contained in a network directory. This directory could reside on the source node or on the probe proxy server nodes on the LAN. For the nodes containing this directory information, you need to set the Load Network Directory Mappings flag to yes on the LAN802.3 Network Interface Configuration Screen. The node name, IP address and IEEE 802.3 address mapping information of the non-HP node must be entered into the network directory.

**X.25 Address Resolution**

During configuration of X.25 nodes with NMMGR, you are asked to provide X.25 addressing information for all nodes on the same X.25 network with which you expect to communicate. This information consists of an X.25 Address Key (a label used for mapping to Network Directory entries) and an X.25 address (for connections using SVCs) or PVC Number (for PVC connection). This information resides in the node's NMCONFIG.PUB.SYS configuration file. For each remote node identified at subnet level in this way, you must create a corresponding entry (X.25 Address Key/IP Address) in the Network Directory (NSDIR) file.

For DDN networks, the X.25 address should not be configured because it is derived from the IP address.

## Configuration Terminology

The following subsections describe concepts and terms you will encounter during configuration of a node with NMMGR. You will also need to be familiar with the concepts described when you plan your network or internetwork. Use these subsections to gain general familiarity with the terms and ideas before beginning to plan or configure the network or internetwork; you may also wish to use these descriptions for reference in later stages of the planning and configuration process.

# General Terms

**Remote Node** and **Local Node**. The term **local node** usually means the node that you are configuring or to which you are logged on. A **remote node** is any *other* node in the internetwork; that is, any node other than the local node.

**Buffers**. A **buffer** is a logical grouping of a system's memory resources used by NS3000/XL. There are several kinds of NS3000/XL buffers: **inbound transport buffers, outbound transport buffers,** and **store and forward buffers**. The amount of space allocated for these can be specified using NMMGR.

**Inbound** and **outbound** buffers are allocated for each node. Inbound buffers hold data being received by a node until it is used by a particular protocol or a user process. Outbound buffers hold data that will be sent on a link (or through loopback) from the originating node. The number of outbound buffers can be specified during configuration with NMMGR.

**Store and forward buffers** are allocated on gateway nodes (full and half) and on nodes belonging to router networks. The number of store-and forward buffers can be changed (via NMMGR) to allow for tuning to achieve better network performance.

**Loopback**. Software **loopback** enables a node to communicate with itself; in other words, it allows a single node to be both the source and destination of a message. A network interface (see definition below) must be configured to provide the loopback function.

**Network Interface**. The term **network interface** refers to the software that interfaces a node to a network. On each node, one network interface is required for each network or gateway half connection, and for the software loopback function. Most nodes, therefore, require two network interfaces: one for the network the node belongs to and one for loopback. A full gateway requires a network interface for every network to which it belongs. A gateway half requires a network interface for the gateway of which it forms a part, and for the other networks to which it belongs. The term network interface is often abbreviated as "NI" throughout this manual.

## Dial Link Terms

You should understand the following terms used to describe dial (also referred to as switched) links:

**Direct Dial and Shared Dial.** A **direct dial** link provides connection to a single remote system over a phone line. The telephone number dialed by the local node to reach the remote node never changes unless it is reconfigured with NMMGR. A **shared dial link** provides connection to more than one remote system although to only one system at a time. The link is thus *shared* by more than one remote node.

**Autodial.** An **autodial** link refers to a link using automatic dialing hardware. This hardware enables a remote phone number to be dialed without requiring a user to manually dial a telephone number. Instead, the telephone number of the receiving modem is entered during a node's configuration, and when a connection must be made, the telephone number is read from the NMCONFIG.PUB.SYS configuration file and "dialed" automatically.

**Dial ID Protocol.** The Dial ID protocol is a proprietary Hewlett-Packard protocol used to provide security for dial links. The protocol verifies the identity of nodes dialing in to a receiving node, and ensures that both the local and remote nodes have the required security access. Hewlett-Packard computers support the Dial ID protocol; however, other computer systems may not support it. The Dial ID protocol must be disabled (during configuration) if the node being configured will be connecting to a node that does not support this protocol.

**Security String.** A **security string** is an alphanumeric ASCII character string that acts as a password for dial links. The security string is used by the Dial ID protocol. When a node attempts to connect to another node via a dial link, security strings are exchanged between the nodes. Each node checks the security string it receives against a configured list of valid security strings. If a match is found by both nodes, the link can be used. If one or both of the security strings fail this check, then the link is disconnected. Security string checking can be disabled at any node (via configuration) if desired.

## Router Network Terms

You will encounter most of the following terms during planning and configuration of a router network:

**Hop Count.** The term **hop count** is used in two ways: (1) an **intranet hop count** is the maximum number of intermediate nodes that lie between a source and destination node on the same router network; and (2) an **internet hop count** is the number of gateways that are used to route a message to its destination network. Because two partner gateway halves perform the function of a full gateway, they are counted together as a single internet hop. Note that if no intermediate nodes lie between a source and destination, the hop count is zero.

**Non-Adjacent and Adjacent.** The term **adjacent**, when used in the context of configuring routing for a router network, refers to a node that is separated from a given node by zero intermediate nodes. In other words, the adjacent node lies at the other end of a link connected to a given node. A **non-adjacent** node, in contrast, is a node that is separated from a given node by intermediate nodes.

**Directly Connected .** The term **directly connected** describes nodes that are members of the same network. For example, if node A is directly connected to node B, A and B must be members of the same network. Do not confuse the term "directly connected" with the term "direct connect," which describes a non-switched point-to-point link (hardwired or leased or private line).

**Entry Priority.** During configuration of router networks, you must define the route used to transmit information from the node you are configuring to the other nodes in the network. If desired, you can configure more than one route to the same node. If you do so, you can specify which of the multiple routes should be chosen first. For example, if one route has a greater number of intranet hops, you might wish to give it a lower priority (specified as a lower numerical value) than another route with fewer hops. If for some reason the route given the highest priority is not available, the message will be routed to its destination with the alternate (but lower entry priority and greater number of hops) route.

If the same value is used for all entry priorities, the Network Transport software chooses the route to be used. The choice is based on an internal algorithm that selects the best route by taking into account some of the configured characteristics of the intervening links.

## X.25 Network Terms

You will encounter most of the following terms when planning and configuring an X.25 network:

**X.25 Address Key.** An X.25 Address Key is a label that maps a node's IP address to its X.25 address and its associated X.25 parameters. These parameters include an X.25 Address for SVCs or a PVC number for PVCs. In addition, for each X.25 address identified, the X.25 Address Key associates a default set of X.25 user facilities with the X.25 address whenever communication with that remote destination is requested or if an incoming call from that same address is received.

X.25 Address Keys for each of the remote destinations with which your node expects to communicate are included in each node's configuration file as well as in the node's Network Directory. This allows IP addresses to be mapped to the appropriate X.25 (subnet) addresses and connection information.

**X.25 Address.** This is the X.25 (subnet) address provided by the network administration if you are connected to a Public Data Network (refer to your subscription form). The X.25 address is needed when a switched virtual circuit (SVC) will be used to reach a remote destination. This address will be inserted in CALL packets sent whenever communication with that remote destination is requested. If permanent virtual circuits (PVCs) are used, the X.25 address is not required.

**Facilities Set.** A facilities set defines the various X.25 connection parameters and X.25 facilities that can be negotiated for each virtual circuit on a per-call basis. A default facilities set can be associated with a node when each node is configured. The associated parameters will be used whenever communicating with that particular address.

## Gateway Terms

You will need to understand the following terms if the node you will be configuring will be part of an internetwork:

**Reachable Networks.** A **reachable network** is a network that can be accessed (with additional internet hops possibly required) by a particular gateway.

**Neighbor Gateway.** A **neighbor gateway** is a gateway node (full or half) on the same network as the node being configured.

**Gateway Half.** A gateway half is a node on which a gateway half network interface has been configured with NMMGR. Together, two gateway half nodes joined by the same link perform the function of a gateway, which is to connect two networks.

**Gateway Half Pair.** Two gateway halves connected by a gateway half link are considered a **gateway half pair.**

**Gateway Half Link.** A **gateway half link** is a link that joins two gateway halves. A gateway half link must be an NS Point-to-Point 3000/XL Link.

# Network Installation and Administration

Many tasks must be completed before a network or internetwork is ready to operate. If there is more than one network (i.e., an internetwork is being created), the internetwork administrator is responsible for overseeing the completion of the tasks. If you are the internetwork administrator or network manager, it is your responsibility to make sure that the configuration of network software at each node is consistent and correct and that software and hardware are correctly installed before internetwork or network operation begin. If you are a node manager, it is your responsibility to make sure that the software and hardware installed and configured on your node (or nodes) is correct and consistent with the plans for the network as determined by the network manager.

This section provides an overview of the tasks that must be completed to start network or internetwork operation. Details of the steps summarized here can be found in other sections of this manual. Initial installation can be divided into six main parts:

1. Planning
2. Software and hardware installation
3. Configuration
4. Nodal validation, verification, and synchronization
5. Network startup
6. Line verification

## Planning

**Planning** a network or internetwork is an important process that must be done with care to ensure that the network meets the needs of your organization. Many factors must be taken into consideration when planning the network or internetwork: for example, volume of usage over particular links, volume of non-network usage of each node, physical layout needs and limitations (such as geographical distances), and desirability of connections to non-NS3000/XL nodes. These and other factors are discussed in "Network and Internetwork Design" later in this chapter.

This manual contains worksheets that you can use to assist in network and internetwork planning and configuration. You should already have a network design (including physical topology and types of links) in mind before you use the worksheets. However, you will need to draw a plan of the network, called a *network map*, before you begin filling out the worksheets. An example of a network map and specific directions for creating your own map are included in the configuration worksheets later in this manual.

## Software and Hardware Installation

After you have determined the network or internetwork's design, software and hardware must be installed on each node. Make sure that each node has the following hardware, as appropriate, for the particular kind of link:

- Hardware interface card(s). For NS Point-to-Point 3000/XL links, this is a Programmable Serial Interface (PSI). For DTC/X.25 XL Network Links, this is a DTC/X.25 Network Access Card. For StarLAN 10 3000/XL, this is a StarLAN 10 3000/XL Interface card. For ThinLAN 3000/XL (including the ThickLAN option) links this is a LANIC.

- Cables. For NS Point-to-Point 3000/XL links, this is hardwire cable for whatever length necessary to reach between every pair of nodes. For ThinLAN 3000/XL this is .18 cm. coaxial cable; for ThickLAN this is .4 cm. coaxial cable. For StarLAN 10 3000/XL, this is unshielded twisted-pair wire. If any nodes are dial (modem) links, you will need cable to connect the modem with the HP3000.

- Modems and other dial link devices. You will need a modem for each telephone line that a node is connected to. You will need a synchronous modem for every connection to a public data network (PDN). If desired, and if it is not a function performed by your modem, you might also need a device that performs automatic dialing (usually called an autocall unit). See Appendix A for a list of supported modems and autocall units.

- Other hardware. You may need additional hardware, depending upon the types of links you plan to install. For example, ThickLAN links require devices called MAUs (Media Attachment Units). Networks using StarLAN 10 3000/XL might require a device called a bridge. Refer to the hardware installation manuals listed in the Preface of this manual for detailed hardware requirements of the type of network you are installing.

The node must have the following software installed before configuration and subsequent network startup can occur:

- The software products that are provided on MPE XL Fundamental Operating System (FOS) tapes.

- The software provided on a subsystem tape containing NS3000/XL link product software and services, if applicable.

## Configuration

Network configuration tasks must be completed on each node on the network or internetwork. Network configuration is accomplished through the Node Management Configuration Manager (NMMGR).

### NMMGR Configuration

NMMGR allows you to configure items such as:

- Node names and addresses.
- Link types (so that network software responds in accordance with the hardware providing the link to another node).
- Buffer sizes.
- Timeout values.
- Preferred point-to-point routes to get from one node to another.
- Intranet and internet routes.
- Network directory entries.
- Probe proxy server nodes.
- Logging parameters, such as which subsystems should be logged.
- X.25 SVC address and PVC numbers.

NMMGR provides two methods of configuring a node--with Guided Configuration, or through **manual configuration.** Guided Configuration enables you to configure the network more quickly by automatically using default values for certain required configuration parameters, and by automatically bypassing certain optional configuration tasks. To accomplish any of the tasks bypassed by Guided Configuration, you will need to use manual configuration. Also, to configure the network directory, you will need to use manual configuration.

**Note**

HP strongly recommends that you use Guided Configuration to initially configure each node, and for most network maintenance and updating. Use manual configuration *only* if Guided Configuration does not provide access to the configuration data you need to change. The defaults used by Guided Configuration are the defaults indicated in the *NS3000/XL Screens Reference Manual.*

Manual configuration with NMMGR can be divided into five parts:

- Link configuration.
- Configuration of Network Transport parameters that must be completed for every node, regardless of link type. This is referred to as transport configuration.
- Network Interface (NI) configuration. This consists of configuring parameters used by each of the node's network interfaces. These parameters differ for different types of links, so NI configuration is separated from configuration of Network Transport items that must be configured for all link types. If a node is a gateway (either full or half), separate NI configuration is needed for each of its links (one for each network or gateway half link).
- Logging configuration. Logging configuration for each NS3000/XL subsystem can be configured during this portion of network configuration tasks.
- Network directory configuration. Configuration of each node's network directory (for nodes on router networks, X.25 networks, proxy server nodes on IEEE 802.3 networks, and for full or half gateway nodes) consists of entering node names, their IP address(es), and the protocols used on each node.

Guided Configuration is documented in a configuration guide depending on the type of network you have. The LAN configuration is described in the *NS3000/XL Local Area Network Configuration Guide*, the configuration of router networks is described in the *NS Point-To-Point 3000/XL Network Configuration Guide*, and the configuration of X.25 networks is described in the *X.25 XL System Access Configuration Guide*. Manual configuration is achieved by using the screens in the *NS3000/XL Screens Reference Manual*. Configuring a network directory is explained in the network configuration guide for your type of network.

**Note**

If you are configuring access to an X.25 network, you must also refer to the *Using the Openview DTC Manager* manual because much of the configuration must be performed on a Network Management Workstation.

## Nodal Validation, Verification, and Synchronization

After a node's network hardware and software has been installed and it has been configured using SYSGEN and NMMGR, the node manager will need to take several steps to ensure that the software and hardware are operating correctly. These steps, as detailed below, need to be taken *before* the Network Transport is started:

- The configuration files must be validated using the NMMGR Validate Configuration File screen. This validation utility, which is part of

NMMGR, is described in the individual network configuration guides or in *Using the Node Management Services (NMS) Utilities*. It checks that certain configuration file items are correct and consistent.

- Network directories need to be synchronized on each node. The network manager (or internetwork administrator) should make sure that every network directory is the same. Hewlett-Packard recommends that tapes containing copies of a master network directory be given to the node managers of every node that will contain a network directory. This master network directory should be configured by the network manager (or internetwork administrator) on a node that is designated the **Central Administrative Node**--which means that it will always contain the most up-to-date version of the network directory. This node's network directory should actually be an internetwork directory--it should contain entries for each node in the internetwork.

If a protocol and addressing information for a particular node is missing from a network directory, messages will not be able to reach that node in cases in which their correct transmission depends on receiving information from that network directory.

**Note**

If configuration files created with a previously released version of NMMGR currently reside on your system, you must convert the files so that they are compatible with the current version of NMMGR and other Node Management Services software. A utility called NMMGRVER can convert your files. For information on using NMMGRVER, refer to the *Using the Node Management Services (NMS) Utilities*.

## Network Startup

After the node manager has determined that the network software on each node is functioning correctly, the network can be started. To start the network, you must issue the following commands on each node:

- `NETCONTROL` to start the Network Transport software
- `NSCONTROL` to start Network Services

The syntax and use of these commands is described in the *NS3000/XL Operations and Maintenance Manual.*

## Line Verification

After each node's Network Transport software has been started, the network manager (and, if applicable, the internetwork administrator) should perform the line verification tests described in the *NS3000/XL Operations and Maintenance Manual.* These include:

- Start software loopback.

- Test the operation of Network Transport by performing the XPVAL-LOC and XPVALREM line tests.
- Use the QuickVal utility to check for correct operation of Network Services.
- Start other network interfaces (either on this node or other nodes); use the NSLOGON diagnostic to ensure that connectivity exists between network interfaces.
- If desired, perform the XPVALLOC, XPVALREM, and QuickVal tests to test for connectivity to remote nodes. For X.25 verification, you can run X25CHECK and X25SERVR tests.

## Network and Internetwork Design Considerations

Network and internetwork design must take many factors into consideration: the desired physical location of the computers comprising the network or internetwork's nodes; the volume of projected communications traffic between nodes; communications traffic patterns; and the possibility of connections to other nodes (such as those in a public data network) are just some of the criteria to consider.

These factors will affect your choice of NS network type (IEEE 802.3, router, X.25) as well as choice of specific links.

Some design decisions depend upon the capabilities of NS links. These capabilities and corresponding restrictions are described in the following sections.

## Line Speed

Line speed is a measure of the rate at which data is transmitted by a physical link (usually measured in bits or kilobits per second). The maximum line speed varies among different NS links. Line speed may therefore influence your choice of link. Although line speed does not indicate the exact throughput of a particular link, it can be used on a comparative basis to indicate relative throughput.

In general, an IEEE 802.3 link will be faster than a point-to-point router or X.25 network because the bus topology provides a faster routing mechanism than a series of point-to-point hops. Links using leased lines will have a higher line speed than links using normal telephone lines.

Consult your Hewlett-Packard representative for line speeds and the most up-to-date performance data for various links.

## Geographical Location

The geographical location of the computers that will be part of your network or internetwork will be an important factor in deciding both the physical topology and the kinds of links comprising the network or internetwork.

If all of the nodes you want to connect are located relatively close to each other (in the same building, for example), you might choose to connect them via a ThinLAN 3000/XL link, or the ThickLAN or StarLAN 10 options. If you wish to connect PCs to the IEEE 802.3 network, you can use ThinLAN 3000/XL or StarLAN 10 3000/XL links to connect one or more PCs to an HP 3000.

Another option for nodes located in the same geographic location is the use of hardwired (direct-connect) router links. You might wish to use a point-to-point router network if the distance between some nodes on the network will be greater than the maximum distance allowed between nodes on an IEEE 802.3 network.

If, on the other hand, you need to connect nodes that are geographically distant--for example, HP 3000s located in different cities--you might choose to connect them via a dial link. For NS dial links, you can use the Point-to-Point 3000/XL Network link.

Finally, if you need to use satelite transmission because of the large geographical distance between nodes, or if you need to have access to other nodes on a public or private X.25 network, you might wish to use the DTC/X.25 XL Network Link.

## Special Cases

The following sections describe certain design requirements for special situations, such as shared dial links, personal computers, and using non-HP 3000 minicomputers on an NS network.

### Dial Links

Shared dial links have two limitations that must be considered when designing a network. First, a shared dial link cannot be used as an intermediate link in a router network. Any other kind of dial link can be used for intermediate links, but shared dial links can be used only to connect leaf nodes--that is, nodes that receive messages targeted only for themselves. Second, shared dial links cannot be used as gateway halves.

### Personal Computers

Personal computers (PCs) can be used as nodes by being connected to HP 3000s with ThinLAN 3000/XL or StarLAN 10 3000/XL. Like a shared dial link, a personal computer must be used as a node that receives only those messages targeted for itself.

### Other Non-HP 3000 Nodes

Non-HP 3000 minicomputers, such as HP 1000s and HP 9000s, can operate as nodes on NS IEEE 802.3 networks. If you want to include one of these computers in your internetwork, it must be part of an IEEE 802.3 network. Router networks must be composed of only HP 3000s (and PCs, if applicable). X.25 networks can access non-HP nodes.

## Network Interfaces and Design

The network interface (NI), the software that provides an interface between a node and a network, specifies the type and maximum number of links that can be configured for a node. Because a node's network interface(s) determine what links can be configured for the node, links are said to be configured underneath network interfaces.

Remember, there are four types of network interfaces (in addition to loopback):

- **LAN802.3** for IEEE 802.3 networks
- **Router** for networks that use point-to-point routing
- **X.25** for X.25 networks
- **Gateway half** for nodes that function as gateway halves

Each HP 3000 must have at least one LAN802.3, router or X.25 network interface configured. This network interface must be associated with the network to which the system belongs.

### Number of Network Interfaces

A node can have up to 12 network interfaces configured. One of these network interfaces must be loopback. For each network interface, the maximum number of links you can configure and the kinds of links possible are determined by the network interface type, as follows:

- A LAN802.3 network interface can have only one IEEE 802.3 link configured under it; however, each IEEE 802.3 link can support a large number nodes. ThickLAN cable supports up to 100 nodes per segment; ThinLAN cable can be used for up to 30 nodes per segment; and each StarLAN 10 3000/XL can be used for up to 50 nodes.
- A router network interface can have up to 40 links configured under it. Router links can be NS Point-to-Point 3000/XL Network links.
- An X.25 network interface can have only one link configured. The link can be connected to as many as 1,024 remote nodes, with communication allowed with as many as 256 nodes at the same time.
- A gateway half network interface can have only one link configured under it--the gateway half link. Links connecting two gateway halves can be only NS Point-to-Point 3000/XL Network links.

### Gateways

If more than one (non-loopback) network interface is configured on a node, the network portions of the IP addresses configured for the interfaces should differ to correspond to the multiple networks to which the node belongs.

A network can have up to 16 gateways (combined number of full gateways and gateway halves).

**Full Gateways versus Gateway Halves.** NS3000/XL allows you to choose between connecting two networks with a full gateway, and connecting them with two gateway halves. A full gateway is a node configured as a full member of two (or more) networks for the purpose of passing information between the networks to which it belongs. The node is considered a member of each of the networks for which it is configured.

A node that is a gateway half is configured as a member of a network and as a partner of another gateway half. A gateway half link that joins two networks connects two nodes (a gateway half pair) by a point-to-point link (NS Point-to-Point 3000/XL Network link). The gateway half link and pair is not considered a network itself. Each of the paired gateway halves is configured as a member of a different network--the two networks to be connected--and as a gateway half on the same gateway half link. Together, the two gateway halves function as a full gateway.

The following subsections explain situations in which you might want to use a gateway half pair rather than a full gateway to connect networks:

**Gateways Connecting Router or X.25 Networks.** If you need to connect two router or X.25 networks, fewer internetwork administrative tasks might be required if the networks are connected by two gateway halves rather than by one full gateway. A full gateway must possess intranet routing information about nodes on all of the networks to which it belongs; a gateway half, in contrast, needs to possess intranet routing information only for the network to which it belongs. Making a node a gateway half therefore reduces the amount of configuration changes that must be made to it. If the change occurs to the network to which the node's partner gateway half belongs, the node's `NMCONFIG.PUB.SYS` configuration file does not have to be updated. You might choose to use a gateway half link between two geographically or organizationally distanced networks for this reason, to reduce the amount of information that has to be passed between different network managers.

**Gateways Connecting IEEE 802.3 Networks.** IEEE 802.3 networks must use gateway halves to connect to adjacent IEEE 802.3 networks in the same internetwork. This is because no more than one LAN802.3 network interface can be configured per node.

## Network Boundaries

The term **network boundary** refers to the divisions between multiple networks. For example, you might think of two networks in the same internetwork as being logically disjoint; hence divided from each other by a network boundary. Nodes in each network, of course, will have the same network address (network portion of the IP address), which will differ on the two networks. The networks will be connected by an appropriate link or links; by either a gateway half link or a node acting as a full gateway.

The location of some network boundaries is sometimes dictated by the differences in link types used in two adjacent networks: for example, an IEEE 802.3 local area network must be logically disjoint from a router network. Two such networks, connected by a gateway half link or a full gateway, are separated by a network boundary.

You may wish to establish network boundaries even among links connected by the same link type so that one group of nodes is isolated from another for administrative purposes. For example, you might divide a group of nodes into two router networks instead of one network because you want two different individuals (network managers) to be responsible for each of two smaller groups of nodes. The following are other situations in which it might be useful to establish additional network boundaries:

- Situations in which you want to place nodes that will frequently communicate with each other into the same groups. Such groups might reflect your installation's organization. Separating nodes that need to communicate infrequently can result in less distance, in terms of intranet hops, between nodes that do communicate frequently, resulting in improved performance within each network.

- Situations in which the arrangement and configuration of one group of nodes is not expected to change often, and the arrangement of another group is expected to change fairly often for some extended period of time. Separating the nodes into two networks can isolate the stable nodes from those whose configuration has to change to reflect the addition or deletion of nodes. Changes made to the frequently changing network need to be reflected by means of additions to only the network directories on the more stable network, instead of to the `NMCONFIG.PUB.SYS` configuration file for each node.

- Situations in which you want to restrict access to a group of nodes.

## Network Implementation and Support Plan

Once you have designed your network or internetwork, your HP representative will submit the design specifications and other information to HP as part of your Network Implementation and Support Plan (NISP). Networking consultants will review the plans for your network and inform your own HP representative of any changes that need to be made to the design for the network or internetwork to operate effectively.

## Network Design Questions

Ask yourself the following questions to make sure your design adheres to the considerations mentioned above:

1. Are all of the nodes in the network within roughly 550 meters of each other?

   If so, consider connecting them with ThinLAN 3000/XL links. The maximum cable length for segments of ThinLAN 3000/XL cable is 185 meters, with a maximum of three segments connected by repeaters.

2. Are all of the nodes in the network within roughly 1,500 meters of each other?

   If so, consider connecting them with ThickLAN (thick coaxial cable). The maximum cable length for each segment of ThickLAN coaxial cable is 500 meters, with a maximum of three segments connected by repeaters.

3. Are nodes located at remote sites? (For example, in different buildings in the same city, or in different cities?)

   If so, consider installing a router network using dial links or leased lines. Choose leased lines if you have a critical need for clear transmission or if the volume of data to be transmitted is relatively large.

4. Is the set of nodes you wish to connect composed of some nodes that are in close proximity to one another (for example, in the same building) and other nodes that are geographically distanced (for example, in different buildings or different cities)?

   If so, you may wish to use a combination of StarLAN 10 3000/XL or ThinLAN 3000/XL networks for nodes that are located near one another and dial links for nodes in different buildings or cities.

5. Do you need to connect personal computers to the network?

   If so, consider either StarLAN 10 3000/XL or ThinLAN 3000/XL. Networks of personal computers can be created using StarLAN 10 3000/XL or ThinLAN 3000/XL links. One or more of the personal computers can also be connected to one or more HP 3000s using StarLAN 10 3000/XL or ThinLAN 3000/XL links.

6. Will HP 9000s, HP 1000s, or other minicomputers (such as Digital Equipment VAX (TM) minicomputers) need to be part of the network?

   If so, you will need to use them as nodes on a coaxial cable local area network (ThinLAN 3000/XL or its ThickLAN option).

7. Do you need access to nodes on public or private X.25 networks?

   If so, consider using DTC/X.25 XL Network Links.

8. Is a subset of nodes either geographically or organizationally distanced from another subset of nodes?

   If so, you may wish to establish a network boundary between them in order to make them two separate networks joined by a full gateway or two gateway halves.

9. If you decide to connect two networks via a gateway, would it be administratively easier (and require less configuration if changes occur) to join the two networks by a gateway half link rather than a full gateway?

10. If you have decided you need an IEEE 802.3 network, do you need to connect any nodes on it with nodes that are part of another IEEE 802.3 network?

    If so, one of the nodes on the IEEE 802.3 network must be a gateway half which connects to another gateway half that is a node on the remote IEEE 802.3 network.

11. If you need to use a gateway half, is the partner gateway half in the same building or further away?

    If the two gateway halves are in the same building, you can use a direct connect link between them. If the two gateway halves are further away, you will need to use a dial link or leased line between them.

4

# Internetwork Worksheets

Sections 4, 5 and 6 contain worksheets to help you plan and configure your networks. This section deals with the internetwork as a whole, while Section 5 focuses on specific networks and Section 6 deals with specific nodes. The internetwork worksheets consist of an internetwork map, used to show an overview of your internetwork, and an internetwork table. You will take the following steps when filling out the internetwork worksheets.

- Draw sketches of each network in the internetwork (Internetwork Map).
- Write network names, IP network addresses and network types (Internetwork Map).
- Draw gateway nodes (Internetwork Map).
- Indicate network boundaries (Internetwork Map).
- Complete an Internetwork Table (Table 4-1).

# Internetwork Map

Figure 4-1 is an example of an internetwork map. We will use this sample internetwork throughout the instructions to help explain the other drawings and tables that make up the configuration worksheets.

Before you can draw your internetwork map, you must know how many networks your internetwork will contain, and you must know each network type (router, LAN, or X.25). The internetwork in our example (Figure 4-1) contains three networks. NET1 is a LAN, NET2 is a router network, and NET3 is an X.25 network..

**Note**

If you have an X.25 network, you should indicate the presence of each Datacomm and Terminal Controller (DTC) in your internetwork map, as shown in this example. Both the NS3000/XL node and the DTC must be specially configured for X.25 links. The configuration process for the NS3000/XL node is performed on the host, while the DTC configuration is PC-based. However, because some of the information configured on the host is also required during the PC-based configuration, the worksheets will provide space for you to fill in these common parameters. You will also need to refer to *Using the OpenView DTC Manager* for complete DTC configuration information.

You must decide where you want your networks to be physically located and how they will be physically connected. Therefore, you must determine which nodes will be used as gateway nodes (full gateways or gateway halves) to communicate with remote networks.

## Communication Between Networks

Because the main purpose of the Internetwork Map is to show how networks are connected, gateway nodes are the only nodes you should label on the Internetwork Map. All other nodes and their networks can be represented by drawing sketches of the networks, as shown in Figure 4-1. In our example, Node C is a full gateway that belongs to NET1 and NET2. Nodes G and H are gateway halves that belong to NET2 and NET3, respectively. Nodes X and Y are gateway halves that belong to NET1 and NET3, respectively.

**Note**

For simplicity, we have used single letters to represent node names in our example. Actual node names must be of the form listed in the terminology subsection. As for addresses, the network portions of IP addresses used in our examples have been reserved for such use. You should not use C 192.006.001, C 192.006.250 or C 192.006.251 for your actual network addresses.

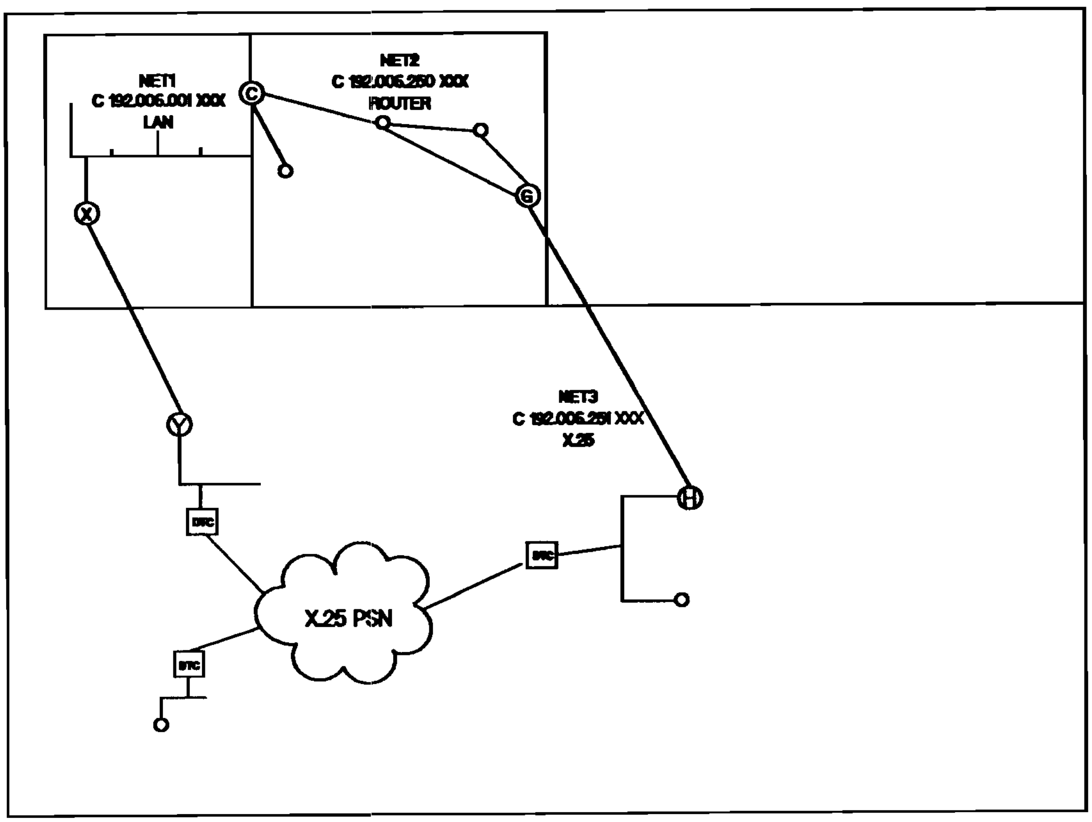



**Figure 4-1. Internetwork Map**

## Network Boundaries

Once you have drawn your gateway nodes, you have established network boundaries. Let us again consider our example and look at Figure 4-1. Because Node C in our example is a full gateway and belongs to both NET1 and NET2, the boundary between these two networks is at Node C itself. For purposes of the map, we have drawn this boundary through the middle of Node C. The boundary between NET2 and NET3 is along the gateway-half link that connects gateway nodes G and H. The boundary between NET1 and NET3 is along the gateway-half link that connects gateway nodes X and Y.

## IP Network Addresses

Each network in your internetwork must have a unique IP network address. Add these IP addresses to your internetwork map.

In our example, we assume that we have been assigned the Class C IP network addresses shown in Figure 4-1. The specific IP node addresses do not need to be shown until completion of specific parts of the network worksheets, so we will represent node portions of IP addresses with XXX in some maps and tables.

## Completing the Internetwork Table

Once your internetwork map contains the information just described,you are ready to complete the Internetwork Table (Table 4-1).

**Table 4-1. Internetwork Table**

| NETWORK | NETWORK TYPE (LAN, ROUTER, X25) | IP NETWORK ADDRESS | IMPLEMENTATION PRIORITY |
|---|---|---|---|
| NET1 | LAN | C 192.006.001 XXX | 1 |
| NET2 | ROUTER | C 192.006.250 XXX | 2 |
| NET3 | X.25 | C 192.006.251 XXX | 3 |

The information requested for the first three columns of the Internetwork Table can be taken directly from the Internetwork Map, as we have done in our example. As for the Implementation Priority column, consider which networks must be operational in as little time as possible. You also may want to consider which networks will be the easiest to initiate. Analyzing these and other factors important to you, determine the order in which you plan to initiate your networks, and then enter the information in the Implementation Priority column of the Internetwork Table.

When you have completed both the Internetwork Map and the Internetwork Table, you have finished the internetwork worksheets.

# Internetwork Worksheets for Your Records

## INTERNETWORK MAP

INTERNETWORK TABLE

| NETWORK | NETWORK TYPE (LAN, ROUTER, X25) | IP NETWORK ADDRESS | IMPLEMENTATION PRIORITY |
| --- | --- | --- | --- |
| | | | |

# Network Examples and Records

## Network Worksheets

For each network in your internetwork, you are asked to draw a map of the network and to complete two tables. One table lists node-specific information, and one table lists network routing information.

You also are asked to complete worksheets for each gateway-half pair in your internetwork. The worksheets for a gateway-half pair consist of a map of the gateway-half nodes and their connecting link, and a table containing information about the gateway-half network interfaces.

For our sample internetwork, five sets of network worksheets need to be completed--one set for each of the three networks, and one set for each of the two gateway-half pairs.

You will take the following steps when filling out a set of network worksheets.

- Draw your map, showing all nodes and node names. (For router networks, also show all router links and link names. For a gateway-half pair, include the link name.)

- Complete the table(s)--two for each network, one for each gateway-half pair.

## LAN Network Worksheets

One set of LAN network worksheets should be used for each LAN in your internetwork. The LAN network worksheets consist of a map of the LAN and two tables. One table contains information about each node on the LAN, and one table contains network-specific internet routing information. We now refer to NET1, our sample LAN, to describe the LAN Network Worksheets in detail. Use the discussion of our sample LAN Network Worksheets as a guide for filling out your own LAN Network Worksheets.

### LAN Network Map

Figure 5-1 is a drawing of the network map for NET1. The network map is a more detailed drawing of the same network shown in the Internetwork Map (Figure 4-1). The network name, the IP network address and the network type are listed at the top of the network map. This information is derived from the Internetwork Map, which should be kept available at all times.

In our example, the Internetwork Map shows that nodes C and X are gateway nodes. We mark them as such on the NET1 network map and show the networks that the gateway nodes can reach. We then add the remaining NET1 nodes and their names to the network map. We also indicate that nodes C and X are proxy servers.

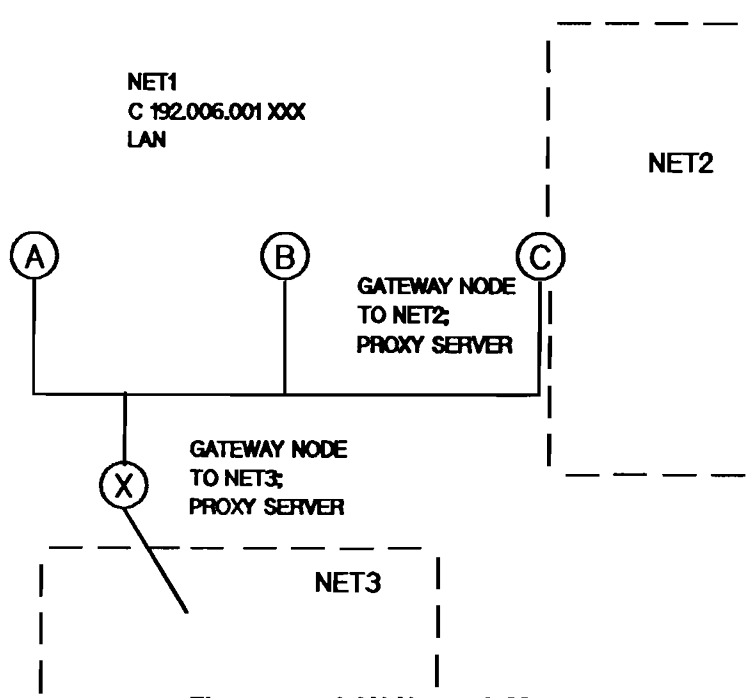



**Figure 5-1. LAN Network Map**

## LAN Network Table

We refer to the LAN Network Map to fill in the LAN Network Table (Table 5-1). We complete the first column by listing the names of all the nodes on NET1. We then assign to each node an IP adress that is unique within the network. We list only the node portions of the IP address because we have listed the IP network address at the top of the table. In the third column of Table 5-1, we indicate that nodes C and X are proxy servers. In the fourth column, we indicate that nodes C and X also are gateway nodes. For the Implementation Priority column, we rank the nodes in the order we think they should be configured.

**Table 5-1. LAN Network Table**



NETWORK NAME: NET1

IP NETWORK ADDRESS: C 192.006.001 XXX

| NODE NAME | IP NODE ADDRESS | PROXY SERVER (Y/N) | GATEWAY NODE (Y/N) | IMPLEMENTATION PRIORITY |
|---|---|---|---|---|
| A | 001 | | | 3 |
| B | 002 | | | 4 |
| C | 003 | YES | YES | 1 |
| X | 004 | YES | YES | 2 |

## LAN Internet Routing Table

The purpose of the LAN Internet Routing Table (Table 5-2) is to list all possible networks that can be reached from each gateway node on a LAN, such as NET1 in our example.

As shown on the Internetwork Map, NET1 includes two gateway nodes, C and X. We indicate in our LAN Internet Routing Table that NET1 nodes using Node C as a gateway can reach NET2 in one hop and NET3 in two hops. NET3 provides access to the X.25 network shown in the internetwork map. In the IP Node Address column of the LAN Internet Routing Table, we list the node portion of Node C's IP address.

For Node X, we list the same type of information in the LAN Internet Routing Table.

**Table 5-2. LAN Internet Routing Table**

NETWORK NAME: NET1

IP NETWORK ADDRESS: C 192.006.001 XXX

| THROUGH GATEWAY NODE | IP NODE ADDRESS | DESTINATION NETWORK/ADDRESS | HOPS NEEDED TO REACH DESTINATION NETWORK |
|---|---|---|---|
| C | 003 | NET2/ C 192.006.250 000 | 1 |
| | | NET3/ C 192.006.251 000 | 2 |
| X | 004 | NET3/ C 192.006.251 000 | 1 |
| | | NET2/ C 192.006.250 000 | 2 |

# Network Worksheets for Your Records

## LAN NETWORK MAP

LAN NETWORK TABLE

NETWORK NAME:

IP NETWORK ADDRESS:

| NODE NAME | IP NODE ADDRESS | PROXY SERVER (Y/N) | GATEWAY NODE (Y/N) | IMPLEMENTATION PRIORITY |
|---|---|---|---|---|
| | | | | |

LAN INTERNET ROUTING TABLE

NETWORK NAME:

IP NETWORK ADDRESS:

| THROUGH GATEWAY NODE | IP NODE ADDRESS | DESTINATION NETWORK/ADDRESS | HOPS NEEDED TO REACH DESTINATION NETWORK |
|---|---|---|---|
| | | | |

## Router Network Worksheets

One set of Router Network Worksheets should be used for each router network in your internetwork. The router network worksheets consist of a map of the router network and two tables. One table contains information about each node on the router network, and one table contains network-specific internet routing information. We now will refer to the router network in our sample internetwork to describe the router network worksheets in detail. Use the discussion of our sample Router Network Worksheets as a guide for filling out your own router network worksheets.

### Router Network Map

NET2 is the router network in our sample internetwork. Figure 5-2 is a drawing of the network map for NET2. The network map is a more detailed drawing of the same network shown in the Internetwork Map (Figure 4-1). The network name, the IP network address and the network type are listed at the top of the network map. This information is derived from the Internetwork Map, which should be kept available at all times.

In our example, the Internetwork Map shows that nodes C and G are gateway nodes. We mark them as such on the NET2 network map and show the networks that the gateway nodes can reach. We then add the remaining NET2 nodes and their names to the network map. We also indicate that Node G is a central administrative node.

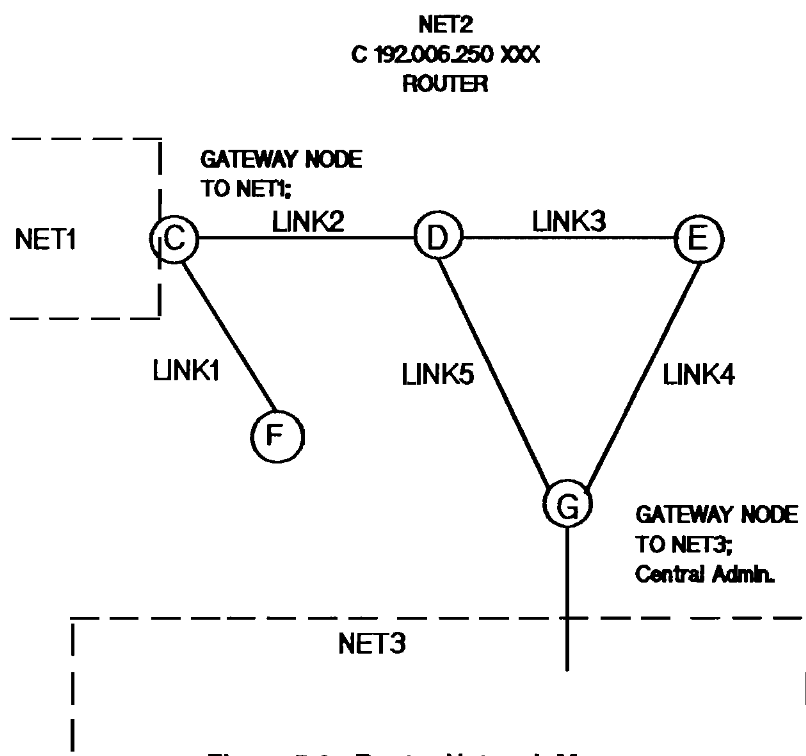



Figure 5-2. Router Network Map

## Router Network Table

We refer to the Router Network Map to fill in the Router Network Table (Table 5-3 ). We complete the first column by listing the names of all the nodes on NET2. We then assign to each node an IP address that is unique within the network. We list only the node portions of the IP addresses because we have listed the IP network address at the top of the table. In the third column of Table 5-3, we indicate that Node G is a central administrative node. In the fourth column, we indicate that nodes C and G are gateway nodes. For the Implementation Priority column, we rank the nodes in the order we think they should be configured.

**Table 5-3. Router Network Table**

NETWORK NAME: NET2

IP NETWORK ADDRESS: C 192.006.250 XXX

| NODE NAME | IP NODE ADDRESS | CENTRAL ADMIN. NODE (Y/N) | GATEWAY NODE (Y/N) | IMPLEMENTATION PRIORITY |
|---|---|---|---|---|
| C | 001 | | YES | 2 |
| D | 002 | | | 3 |
| E | 003 | | | 4 |
| F | 004 | | | 5 |
| G | 005 | YES | YES | 1 |

## Router Internet Routing Table

The purpose of the Router Internet Routing Table (Table 5-4) is to list all possible networks that can be reached from each gateway node on a router network, which is NET2 in our example.

As shown on the Internetwork Map, NET2 includes two gateway nodes, C and G. We indicate in our Router Internet Routing Table that NET2 nodes using Node C as a gateway can reach NET1 in one hop and NET3 in two hops. NET3 provides access to the X.25 network shown in the internetwork map. In the IP Node Address column of the Router Internet Routing Table, we list the node portion of Node C's IP address.

For Node G, we list the same type of information in the Router Internet Routing Table.

**Table 5-4. Router Internet Routing Table**

NETWORK NAME: NET2

IP NETWORK ADDRESS: C 192.006.250 XXX

| THROUGH GATEWAY NODE | IP NODE ADDRESS | DESTINATION NETWORK/ADDRESS | HOPS NEEDED TO REACH DESTINATION NETWORK |
|---|---|---|---|
| C | 001 | NET1/ C 192.006.001 000 | 1 |
| | | NET3/ C 192.006.251 000 | 2 |
| G | 005 | NET3/ C 192.006.251 000 | 1 |
| | | NET1/ C 192.006.001 000 | 2 |

# Network Worksheets for Your Records

ROUTER NETWORK MAP

ROUTER NETWORK TABLE

NETWORK NAME:

IP NETWORK ADDRESS:

| NODE NAME | IP NODE ADDRESS | CENTRAL ADMIN. NODE? (Y/N) | GATEWAY NODE (Y/N) | IMPLEMENTATION PRIORITY |
|---|---|---|---|---|
| | | | | |

ROUTER INTERNET ROUTING TABLE

NETWORK NAME:

IP NETWORK ADDRESS:

| THROUGH GATEWAY NODE | IP NODE ADDRESS | DESTINATION NETWORK/ADDRESS | HOPS NEEDED TO REACH DESTINATION NETWORK |
|---|---|---|---|
| | | | |

## X.25 Network Worksheets

One set of X.25 network worksheets should be used for each X.25 network in your internetwork. The X.25 worksheets consist of a map of the X.25 network and two tables. One table contains information about each node on the X.25 network. The other table contains network-specific internet routing information.

### X.25 Network Map

Figure 5-3 is a drawing of the network map for NET3. The network map is a more detailed drawing of the same network shown in the internetwork map. The network name, the IP address, and the network type are listed at the top of the network map. This information is derived from the internetwork map.

In our example, the internetwork map shows that nodes H and Y are gateway nodes. We mark them as such on the NET3 network map and draw lines to show the networks that the gateway nodes can reach. We then add the remaining NET3 nodes and their names to the network map. The network map also indicates that nodes H and Y are central administrative nodes.

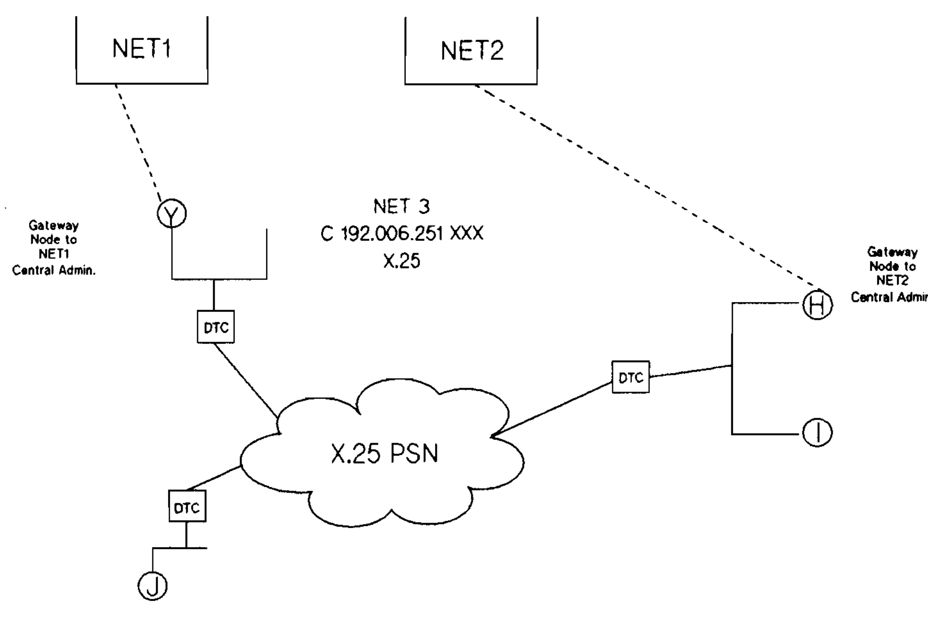



**Figure 5-3. X.25 Network Map**

## X.25 Network Table

We refer to the X.25 Network Map to fill in the X.25 Network Table. We complete the first column by listing the names of all the nodes on NET3. We then assign to each node an IP address that is unique within the network. We list only the node portions of the IP addresses because we have listed the IP network address at the top of the table. In the third column of the table, we indicate that nodes H and Y are central administrative nodes. In the fourth column, we indicate that nodes H and Y are also gateway nodes. Where appropriate, we also assign the X.25 (subnet) address for a node into the fifth column of the network table. The X.25 address is a decimal number (up to 15 digits) identifying a node's location on the X.25 subnet for connections using switched virtual circuits (SVCs). Usually this address is inserted in CALL packets to set up connections using SVCs. If the network you will access is a public packet switching network (PSN), these addresses (where appropriate) are recorded on the subscription form provided by the network's administration.

**Table 5-5. X.25 Network Table**

NETWORK NAME: NET3

IP NETWORK ADDRESS: C 192.006.251 XXX

| NODE NAME | IP NODE ADDRESS | CENTRAL ADMN. NODE? (Y/N) | GATEWAY NODE (Y/N) | X.25 ADDRESS |
|---|---|---|---|---|
| H | 001 | Y | Y | 1234 |
| I | 002 | N | N | 5678 |
| J | 003 | N | N | 6879 |
| Y | 004 | Y | Y | 9876 |

## X.25 Internet Routing Table

The purpose of the X.25 Internet Routing Table is to list the other networks in the internetwork that can be reached from each gateway node on NET3 in our example.

As shown in the internetwork map, NET3 includes two gateway nodes, H and Y. We indicate in our X.25 Internet Routing Table that NET3 nodes using Node H can reach NET2 in one hop and NET1 in two hops, and so on. In the IP Node Address column, we list the node portion of Node H's IP address.

For Node Y, we list the same information.

**Table 5-6. X.25 Internet Routing Table**

NETWORK NAME: NET3

IP NETWORK ADDRESS: C 192.006.251 XXX

| GATEWAY NODE | IP NODE ADDRESS | DESTINATION NETWORK/ADDRESS | HOPS NEEDED TO REACH DESTINATION NETWORK |
|---|---|---|---|
| H | 001 | NET2/ C 192.006.250 000<br>NET1/ C 192.006.001 000 | 1<br>2 |
| Y | 004 | NET1/ C 192.006.001 000<br>NET2/C 192.006.250 000 | 1<br>2 |

# Network Worksheets for Your Records

X.25 NETWORK MAP

X.25 NETWORK TABLE

NETWORK NAME:

IP NETWORK ADDRESS:

| NODE NAME | IP NODE ADDRESS | CENTRAL ADMN. NODE? (Y/N) | GATEWAY NODE (Y/N) | X.25 ADDRESS |
|---|---|---|---|---|
| | | | | |

X.25 INTERNET ROUTING TABLE

NETWORK NAME:

IP NETWORK ADDRESS:

| THROUGH GATEWAY NODE | IP NODE ADDRESS | DESTINATION NETWORK/ADDRESS | HOPS NEEDED TO REACH DESTINATION NETWORK |
|---|---|---|---|
| | | | |

## NETWORK DIRECTORY INFORMATION

After reading about the Network Directory in the *NS3000/XL Screens Reference Manual*, you can complete the information below for all nodes you wish to manually configure into your network directory file. For your node and for each node you have configured as a destination node in your Node Configuration file you must make a full entry in the Network Directory.

*Type: 1 = IP, 2 = IP/LAN 802.3, 3 = X.25

| Node Name | Global or Local | IP Address | Type | Additional Address * |
|---|---|---|---|---|
| H | Global | C 192.006.251 001 | 3 | H |
| I | Global | C 192.006.251 002 | 3 | I |
| J | Global | C 192.006.251 003 | 3 | J |
| Y | Global | C 192.006.251 006 | 3 | Y |
| X | | C 192.006.001 004 | 1 | |
| G | | C 192.006.250 005 | 1 | |
| D | | C 192.006.250 002 | 1 | |
| F | | C 192.006.250 004 | 1 | |
| C (LAN NI) | | C 192.006.001 003 | 1 | |
| C (ROUTER NI) | | C 192.006.250 001 | 1 | |

*For Type 3 (X.25) this address will be the X.25 Address key you designate in your Node Intranet Routing Table. This additional address is not needed for type 1 addresses.

## Network Worksheet for Your Records

NETWORK DIRECTORY INFORMATION

Complete the information below for all nodes you wish to manually configure into your network directory file.

Type: 1 = IP, 2 = IP/LAN802.3, 3 = X.25

| Node Name | Global or Local | IP Address | Type | Additional Address * |
| --- | --- | --- | --- | --- |
| | | | | |

*For Type 3 (X.25) this address will be the X.25 Address key you designate in your Node Intranet Routing Table. This additional address is not needed for type 1 addresses.

## Gateway-Half Pair Worksheets

One set of Gateway-Half Pair Worksheets should be used for each gateway-half pair in your internetwork. The Gateway-Half Pair Worksheets consist of a map of the two gateway half nodes and their connecting link, and one table that contains information about the gateway half network interfaces. We now refer to one of the gateway-half pairs in our sample internetwork to describe the Gateway-Half Pair Worksheets in more detail. Use the discussion of our sample Gateway-Half Pair Worksheets as a guide for filling out your own Gateway-Half Pair Worksheets.

### Gateway Half Map

Our sample internetwork contains two gateway-half pairs, as shown in our Internetwork Map. One gateway-half pair is made up of nodes G and H and their connecting link, and the other gateway-half pair is made up of nodes X and Y and their connecting link. Let us focus on the G and H gateway-half pair.

Figure 5-4 is a drawing of this gateway-half pair. We show the two nodes and the networks to which they belong. In addition, we select a name for the link. We have decided to name the link LINKRL1.

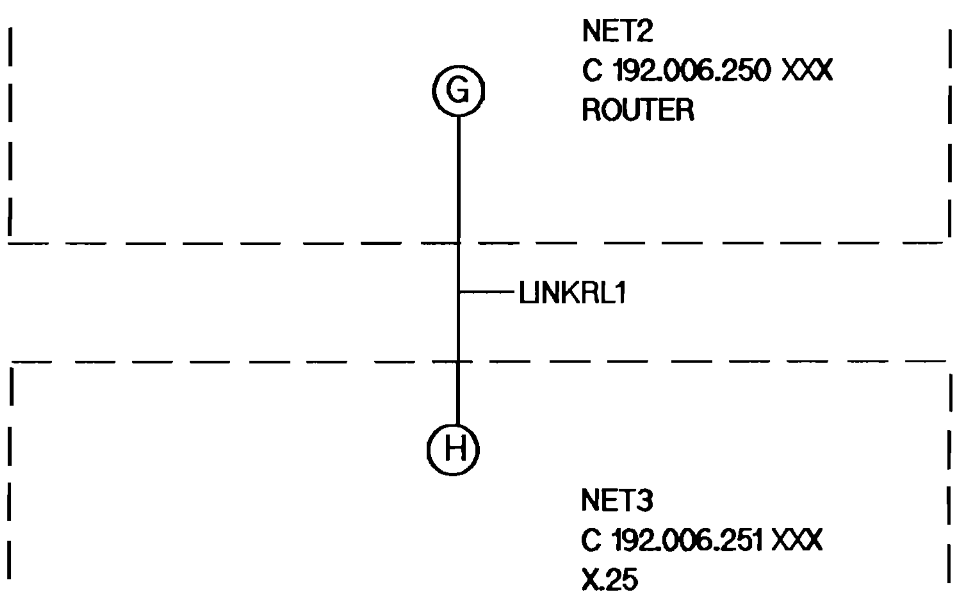



**Figure 5-4. Gateway-Half Map**

## Gateway-Half Network Interface Table

This table (Table 5-7) is based on the map we have just discussed. We list both gateway-half nodes, the full IP addresses of the partner nodes, the connected networks, and the name of the link. Usually, the link name will be the same from the perspective of each gateway half. The reason we list the address of the partner gateway half is that the partner's address is entered during configuration of a gateway half network interface.

**Table 5-7. Gateway-Half Network Interface Table**

NETWORK NAMES: NET2, NET3

| GATEWAY HALF NODE | FULL IP ADDRESS OF PARTNER | CONNECTED NETWORK | LINK NAME |
|---|---|---|---|
| G/NET 2 | C 192.006.251 001 | NET3 | LINKRL1 |
| H/NET 3 | C 192.006.250 005 | NET2 | LINKRL1 |

**Note**

Figure 5-5 and Table 5-8 pertain to the other gateway-half pair in our sample internetwork.

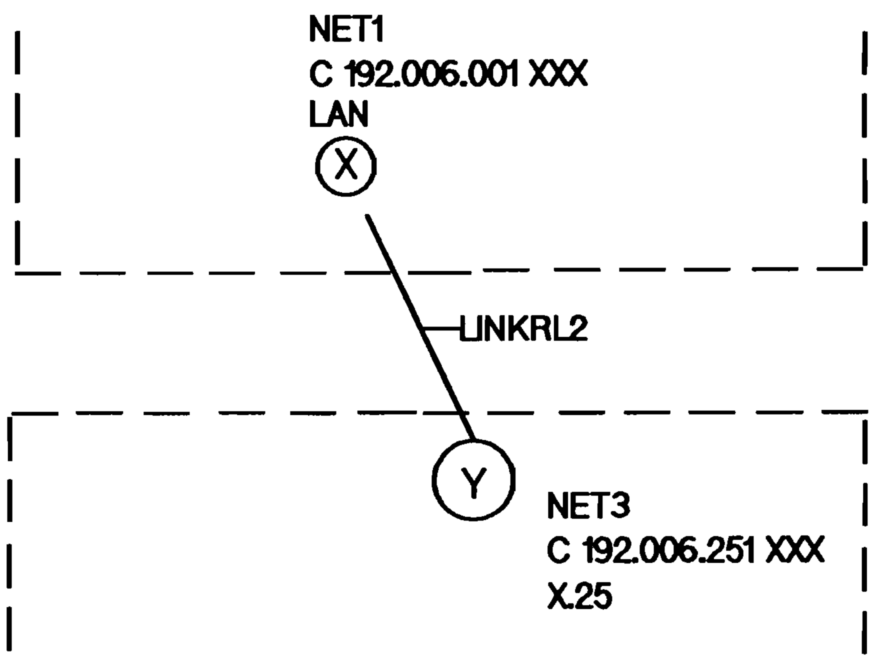



Figure 5-5. Second Gateway-Half Map

Table 5-8. Second Gateway-Half Network Interface Table

NETWORK NAMES: NET1, NET3

| GATEWAY NODE | FULL IP ADDRESS OF PARTNER | CONNECTED NETWORK | LINK NAME |
|---|---|---|---|
| X/NET 1 | C 192.006.251 006 | NET3 | LINKRL2 |
| Y/NET 3 | C 192.006.001 004 | NET1 | LINKRL2 |

# Network Worksheet for Your Records

## GATEWAY-HALF MAP

GATEWAY-HALF NETWORK INTERFACE TABLE

NETWORK NAMES:

| GATEWAY NODE | FULL IP ADDRESS OF PARTNER | CONNECTED NETWORK | LINK NAME |
|---|---|---|---|
| | | | |

6

# Node Examples and Records

## Node Worksheets

The main purpose of the node worksheets is to determine ahead of time the information you will need to configure during NMMGR's Guided Configuration. This information depends on the type of network to which a node belongs. Guided Configuration includes information for routing, links, and protocols.

You take the following steps when you start to complete the node worksheets.

- Fill in the necessary internet routing information (intranet routing information also for nodes on a router or X.25 network).
- Determine the values for fields you will configure during Guided Configuration.
- Perform the actual Guided Configuration.

Node worksheets contain routing information, screen names, NMMGR paths, fields you will configure, and instructions on how to determine values for these required fields. The worksheets list only the fields you can configure during Guided Configuration, which allows you to configure your nodes as quickly as possible. Detailed descriptions of all fields are located in the *NS3000/XL Screens Reference Manual*. Screen names in this section are given in uppercase letters, and the NMMGR path used to reach a screen is listed in parentheses following the screen name.

We will continue to refer to our example as we discuss the node worksheets, and figure numbers and table numbers still will be based on the example. Descriptions of fields should be applicable to all situations.

**Note**

To demonstrate our example, we have filled out values on the following node-worksheet pages based on previous worksheet information. In cases where information could not be taken from previous worksheets, values have been left blank.

After you choose to perform Guided Configuration, you select the Go To NET CON function key to perform first-time configuration of a node. You then select an NI name and press the appropriate topology function key. For NI names, use the network names on the network maps. This way, you will be able to keep track of the NI names you enter. You will then visit the Node Name Configuration Screen, listed below. (This screen is always visited during loopback guided configuration, but is visited for X.25, LAN, router, and gateway half guided configurations only if a node name has not already been configured.)

**NODE NAME CONFIGURATION** (`NETXPORT.NODE.NAME`)

Local Node Name______________________

Name of the node you are configuring. Must be in the form *node.domain.organization*.

## LAN Node Internet Routing

As an example of a LAN node's routing worksheet, look at Table 6-1. This table shows the internet routing information that we plan to configure for Node B on NET1 in our example. We see from our LAN Internet Routing Table (Table 5-2) that NET1 includes nodes C and X as gateway nodes. This table also shows that NET1 nodes can use Node C as a gateway to reach NET2 in one hop and NET 3 in two hops, and that Node X can be used to reach NET3 in one hop and NET2 in two hops. We decide to configure each gateway to reach both networks, which means that more than one gateway is available for Node B to reach the same remote network. We are not required to configure multiple gateways to reach the same network. It is our choice. When multiple gateways are configured, the software determines which route to use--usually the one with the fewest hop counts.

Internet routing information is not necessarily the same for all nodes on a network. Suppose we do not want Node A in NET1 ever to communicate with any node on NET3. When completing the internet routing table for Node A, we would not list NET3 as a destination network and we would not use Node X as a gateway node because it would route packets to NET3.

**Table 6-1. LAN Node Internet Routing**

NODE NAME: B

IP ADDRESS: C 192.006.001 002

NETWORK NAME: NET1

| GATEWAY NODE/IP ADDRESS | DESTINATION NETWORKS/ IP ADDRESSES | HOP COUNTS |
|---|---|---|
| C/ C 192.006.001 003 | NET2/C 192.006.250 000 | 1 |
| | NET3/C 192.006.251 000 | 2 |
| X/ C 192.006.001 004 | NET2/C 192.006.250 000 | 2 |
| | NET3/C 192.006.251 000 | 1 |

## Node Worksheet for Your Records

LAN NODE INTERNET ROUTING

NODE NAME:

IP ADDRESS:

NETWORK NAME:

| GATEWAY NODE/IP ADDRESS | DESTINATION NETWORKS/ IP ADDRESSES | HOP COUNT |
|---|---|---|
| | | |

LAN CONFIGURATION SCREENS

As an example of filling out configuration fields for a LAN node, we have chosen Node B on NET1. Only information derived from previous worksheets has been filled out.

LINK SELECTION (`LINK`)

Link Name ______________

Assign a link name that is eight alphanumeric characters or fewer; the first character must be alphabetic.

IEEE802.3 LINK CONFIGURATION (`LINK.`*`linkname`*)

Physical Path ______________________________

The physical path of the LANIC.

PROBE PROTOCOL CONFIGURATION (`NETXPORT.NI.`*`ni-Name`*`.PROTOCOL.PROBE`)

Proxy Enabled __N__

Answer Y if this node will be a proxy server (will have a network directory). Refer to the LAN1 Network Map (Figure 5-1).

IP PROTOCOL CONFIGURATION (`NETXPORT.NI.`*`ni-Name`*`.PROTOCOL.IP`)

IP Address __C 192.006.001 002__

Full IP address of the node being configured. Refer to LAN Network Table (Table 5-1).

**Note**

This page and the next page contain information for one gateway. Additional gateways need their own information, but we will focus on only one gateway for this example. During Guided Configuration, press the Next Screen function key when finished configuring information for a gateway. This returns you to the first screen shown on this page. If you are finished for all gateways, press the Next Screen key again.

LAN CONFIGURATION SCREENS (Continued)

NEIGHBOR GATEWAYS (NETXPORT.NI.*niName*.INTERNET)

Gateway Name GATEC

Assign a name (maximum eight characters) to reference a gateway that is on the network to which the node belongs. Refer to Internet Map (Figure 4-1) and LAN Network Map (Figure 5-1).

NEIGHBOR GATEWAY REACHABLE NETWORKS (NETXPORT.NI.*niName*.INTERNET.*gatewayn*)

Neighbor Gateway IP Internet Address C 192.006.001.003

Full IP address of the gateway node. Refer to LAN Network Table (Table 5-1).

IP Network Address

C 192.006.250 000 ____________ (1)

C 192.006.251 000 ____________ (2)

______________________________ (3)

______________________________ (4)



The IP addresses of all reachable networks in the internet, through the gateway node named above. Refer to LAN Node Internet Routing Table (Table 6-1). We have filled in the node portion for each IP network address with zeroes because the node portion will be ignored in this field during configuration. A node portion still must be entered, however.

Hops

________ 1 ____________ (1)

________ 2 ____________ (2)

______________________ (3)

(4)

Refer to LAN Node Internet Routing Table (Table 6-1) for Hop Count. The numbers in parentheses correspond to the numbers regarding IP network addresses.

## Node Worksheets for Your Records

LAN CONFIGURATION SCREENS

LINK SELECTION (LINK)

Link Name ______________

Assign a link name that is eight alphanumeric characters or fewer; the first character must be alphabetic.

IEEE802.3 LINK CONFIGURATION (LINK.*linkname*)

Physical Path ___________________________________

The physical path of the LANIC.

PROBE PROTOCOL CONFIGURATION (NETXPORT.NI.*ni-Name*.PROTOCOL.PROBE)

Proxy Enabled ________

Answer Y if this node will be a proxy server (will have a network directory). Refer to the LAN Network Map.

IP PROTOCOL CONFIGURATION (NETXPORT.NI.*ni-Name*.PROTOCOL.IP)

IP Address __________

Full IP address of the node being configured. Refer to LAN Network Table.

**Note**

This page and the next page contain information for one gateway. Additional gateways will need their own information, so make enough copies of this page and the next page before you proceed. During Guided Configuration, press the Next Screen function key when finished configuring information for a gateway. This returns you to the first screen shown on this page. If you are finished for all gateways, press the Next Screen key again.

LAN CONFIGURATION SCREENS (Continued)

NEIGHBOR GATEWAYS (`NETXPORT.NI.`*`niName`*`.INTERNET`)

Gateway Name ________

Assign a name (maximum eight characters) to reference a gateway that is on the network to which the node belongs. Refer to Internet Map and LAN Network Map.

NEIGHBOR GATEWAY REACHABLE NETWORKS (`NETXPORT.NI.`*`niName`*`.INTERNET.`*`gatewayn`*)

Neighbor Gateway IP Internet Address______

Full IP address of the gateway node. Refer to LAN Network Table.

IP Network Address

________________________(1)

________________________(2)

________________________(3)

________________________(4)

The IP addresses of all reachable networks in the internet, through the gateway node named above. Refer to LAN Node Internet Routing Table. You need to fill out a node portion for each IP address, even though the node portion is ignored. You can simply enter zeroes for these node portions.

Hops

________________________(1)

________________________(2)

________________________(3)

________________________(4)

Refer to LAN Node Internet Routing Table for Hop Count. The numbers in parentheses correspond to the numbers regarding IP network addresses.

## SUBSEQUENT LAN NODES

If you are adding a LAN node, be sure to complete this information and update the corresponding maps and tables.

Link Name ______________________________

Logical Device ______________________________

Proxy Enabled? ______________________________

IP Address of the node being configured

______________________________

Gateway Names

1)__________ 2) __________ 3) __________

Neighbor Gateway IP Internet Addresses

1) __________ 2) __________ 3) __________

For first gateway:

IP Network Address__________ Hops __________

IP Network Address__________ Hops __________

IP Network Address__________ Hops __________

IP Network Address__________ Hops __________

Be sure to add IP network addresses and hops for other specified gateways.

## Router Node Routing Information

Tables 6-2 and 6-3 show routing information for Node E on NET2 in our example.

Because NET2 is a router network, intranet and internet routing information is needed. Intranet routing is shown in Table 6-2. Using information from the NET2 network map (Figure 5-2) and the Router Network Table (Table 5-3), we obtain the destination node names, the router link names and the IP addresses needed for completing Table 6-2. Let us look at some examples from Table 6-2. Node E can reach Node F (IP address C 192.006.250 004) by sending a packet over Link3. This is all the information needed in Node E's intranet routing table for sending packets to Node F. The reason for this is that, once the packet crosses over LINK3 and arrives at Node D, Node D will use its own intranet routing information to continue moving the packet toward its destination node.

Notice the Entry Priority column. This column becomes important when multiple link names are configured. **When multiple link names are configured, the highest entry-priority number is the top-priority link.** For example, we see from our Router Network Map (Figure 5-2) that Node E can reach Node D directly by using LINK3 and indirectly by using LINK4 and then LINK5. We decide to configure this indirect link and list it as entry priority 30 in Table 6-2. Unless LINK3 should go down, LINK4 will never be used because it has a lower priority number than LINK3. We are not required to configure this secondary link. It is our choice. The reason we have used priority numbers 30 and 50 in Table 6-2 is to allow for possible additions with higher or lower priority numbers; 50 is the default.

**Table 6-2. Router Node Intranet Routing Table**

NODE NAME: E

IP ADDRESS: C 192.006.250 003

NETWORK NAME: NET2

| DESTINATION NODE | LINK NAME | DESTINATION NODE'S IP ADDRESS | ENTRY PRIORITY |
|---|---|---|---|
| D | LINK3 | 002 | 50 |
| D | LINK4 | 002 | 30 |
| G | LINK4 | 005 | 50 |
| G | LINK3 | 005 | 30 |
| C | LINK3 | 001 | 50 |
| F | LINK3 | 004 | 50 |

Now we proceed to Node E's Internet Routing Table (Table 6-3). Remember that Node E belongs to NET2. We see from our Router Internet Routing Table (Table 5-4) that NET2 includes nodes C and G as gateway nodes. This table also shows that NET2 nodes using Node C as a gateway can reach NET1 in one hop and NET3 in two hops, and that Node G can be used to reach NET3 in one hop and NET1 in two hops. We decide to configure each gateway to reach both networks, which means that more than one gateway is available for Node E to reach the same remote network. We are not required to configure multiple gateways to reach the same network. It is our choice. When multiple gateways are configured, the software determines which route to use--usually the one with the lowest hop count.

Internet routing information is not necessarily the same for all nodes on a network. Suppose we do not want Node D in NET2 ever to communicate with any node on NET3. When completing the internet routing table for Node D, we would not list NET3 as a destination network and we would not use Node G as a gateway node because it would route packets to NET3.

**Table 6-3. Router Node Internet Routing**

NODE NAME: E

IP ADDRESS: C 192.006.250 003

NETWORK NAME: NET2

| GATEWAY NODE/IP ADDRESS | DESTINATION NETWORKS/ IP ADDRESSES | HOP COUNTS |
|---|---|---|
| C/001 | NET1/C 192.006.001 000 | 1 |
| | NET3/C 192.006.251 000 | 2 |
| G/005 | NET1/C 192.006.001 000 | 2 |
| | NET3/C 192.006.251 000 | 1 |

## Node Worksheets for Your Records

ROUTER NODE INTRANET ROUTING TABLE

NODE NAME:

IP ADDRESS:

NETWORK NAME:

| DESTINATION NODE | LINK NAME | DESTINATION NODE'S IP ADDRESS | ENTRY PRIORITY |
|---|---|---|---|
| | | | |

# Node Worksheets for Your Records

ROUTER NODE INTERNET ROUTING

NODE NAME:

IP ADDRESS:

NETWORK NAME:

| GATEWAY NODE/IP ADDRESS | DESTINATION NETWORKS/ IP ADDRESSES | HOP COUNT |
|---|---|---|
| | | |

ROUTER CONFIGURATION SCREENS

As an example of filling out configuration fields for a router node, we have chosen Node E on NET2. Only information derived from previous worksheets has been filled out.

LINK SELECTION (LINK)

Link Name___LINK3____

Assign a link name that is eight characters or fewer. The first character must be alphabetic. This link name corresponds to one link the node belongs to. After you have been taken to all the necessary screens for this link, Guided Configuration will bring you back to this screen to configure other links connected to this node. Refer to Router Network Map (Figure 5-2). When you are finished configuring the links for this node, press the Next Screen function key.

Type: LAP-B

LAP-B LINK DATA (LINK.*linkname*)

Physical Path ________

The physical path of the PSI card.

Local Mode (5 = DTE, 6 = DCE, 11 = HP Point to Point) _____

HP recommends that you use the default, HP Point to Point. If so, both sides of the link must be configured as HP Point to Point.

**ROUTER CONFIGURATION SCREENS (Continued)**

NETWORK INTERFACE LINKS (`NETXPORT.NI.`*`niName`*`.LINK`)

Type ______________

DD--Direct Dial, DC--Direct Connect, or SD--Shared Dial.

DIRECT CONNECT LINK CONFIGURATION (`NETXPORT.NI.`*`niName`*`.LINK.`*`linkname`*)

No fields required to configure.

OR

ROUTER DIAL LINK CONFIGURATION (`NETXPORT.NI.`*`niName`*`.LINK.`*`linkname`*)

No fields required to configure.

ROUTER NETWORK INTERFACE CONFIGURATION (`NETXPORT.NI.`*`niName`*)

Network Hop Count ____3____

The greatest possible number of intermediate nodes between the two nodes farthest apart on the network. See the Router Network Map (Figure 5-2).

Idle Device Timeout Value (Minutes) ________

For dial links, this is the number of minutes a device can remain inactive before shutting down. A value of zero will disable the idle device timer for all devices on this network interface. (Enter 0 for Direct Connect links.)

IP PROTOCOL CONFIGURATION (`NETXPORT.NI.`*`niName`*`.PROTOCOL.IP`)

IP Address __C192.006.250 003__

Full IP address of the node being configured. Refer to Router Network Table (Table 5-3).

**ROUTER CONFIGURATION SCREENS (Continued)**

**Note**

Mapping configuration is required for each local link the node can use to reach each remote node on the router network. Therefore, make enough copies of this page and the next page before you fill in any information. After configuring mapping information for one node, Guided Configuration will bring you back to the first screen on this page. Repeat the process until you have completed all mapping configuration, then press the Next Screen function key.

ROUTER MAPPING CONFIGURATION (NETXPORT.NI.*niName*.MAPPING)

Router Node Name ___D1___

Assign a name (maximum eight characters) to represent a node you wish to be able to reach from your node. Refer to Router Node Intranet Routing Table (Table 6-1).

ROUTER REACHABLE NODES (NETXPORT.NI.*niName*.MAPPING.*mapentry*)

IP Internet Address C 192.006.250.002

Full IP address of the destination node named above. Refer to Router Node Intranet Routing Table (Table 6-1).

Link Name ___LINK3___

Name of the link used to reach the destination node. Must match a link name that you configured on the link configuration screen. If more than one link is required to reach the destination node, list only the first link to be used.

Adjacent (0)/ Non-adjacent (1) ___0___

If the destination node is not directly connected to the link just named, enter 1. Otherwise, enter 0. Refer to Router Network Map (Figure 5-2).

Entry Priority ___50___

Important when alternate local links are configured to reach a remote node. Refer to the Router Node Intranet Routing Table (Table 6-1). If no alternate links will be configured, use the default of 50 for the priority so that you allow for possible additions with higher or lower priority numbers.

Phone Number __________

The phone number of the destination node is required if the destination node is directly connected to the other end of the link and if the link is a direct dial or a shared dial link.

ROUTER CONFIGURATION SCREENS (Continued)

**Note**

This page and the next page contain information for one gateway. Before you proceed, make copies of this page and the next page for additional gateways. During Guided Configuration, press the Next Screen function key when finished configuring information for a gateway. This returns you to the first screen shown on this page. If you are finished for all gateways, press the Next Screen key again.

NEIGHBOR GATEWAYS (`NETXPORT.NI.`*`niName`*`.INTERNET`)

Gateway Name GATEG

Assign a name (maximum eight characters) to a gateway that is on the network to which the node belongs. Refer to Internet Map (Figure 4-1) and Router Network Map (Figure 5-2).

NEIGHBOR GATEWAY REACHABLE NETWORKS (`NETXPORT.NI.`*`niName`*`.INTERNET.`*`gatewayn`*)

Neighbor Gateway IP Internet Address C 192.006.250 005

Full IP address of the gateway node. Refer to Router Network Table (Table 5-3).

IP Network Address

C 192.006.001 000 (1)

C 192.006.251 000 (2)

________________ (3)

________________ (4)

The IP addresses of all reachable networks in the internet, through the gateway node named above. Refer to Router Node Internet Routing Table (Table 6-3). We have filled in the node portion for each IP network address with zeroes because the node portion will be ignored in this field during configuration. A node portion still must be entered, however.

Hops

_______2__________(1)

_______1__________(2)

__________________(3)

__________________(4)

Refer to Router Node Internet Routing Table (Table 6-3) for Hop Count. The numbers in parentheses correspond to the numbers regarding IP network addresses.

## Node Worksheets for Your Records

ROUTER CONFIGURATION SCREENS

LINK SELECTION (`LINK`)

Link Name__________

Assign a link name that is eight characters or fewer. The first character must be alphabetic. This link name corresponds to one link the node belongs to. After you have been taken to all the necessary screens for this link, Guided Configuration will bring you back to this screen to configure other links connected to this node. Refer to Router Network Map. When you are finished configuring the links for this node, press the Next Screen function key.

Type: LAP-B

LAP-B LINK DATA (`LINK.`*`linkname`*)

Physical Path _________

The physical path of the PSI card.

Local Mode (5 = DTE, 6 = DCE, 11 = HP Point to Point) ____

HP recommends that you use the default, HP Point to Point. If so, both sides of the link must be configured as HP Point to Point.

**ROUTER CONFIGURATION SCREENS (Continued)**

NETWORK INTERFACE LINKS (NETXPORT.NI.*niName*.LINK)

Type ______________

DD--Direct Dial, DC--Direct Connect, or SD--Shared Dial.

DIRECT CONNECT LINK CONFIGURATION (NETXPORT.NI.*niName*.LINK.*linkname*)

No fields required to configure.

OR

ROUTER DIAL LINK CONFIGURATION (NETXPORT.NI.*niName*.LINK.*linkname*)

No fields required to configure.

ROUTER NETWORK INTERFACE CONFIGURATION (NETXPORT.NI.*niName*)

Network Hop Count __________

The greatest possible number of intermediate nodes between the two nodes farthest apart on the network. See the Router Network Map.

Idle Device Timeout Value (Minutes) ________

For dial links, this is the number of minutes a device can remain inactive before shutting down. A value of zero will disable the idle device timer for all devices on this network interface. (Enter 0 for Direct Connect links.)

IP PROTOCOL CONFIGURATION (NETXPORT.NI.*niName*.PROTOCOL.IP)

IP Address ________________________________

Full IP address of the node being configured. Refer to Router Network Table.

**ROUTER CONFIGURATION SCREENS (Continued)**

**Note**

Mapping configuration is required for each local link the node can use to reach each remote node on the router network. Therefore, make enough copies of this page and the next page before you fill in any information. After configuring mapping information for one node, Guided Configuration will bring you back to the first screen listed on this page. Repeat the process until you have completed all mapping information, then press the Next Screen function key.

ROUTER MAPPING CONFIGURATION (NETXPORT.NI.*ni-Name*.MAPPING)

Router Node Name ______________________________

Assign a name (maximum eight characters) to represent a node you wish to be able to reach from your node. Refer to Router Node Intranet Routing Table.

ROUTER REACHABLE NODES (NETXPORT.NI.*niName*.MAPPING.*mapentry*)

IP Internet Address ______________________________

Full IP address of the destination node named above. Refer to Router Node Intranet Routing Table.

Link Name______________________________

Name of the link used to reach the destination node. Must match a link name that you configured on the link configuration screen. If more than one link is required to reach the destination node, list only the first link to be used.

Adjacent (0)/ Non-adjacent (1) ________

If the destination node is not directly connected to the link just named, enter 1. Otherwise, enter 0. Refer to Router Network Map.

Entry Priority______________________

Important when alternate local links are configured to reach a remote node. Refer to the Router Node Intranet Routing Table . If no alternate links will be configured, use the default of 50 for the priority so that you allow for possible additions with higher or lower priority numbers.

Phone Number______________________

The phone number of the destination node is required if the destination node is directly connected to the other end of the link and if the link is a direct dial or a shared dial link.

ROUTER CONFIGURATION SCREENS (Continued)

**Note**

This page and the next page contain information for one gateway. Before you proceed, make copies of this page and the next page for additional gateways. During Guided Configuration, press the Next Screen function key when finished configuring information for a gateway. This returns you to the first screen listed on this page. If you are finished for all gateways, press the Next Screen key again.

NEIGHBOR GATEWAYS (NETXPORT.NI.*niName*.INTERNET)

Gateway Name ____________________

Assign a name (maximum eight characters) to a gateway that is on the network to which the node belongs. Refer to Internet Map and Router Network Map.

NEIGHBOR GATEWAY REACHABLE NETWORKS (NETXPORT.NI.*niName*.INTERNET.*gatewayn*)

Neighbor Gateway IP Internet Address ____________________

Full IP address of the gateway node. Refer to Router Network Table .

IP Network Address

____________________(1)

____________________(2)

____________________(3)

____________________(4)

The IP addresses of all reachable networks in the internet, through the gateway node named above. Refer to Router Node Internet Routing Table. You need to fill out a node portion for each IP Address, even though the node portion is ignored. You can simply enter zeros for these node portions.

Hops

______________________________ (1)

______________________________ (2)

______________________________ (3)

______________________________ (4)

Refer to Router Node Internet Routing Table for Hop Count. The numbers in parentheses correspond to the numbers regarding IP network addresses.

## SUBSEQUENT ROUTER NODES

If you are adding a router node, be sure to complete this information and update the corresponding maps and tables.

Link Name_______________________________________

Type = LAP-B

Logical Device ___________________________________

DTE/DCE for LAP-B ______________________________

Network Hop Count _______________________________

Idle Device Timeout Value __________________________

IP Address of the node being configured

_________________________________________________

Router Node Name ________________________________

(Time name is for mapping information to follow; the name represents a destination node on the network.)

IP Internet Address of the destination node _____________

Link name used to reach the destination node____________

Adjacent (0)/ Non-adjacent (1) ______________________

Entry Priority __________

Phone Number _________

From Router Node Name, above, to this point, information must be repeated for all mappings to be configured.

See next page for additional router fields.

## SUBSEQUENT ROUTER NODES (Continued)

Gateway Names

1) ____________ 2) ________________ 3) ________________

Neighbor Gateway IP Internet Addresses

1) ____________ 2) ________________ 3) ________________

For first gateway:

IP Network Address________________ Hops______________

IP Network Address________________ Hops______________

IP Network Address________________ Hops______________

IP Network Address________________ Hops______________

Be sure to add IP network addresses and hops for other specified gateways.

## X.25 Node Routing Information

Tables 6-4 and 6-5 show routing information for Node I on NET3 in our example.

Because NET3 is an X.25 network, intranet and internet routing information is needed. Intranet routing is shown in Table 6-4. Using information from the NET3 network map and the X.25 Network Table , we obtain the destination node names, the X.25 addresses (where appropriate), and the IP addresses needed for completing Table 6-4.

In order to map X.25 (subnet) information to IP addresses, you must also *always* enter an X.25 Address Key label (the middle column of this table). This label associates an X.25 address (or PVC Number, if using Permanent Virtual Circuits) to a named set of X.25 user facilities by default (entered in the end column). For convenience, we have used each computer's node name (without domain and organization names) as its address key.

**Table 6-4. X.25 Node Intranet Routing Table**

NODE NAME: I

IP ADDRESS: C 192.006.251 002

NETWORK NAME: NET3

| DESTINATION NODE | DEST. NODE'S IP ADDRESS | X.25 ADDRESS KEY | X.25 ADDRESS | FAC. SET NAME |
|---|---|---|---|---|
| H | 001 | H | 1234 | STDFSET |
| J | 003 | J | 6879 | STDFSET |
| Y | 004 | Y | 9876 | STDFSET |

Now we proceed to Node I's Internet Routing Table (Table 6-5). Remember that Node I belongs to NET3. We see from our X.25 Internet Routing Table that NET3 includes nodes H and Y as gateway nodes. This table also shows that NET3 nodes using Node H as a gateway can be used to reach NET2 in one hop and NET1 in two hops, and that Node Y can be used to reach NET1 in one hop and NET2 in two hops. Internet routing information for Node I in this example includes both NET1 and NET2 as destination networks and both Node H and Node Y as gateway nodes.

**Table 6-5. X.25 Node Internet Routing Table**

NODE NAME: I

IP NODE ADDRESS: 002

NETWORK NAME: NET3

| GATEWAY NODE/IP ADDRESS | DESTINATION NETWORKS/ IP ADDRESSES | HOP COUNT |
|---|---|---|
| H | NET2/C 192.006.250 000 | 1 |
| | NET1/C 192.006.001 000 | 2 |
| Y | NET1/C 192.006.001 000 | 1 |
| | NET2/C 192.006.250 000 | 2 |

## Node Worksheets For Your Records

X.25 NODE INTRANET ROUTING TABLE

NODE NAME:

IP ADDRESS:

NETWORK NAME:

| DESTINATION NODE | DEST. NODE'S IP ADDRESS | X.25 ADDRESS KEY | X.25 ADDRESS | FAC. SET NAME |
|---|---|---|---|---|
| | | | | |

# Node Worksheets For Your Records

X.25 NODE INTERNET ROUTING TABLE

NODE NAME:

IP NODE ADDRESS:

NETWORK NAME:

| GATEWAY NODE/IP ADDRESS | DESTINATION NETWORKS/ IP ADDRESSES | HOP COUNT |
|---|---|---|
| | | |

**X.25 CONFIGURATION SCREENS**

As an example of filling out configuration fields for an X.25 node, we have chosen Node I on NET3. Only information derived from previous worksheets and default values have been filled out.

**Caution**

To configure access to an X.25 network, you must configure two software components: the X.25 XL System Access (discussed in these worksheets) and the DTC/X.25 Network Access. Some of the parameters that you must configure for the X.25 XL System Access must match parameters configured for DTC/X.25 Network Access. These parameters are listed below for your information. Also, a worksheet is provided at the end of the X.25 Node Worksheets for you to copy these values onto one sheet. This sheet can then be used when configuring the DTC/X.25 Network Access. The parameters that are unique to DTC/X.25 Network Access are described in *Using the OpenView DTC Manager.*

- Node Name: Within NMMGR, it is called Local Node Name and is listed near the beginning of this chapter. Within the OpenView DTC Manager, it is called the System Node Name.
- Link Name
- DTC Node Name
- DTC Card Number
- X.25 User Facility Set Parameters

LINK SELECTION (`LINK`)

Link Name________________

Assign a Link Name to represent each individual DTC/X.25 Network Access card in the Datacomm and Terminal Controller (DTC). The Link Name must be unique to both the node and the network. The name can have up to eight alphanumeric characters, and the first character must be alphabetic.

Type____X25_______

When you are finished adding links, press the Next Screen function key.

X.25 LINK CONFIGURATION (`LINK.`*`linkname`*)

DTC Node Name_______

X.25 CONFIGURATION SCREENS (CONTINUED)

Enter the DTC Node Name, which is the name of the DTC that is to provide X.25 access for this node.

DTC Card Number_______

Enter the DTC Card Number, which is the slot number of the DTC/X.25 Network Access card in this node's DTC. The number can be any number from 1 to 5. A maximum of three cards per DTC is allowed.

X.25 CONFIGURATION SCREENS (Continued)

NETWORK INTERFACE LINKS (NETXPORT.NI.*linkname*.Link)

Link Name______________

This field should show the Link Name that you entered on the Link Selection screen.

X.25 LINK CONFIGURATION (NETXPORT.NI.*ni-Name*.LINK.*linkname*)

No field required to configure.

X.25 User Facility Sets (NETXPORT.NI.*ni-Name*.PROTOCOL.X25.FACSET)

Facility Set Name______________

Enter a Facility Set Name if you are planning to configure a new facility set. The name can contain as many as eight characters, and the first character must be alphabetic. You can enter up to 128 facility set names. After entering a Facility Set Name in Guided Configuration, you will be taken to the X.25 User Facility Set Parameters Screen. However, if you are going to use the default facility set, press the Next Screen function key during Guided Configuration and you will be taken to the X.25 SVC Address key Paths Screen.

**X.25 CONFIGURATION SCREENS (Continued)**

X.25 User Facility Set Parameters (`NETXPORT.NI.`*`ni-Name`*`.Protocol.X25.FACSET.`*`fsetname`*)

If you plan to change any of the default facility parameters, refer to the field explanation in the *X.25 XL System Access Configuration Guide*.

Packet Size Negotiation __________
Enter Y (Yes) or N(No). Default is N

Window Size Negotiation__________
Enter Y (Yes) or N(No). Default is N

Throughput Class Negotiation________
Enter Y (Yes) or N(No). Default is N

Flow Control Parameters - Negotiation values:

Packet Size Negotiation

| | |
|---|---|
| Incoming______________ | Outgoing______________ |
| (Default is 128) | (Default is 128) |

Window Size Negotiation

| | |
|---|---|
| Incoming______________ | Outgoing______________ |
| (Default is 2) | (Default is 2) |

Throughout Class Negotiation

| | |
|---|---|
| Incoming______________ | Outgoing______________ |
| (Default is 11) | (Default is 11) |

X.25 CONFIGURATION SCREENS (CONTINUED)

Use of D-Bit______Enter Y(Yes) or N(No). Default is N.

Accept Reverse Charge (collect) Call______________
Enter Y(Yes) or N(No). Default is N.

Make Reverse Charge (collect) Call ______________
Enter Y(Yes) or N(No). Default is N.

Close User Group (CUG) ______________
Enter Y(Yes) or N(No). Default is N.

Fast Select ______________
Enter Y(Yes) or N(No). Default is N.

Fast Select Restricted ______________
Enter Y(Yes) or N(No). Default is N.

CUG Number ______________
Enter Y(Yes) or N(No). Default is N.

**X25. CONFIGURATION SCREENS (Continued)**

X.25 SVC Address Key Paths (NETXPORT.NI.*ni-Name*.PROTOCOL.X25.SVCPATH)

X.25 Address Key______J__________

For the X.25 Address key, use the *node* portion of the remote node's configured nodename. Refer to the X.25 Node Intranet Routing Table. POOL is the X.25 Address Key reserved for calls from nodes whose addresses are not specified in this screen. When POOL is specified, any system can access the local system even if its address is not configured.

X.25 Address______6879__________

Enter the X.25 address of the remote host for X.25 public data networks or private networks. Refer to the X.25 Node Intranet Routing Table. An X.25 address is unnecessary if you have specified the POOL Address key. An X.25 Address is also unnecessary for Defense Department Networks (DDN).

Default Facility Set________________

Enter the name of one of the facility sets that is specified on the X.25 User Facility Sets Screen. This parameter is required if you have specified an X.25 Address Key.

Security__________________

Enter IN, OU, IO or LK. IN denotes that only incoming calls are accepted from this particular remote address. OU means that only outgoing calls are accepted to this remote address and that incoming calls will be rejected. IO means that both incoming and outgoing calls are accepted. IO is the default. LK denotes that entry is locked and no call, inbound or outbound, is accepted. This parameter is required if you have specified an X.25 Address Key.

**X.25 CONFIGURATION SCREENS (Continued)**

X.25 PVC Address key Paths (NETXPORT.NI.*ni-Name*.PROTOCOL.X25.PVCPATH)

X.25 Address key___________________

If you are assigning any Permanent Virtual Circuits (PVCs), enter the X.25 Address key. Use the *node* portion of the remote node's configured nodename.

PVC Number___________________

Enter the PVC Number of the PVC on the remote node. This value cannot be greater than the number of PVCs for which you subscribed.

If you are not assigning PVCs, press the Next Screen key during Guided Configuration. This will take you to the IP Protocol Configuration screen.

IP Protocol Configuration (NETXPORT.*niName*.PROTOCOL.IP)

IP Internet Address______________________

Full IP Address of the node being configured. Refer to the X.25 Network Table.

X.25 CONFIGURATION SCREENS (Continued)

**Note**

This page and the next page contain information for one gateway. Before you proceed, make copies of this page and the next page for additional gateways. During Guided Configuration, press the Next Screen function key when finished configuring information for a gateway. This returns you to the first screen shown on this page. If you are finished for all gateways, press the Next Screen key again.

---

NEIGHBOR GATEWAYS (NETXPORT.NI.*niName*.INTERNET)

Gateway Name______GATEH__________

Assign a name (maximum eight characters) to a gateway that is on the network to which the node belongs. Refer to Internet Map (Figure 4-1) and X.25 Network Map (Figure 5-3).

NEIGHBOR GATEWAY REACHABLE NETWORKS
(NETXPORT.NI.*niName*.INTERNET.*gatewayn*)

Neighbor Gateway IP Internet Address_C 192.006.251 001________

Full IP address of the gateway node. Refer to X.25 Network Table (Table 5-5).

IP Network Address

____C 192.006.001 000____________(1)

____C 192.006.250 000____________(2)

________________________(3)

________________________(4)

The IP addresses of all reachable networks in the internet, through the gateway node named above. Refer to X.25 Node Internet Routing Table (Table 6-5), We have filled in the node portion for each IP network address with zeroes because the node portion will be ignored in this field during configuration. A node portion still must be entered, however.

Hops

__________2_____________(1)

__________1_____________(2)

__________________________(3)

__________________________(4)

Refer to X.25 Node Internet Routing Table (Table 6-5) for Hop Count. The numbers in parentheses correspond to the numbers regarding IP network addresses.

**Common NMMGR - OpenView Parameters**

Node Name (Local Node Name in NMMGR; System Node Name in the OpenView DTC Manager)____________________

Link Name____________________

DTC Node Name_______________

DTC Card Number______________

X.25 User Facility Set Parameters
Field __________________Value ______________________

Field __________________ Value ______________________

Field __________________Value_______________________

Field __________________Value_______________________

Field __________________Value_______________________

Field __________________Value_______________________

Field __________________Value_______________________

Field __________________Value_______________________

Field __________________Value_______________________

Field __________________Value_______________________

## Node Worksheets For Your Records

X.25 CONFIGURATION SCREENS

**Caution**

To configure access to an X.25 network, you must configure two software components: the X.25 XL System Access (discussed in these worksheets) and the DTC/X.25 Network Access. Some of the parameters that you must configure for the X.25 XL System Access must match parameters configured for DTC/X.25 Network Access. These parameters are listed below for your information. Also, a worksheet is provided at the end of the X.25 Node Worksheets for you to copy these values onto one sheet. This sheet can then be used when configuring the DTC/X.25 Network Access. The parameters that are unique to DTC/X.25 Network Access are described in *Using the OpenView DTC Manager.*

- Node Name: Within NMMGR, it is called Local Node Name and is listed near the beginning of this chapter. Within the OpenView DTC Manager, it is called the System Node Name.
- Link Name
- DTC Node Name
- DTC Card Number
- X.25 User Facility Set Parameters

LINK SELECTION (`LINK`)

Link Name___________________

Assign a Link Name to represent each individual DTC/X.25 Network Interface card in the Datacomm and Terminal Controller (DTC). The Link Name must be unique to both the node and the network. The name can have up to eight alphanumeric characters, and the first character must be alphabetic.

Type__________

When you are finished adding links, press the Next Screen function key.

X.25 LINK CONFIGURATION (`LINK.`*`linkname`*)

DTC Node Name________

X.25 CONFIGURATION SCREENS (CONTINUED)

Enter the DTC Node Name, which is the name of the DTC that is to provide X.25 access for this node.

DTC Card Number_______

Enter the DTC Card Number, which is the slot number of the DTC/X.25 Network Access card in this node's DTC. The number can be any number from 1 to 5. A maximum of three cards per DTC is allowed.

X.25 CONFIGURATION SCREENS (Continued)

NETWORK INTERFACE LINKS (`NETXPORT.NI.`*`linkname`*`.Link`)

Link Name______________

This field should show the Link Name that you entered on the Link Selection screen.

X.25 LINK CONFIGURATION (`NETXPORT.NI.`*`ni-Name`*`.LINK.`*`linkname`*)

No fields required to configure.

X.25 User Facility Sets (`NETXPORT.NI.`*`ni-Name`*`.PROTOCOL.X25.FACSET`)

Facility Set Name______________

Enter a Facility Set Name if you are planning to configure a new facility set. The name can contain as many as eight characters, and the first character must be alphabetic. You can enter up to 128 facility set names. After entering a Facility Set Name in Guided Configuration, you will be taken to the X.25 User Facility Set Parameters Screen. However, if you are going to use the default facility set, press the Next Screen function key during Guided Configuration and you will be taken to the X.25 SVC Address key Paths Screen.

**X.25 CONFIGURATION SCREENS (Continued)**

X.25 User Facility Set Parameters (NETXPORT.NI.*ni-Name*.Protocol.X25.FACSET.*setname*)

If you plan to change any of the default facility parameters, refer to the field explanation in the *X.25 XL System Access Configuration Guide*.

Packet Size Negotiation __________
Enter Y (Yes) or N(No). Default is N

Window Size Negotiation__________
Enter Y (Yes) or N(No). Default is N

Throughput Class Negotiation________
Enter Y (Yes) or N(No). Default is N

Flow Control Parameters - Negotiation values:

Packet Size Negotiation
Incoming______________Outgoing____________
(Default is 128) (Default is 128)

Window Size Negotiation
Incoming______________Outgoing____________
(Default is 2) (Default is 2)

Throughout Class Negotiation
Incoming______________Outgoing____________
(Default is 11) (Default is 11)

X.25 CONFIGURATION SCREENS (CONTINUED)

Use of D-Bit____________________Enter Y(Yes) or N(No). Default is N.

Accept Reverse Charge (collect) Call____________________________
Enter Y(Yes) or N(No). Default is N.

Make Reverse Charge (collect) Call ____________________________
Enter Y(Yes) or N(No). Default is N.

Close User Group (CUG) ____________________________
Enter Y(Yes) or N(No). Default is N.

Fast Select ____________________________
Enter Y(Yes) or N(No). Default is N.

Fast Select Restricted ____________________________
Enter Y(Yes) or N(No). Default is N.

CUG Number ____________________________
Enter Y(Yes) or N(No). Default is N.

**X25. CONFIGURATION SCREENS (Continued)**

X.25 SVC Address Key Paths (NETXPORT.NI.*ni-Name*.PROTOCOL.X25.SVCPATH)

X.25 Address Key______________

For the X.25 Address key, use the *node* portion of the remote node's configured nodename. Refer to the X.25 Node Intranet Routing Table. POOL is the X.25 Address Key reserved for calls from nodes whose addresses are not specified in this screen. When POOL is specified, any system can access the local system even if its address is not configured.

X.25 Address____________

Enter the X.25 address of the remote host for X.25 public data networks or private networks. Refer to the X.25 Node Intranet Routing Table. An X.25 address is unnecessary if you have specified the POOL Address key. An X.25 Address is also unnecessary for Defense Department Networks (DDN).

Default Facility Set________________

Enter the name of one of the facility sets that is specified on the X.25 User Facility Sets Screen. This parameter is required if you have specified an X.25 Address Key.

Security___________________

Enter IN, OU, IO or LK. IN denotes that only incoming calls are accepted from this particular remote address. OU means that only outgoing calls are accepted to this remote address and that incoming calls will be rejected. IO means that both incoming and outgoing calls are accepted. IO is the default. LK denotes that entry is locked and no call, inbound or outbound, is accepted. This parameter is required if you have specified an X.25 Address Key.

**X.25 CONFIGURATION SCREENS (Continued)**

X.25 PVC Address Key Paths (NETXPORT.NI.*ni-Name*.PROTOCOL.X25.PVCPATH)

X.25 Address key________________

If you are assigning any Permanent Virtual Circuits (PVCs), enter the X.25 Address key. Use the *node* portion of the remote node's configured nodename.

PVC Number________________

Enter the PVC Number of the PVC on the remote node. This value cannot be greater than the number of PVCs for which you subscribed.

If you are not assigning PVCs, press the Next Screen key during Guided Configuration. This will take you to the IP Protocol Configuration screen.

IP Protocol Configuration (NETXPORT.*niName*.PROTOCOL.IP)

IP Internet Address____________________

Full IP Address of the node being configured. Refer to the X.25 Network Table.

**X.25 CONFIGURATION SCREENS (Continued)**

**Note**

This page contains information for one gateway. Before you proceed, make copies of this page for additional gateways. During Guided Configuration, press the Next Screen function key when finished configuring information for a gateway. This returns you to the first screen shown on this page. If you are finished for all gateways, press the Next Screen key again.

NEIGHBOR GATEWAYS (`NETXPORT.NI.`*`niName`*`.INTERNET`)

Gateway Name________________

Assign a name (maximum eight characters) to a gateway that is on the network to which the node belongs. Refer to Internet Map and X.25 Network Map.

NEIGHBOR GATEWAY REACHABLE NETWORKS (`NETXPORT.NI.`*`niName`*`.INTERNET.`*`gatewayn`*)

Neighbor Gateway IP Internet Address______________

Full IP address of the gateway node. Refer to X.25 Network Table.

IP Network Address

________________________(1)
________________________(2)
________________________(3)
________________________(4)

The IP addresses of all reachable networks in the internet, through the gateway node named above. Refer to X.25 Node Internet Routing Table. We have filled in the node portion for each IP network address with zeroes because the node portion will be ignored in this field during configuration. A node portion still must be entered, however.

Hops

________________________(1)
________________________(2)
________________________(3)
________________________(4)

Refer to X.25 Node Internet Routing Table for Hop Count. The numbers in parentheses correspond to the numbers regarding IP network addresses.

**Common NMMGR-OpenView Parameters**

Node Name (Local Node Name in NMMGR; System Node Name in the OpenView DTC Manager)____________________

Link Name____________________

DTC Node Name________________

DTC Card Number______________

X.25 User Facility Set Parameters
Field __________________Value ______________________

Field __________________ Value ______________________

Field __________________Value______________________

Field __________________Value______________________

Field __________________Value______________________

Field __________________Value______________________

Field __________________Value______________________

Field __________________Value______________________

Field __________________Value______________________

Field __________________Value______________________

## Subsequent X.25 Nodes

If you are adding an X.25 node, be sure to complete this information and update the corresponding maps and tables.

Link Name________________________________

Type________________________________

DTC Node Name________________________________

DTC Card Number________________________________

Facility Set Name________________________________

Packet Size Negotiation — Circle Y or N

Window Size Negotiation — Circle Y or N

Throughput Class Negotiation — Circle Y or N

Flow Control Parameters - Negotiation Values:

Packet Size Negotiation

Incoming____________________Outgoing____________________

Window Size Negotiation

Incoming____________________Outgoing____________________

Throughout Class Negotiation

Incoming____________________Outgoing____________________

Use of D-Bit — Circle Y or N

Accept Reverse charge (collect) call — Circle Y or N

Make Reverse charge (collect) call — Circle Y or N

Close User Group (CUB) — Circle Y or N

Fast select — Circle Y or N

Fast select restricted — Circle Y or N

CUB Number — Circle Y or N

## Subsequent X.25 Nodes (Continued)

X.25 Address Key______________________________

X.25 Address (for SVC)________________________

Default Facility Set (for SVC)__________________

Security (for SVC) Circle IN, OU, IO or LK

PVC Number (for PVC)_________________________

IP Address____________________________________

Gateway Names

1)______________2)__________________3)__________________

Neighbor Gateway IP Internet Addresses

1)______________2)__________________3)__________________

For First Gateway:

IP Network Address____________________Hops________________

IP Network Address____________________Hops________________

IP Network Address______________ Hops________________

IP Network Address____________________Hops________________

Be sure to add IP network addresses and hops for other specified gateways.

## Gateway Half Information for Node Worksheets

As an example of the information needed for every gateway half in the internet, look at Table 6-6. This table shows internet routing information for Node G, which is a gateway half on NET2. Referring to our Gateway Half Map (Figure 5-4) and our Gateway-Half Network Interface Table (Table 5-7), we indicate in Table 6-6 that Node H is a gateway half that is connected to Node G. We also see that we have named the gateway-half link LINKRL1. We see from our Internet Map that, from Node G, we can reach NET1 in one hop. The reason NET3 is not included in Table 6-6 is that Node G can reach NET3 in zero hops. This is because Node G is a partner gateway half with Node H, and Node H is a member of NET3. Therefore, Node G is considered to be directly connected to NET3 and does not require a hop to reach NET3.

**Table 6-6. Gateway-Half Node Internet Routing Table**

NAME OF GATEWAY-HALF NODE: G
IP ADDRESS: 192.006.250 005
NETWORK NAME: NET2

| CONNECTED GATEWAY-HALF NODE/ IP ADDRESS | GATEWAY-HALF LINK NAME | DESTINATION NETWORKS/ IP ADDRESSES | HOP COUNT |
|---|---|---|---|
| H/192.006.251 001 | LINKRL1 | NET1/C 192.006.001 000 | 1 |

## Node Worksheets for Your Records

GATEWAY–HALF NODE INTERNET ROUTING TABLE

NAME OF GATEWAY–HALF NODE:
IP ADDRESS:
NETWORK NAME:

| CONNECTED GATEWAY–HALF NODE/ IP ADDRESS | GATEWAY–HALF LINK NAME | DESTINATION NETWORKS/ IP ADDRESSES | HOP COUNT |
|---|---|---|---|
| | | | |

GATEWAY-HALF CONFIGURATION SCREENS

As an example of filling out configuration fields for a gateway half, we have chosen Node G on NET2. Only information derived from previous worksheets has been completed.

GLOBAL TRANSPORT CONFIGURATION (NETXPORT.GLOBAL)

Home Network Name___NET2____

Enter the name of a network the node belongs to, which is the same as the corresponding NI name. Refer to the appropriate maps. If the node belongs to more than one network, the home network should be the one that will allow the greatest number of destination networks a short return route to the node.

LINK SELECTION (LINK)

Link Name ____LINKRL1____

Assign a link name that is eight alphanumeric characters or fewer; the first character must be alphabetic. Refer to the Gateway-Half Map (Figure 5-4).

Type: LAP-B

LAP-B LINK DATA (LINK.*linkname*)

Physical Path ________

The physical path of the PSI card.

Local Mode (5 = DTE, 6 = DCE, 11 = HP Point to Point) _____

HP recommends that you use the default, HP Point to Point. If so, both sides of the link must be configured as HP Point to Point.

**GATEWAY-HALF CONFIGURATION SCREENS (Continued)**

NETWORK INTERFACE LINKS (`NETXPORT.NI.`*`niName`*`.LINK`)

Type ______________________________

DD--Direct Dial, or DC--Direct Connect

GATEWAY-HALF DIAL LINK CONFIGURATION (`NETXPORT.NI.`*`niName`*`.LINK.`*`linkname`*)

Gateway Phone ______________________________

The phone number of the remote gateway-half node.

Security String ______________________________

Security String of the remote gateway-half node.

OR

DIRECT CONNECT CONFIGURATION (`NETXPORT.NI.`*`ni-Name`*`.LINK.`*`linkname`*)

No fields required to configure.

GATEWAY-HALF NETWORK INTERFACE CONFIGURATION (`NETXPORT.NI.`*`niName`*)

Idle Device Timeout Value (Minutes)______________________

For dial links, this is the number of minutes a device can remain inactive before shutting down. A value of zero will disable the idle device timer for all devices on this network interface. (Enter 0 for Direct Connect links.)

IP PROTOCOL CONFIGURATION (`NETXPORT.NI.`*`ni-Name`*`.PROTOCOL.IP`)

IP Address C 192.006.251.001

Full IP address of the partner gateway-half node (the node connected to the gateway half being configured). Refer to Gateway-Half Network Interface Table (Table 5-7).

**GATEWAY-HALF CONFIGURATION SCREENS (Continued)**

NEIGHBOR GATEWAYS (NETXPORT.NI.*niName*.INTERNET)

Gateway Name __GATEH__

Assign a name (maximum eight characters) to represent the partner gateway half whose address was just listed in the previous field. Refer to the Internet Map (Figure 4-1) and Gateway-Half Map (Figure 5-4).

NEIGHBOR GATEWAY REACHABLE NETWORKS (NETXPORT.NI.*niName*.INTERNET.*gatewayn*)

Neighbor Gateway IP Internet Address C 192.006.251 001

Full IP address of the gateway node named above; same as the address in the IP Address field, listed previously.

IP Network Address

C 192.006.001 000 ______________ (1)

______________ (2)

______________ (3)

______________ (4)

The IP addresses of all reachable networks in the internet, through the gateway node named above. Refer to Gateway-Half Node Internet Routing Table (Table 6-6). We have filled in the node portion for each IP network address with zeroes because the node portion will be ignored in this field during configuration. A node portion still must be entered, however.

Hops

______ 1 ______ (1)

______________ (2)

______________ (3)

______________ (4)

Refer to Gateway-Half Node Internet Routing Table (Table 6-6) for Hop Count. The numbers in parentheses correspond to the numbers regarding IP network addresses.

## Node Worksheets for Your Records

GATEWAY-HALF CONFIGURATION SCREENS

GLOBAL TRANSPORT CONFIGURATION (NETXPORT.GLOBAL)

Home Network Name ________________

Enter the name of the network the node belongs to; the node must have a corresponding LAN or Router NI name configured. Refer to the appropriate maps. If the node belongs to more than one network, the home network should be the one that will allow the greatest number of destination networks a short return path to the node.

LAP-B LINK DATA (LINK.*linkname*)

Physical Path __________

The physical path of the PSI card.

Local Mode (5 = DTE, 6 = DCE, 11 = HP Point-to-Point______

HP recommends that you use the default, HP Point to Point. If so, both sides of the link must be configured as HP Point to Point.

NETWORK INTERFACE LINKS (NETXPORT.NI.*niName*.LINK)

Type ____________

DD--Direct Dial, or DC--Direct Connect

GATEWAY-HALF DIAL LINK CONFIGURATION (NETXPORT.NI.*niName*.LINK.*linkname*)

Gateway Phone _________

The Phone number of the remote gateway-half node.

Security String ________________

Security String of the remote gateway-half node.

OR

DIRECT CONNECT CONFIGURATION (NETXPORT.NI.*ni-Name*.LINK.*linkname*)

No fields required to configure.

GATEWAY-HALF NETWORK INTERFACE CONFIGURATION (NETXPORT.NI.*niName*)

Idle Device Timeout Value (minutes)__________________________.

For dial links, this is the number of minutes a device can remain idle (no traffic) before shutting down. A value of zero will disable the idle device timer for all devices on this network interface. (Enter 0 for Direct Connect links.)

IP PROTOCOL CONFIGURATION (NETXPORT.NI.*ni-Name*.PROTOCOL.IP)

IP Address ____________

Full IP address of the partner gateway-half node (the node connected to the gateway half being configured). Refer to Gateway-Half Network Interface Table.

NEIGHBOR GATEWAYS (NETXPORT.NI.*niName*.INTERNET)

Gateway Name ____________

Assign a name (maximum eight characters) to reference a gateway half that is connected to the node by the gateway-half link previously named. Refer to Internetwork Map and Gateway-Half Map.

NEIGHBOR GATEWAY REACHABLE NETWORKS (NETXPORT.NI.*niName*.INTERNET.*gatewayn*)

Neighbor Gateway IP Internet Address __________

Full IP address of the gateway node named above. Refer to Gateway-Half Network Interface Table. This address will match the address configured in the IP Address field listed above.

IP Network Address

________________________(1)

________________________(2)

________________________(3)

________________________(4)

The IP address of all reachable networks in the internetwork, through the gateway node named above. Refer to Gateway-Half Node Internet Routing Table. You need to fill out a node portion for each IP Network Address, even through the node portion is ignored. You can simply enter zeros for these node portions.

Hops

________________________(1)

________________________(2)

________________________(3)

________________________(4)

Refer to Gateway Half Node Internet Routing Table for Hop Count. The numbers in parentheses correspond to the numbers regarding IP network addresses.

## SUBSEQUENT GATEWAY-HALF NODES

Home Network Name ______________________________

Link Name ______________________________________

Type = LAP-B

Logical Device ___________________________________

DTE/DCE for LAP-B _____________________________

Is link Direct Dial or Direct Connect ___________________

If Dial, phone number of remote gateway-half node ________

If Dial, security string of remote gateway-half node ________

Idle Device Timeout Value __________________________

IP Address of partner gateway half_____________________

Gateway name ___________________________________

Neighbor Gateway IP Internet Address

_______________________________________________

IP Network Address____________ Hops _____________

IP Network Address____________ Hops _____________

IP Network Address____________ Hops _____________

IP Network Address____________ Hops _____________

A

# Supported Modems

The following modems are supported for NS Point-to-Point 3000/XL links:

| Modem | Link Protocol |
|---|---|
| AT&T/201C | LAP-B |
| AT&T/2024A | LAP-B |
| AT&T/2048A | LAP-B |
| AT&T/2096A | LAP-B |
| AT&T/2248 | LAP-B |
| AT&T/2296 | LAP-B |
| AT&T/2556 DSU | LAP-B |
| AT&T/2597 DSU | LAP-B |
| CODEX/2640 | LAP-B |
| CODE/ 2660 | LAP-B |
| CODEX/2680 | LAP-B |
| CODEX/2260 | LAP-B |

**Note**

A node *initiating* a connection across a dial link MUST use a modem with an **autodialer**; otherwise, a dial-up connection cannot be established. If an autodialer is not used on one end of a connection, the connection may time out and be unavailable. Therefore, HP strongly advocates using modems with autodialers for both the initiating and receiving ends of a dial-up connection.

B

# PC-TO-HP 3000 Communication

This appendix summarizes the tasks required for connecting personal computers (PCs) to HP 3000 Series 900s over ThinLAN 3000/XL or StarLAN 10 3000/XL networking links. Connecting PCs and HP 3000 Series 900s over these links enables PC users to take advantage of Hewlett-Packard software products that make resources and programs operating on the HP 3000 available to PCs. For full details about the HP 3000 tasks that this appendix summarizes, read and follow the instructions given earlier in this manual.

**Note**

This appendix discusses the tasks required for the configuration of an HP 3000 connected to a PC workstation over a ThinLAN 3000/XL or StarLAN 10 3000/XL Network Link. For workstation configuration tasks, refer to the *PC Workstation Configuration Guide for LANs -- HP OfficeShare Network* (part no. 50929-90001).

The procedures summarized in this appendix will normally be completed by the individual responsible for managing the networking capabilities of the HP 3000--usually the HP 3000 network manager or HP 3000 Series 900 system manager. The actual titles and responsibilities of people at your installation may differ from those used here.

**Your HP systems engineer may already have completed some or all of these procedures for your network installation. Consult your systems engineer to determine which tasks, if any, already have been completed.**

# Link Requirements

## Software Required

Resource Sharing and virtual terminal access require several Hewlett-Packard software packages. The following lists indicate the software required for different uses of PCs and HP 3000 Series 900:

### HP 3000 Series 900 Server Software

An HP 3000 is used as a server with Resource Sharing to provide shared discs, shared printers, and an HP 3000 backup facility. The following software is required for the HP 3000 Series 900:

- MPE XL Operating System
- NS3000/XL Network Services or the services software included with either ThinLAN 3000/XL Link or StarLAN 10 3000/XL Link.
- Productivity Services/3000 Resource Sharing.

### HP 3000 Series 900 Software

An HP 3000 is used as a host over ThinLAN 3000/XL Link or StarLAN 10 3000/XL Network Link for products such as Information Access and AdvanceMail. The following software is required on the HP 3000 Series 900 when operating as a host over these links:

- MPE XL Operating System
- NS3000/XL Network Services or the services included with either ThinLAN 3000/XL Link, StarLAN 10 3000/XL.

### Software for a PC Workstation using Server Resources

A PC used as a workstation on the network can use the network to perform certain tasks. The following software is required for the PC if it is using a PC server's or HP 3000 Series 900 server's shared resources:

For ThinLAN

- Version 3.1, 3.2 or 3.3 (the latest version available for your computer is recommended) of the DOS operating system and utilities, and
- Version A.03.00 or later of the HP ThinLAN User Link Software for Vectra/IBM PCs or Version A.03.00 or later of the HP ThinLAN User Link Software for Touchscreen PCs.

For StarLAN 10 3000/XL

- Version 3.1, 3.2 or 3.3 (the latest version available for your computer is recommended) of the DOS operating system and utilities, and
- Version A.01.00 or later of the HP StarLAN 10 3000/XL User Link Software for Vectra/IBM PCs

## Software for a PC Workstation Used as a Terminal

A PC workstation can use AdvanceLink to communicate with an HP 3000 host computer as though the workstation were a terminal connected to the HP 3000 Series 900 by RS-232 cable. When used as a terminal, the following software is required for the PC:

For ThinLAN

- Version 3.1, 3.2 or 3.3 (the latest version available for your computer is recommended) of the DOS operating system and utilities
- Version A.03.00 or later of the HP ThinLAN User Link Software for Vectra/IBM PCs or Version A.03.00 or later of the HP ThinLAN User Link Software for Touchscreen PCs
- Version A.03.02 or later of the HP AdvanceLink (for Touchscreen PCs) or HP AdanceLink 2392 (for HP Vectra PCs and IBM PC/XT/ATs).

For StarLAN 10 3000/XL

- Version 3.1, 3.2 or 3.3 (the latest version available for your computer is recommended) of the DOS operating system and utilities
- Version A.01.00 or later of the HP StarLAN 10 3000/XL User Link Software for Vectra/IBM PCs
- HP AdvanceLink 2392 (for HP Vectra PCs and IBM PC/XT/ATs).

**Note**

A PC being use as both a terminal and as a workstation sharing a server's resources requires the software listed under "For a PC Workstation Used as a Terminal." One copy of DOS and utilities and either HP ThinLAN User Link Software or HP StarLAN 10 3000/XL User Link Software is needed for each workstation.

## Related Publications

You should refer to the following Hewlett-Packard documentation when configuring a PC workstation or HP 3000 Series 900:

HP ThinLAN for PCs

- *PC Workstation Configuration Guide for LANs -- HP Office-Sharing Network* (part no. 50929-90001)
- *Planning Guide for LANs -- HP OfficeSharing Network* (part no. 50929-90000)

HP Star LAN 10 3000/XL for PCs

- *PC Workstation Configuration Guide for LANs -- HP Office-Sharing Network* (part no. 50929-90001)
- *Planning Guide for LANs -- HP OfficeSharing Network* (part no. 50929-90000)
- *HP 27211A StarLAN 10 3000/XL Interface Card Installation Guide* (part no. 27211-90010)

Resource Sharing

- *Resource Sharing: System Management* (part no. 32597-90001)
- R*esource Sharing: Utilities* (part no. 32597-90001)

NS3000/XL Links

- *NS3000/XL Local Area Network Configuration Guide* (part no. 36922-90005)

Other HP manuals describe additional products that use the HP 3000 Series 900 as a host. Consult your HP representative for information on additional products and the publications that describe them.

**Note**

Although this appendix outlines required PC configuration tasks, the tasks are described in detail only in the manuals listed above for HP ThinLAN for PCs or HP StarLAN 10 3000/XL for PCs. The specific manual or sections of this manual to which you should refer for more information about a particular task are noted throughout this appendix.

## Hardware and Software Installation

Before you can attempt the procedure summarized in this appendix, the installation of certain hardware and software already must be completed on either each PC workstation being configured or on the HP 3000 Series 900. Before you begin the procedures summarized on the following pages, **make sure that:**

For HP 3000 Series 900s

- A hardware card (LANIC for IEEE 802.3 networks, PSI for router networks) is properly installed in the backplane of the HP 3000 Series 900
- Resource Sharing is installed on the HP 3000 Series 900, if Resource Sharing will be used.
- (For Resource Sharing only) Public shared discs and shared printers, if applicable, have been set up on the HP 3000 Series 900 with the RESMGR utility.

For PC Workstations

- The network is planned as described in the *Planning Guide for LANs -- HP OfficeSharing Network* and a "User Reference Worksheet" has been filled out for each PC workstation.
- The required network hardware is set up, as described in the *Planning Guide for LANs -- HP OfficeSharing Network.*
- Each PC workstation's software is installed, either on work discs or on a fixed disc, as described in the *Planning Guide for LANs -- HP OfficeSharing Network.*

If PC servers are also being used as part of the network, they should also be configured before the tasks described in this appendix are begun. For more information on configuring PC servers, refer to the *PC Server Guide for LANs -- HP OfficeSharing Network.*

## HP 3000 Series 900 Logon and Shortname Correspondence

The PC network manager and HP 3000 Series 900 system manager should agree upon HP 3000 Series 900 account pathnames (user logons, groups, accounts, and access permissions) and corresponding **shortnames** before the tasks summarized in the following pages are begun. (A **shortname** is an alias used to designate the full device ID and pathname on a shared disc. Refer to the *Resource Sharing* documentation cited previously.)

# Configuration Procedures Summary

The following sections summarize the tasks that must be completed to configure PC workstations and HP 3000 Series 900s in order to use the HP 3000 Series 900 as a server to PC workstations (via Resource Sharing), to use HP AdvanceLink, and for other software products that use the HP 3000 Series 900 as a host.

The configuration tasks can be divided as shown in the Table B-1 and as described in the following sections.

**Table B-1. Configuration Task Summary**

| Task | Done By | Reference |
|---|---|---|
| Configuring the PC workstation with the USRCONF utility and loading PC workstation network software | PC network manager | For ThinLAN-- *PC Workstation Configuration Guide for LANS -- HP OfficeShare Network*<br>For StarLAN 10 3000/XL-- *PC Workstation Configuration Guide for LANs -- HP Office Share Network* |
| Configuring the HP 3000 Series 900 | HP 3000 Series 900 Network manager | Individual network configuration guides, or *NS3000/XL Screens Reference Manual*<br><br>*Resource Sharing: System Management* (for Resource Sharing only) |
| Assigning HP 3000 Series 900 Logons | HP 3000 Series 900 system manager | *Account Structure and Security* (MPE XL System Administrator Series) |

## PC Workstation Configuration

After the HP 3000 Series 900 has been configured, configure the PC workstation and load PC workstation network software. Refer to the manuals listed above.

## Configuring the HP 3000 Series 900

**(HP 3000 Series 900 network manager)**

Two utilities are used to configure the HP 3000 Series 900: SYSGEN and NMMGR. SYSGEN is used to configure the hardware card that has been installed in the backplane of the HP 3000 Series 900.

**Note**

A hardware card must be installed on the HP 3000 Series 900 before any further configuration tasks can be performed. Consult your HP 3000 Series 900 network manager or HP System Engineer for more information.

Once the hardware card has been installed, configuring the HP 3000 Series 900 to support Resource Sharing, AdvanceLink, or other products that use the HP 3000 Series 900 as a host consists of configuring the HP 3000 Series 900 as part of an NS3000/XL network with the NMMGR utility. (Note: this appendix assumes that the HP 3000 Series 900 has not been previously configured as a node on an NS3000/XL network. If the HP 3000 Series 900 *has* been configured already, some configuration changes may be required. These are noted later in this appendix.)

## Configuring the Network Configuration File (NMCONFIG.PUB.SYS)

This subsection describes the minimum tasks that must be performed to configure an HP 3000 Series 900 as a node on an NS3000/XL IEEE 802.3 network.

**Consult your HP 3000 Series 900 network manager or your HP systems engineer before attempting the tasks described here.**

NMMGR is a screen-based utility. This means that as you press function keys or type in commands, a series of display screens appear at your terminal. Various fields displayed within each screen correspond to configurable items; configuration occurs when values are typed into the field and recorded.

The following tables contain two types of fields in the **Item** column. One type is a field that *must* be be user-configured as part of a minimum network configuration as no default value is supplied by NMMGR. However, Guided Configuration enables you to input data for each screen that requires values input by the HP 3000 Series 900 System Manager. Guided Configuration completely and correctly configures a network for you. The other type of field is a field for which a default value is provided, but which can be modified by the HP 3000 Series 900 System Manager to meet the needs of the network. The **Requirement Status** field indicates whether the parameter in the Item field has a default value or requires that a be input by the HP 3000 Series 900 System Manager. The screen on which an item appears is listed in the **Screen** column.

To reach screens not visited by guided configuration, you need to use manual configuration. See the *NS3000/XL Screens Reference Manual* for details.

**Note**

If your HP 3000 Series is already part of an NS3000/XL network, you may have to alter some fields in the following tables, but you will not need to configure the HP 3000 Series 900 node name, IP address, or physical address, as they will have been configured already.

Internet screens are not shown in the table because they are not necessary for this discussion of PC-to-HP 3000 Series 900 communication. However, internet routing screens, no matter what network type, must be visited if you want the HP 3000 Series 900 to be able to communicate with other networks that are part of the same internetwork. See the individual network configuration guide for your network or the *NS3000/XL Screens Reference Manual* for more information.

Also, the Probe Protocol screen is not included in the LAN table. This screen is used when you want to configure an HP 3000 Series 900 as a proxy server containing directory information about all nodes in the catenet.

The term "node name" in this appendix has the same meaning as "computer name" in HP networking PC manuals.

---

For information on configuring additional items, as well as complete information on configuring with NMMGR, refer to either the individual network configuration guide for your type of network or the *NS3000/XL Screens Reference Manual.*

For information on configuring the HP 3000 Series 900 as a node on the network in order to operate Resource Sharing, refer to *Resource Sharing: System Management.*

## Assigning HP 3000 Series 900 Logons

**(HP 3000 Series 900 system manager)**

For each PC user using AdvanceLink or AdvanceLink 2392 for HP Series 900 access, the HP 3000 Series 900 System Manager should assign a user logon. Refer to the *Account Structure and Security Manual* in the System Administrator's Series for information about assigning user logons.

For each PC user using Resource Sharing, assign Resource Sharing automatic logons with the RESMGR utility. Refer to *Resource Sharing: Utilities* for more information.

The configuration of PC user logons may vary for different application software products. Refer to the documentation provided for a particular product for information about logon configuration.

**Table B-2. Configuration Items for ThinLAN and StarLAN 10 3000/XL Networks**

| Screen | Item | Requirement Status |
|---|---|---|
| GUIDED NETWORK INTERFACE CONFIGURATION | Network interface name. | Required. |
| NODE NAME CONFIGURATION | HP 3000 Series 900 node name. | Required. Keep track of this node name, including its *domain* and *organization* fields, because you will need it during configuration of a PC workstation with the USRCONFG utility. |
| LINK CONFIGURATION | Link Name. | Required. |
| LINK CONFIGURATION IEEE 802.3 LINK DATA | LANIC card's physical path. | Required. |
| IP PROTOCOL CONFIGURATION | HP 3000 Series 900 IP address. | Required. |
| GLOBAL TRANSPORT CONFIGURATION | Maximum directly connected nodes and maximum inbound destinations. (Values for these fields should be greater than or equal to the number of nodes, including PC workstations and PC servers, in the network.) | Use the default unless number of network nodes (including PC workstations and servers) exceeds 100. |

**Table B-2. Configuration Items for ThinLAN and StarLAN 10 3000/XL Networks (continued)**

| Screen | Item | Requirement Status |
|---|---|---|
| TRANSMISSION CONTROL PROTOCOL (TCP) CONFIGURATION | Maximum number of connections. | Use the default unless maximum number of connections in use at one time will exceed 128 (the default). This value should allow for two connections for each concurrent usage of Resource Sharing and one connection for each concurrent usage of other network applications and services. |
| LAN 802.3 NETWORK INTERFACE CONFIGURATION | Maximum number of nodes in network (to include all PC workstations and servers). | Use the default unless number of nodes in network exceeds 100 (the default). |
| | Number of outbound buffers. | Use the default unless maximum number of connection configured in TRANSMISSION CONTROL PROTOCOL (TCP) CONFIGURATION screen is greater than 128. |

C

# MPE/V to MPE XL Migration

This appendix provides a quick overview of the planning and tasks you will need to do to migrate an NS3000 network from an MPE/V system to an MPE XL system. This appendix assumes that you are migrating your network as a whole; that is, replacing all MPE V systems with MPE XL systems and maintaining the same basic network function. If you are making additional changes to your network (for example, converting from a LAN-only version of NS3000 to one that supports multiple link types) you should refer to the *NS3000/XL Operations and Maintenance Reference Manual* (36920-90010). The "Changing a Network" chapter of this manual includes information on changing the network topology once the migration to MPE XL is accomplished.

The following topics are covered by this appendix:

- Differences between NS3000/V and NS3000/XL networks.
- An overview of migration tasks.
- Guidelines for converting files.
- Guidelines for reconfiguring a network.

**Note**

This appendix does not cover the situation where you want to merge MPE/V X.25 configuration information with a prior version of MPE/XL. For this situation, you must refer to the *X.25 XL System Access Configuration Guide.*

# Differences Between NS3000/V and NS3000/XL

There are a number of differences between the way NS is implemented on MPE V systems and the way it is implemented on MPE XL systems. These differences affect the network itself, some of the applications that users may run over the network, and the command used to obtain status information about the network. Since it is helpful to understand these differences as you prepare to move an existing MPE V network to MPE XL, they are summarized below.

## Differences in the Network

A number of the methods available for making connections to an MPE V network are not available with NS3000/XL. If your MPE V network includes one of these you will need to modify your network configuration before attempting to use the network on MPE XL systems. More information on the specific steps required to modify or remove unsupported links or connections can be found later in this appendix.

The connection methods that are not supported on NS3000/XL are:

- Manual dial modems.
- Asynchronous Network Link .
- Bisynchronous link-level protocol.

In addition, while it is possible to access a DS/3000 node directly from an NS3000/V node, this capability is not supported on NS3000/XL. A user of an NS3000/XL network who wants to access a DS/3000 node must first access an MPE V NS node. This is because the DS/3000 code that was included as a subset of the NS3000/V code is not provided with NS3000/XL.

## Differences in Applications Support

There are also differences in the implementations of NS3000/V and NS3000/XL that will affect certain applications that users may currently be running on your MPE V network. These differences are as follows:

- NS3000/XL supports PTOP for HPDESK only.

  On NS3000/XL PTOP is not supported for applications other than HPDESK. Network users who are running PTOP programs will need to convert them to NetIPC/RPM programs before running them on an NS3000/XL network. Refer to the *NetIPC 3000/XL Programmer's Reference Manual* (5958-8600) and the *NS3000/XL User/Programmer Reference Manual* (36920-90001) for more information.

- Nowait I/O RFA is not available with NS3000/XL.

  Privileged mode programs that use nowait I/O Remote File Access over an MPE V network will need to be modified before they can be run on an NS3000/XL network. Refer to the *NS3000/XL User/Programmer Reference Manual* (36920-90001) for more information.

## Difference in How to Obtain Status Information

On MPE V systems the `SHOWCOM` command returns status information about a communication device, and is used to determine line activity and quality. This information is still available on NS3000/XL, but is accessed through a different command. Use the `LINKCONTROL...;STATUS` command to access status information on NS3000/XL.

# Migration Overview

There are a number of steps that you must take to successfully convert an MPE V network for use as an MPE XL network. These tasks are summarized below, and described in more detail in the remainder of this appendix. Keep in mind that, depending on the needs of your installation, you may need to perform additional tasks to complete your migration. For example, if you are adding communication links that did not exist on your MPE V network you will need to configure the new links in addition to making the changes required by the differences between NS3000/V and NS3000/XL.

## Before You Start

This guide provides an extensive overview of NS architecture and networking concepts. It also furnishes configuration design checks, planning worksheets and examples to aid you in organizing new network configurations. You should be thoroughly familiar with this material before you begin your migration.

## File Migration Tasks

There are two primary tasks you will need to perform to migrate your network configuration files. These are:

1. Run the NMMGRVER utility on the old configuration files to convert them to the current software version. (You will first need to install a copy of all configuration files used for your NS3000/V network to the MPE XL network). Refer to "File Conversion Guidelines" later in this appendix.

2. Run the NMMGR utility on the new configuration file(s) to make any changes required due to the differences between NS3000/V and NS3000/XL. Refer to "Reconfiguration Guidelines" later in this appendix.

## Additional Migration Considerations

This appendix does not discuss hardware migration considerations; however, you will find a description of hardware components in this manual. Additionally, details of hardware installation and configuration can be found in the following manuals:

- *LANIC Installation and Service Manual* (36923-90001)
- *LAN Cable and Accessories Installation Manual* (5955-7680)
- *Central Bus Programmable Serial Interface Installation and Reference Manual* (30263-90001)

# File Conversion Guidelines

A file conversion utility called NMMGRVER.PUB.SYS allows you to convert earlier versions of subsystems for use with the current version of Node Management Services (NMS) by converting the files to an acceptable format.

## When you Need to Convert Files

If you have not successfully converted your files you will be notified that conversion is necessary when you try either to run NMMGR or to perform a NETCONTROL command. If you attempt to run NMMGR against an unconverted configuration file you will receive the message:

```
Version mismatch found on specified subsystem. Please run NMMGRVER. (NMGRERR 53)
```

If you attempt to perform NETCONTROL while using unconverted files you will receive the following message at the console:

```
Bad CONFIG File Version
```

In either case you should stop your current activity and run the NMMGRVER.PUB.SYS file conversion utility on your configuration files.

**Warning**

**The conversion procedure that follows will not preserve any previously configured Distributed Terminal Subsystem (DTS) configuration values. If you are updating from an earlier version of MPE XL at the same time you are migrating from NS3000/V to NS3000/XL, you should see the information under "Updating From a Previous MPE XL Version" later in this appendix before converting your configuration files.**

## How to Convert Files

You should follow the steps below to convert your configuration files using NMMGRVER:

1. Make a backup copy of the existing configuration files.

2. Install a copy of the MPE/V NMCONFIG file to NMCONFIG.PUB.SYS on the MPE XL system, and then install copies of any NSCONF files.

3. Execute NMMGRVER.PUB.SYS by entering:

   ```
   RUN NMMGRVER.PUB.SYS
   ```

   The system responds with the following banner:

```
NMS Configuration File Conversion Utility 32099-11018 V.uu.ff
(C) Hewlett-Packard Co. 1985
```

4. The system will then prompt for the name of the configuration file to be converted by displaying the message:

   ```
   Fileset to be scanned?
   ```

   You can then choose to end the conversion program by pressing the [Enter] key, or you can enter one of the following filesets:

   *filename [.groupname [.acctname]]*
   *@ [.groupname [.acctname]]*
   *@.@ [.acctname]*
   *@.@.@*

   NMMGRVER searches for files of type nconf in the specified fileset. For each file found, it asks:

   OK to convert *filename.groupname.acctname*?

   where *filename.groupname.acctname* is the name of a configuration file. Enter Y for yes, or enter either N or [Enter] for no.

5. NMMGRVER checks the configuration file to determine whether it is an MPE/V or an MPE XL configuration file. If it is an MPE XL file the conversion proceeds without further user input. If the file is an MPE/V file, however, NMMGRVER prompts you for the type of MPE/V file you are converting, as follows:

   ```
   What is the type of this file?
   1) MPE V NSCONF
   2) MPE V NMCONFIG
   3) skip this file
   Enter a value between 1 and 3.
   ```

   Enter the appropriate value.

6. After each file is converted NMMGRVER will display the following message:

   ```
   FILE CONVERTED
   ```

Continue to enter either Y, N, or [Enter] until you have converted all files.

In the conversion process, NMMGRVER will merge the information from each NSCONF file accepted for conversion with NMCONFIG.PUB.SYS, and create new (converted) NSCONF files. If you have converted more than one NSCONF file, you will need to choose the file that corresponds to the network configuration you want, and rename it as the new NMCONFIG.PUB.SYS. Choose the NSCONF file that corresponds to the network configuration you want to use as your NS3000/XL configuration.

This new NMCONFIG.PUB.SYS file contains your NS configuration in a format acceptable to MPE XL. You can now run NMMGR to configure the DTS subsystem, and to perform any needed modifications to the NS configuration. See "Reconfiguration Guidelines" later in this appendix.

## Updating From a Previous MPE XL Version

If you are updating from an earlier version of MPE XL at the same time you are migrating from NS3000/V to NS3000/XL, you will need to make a choice between reconfiguring your Distributed Terminal Subsystem (DTS) and reconfiguring your NS network. The choice is necessary because MPE/V versions of NMCONFIG.PUB.SYS files do not include DTS configuration values.

You should let the circumstances of your installation determine which configuration values you preserve. If your NS network is complex, you may decide to convert the existing MPE/V configuration files, and reconfigure DTS. In this case you should follow the steps under "File Conversion Guidelines" earlier in this appendix.

If, on the other hand, your DTS configuration is extensive, you may decide to migrate your existing MPE XL configuration files to the new version of MPE XL. You will then need to redo your NS network configuration so that both the NS and DTS configurations are contained in a single, valid, MPE XL NMCONFIG.PUB.SYS file.

In any case, you will need to reconfigure either NS or DTS if you are both updating MPE XL and converting from an NS3000/V network to an NS3000/XL network.

# Reconfiguration Guidelines

Once your MPE/V NS configuration files have been converted for use with the MPE XL version of NS you will need to reconfigure your network to account for the implementation differences between NS3000/V and NS3000/XL. Run the NMMGR utility against the configuration file generated by the file conversion process and perform the following reconfiguration tasks:

- Configure the physical path of all links for your network. This configuration consists of a channel number (ccc) and subchannel number (sss) in the form ccc.sss. There is no channel or subchannel associated with NS on MPE V.
- Since the LAP-B protocol is the only point-to-point link-level protocol supported on the MPE XL computer, you must reconfigure links that were configured as bisynchronous links on NS3000/V as LAP-B links, or remove them from the network configuration.
- Configure the Distributed Terminal Subsystem (DTS) according to the needs of your installation. Refer to the *Asynchronous Serial Communications System Administrator's Reference Manual* for instructions on how to configure the DTS.

The above configuration tasks are a general summary of what you will need to do to reconfigure your network to run on MPE XL. You should be aware that there are many changes to individual screens and screen fields. For more information on configuration screens and the values to enter for your configuration you should refer to the *NS/XL Local Area Network Configuration Guide* (36922-90005) or the *NS Point-to-Point 3000/XL Network Configuration Guide* (36922-90006), as appropriate for the link type(s) you are configuring.

# Glossary

## A

**access port**
A special interface card in the system cabinet through which the MPE XL system console is connected.

**address**
A numerical identifier defined and used by a particular protocol and associated software to distinguish one node from another.

**address key**
*See* X.25 address key.

**address resolution**
In NS networks, the mapping of node names to IP addresses and the mapping of IP addresses to subnet addresses.

**adjacent**
A node on a point-to-point network that is connected to another node by a single link with no intervening nodes.

**ASCII**
American National Standard Code for Information Interchange. A character set using 7-bit code used for information interchange among data processing and data communications systems. The American implementation of International Alphabet No. 5.

**asynchronous**
A device's mode of operation in which a sequence of operations are executed irrespective of time coincidence with any event. Devices that are directly accessible by people (for example, terminal keyboards) operate in this manner.

**Attachment Unit Interface**
AUI. The cable that runs between each node (host, DTC, or other device) and the Medium Attachment Unit (MAU) that connects it to the LAN in a ThickLAN configuration.

**autodial**
A dial link in which the remote node's telephone number is automatically dialed by a modem or other device with this capability.

## B

**backbone LAN**
A thick LAN cable conforming to the IEEE 802.3 Type 10 BASE 5 Standard.

**back-to-back configuration**
A DTC configuration whereby MPE users connected to one DTC can communicate with a non-MPE XL system connected to another DTC via the LAN. *See also* local switching.

**banner** A welcome message displayed on your screen. On the local OpenView workstation a banner appears when a remote connection is established with the OpenView DTC Manager. A banner also can appear when you log on to MPE.

**baud** The measure of the speed at which information travels between devices, most commonly used in reference to terminal speed settings. Baud represents signal events per second. When one bit represents each signal change, baud is the same as "bits per second."

**binary mode** A data-transfer scheme in which no special character processing is performed. All characters are considered to be data and are passed through with no control actions being taken.

**bit** Binary digit. A unit of information that designates one of two possible states, which are represented by either 1 or 0.

**block mode** A terminal processing mode in which groups, or "blocks," of data are transmitted all at once.

**BNC T-Connector** A connector used to connect a computer or a component such as a DTC to the LAN in a ThinLAN configuration.

**boundary** *See* network boundary.

**bps** Bits per second. The number of bits passing a point per second.

**broadcast** Communication method of sending a message to all devices on a link simultaneously.

**buffer** A logical grouping of a system's memory resources used by NS3000/XL.

**byte** A sequence of eight consecutive bits operated on as a unit.

## C

**call** In X.25, a call is an attempt to set up communication between two DTEs using a virtual circuit. Also known as a virtual call.

**call collision** A conflict that occurs at a DTE/DCE interface when there is a simultaneous attempt by the DTE and DCE to set up a call using the same logical channel identifier.

**called address** When a node sends out a call request packet, the packet contains the address of the destination node. The address of the destination node is the called address.

**calling address** When a node receives an incoming call packet, the packet contains the address of the sending node. The address of the sending node is the calling address.

**carrier** A continuous wave that is modulated by an information-bearing signal.

**catenet** *See* internetwork.

**CCITT** Consultative Committee for International Telephony and Telegraphy. An international organization of communication carriers, especially government telephone monopolies, responsible for developing telecommunication standards by making recommendations. The emphasis is on "recommendations." No carrier is required to adhere to a CCITT recommendation, although most do so in their own interests.

**CIB** The channel input/output bus in the backplane of an HP 3000.

**circuit-switching network** A type of data communications network wherein a physical and exclusive link is maintained between two communicating devices for the call duration. An all-digital, circuit-switching network is often referred to as an X.21 network.

**closed user group** An X.25 user facility that allows communication to and from a prespecified group of users and no one else.

**compatibility mode** A processing mode on HP 3000 Series 900 computers that allows applications written for MPE V/E-based systems to be ported and run without changes or recompilation.

**computer network** A group of computer systems connected in such a way that they can exchange information and share resources.

**configuration** 1) The way in which computer equipment is physically interconnected and set up to operate as a system. 2) The layout of the computer system, including the MPE table, memory, and buffer sizes, that tells which peripheral devices are (or can be) connected to the computer and how they can be accessed. 3) The process of defining the characteristics of a network in software.

For MPE XL-based computers, the operating systems are configured through use of the SYSGEN utility.

Next, the Distributed Terminal Subsystem (DTS) link is configured by using NMMGR (running on the host) and can, in addition, be configured using the OpenView DTC Manager software (running on the OpenView Windows Workstation) depending on the type of network management you use.

A system that is to run network services (NS3000/XL) is configured through use of NMMGR.

Access to X.25 is configured in two parts. The X.25 XL System Access software is configured on the host through use of NMMGR. The DTC/X.25 Network Access software residing on the DTC is configured at the OpenView Windows Workstation through use of the OpenView DTC Manager.

**configuration file** The configuration file contains the information that the network needs in order to operate. This file also contains information necessary for link-level and NetIPC logging. The only file name that the system recognizes is NMCONFIG.PUB.SYS.

**control-X echo** Three exclamation marks (! ! !) output to the terminal screen when the cancel character (normally **[CTRL]X**) is entered.

**control-Y trap** A user-written procedure to which control is passed when the subsystem break character (normally**[CTRL]Y**) is entered during execution of a program with subsystem break enabled.

**cross-validate** The process of assuring that information contained in two locations is consistent where it is imperative that it be consistent. For example, an automatic cross-validation occurs when you enter SYSGEN to assure that information contained in NMCONFIG.PUB.SYS agrees with system configuration data.

**CSMA/CD** Carrier Sense Multiple Access with Collision Detect, transmission access method used by the IEEE 802.3 LAN standard.

**CSN** *See* circuit-switching network.

**CTB** The cache transfer bus in the backplane of an HP 3000.

**CUG** *See* closed user group.

## D

**data** Basic elements of information that can be processed or produced by a computer.

**Datacommunications and Terminal Controller** *See* DTC.

**data overrun** Transmitted data that is sent faster than the receiving equipment can receive it. The resultant overflow data is lost. *See also* flow control.

**Datapac** The national public PSN of Canada.

**Datex-P** The national public PSN of West Germany.

**D bit** Delivery confirmation bit. Used in the X.25 protocol, the setting of the D bit in DATA packets indicates whether delivery acknowledgement of the packet is required from the local DCE or from the remote DTE. It therefore allows the choice between local and end-to-end acknowledgement.

**DCE** Data circuit-terminating equipment. The interfacing equipment required in order to interface to data terminal equipment (DTE) and its transmission circuit. Synonyms: data communications equipment, dataset.

**DDX** The national public PSN of Japan.

**dedicated printer** A printer that can be used only by one host on the LAN--the one specified in the Destination Node Name in that printer's configuration screen.

**demodulation** The process by which the information-bearing signal is retrieved from a modulated carrier wave. The inverse of modulation.

**destination node name** In DTS configuration, it is either 1) the name of a host that a user can be connected to by default (if switching is not enabled for that user, or if automatic modem connection is enabled), or 2) the name of the only host that can access a dedicated printer.

**device class** A collection of devices that have some user-defined relation. Device classes are assigned through use of the NMMGR configuration program.

**device-dependent characteristic** A file specification for which modifications are restricted because of the type of device on which the file is opened. For example, data directed to terminals must have a blocking factor of one.

**device driver** A software module that controls a specific type of input/output device.

**devicefile** A file being input to or output from any peripheral device except a disc. MPE XL allows operations to be performed on the device itself as if it were a file.

**device independence** A characteristic of the operating system that allows users to selectively redirect input/output from a program, session, or job without regard to the nature of the device.

**device name** *See* PAD name.

**Dial ID protocol** A proprietary Hewlett-Packard protocol that provides security checking and address exchange for dial links.

**dial link** A connection made through public telephone lines.

**direct-connect device** An asynchronous device that is connected directly to a DTC through an RS-232-C or RS-422 cable, with no intervening communications equipment. Also referred to as a "local connection."

**direct connection** A leased line, private line, or other non-switched link in a network.

**direct dial** A dial link through which only one remote node can be reached.

**direct-path branching** The process of directly accessing any screen in NMMGR by entering a path name in the `Command:` field. The path name must be preceded by an at sign (@).

**download** The process of loading operating code and configuration files into the DTC's memory. The DTC is downloaded by the MPE XL host for LANs using host-based network management, and by the PC for DTCs managed by the OpenView DTC Manager.

**driver** Software that controls input/output devices including NS3000/XL links.

**DTC** Datacommunications and Terminal Controller. The DTC is a hardware device, configured as a node on a LAN, that enables asynchronous devices to access HP 3000 Series 900 computers. Terminals can either be directly connected to the DTC, or they can be remotely connected through a Packet Assembler Disassembler (PAD). The DTC can be configured with DTC/X.25 Network Access cards and DTC/X.25 Network Access software. A DTC/X.25 XL Network Link consists of two software modules: the X.25 XL System Access software (running on the host) and the DTC/X.25 Network Access software (running on the DTC).

**DTC identifier** An identifier used only within NMMGR to define the branch of the configuration file containing information about a particular DTC. The identifier must begin with a letter and can be up to eight characters long.

**DTC Manager** *See* OpenView DTC Manager.

**DTC node name** A unique name used to identify a DTC on a LAN. The node name format is *nodename.domain.organization*, with each of the three parts having up to 16 characters. The name begins with either a letter or a digit.

**DTC station address (802.3 address)** A 12-digit hexadecimal number used to identify the DTC as a node belonging to the network configuration. Also called the LAN address or node address.

**DTC switching** A facility enabling terminal users to select any host system that they want to connect to. DTC switching is available only when the OpenView DTC Manager is used for network management.

**DTC/X.25 Network Access** The software that resides on the Datacommunications and Terminal Controller (DTC). To configure access to an X.25 network, you must configure two software components: the X.25 XL System Access (residing on the HP 3000 host and configured through use of NMMGR software) and the DTC/X.25 Network Access (configured on the OpenView Windows Workstation through use of the OpenView DTC Manager software).

**DTC/X25 Network Access card**
The hardware card and channel adapter that provides X.25 Network Access. It resides in the Datacommunications and Terminal Controller (DTC).

**DTC/X.25 XL Network Link**
Software and hardware that provides MPE XL access to private and public X.25 networks. The X.25 XL System Access software resides on an HP 3000 host and is configured through use of NMMGR. The DTC/X.25 Network Access software resides on the Datacommunications and Terminal Controller and is configured at the OpenView Windows Workstation.

**DTE**
Data terminal equipment. Equipment that converts user information into data-transmission signals or reconverts received data signals into user information. Data terminal equipment operates in conjunction with data circuit-terminating equipment.

**DTS**
Distributed Terminal Subsystem. This consists of all of the Datacommunications and Terminal Controllers (DTCs) on a LAN, their LANIC cards (attached to the host), the LAN cable, and the host and DTC software that controls all related DTS hardware.

**duplex**
A transmission method that allows two-way communication. If both ends of the transmission link can transmit simultaneously, it is called full duplex. If only one end can transmit at a time, it is half-duplex transmission.

## E

**entry priority**
In a point-to-point network, it is a ranking that identifies the most desirable route for data to travel from a given local node to a remote node.

**environment**
A session that is established on a remote node.

**escape from data transfer character**
A character that allows a user who is connected to a host system through the DTC to break that connection and return to the DTC switching user interface. The default is **[CTRL] K**. This character is used only on networks managed by the OpenView Windows Workstation.

**escape sequence**
A sequence of characters beginning with the escape character and followed by one or more other characters, used to convey control directives to printers, plotters, or terminals.

**Ethernet**
A Local Area Network system that uses baseband transmission at 10 Mbps over coaxial cable. Ethernet is a trademark of Xerox Corporation.

**event log**
One of three circular files stored on the OpenView windows workstation. It contains lists of events that are reported by the DTCs for which it is responsible.

**extended packet sequence numbering**
One of the optional Network Subscribed Facilities that provides packet sequence numbering using modulo 128. If not subscribed, modulo 8 is used.

## F

**facility**
An optional service offered by a packet switching network's administration and requested by the user either at the time of subscription for network access or at the time a call is made. Also known as user facility.

**facility set**
A facility set defines the various X.25 connection parameters and X.25 facilities that can be negotiated for each virtual circuit on a per-call basis.

**fast select**
An optional packet-switching network facility by which user data can be transmitted as part of the control packets that establish and clear a virtual connection.

**FCS**
Frame Check Sequence. A sequence of bits generated by X.25 at Level 2 that forms part of the frame and guarantees the integrity of its frame's contents. The FCS is also used by the IEEE802.3 protocol to check the validity of frames.

**file equation**
An assignment statement used to associate a file with a specific device or type of device during execution of a program.

**file number**
A unique number associated with a file when the file is opened. The file number is returned in the FOPEN or HPFOPEN call used to open the file. It can be used to access that file until the file is closed.

**file specification**
The name and location of a file. The full specification for a file includes the file name, group, and account.

**file system**
The part of the operating system that handles access to input/output devices (including those connected through the DTC), data blocking, buffering, data transfers, and deblocking.

**flow control**
A means of regulating the rate at which data transfer takes place between devices to protect against data overruns.

**flow control negotiation**
One of the network subscribed facilities selected at subscription time. This facility allows the Flow Control parameter to be negotiated at call set-up time, as opposed to having a predefined value.

**formal file designator**
A name that can be used programmatically or in a file equation to refer to a file.

**FOS**
Fundamental Operating System. The programs, utilities, and subsystems supplied on the Master Installation Tape that form the basic core of the MPE XL operating system.

**full gateway** — A full gateway is a node that belongs to more than one network and has one IP address for each network. It uses store and forward to transfer packets between each network that it belongs to.

## G

**gateway** — A node that connects two dissimilar network architectures. A gateway can be either a single node (full gateway) or two gateway halves.

**gateway half** — A node that works in conjunction with another node on another network to form an internetwork. The only protocol used by gateway halves is the NS Point-to-Point 3000/XL Link. *See also* full gateway.

**gateway-half link** — A link between the two nodes of a gateway-half pair. Each of the two nodes of a gateway-half pair has a configured link (hardware interface card) that is used for the gateway half network interface. The NS Point-to-Point 3000/XL Link is the only link that can be used as a gateway-half link.

**gateway-half pair** — A set of two nodes that are joined by a gateway-half link. Each node in the pair must have a gateway-half network interface configured, using the link.

**Guided Configuration** — A method of configuring a node in which a subset of the complete NMMGR interface is presented, and defaults of configurable values are used automatically.

## H

**handshaking** — A communications protocol between devices or between a device and the CPU. Provides a method of determining that each end of a communications link is ready to transmit or receive data, and that transmission has occurred without error.

**hop count** — *See* internet hop count and intranet hop count

**host-based network management** — A method of managing asynchronous communications for HP 3000 Series 900 computers. All of the control software is configured on a single MPE XL host and is downloaded to the DTCs that are managed by that host. With host-based management, a permanent relationship exists between each DTC and the host. Terminal users can access only the single MPE XL system that owns the DTC their terminal is connected to.

**host computer** — The primary or controlling computer on a network. The computer on which the network control software resides. For HP purposes, it can also be used to distinguish the MPE XL system (host) from the DTC.

**HP block mode** A block mode transmission method employed by HP computers where the system controls the block mode handshake. When HP block mode is used, the user program need not concern itself with data transfer protocol.

**HP PPN** Hewlett-Packard Private Packet Network. Hewlett Packard's own packet-switching X.25 network, which gives users full control over the administration and security of their data communication.

**HP TS8** A terminal server that can support up to eight asynchronous serial connections. When used in back-to-back configuration, users can access HP 3000 MPE/V systems on it through a DTC.

# I

**idle device timeout** A timeout defined by the Configure:CPU command. When the timer lapses, a device connected to the DTC user interface that is still inactive will be disconnected.

**IEEE 802.3** A standard for a broadcast local area network published by the Institute for Electrical and Electronics Engineers (IEEE). This standard is used for both the ThinLAN and ThickLAN implementations of the LAN.

**IEEE 802.3 multicast address** A hexadecimal number that identifies a set of nodes, this address is used for multicast delivery.

**IEEE 802.3 nodal address** A unique hexadecimal number that identifies a node on an IEEE 802.3 LAN.

**initialization string** A sequence of control characters used to initialize a terminal, printer, or plotter when a connection is established from a host on the network.

**INP** Intelligent Network Processor. The card residing in the back of an MPE V-based node that provides a point-to-point or X.25 interface.

**interactive communications** Processing that allows users to enter commands and data at the terminal and receive an immediate response. Interactive processing occurs in session mode on MPE XL systems.

**internet communication** Communication that occurs between networks.

**internet hop count** The number of full gateways plus the number of gateway-half links that a packet must pass through in moving from source node to destination.

**Internet Protocol** A protocol used to provide routing between different local networks in an internetwork, as well as among nodes in the same local network. The Internet Protocol corresponds to Layer 3, the Network Layer, of the OSI model. *See also* IP address.

**internet routing** Internet routing involves all the processes required to route a packet from a node on one network to a destination node on another network.

**internetwork** Two or more networks joined by gateways.

**intranet communication** Communication that occurs between nodes in a single network.

**intranet hop count** The number of intermediate nodes that lie between a source and destination node on the same point-to-point network.

**intranet routing** Intranet routing involves all the processes required to route a packet from one node in a network to another node in the same network.

**intrinsic** A system routine accessible by user programs. It provides an interface to operating system resources and functions. Intrinsics perform common tasks such as file access and device control.

**IP** *See* Internet Protocol.

**IP address** Internet Protocol address. An address used by the Internet Protocol to perform internet routing. A complete IP address comprises a network portion and a node portion. The network portion of the IP address identifies a network, and the node portion identifies a node within the network.

**ISO** International Organization of Standards. An international federation of national standards organizations involved in developing international standards, including communication standards.

## L

**LAN** Local Area Network. A collection of data communication systems sharing a common cable whereby each system can communicate directly with another.

**LAN address** *See* DTC station address.

**LANIC** *See* Local Area Network Interface Controller.

**LANIC physical path** The physical location (slot number) of the LANIC within the SPU.

**LANIC Self-Test** A ROM-based program on a LANIC card that tests and reports the status of the LANIC hardware.

**LAP** Link Access Protocol. The data link protocol specified by older versions (prior to 1980) of X.25 at Level 2 but still permitted and therefore usable. All new implementations of X.25 must use LAP-B, and all old implementations must migrate to LAP-B at a future date.

**LAP-B** Link Access Protocol - Balanced. The data link protocol specified by the 1980 version of X.25 at Level 2 that determines the frame exchange procedures. LAP-B must also be used over direct-connect NS Point-to-Point 3000/XL Links.

**LCI** Logical Channel Identifier. Local value on a network node that identifies the channel used to establish a virtual circuit (SVC or PVC) through an X.25 network.

**ldev** *See* logical device number.

**leased line** A data-grade telephone line leased directly to a subscriber and allocated specifically for the subscriber's needs.

**line speed** The speed at which data is transferred over a specific physical link (usually measured in bits or kilobits per second).

**link name** A name that represents a hardware interface card. The link name can contain as many as eight characters. All characters except the first can be alphanumeric; the first character must be alphabetic.

**Local Area Network Interface Controller (LANIC)** A hardware card that fits into the backplane of the HP 3000 Series 900 computer and provides a physical layer interface for IEEE 802.3 local area networks.

**local connection** *See* direct connection.

**local node** The computer that you are configuring or that you are logged on to.

**local switching** A feature of the DTC, which permits back-to-back configuration (for connections to an HP 3000 MPE/V host), using two ports of the same DTC.

**logging** The process of recording the usage of network resources. Events can be logged to both the OpenView workstation and to the MPE XL host.

**logging class** A number defining the severity of any given event logged. An operator uses the logging classes to specify which events are to be logged. Class 1 (catastrophic event) is always logged.

**logical device number (ldev)** A value by which MPE XL recognizes a specific device. All DTC devices that are configured as nailed devices through the NMMGR configuration have ldev numbers permanently assigned. The DTC devices can then be accessed programmatically through use of their ldev number. Non-nailed devices have ldev numbers that are assigned from a pool of available ldev numbers for the life of their connection to a system.

**log off** The termination of a job or session.

**log on** The process of initiating a job or session.

**logon device** *See* session-accepting device.

**loopback** The routing of messages from a node back to itself.

**LUG** Local User Group. A list defined for a particular DTC and card that specifies which *remote* nodes this DTC can send data to and also which *remote* nodes this DTC can receive data from. *See also* Closed User Group.

## M

**map, network** A drawing that shows the topology of the network. For networks managed by the OpenView DTC Manager, a network map must be created through use of the OVDraw capability provided with the management software. A network map is also a hardcopy drawing used when planning a network. It shows network topology, node and network names, addresses, network boundaries (for an internetwork map), and link types.

**mapping** A set of characteristics that describe a route taken by messages to reach a destination node. This set of characteristics is configured with NMMGR at every node on a point-to-point network. One mapping is configured at each node for every other node on the network to which messages will be sent.

**MAU** Medium Attachment Unit. A device attached to a ThickLAN coaxial cable that provides the physical and electrical connection from the AUI cable to the coaxial cable.

**M bit** More data bit. Setting this bit in a DATA packet indicates that at least one more DATA packet is required to complete a message of contiguous data.

**MIT** Master Installation Tape. A magnetic tape containing the Fundamental Operating System for an HP 3000 Series 900 computer.

**modem** modulator/demodulator. A device that modulates and demodulates signals. Primarily used for modulating digital signals onto carriers for transmission and for performing the inverse function at the receiving end. Modems are essential for transmitting and receiving digital signals over telephone lines.

**modulo** Value used as the counting cycle for determining the send sequence number (N(S)) of frames sent across an X.25 network.

**modulation** The process in which certain characteristics of a carrier signal are altered in accordance with the changes of an information-bearing signal.

**MPE XL** MultiProgramming Executive XL. The operating system of the HP 3000 Series 900 computers. The NS3000/XL network services operate in conjunction with the MPE XL operating system.

**multiplexer** MUX. A device that allows multiple communication links to use a single channel.

## N

**nailed device** A device with a permanently assigned ldev. The assignment is established through the system configuration of the MPE XL host system. Nailed devices can be accessed programmatically through their ldev number. Nailed devices can also be assigned to more than one host.

**native mode** The run-time environment of MPE XL. In Native Mode, source code has been compiled into the native instruction set of the HP 3000 Series 900 computer.

**neighbor gateway** A gateway that is in the same network as a given node.

**NetIPC** Network Interprocess Communication. Software that enables programs to access network transport protocols.

**network** A group of computers connected so that they can exchange information and share resources.

**network address** This can be either 1) the network portion of an IP address as opposed to the node portion, or 2) when referring to X.25 networks, it is a node's X.25 address.

**network boundary** The logical division between networks in an internetwork.

**network directory** A file containing information required for one node to communicate with other nodes in 1) an internetwork, 2) an X.25 network, or 3) a network that contains non-HP nodes. The active network directory on a node must be named NSDIR.NET.SYS.

**network interface** NI. The collective software that enables data communication between a system and a network. A node possesses one or more network interfaces for each of the networks to which it belongs. Network interface types are LAN802.3, router (point-to-point), X.25, loopback, and gateway half. The maximum number of supported NIs is 12, one of which is reserved for loopback.

**network management** The collective tasks required to design, install, configure, maintain, and if necessary, change a network.

**network map** A drawing that shows the topology of the network. For networks managed by the OpenView DTC Manager, a network map must be created using the OVDraw capability provided with the management software.

**Network Services** NS. Software application products that can be used to access data, initiate processes, and exchange information among nodes in the network. The HP 3000/XL Network Services include RPM, VT, RFA, RDBA, and NFT.

**network subscribed facilities** A set of parameters that the user chooses when he subscribes to the X.25 network; they include Flow Control Negotiation, Use of D-bit, Throughput Class Negotiation and Extended Packet Sequence Numbering.

**NFT** Network File Transfer. The network service that transfers disc files between nodes on a network.

**NI** *See* network interface.

**NMCONFIG.PUB.SYS** The file that contains all of the network configuration data for the HP 3000 Series 900 computer on which it resides. It includes information about the DTCs that can access the system as well as information about any Network Service (NS) products running on the system. This is the only file name allowed at run-time.

**NMDUMP** A utility used to format log and trace files.

**NMMAINT** A utility that lists the software module version numbers for all HP AdvanceNet products, including NS3000/XL. It detects missing or invalid software modules.

**NMMGR** Node Management Services Configuration Manager. A software subsystem that enables you to configure DTC connectivity and network access parameters for an HP 3000 Series 900 computer.

**NMMGRVER** A conversion program called NMMGRVER.PUB.SYS. It converts configuration files created with NMMGR from an earlier version to the latest format.

**NMSAMP1.PUB.SYS** A sample configuration file supplied with FOS that can be used as a template for DTS configuration.

**node** A computer that is part of a network. The DTC is also considered to be a node and has its own address.

**node address** The node portion of an IP address. The IP address consists of a node portion and a network portion.

**Node Management Services Configuration Manager** *See* NMMGR.

**node name** A character string that uniquely identifies each system in a network or internetwork. Each node name in a network or internetwork must be unique; however, a single node can be identified by more than one node name.

**node names list** A list defined on the OpenView windows workstation and subsequently downloaded to all DTCs for which it is the "owner." The list specifies all of the HP 3000 Series 900 hosts on the LAN that are accessible from the DTCs.

**non-adjacent** Describes a node on an NS Point-to-Point 3000/XL network that is separated from a given node by intervening or intermediate node.

**non-nailed device** A session-accepting device that is not permanently associated with an ldev number at configuration time. When the user at such a device logs on to an MPE XL system, an ldev is assigned from a pool of ldevs set aside for this purpose at configuration time. The association between a non-nailed device and this assigned ldev exists only for the duration of the session. One advantage of the use of non-nailed device connections is that configuration is simplified, since it is not required that each non-nailed device be individually configured.

**NS3000/XL** A Hewlett-Packard data communication product that provides networking capabilities for MPE XL based HP 3000 minicomputers. NS3000/XL consists of a link and network services.

**NS3000/XL Link** Software and hardware that provides the connection between nodes on a network. Some of the NS3000/XL links available are the ThinLAN 3000/XL Link and its ThickLAN option, the DTC/X.25 XL Network Link, the NS Point-to-Point 3000/XL Link, and the StarLAN 10 3000/XL link.

**NS3000/XL Network Services** Software applications that can be used to access data, initiate processes, and exchange information among nodes in a network. The services are RPM, VT, RFA, RDBA, and NFT.

**NSDIR.NET.SYS** Name of the active network directory file. *See also* network directory.

## O

**octet** An eight-bit byte operated upon as an entity.

**OpenView Admin** An OpenView Windows program that enables you to configure how your OpenView Windows applications will function. For example, it enables you to set a default map for the OpenView DTC Manager.

**OpenView Draw** An OpenView windows program that is used to draw the network map and to label the components on it.

**OpenView DTC Manager** An OpenView Windows application that enables you to configure, control, monitor, and troubleshoot the operation of the Distributed Terminal Subsystems on the LAN.

**OpenView Run** An OpenView windows program that covers most of the control features used by the DTC Manager, including monitoring and diagnostic functions.

**OpenView Windows** The set of three programs: OV Admin, OV Draw and OV Run, running on the OpenView workstation under MS Windows, that acts as the platform for all OpenView applications, such as DTC Manager.

**OpenView Windows Workstation** The personal computer that provides software downloads to enable operation of the Datacommunications and Terminal Controller (DTC). The configuration software that runs on this workstation is called the OpenView DTC Manager software.

**OSI model** Open Systems Interconnection model. A model of network architecture devised by the International Standards Organization (ISO). The OSI model defines seven layers of a network architecture with each layer performing specified functions.



## P

**packet** A block of data whose maximum length is fixed. The unit of information exchanged by X.25 at Level 3. The types of packets are DATA packets and various control packets. A packet type is identified by the encoding of its header.

**Packet Exchange Protocol** PXP. A transport layer protocol used in NS3000/XL links to initially establish communication between nodes when NetIPC socket registry is used.

**packet-switched network name** The name of a data communication network adhering to the CCITT X.25 recommendation. This can be a PDN or a private network such as the HP PPN.

**PAD (packet assembler/disassembler)** A device that converts asynchronous character streams into packets that can be transmitted over a packet switching network (PSN).

**PAD name** A name of up to eight characters that is associated with a configured PAD device. The PAD name is known to both the DTC (defined by the DTC Manager) and the MPE XL systems (defined by NMMGR) that the device can access.

**PAD profile** A terminal or printer profile that specifies the configuration characteristics for PAD-connected devices.

**partner gateway half** When gateway halves are used, two gateway halves are required in order to provide communication between two networks. Each is the partner of the other.

**path name** When configuring with NMMGR, you can type a string in the `COMMAND:` field on a screen to branch to another screen. Each screen has a unique path name that corresponds to its location in the hierarchy of configuration screens presented by NMMGR.

**PDN** Public data network. A data communication network whose services are available to any user willing to pay for them. Most PDNs use packet switching techniques.

**point-to-point** A link that connects either two nodes in a NS Point-to-Point 3000/XL network or two gateway halves.

**port** An outlet through which a device can be connected to a computer, consisting of a physical connection point and controlling hardware, controlling software, and configurable port characteristics. Ports can be thought of as data paths through which a device communicates with the computer.

**Precision Architecture** The hardware design structure for the HP 3000 Series 900 computer family.

**printer name** A character string of up to 16 characters specified in the DTC Manager configuration (for networks using OpenView Network Management) to define a printer by name. Can be shared by several printers (port pool).

**printer profile** A set of configuration characteristics that can be associated with one or more printers through the NMMGR configuration. Printer profile specifications include the printer type, line speed, device class assignment, and other values relevant to printers connected through a DTC.

**printer type** A collection of characteristics that cause a printer connected to an MPE XL system to act and react in a specified manner. You can configure a printer to use one of the system-supplied printer types, or you can create custom printer types using Workstation Configurator.

**privileged mode** A capability assigned to accounts, groups, or users allowing unrestricted memory access, access to privileged CPU instructions, and the ability to call privileged procedures.

**probe protocol** An HP protocol used by NS3000/XL IEEE 802.3 networks to obtain information about other nodes on the network.

**probe proxy server** A node on an IEEE 802.3 network that possesses a network directory. A probe proxy server can provide a node with information about other nodes on the same or other networks of an internetwork.

**profile** — A method of grouping device connection specifications and characteristics so that the set of characteristics can be easily associated with groups of like devices. *See also* printer profile, terminal profile.

**program captive device** — *See* programmatic device.

**Programmable Serial Interface** — PSI. A hardware card that fits into the backplane of the HP 3000 Series 900 computer. It provides a physical layer interface for NS Point-to-Point 3000/XL Links.

**programmatic device** — A device operating under control of a program running on a computer. Programmatic devices can be used for input, output, or both, depending on the device and how it is opened by the controlling program.

**protocol** — A set of rules that enables two or more data processing entities to exchange information. In networks, protocols are the rules that govern each layer of network architecture. They define what functions are to be performed and how messages are to be exchanged.

**PSN** — Packet-Switching Network. Any data communication network in which data is disassembled into packets at a source interface and reassembled into a data stream at a destination interface. A public PSN offers the service to any paying customer.

**PSS** — Packet-Switching System. The national public PSN of the United Kingdom.

**PVC** — Permanent Virtual Circuit. A permanent logical association between two physically separate DTEs that does not require call set-up or clearing procedures.

**PXP** — *See* Packet Exchange Protocol.

## Q

**Q bit** — Qualified bit. When set in DATA packets the Q bit signifies that the packet's user data is a control signal for the remote device, not a message for its user.

**QuickVal** — A software program that tests whether Network Services are operating correctly between nodes.

## R

**RDBA** — Remote Data Base Access. A network service that allows users to access data bases on remote nodes.

**reachable network** A network that can be accessed (with additional internet hops possibly required) by a particular gateway.

**remote connect device** An asynchronous device that is indirectly connected to a DTC through a modem and telephone hook-up or through a PAD.

**remote node** Any network node that is physically separate from the node you are currently using or referring to.

**retransmission count (N2)** The maximum number of times a frame will be retransmitted following the expiration of the Retransmission Timer, T1.

**retransmission timer (T1)** The length of time that a transmitter will wait for an acknowledgment from a destination address before attempting to retransmit a frame. When choosing this value, factors like the line speed and maximum frame size should be taken into account.

**RFA** Remote File Access. A network service that allows users to access file and devices on remote nodes.

**routing** The path that packets or fragments of a message take through a network to reach a destination node.

**RPM** Remote Process Management. A network service that allows a process to programmatically initiate and terminate other processes throughout a network from any node on the network.

**RS-232-C** The Electronic Industries Association (EIA) Level 1 protocol specification that defines electrical circuit functions for 25 connector pins. HP provides two implementations of this standard: a 3-pin version for direct connections up to a distance of 15 meters (50 feet), and a version which makes use of additional circuits and can be used for either modem or direct connections.

**RS-422** The Electronic Industries Association (EIA) Level 1 protocol specification implemented by HP in a 5-pin version which can be used for direct device connection up to a distance of 1500 meters (4000 feet).

## S

**security string** An alphanumeric character string that functions as a password for dial links. The security string is used by the Dial IP protocol.

**serial device** Any device that is attached to and communicates with a computer by means of a serial transmission interface. Terminals, printers, and plotters are among the devices that communicate serially with MPE XL computers.

**serial transmission** A method of transferring data in which characters are transmitted one bit at a time and received one bit at a time in the order of transmission. This transmission scheme is employed by devices connected to the MPE XL systems via the DTC.

**session-accepting device** A terminal or personal computer running in terminal-emulation mode that is able to establish an interactive (conversational) session with an HP 3000 computer. Also referred to as a logon device.

**shared dial** A dial link that provides connection to more than one remote system, although to only one at a time.

**shared-line access** The feature that allows two or more HP 3000 Series 900 hosts to use the same DTC/X.25 Network Access card on a DTC to access an X.25 network.

**SIC** Serial Interface Card. A card installed in the front of the DTC that acts as an interface between a corresponding Connector Card (CC) and the DTC's processor.

**slaved device** A device that shares the same DTC port as another device and is connected, to the other device, referred to as its master, by a cable. The actions of the slaved device are controlled by the master device.

**spooled device** A printer that is accessed through the MPE XL spooling facility. The spooling facility allows a nonsharable device to be shared among several users by temporarily storing output data on disc and managing the selection of output spool files destined for the spooled device.

**start bit** A data bit used to signal the start of a character being transmitted in an asynchronous communication mode.

**station address** A link-level address used by the IEEE 802.3 protocol that is assigned to every node on an IEEE 802.3 network.

**stop bit** A data bit used to signal the end of a character being transmitted in an asynchronous communication mode.

**store-and-forward** A technique in which messages are passed from one node to another in a network to reach their destination. Point-to-point networks use the store-and-forward technique to transmit messages.

**subnet** Another name for a network, especially if the network is part of an internetwork. The word subnet is also a synonym for intranet.

**SVC** Switched Virtual Circuit. The path through an X.25 network that is established at call set-up time.

**switching** *See* DTC switching.

**Switching User Interface** The user interface available when DTC switching is enabled that allows terminal users to choose the MPE XL computer with which they want to establish a communication link.

**synchronous** A mode of operation or transmission in which a continuous data stream is generated without intervals between characters. The data stream is synchronized by clock signals at the receiver and transmitter. As a result, fast transmission speeds (above 9600 bps) are attainable.

**SYSGEN** The software program that allows you to configure the operating system on HP 3000 Series 900 computers.

**system configuration** The way you tell MPE XL what peripheral I/O devices are attached to the DTC and what parameters are required for system operation.

## T

**TCP** *See* Transmission Control Protocol.

**Telenet** A proprietary public data network in the USA.

**TermDSM** Terminal Online Diagnostic System Manager. A utility that provides diagnostic services for DTC connections by means of a series of commands accessible through the SYSDIAG utility. TermDSM is used only when DTCs are managed by an MPE XL host system.

**terminal name** A character string of up to 16 characters specified in the Openview DTC Manager configuration (for networks using OpenView Network Management) to define a terminal by name. It can be shared by several terminals (pool port).

**terminal profile** A set of configuration characteristics that can be associated with one or more terminals through the NMMGR configuration. Terminal profile specifications include the terminal type, line speed, device class assignment, and other values relevant to terminals connected through a DTC.

**terminal type** A collection of characteristics that cause a terminal connected to an MPE XL system to act and react in a specified manner. You can configure a terminal to use one of the system-supplied terminal types, or you can create custom terminal types using the Workstation Configurator.

**ThinLAN 3000/XL** A LAN that conforms to the IEEE 802.3 Type 10 BASE 2 standard LAN.

**throughput class** A value assigned to a given virtual circuit that defines how many network resources should be assigned to a given call. It is determined by the access line speed, packet and window sizes, and the local network's internal mechanisms.

**throughput class negotiation** One of the Network Subscribed Facilities defined at subscription time. This allows the user to negotiate the Throughput Class at call set-up time.

**timer (T3)** The length of time that a link can remain in an idle state. After the expiration of the timer, the link is considered to be in a non-active, non-operational state and is automatically reset. The value should be chosen carefully. In particular, it must be sufficiently greater than the Retransmission Timer (T1) so that no doubt exists about the link's state.

**topology** The physical arrangement of nodes in a network. Some common topologies are bus, star, and ring.

**Transmission Control Protocol** TCP. A network protocol that establishes and maintains connections between nodes. TCP regulates the flow of data, breaks messages into smaller fragments if necessary (and reassembles the fragments at the destination), detects errors, and retransmits messages if errors have been detected.

**Transpac** The national public PSN of France.

**transparent mode** A data-transfer scheme in which only a limited number of special characters retain their meaning and are acted on by the system. All other characters are considered to be data and are passed through with no control actions being taken.

**transport, network** Software that corresponds to layers 3 and 4 of the OSI network architecture model. It sends data out over the communications link, receives incoming data, and routes incoming or outgoing data to the appropriate destination node.

**Tymnet** A proprietary public data network in the USA.

**typeahead** A facility that allows terminal users to enter data before a read is actually posted to the terminal.

## U

**unacknowledged frame number (K)** The number of frames that can be transmitted without receiving an acknowledgement from the destination address. When this number (K) frame is reached, the same K frames are retransmitted.

**unedited mode** *See* transparent mode.

## V

**V.24** The CCITT recommendation that defines the function of the interchange circuits between a DTE and a DCE.

**validatlon** The process of ascertaining whether the network transport configuration file has been correctly configured. This is accomplished by using the NMMGR Validate Configuration File screen.

**VAN** Value-Added Network. A data communication network that uses and pays for facilities belonging to another carrier. The value-added package is then sold to a user.

**VC** *See* virtual circuit.

**virtual circuit** A logical association between two physically separate DTEs.

**Virtual Terminal** A network service that allows a user to establish interactive sessions on a node.

**VPLUS** Software used to generate screens such as those displayed by NMMGR.

**V-Series (V.##) CCITT** A set of CCITT recommendations related to data communication over a voice-grade telephone network.

**VT** *See* Virtual Terminal.

## W

**Workstation Configurator** A utility available on MPE XL systems that allows users to create customized terminal and printer types by entering data through a series of VPLUS screens.

## X

**X.3** The protocol that defines which user facilities should be internationally available from a packet assembler/disassembler (PAD) when this is offered by a public data network.

**X.21** The protocol that defines the physical interface between a DTE and a DCE of a public data network where the access to the network is made over synchronous digital lines.

**X.25** The protocol that defines the interface between a DTE and a DCE for packet-mode operation on a Public Data Network (PDN).

**X.25 address** The X.25 address provided by the network administration if you are connected to a public data network (PDN).

**X.25 address key** An X.25 address key is a label that maps a node's IP address to its X.25 address and its associated X.25 parameters. You have a combined maximum of 1024 X.25 address keys in the SVC and PVC path tables.

**X.25 LUG address** X.25 address of a node belonging to a LUG.

**X.25 XL System Access** The software that works in conjunction with the DTC/X.25 Network Access software to provide MPE XL access to X.25. The software resides on an HP 3000 host and is configured through use of NMMGR. To configure access to an X.25 network, you must configure two software components: the X.25 XL System Access and the DTC/X.25 Network Access (residing on the Datacommunications and Terminal Controller and configured at the OpenView Windows Workstation). Together, these two components provide a network connection on HP 3000 systems to private and public X.25 packet-switched networks (PSNs).

**X.29** The protocol that defines the interface for data exchange between a packet-mode DTE and a remote Packet Assembly/Disassembly (PAD) facility over a packet-switching network.

**XON/XOFF protocol** The flow control used by MPE XL systems to protect against data overruns. XON/XOFF protocol is controlled by the data recipient who sends an XOFF character (ASCII DC3) to the sender if it is unable to continue to receive data. The sender suspends transmission until it receives an XON character (ASCII DC1).

**X.Series (X.##) CCITT recommendations** A set of recommendations for data communication networks governing their services, facilities, and terminal equipment operation and interfaces.

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