

2210 Nways Multiprotocol Router



# Introduction and Planning Guide



2210 Nways Multiprotocol Router



# Introduction and Planning Guide

**Note**

Before using this information and the product it supports, be sure to read the general information under Appendix C, "Notices" on page C-1 and "Electronic Emission Notices" on page C-1.

**Fifth Edition (October 1997)**

This edition applies to the IBM 2210 Nways Multiprotocol Router.

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## About This Guide

This guide contains information you will use to plan your network and define hardware you want to purchase. It also contains specifications for the IBM 2210 Nways Multiprotocol Router (hereafter referred to as the *IBM 2210*).

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## Who Should Read This Guide

The intended user of this guide is the person responsible for planning the setup and configuration of the IBM 2210

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## How To Proceed

You will determine which adapters and cables to order you will plan a network configuration. Document all of the network information that will be required to install, connect, and configure the IBM 2210.

Use the following manuals and take the following steps to plan and install your IBM 2210:

**Note:** If you are upgrading from Release 1 of the Multiprotocol Access Services (the operating system software) to Release 2, see the upgrading/migrating information in the *IBM 2210 Nways Multiprotocol Router Service and Maintenance Manual*.

### Planning and Preparation

- **1** Get familiar with the capabilities of the IBM 2210 (See Chapter 1, "Introduction to the IBM 2210" on page 1-1.)
- **2** Determine which adapters and cables you will need. Chapter 3, "Physical Planning and Prerequisites," has details about available options. Design your network and place your order for your IBM 2210s and cables.
- **3** If necessary, obtain and install the required common carrier equipment and services including ATM.
- **4** Obtain and install the required LAN equipment and services.
- **5** Order and install any required cables not included with the IBM 2210, such as ATM multimode and single-mode fiber cables that you will need to set up your network.
- **6** Obtain and install the hardware and software required to run the Configuration Program, as described in Chapter 3, "Physical Planning and Prerequisites" on page 3-1.
- **7** Prepare your site physically, ensuring that you meet the necessary power and environmental requirements. See Chapter 3, "Physical Planning and Prerequisites" on page 3-1.

## Installation and Initial Configuration

- **1** Install the IBM 2210 using the *IBM 2210 Nways Multiprotocol Router Installation and Initial Configuration Guide* provided with the product. (Alternatively, installation by IBM service personnel is available. Contact your IBM representative for additional information.)
- **2** Connect a terminal to the serial port or 14.4 modem to the initial configuration steps.
- **3** Run the “Quick Configuration” program to perform the initial configuration and activate your IBM 2210.

## Configuration

- **1** Perform final configuration. See the *Configuration Program User's Guide* and the *Software User's Guide*.

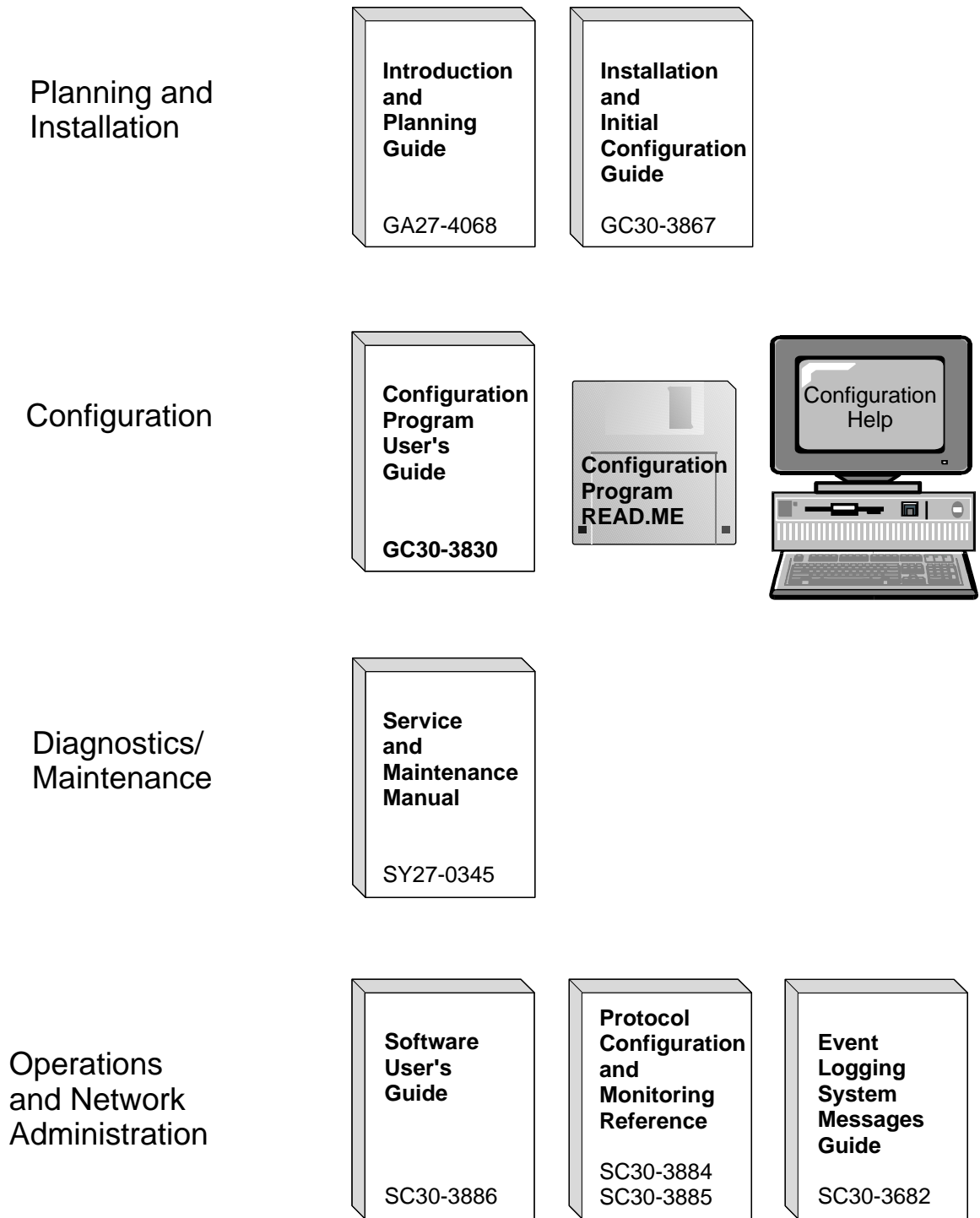


Figure 0-1. IBM 2210 Nways Multiprotocol Router Library Overview

## Library Description

### Introduction and Planning

GA27-4068 *IBM 2210 Nways Multiprotocol Router Introduction and Planning Guide*

This book is shipped with the 2210. It explains how to prepare for your network and for installation.

This book provides translations of danger notices and other safety information.

GC30-3867 *IBM 2210 Nways Multiprotocol Router Installation and Initial Configuration Guide*

It explains how to prepare for installation, install the 2210, perform an initial configuration and verify that the installation is successful.

This book provides translations of danger notices and other safety information.

### Diagnostics and Maintenance

SY27-0345 *IBM 2210 Nways Multiprotocol Router Service and Maintenance Manual*

This book is shipped with the 2210. It provides instructions for diagnosing problems with and repairing the 2210.

### Operations and Network Management

SC30-3681 *Software User's Guide for Multiprotocol Routing Services*

This book explains how to:

- Configure, monitor, and use the IBM Multiprotocol Routing Services software shipped with the router.
- Use the Multiprotocol Routing Services command-line router user interface to configure and monitor the network interfaces and link-layer protocols shipped with the router.

SC30-3680 *Protocol Configuration and Monitoring Reference Volume 1 for Multiprotocol Routing Services*

SC30-3865 *Protocol Configuration and Monitoring Reference Volume 2 for Multiprotocol Routing Services*

These books describe how to access and use the Multiprotocol Routing Services command-line router user interface to configure and monitor the routing protocol software shipped with the router.

They include information about each of the protocols that the devices support.

SC30-3682 *IBM Nways Event Logging System Messages Guide*

This book contains a listing of the error codes that can occur, along with descriptions and recommended actions to correct the errors.

## Configuration

- Online help    The help panels for the Configuration Program assist the user in understanding the program functions, panels, configuration parameters, and navigation keys.
- GC30-3830    *Configuration Program User's Guide for Multiprotocol Routing Services*  
This book discusses how to use the Configuration Program.
- GG24-4446    *IBM 2210 Nways Multiprotocol Router Description and Configuration Scenarios*  
This book contains examples of how to configure protocols using IBM Multiprotocol Routing Services.

## Safety

- SD21-0030    *Caution: Safety Information - Read This First*  
This book provides translations of caution and danger notices applicable to the installation and maintenance of an IBM 2210.

## Library Ordering Information

All 2210 publications can be ordered separately.

These publications are shipped in hardcopy with the 2210:

- IBM 2210 Nways Multiprotocol Router Introduction and Planning Guide*
- IBM 2210 Nways Multiprotocol Router Installation and Initial Configuration Guide*
- IBM 2210 Nways Multiprotocol Router Service and Maintenance Manual*
- Caution: Safety Information - Read This First*

These publications are shipped with the Configuration Program in softcopy on a CD-ROM:

- IBM 2210 Nways Multiprotocol Router Introduction and Planning Guide*
- IBM 2210 Nways Multiprotocol Router Installation and Initial Configuration Guide*
- IBM 2210 Nways Multiprotocol Router Service and Maintenance Manual*
- Software User's Guide for Multiprotocol Routing Services*
- Protocol Configuration and Monitoring Reference Volume 1 for Multiprotocol Routing Services*
- Protocol Configuration and Monitoring Reference Volume 2 for Multiprotocol Routing Services*
- IBM Nways Event Logging System Messages Guide*
- Configuration Program User's Guide for Multiprotocol Routing Services*
- IBM Multiprotocol Routing Services and IBM 2210 Softcopy Library*

## Obtaining Softcopy Information

Softcopy BookManager READ library information is available for many of the 2210 publications in the *IBM Networking Systems Softcopy Collection Kit*. To place a single order for the CD-ROM, use form number SK2T-6012. To place a single order for the 3480 cartridge, use form number SK2T-6013.

Yearly subscriptions to the *IBM Networking Systems Softcopy Collection Kit*, product number 5636-PUB, are available through your branch office representative. Order feature code 2003 and media code 5003 for CD-ROM format. Order feature code 2004 and media code 5004 for 3480 cartridge format.

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## System Library Subscription Service

The 2210 publications are available via the System Library Subscription Service (SLSS). Use machine type 2210 and program number 5765-B86 to receive 2210 publications.

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## Visit Our Web Site

Visit the IBM 2210 website at <http://www.networking.ibm.com/220/220prod.html> for:

- Engineering changes, clarifications, and fixes that have been implemented after the manuals were printed,
- PTFs, configuration programs, and MRNS and MRS releases
- Publications
- Questions & Answers

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# Summary of Changes

The following changes to the IBM 2210 library have been made:

- **Reorganized hardware information:**

- The title of the *2210 Nways Multiprotocol Router Planning and Setup Guide*, GA27-4086, has been changed to the *2210 Nways Multiprotocol Router Introduction and Planning Guide*

This book now contains only information that introduces IBM 2210 router and information necessary for planning your network. Installation instructions have been moved into the new *2210 Nways Multiprotocol Router Installation and Initial Configuration Guide*.

- The title of the *2210 Nways Multiprotocol Router IBM 2210 Models 1Sx and 1Ux Installation Guide*, GC30-3867, has changed to the *2210 Nways Multiprotocol Router Installation and Initial Configuration Guide*.

It now contains instructions for installing all models of the 2210. In addition, it guides you through the initial configuration once you have installed the 2210 router.

- **Information to support hardware**

- New adapters:
  - 4-port S/T ISDN BRI adapter
  - 4-port U ISDN BRI adapter

- **Information to support software**

- New Functions:
  - Dial-In Access to LAN Servers (DIALs)
  - Delete Interface command
  - Full WAN support for concentration adapters
  - Spare interface definition for dynamic reconfiguration
  - Ethernet Local MAC Address Administration
- Enhanced Functions:
  - Bridging Enhancements
    - SR-TB duplicate MAC address support – allows a duplicate MAC address to exist in an SR domain and also offers a load-balancing feature.
  - DLSw Enhancements:
    - Circuit priority – allows you to set the circuit priority for a range of SAPs and MAC addresses.
    - MAC address list – allows you to build address lists for DLSw sessions to exchange as described in RFC 1795.
    - NetBIOS SesionAlive spoofing – allows you to disable TCP keepalive messages for dial-on-demand circuits.
  - Serviceability Enhancements
    - TFTP disable – to prevent unwanted updates or retrievals of device software from the network

- ICMP redirect disable – prevents the device from transmitting a packet on the same interface on which it received the packet.
  - Time-activated load – to allow you to load software into a device in off-peak hours unattended.
- Protocol Enhancements:
- AppleTalk
    - Support for AppleTalk network management applications.
  - APPN
    - Support for APPN Branch Extender which decreases the overall size of a topology database.
    - Improved management of topology database by removing database records for resources that are no longer active in the network.
    - Support for an APPN frame relay port that uses BAN.
    - Support for an implicit focal point which will allow you to specify a node with network management responsibilities on the device. The device uses this focal point when it cannot establish a session with an explicit focal point.
    - The ability to configure the size of the held alert queue.
  - ATM:
    - RFC 1483 bridging over ATM PVCs and SVCs.
    - Shared RFC 1483 PVCs
    - LAN emulation quality of service.
    - Next Hop Routing Protocol (NHRP) client.
    - ATM virtual interface.
    - Redundant default IP gateways for emulated LANs.
    - Classical IP (CIP) redundancy
    - Distributed ARP server support which provides continuous connectivity across logical IP subnets in the event of an ARP server failure.
    - Support for RFC 1577+ clients.
  - BRS
    - The ability to define default circuit traffic classes for BRS.
    - Improvements that allow assigning TCP/IP packets to a BRS class and priority based on a TCP/UDP port number, a TCP/UDP port range, or a TCP/UDP socket.
  - Frame Relay:
    - Frame Relay now runs on V.25bis.
    - Data compression supported on Frame Relay.
      - Note:** If you are currently using compression on PPP interfaces, you will need to configure compression contexts for compression to work.
    - Improved congestion control using BECN, FECN, and CLLM.



- IP:
  - Support for RIP Version 2
  - The ability to define up to 4 static routes for each IP destination host or subnet.
  - The ability to define the same IP subnet on multiple network interfaces.
  - Improved determination of whether a static route will work.
  - Improvements to route filtering and routing policies.
  - OSPF demand circuits for OSPF topology refreshes and hello messages.
  - PING enhancements
- IPX:
  - The ability to configure IPX static routes and services to prevent RIP and SAP from activating V.25bis and ISDN demand circuits.
  - The ability to configure a default route to a destination network.
  - PING enhancements
- ISDN:
  - I.430 and I.431 support
- PPP:
  - Increased bandwidth by increasing the number of links through Bandwidth Allocation Protocol/Bandwidth Allocation Control Protocol (BAP/BACP).
  - Enhanced authentication using authentication servers.
  - Support for Encryption Control Protocol (ECP) negotiation using Data Encryption Standard (DES) Cypher Block Chaining (CBC) mode.
- SNMP Enhancements:
  - Upgrade or Addition of the Following MIBs:
    - Appletalk MIB
    - APPN family of MIBs
    - ATM
    - BRS MIB
    - Ethernet
    - HPR
    - Interfaces MIB
    - IP over ATM MIB
    - IPX MIB
    - ISDN MIB
    - LAN Emulation Client
    - NHRP MIB
    - PPP MIB
  - New trap support
    - FR traps for the receipt of FECN, BECN, and CLLM

- WAN Reroute Enhancements:
  - The ability to dial up additional circuits when the primary circuit capacity is exceeded.
  - Allows Frame Relay traffic to use ISDN circuits as alternate circuits.
- X.25 Enhancements:
  - New change commands for XTP.

- **Clarifications and corrections**

The technical changes and additions are indicated by a vertical line (|) to the left of the change.

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## Chapter 1. Introduction to the IBM 2210

The IBM 2210 Nways Multiprotocol Router (hereafter referred to as the *IBM 2210*) provides a method of routing and bridging across LANs and WANs. Routing is supported for multiple network protocols over a variety of media.

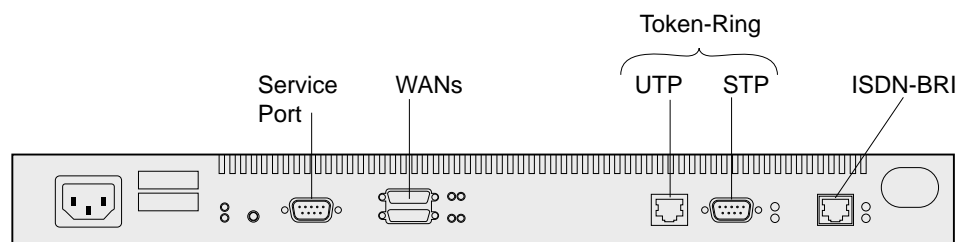


Figure 1-1. Model 127

The IBM 2210 functions as a Simple Network Management Protocol (SNMP) agent and can be managed by network managers that implement certain SNMP management information base (MIB) standards.

The software that supports the IBM 2210 is the IBM Multiprotocol Routing Services, a licensed program (program number 5765-B86). The IBM Multiprotocol Routing Services has three components:

- The code that provides the routing, bridging, data link switching, and SNMP agent functions for the IBM 2210. The base code is installed at the factory on the IBM 2210.
- The Configuration Program with a graphical user interface that allows you to configure the IBM 2210 from a stand-alone workstation.
- A monitoring system that allows you to perform change management, network management, problem determination, and configuration.

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## Models of the IBM 2210

The IBM 2210 is available in several models, based on the types of networks you want to support. In addition, you can tailor your software package, depending upon your needs. Figure 1-2 on page 1-2 shows the different models available.

Note that the only difference between some of the models is the amount of flash or DRAM memory. Flash memory is used to store a compressed version of the router's software. Flash memory is not upgradeable on the 1x4, 1x8, or 12x models of the IBM 2210.

You can add an additional 4 MB of flash memory to the 14T and 24x models of the IBM 2210 by adding a 4 MB Flash Upgrade Feature. This upgrade provides a total of 8 MB of flash memory for those models.

If you need to maintain multiple copies of software for various releases, you need to consider having sufficient flash memory for the copies. Use flash upgrades to increase your software capacity. For help determining your flash or DRAM requirements contact your network planner or IBM marketing support.

IBM 2210's DRAM provides the working memory for the router programs and the router network tables. The amount of required DRAM in a IBM 2210 is determined by the size and complexity of the network the IBM 2210 must support. As you increase the number of protocols, transports, and features that you are using on the IBM 2210, you will need to increase the installed DRAM.

You cannot upgrade the DRAM for models 1S4, 1S8, 1U4, or 1U8. You can upgrade the DRAM for any of the 12x models with the up to 16 MB. You can upgrade the DRAM for x4x models up to 32 MB.

Certain models of the IBM 2210 support ISDN. You cannot use one adapter.

The following table lists the current 2210 models:

Figure 1-2. IBM 2210 Models

Model	LAN	No. of WANs (see note)	ISDN BRI	Base Flash Memory	Base DRAM	Supports Adapter Features
1S4*	Ethernet	1	1	2 MB	4 MB	No
1S8*	Ethernet	1	1	4 MB	8 MB	No
1U4*	Ethernet	1	1	2 MB	4 MB	No
1U8*	Ethernet	1	1	4 MB	8 MB	No
12T	Token-ring	2	0	4 MB	8 MB	No
12E	Ethernet	2	0	4 MB	8 MB	No
127	Token-ring	2	1	4 MB	8 MB	No
128	Ethernet	2	1	4 MB	8 MB	No
14T	Token-ring	4	0, 1, or 4 (optional)	4 MB	16 MB	Yes
24T	2 Token-ring	4	0, 1, or 4 (optional)	4 MB	16 MB	Yes
24E	2 Ethernet	4	0, 1, or 4 (optional)	4 MB	16 MB	Yes
24M	1 Token-ring 1 Ethernet	4	0, 1, or 4 (optional)	4 MB	16 MB	Yes

**Note:**

The standard WAN ports on the IBM 2210 will support any of these physical interfaces:

- EIA 232-D/V.24
- V.35
- V.36
- X.21

WAN Net Handlers:

- V.25 bis (not supported on X.21)
- X.25
- PPP
- FR
- SDLC
- SDLC Relay
- V.34 (only supported on EIA-232)

Expandable base DRAM:

- Base DRAM for the 12x can expand to 16 MB.
- Base DRAM for the 14x can expand to 32 MB.

\*The 1S4, 1S8, 1U4, and 1U8 can use either the ISDN BRI or WAN port at any given time.

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## Chapter 2. Functions of the IBM 2210

The current software that supports the IBM 2210 is the IBM Multiprotocol Routing Services, a licensed program. The IBM Multiprotocol Routing Services has three components:

- The code that provides the routing, bridging, data link switching, and SNMP agent functions for the IBM 2210. The base code is installed at the factory on the IBM 2210.
- The Configuration Program with a graphical user interface that allows you to configure the IBM 2210 from a stand-alone workstation.
- A monitoring system that allows you to perform change management, network management, problem determination, and configuration.

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### Networks Supported by the IBM 2210

The LANs supported by the IBM 2210 are:

- Token-ring (IEEE 802.5) with STP or UTP connection
- Ethernet (IEEE 802.3) with AUI or 10BASE-T connection

The interfaces supported by every IBM 2210 are:

- EIA 232D/V.24
- V.35
- V.36
- X.21

WAN Net Handlers

- V.25 bis (not supported on X.21)
- X.25
- PPP
- FR
- SDLC
- SDLC Relay
- V.34 (supported only on EIA-232)

In addition to these interfaces, some models also support ISDN and ATM.

---

### Protocols Supported by the IBM 2210

Figure 2-1 shows the protocols supported by each IBM 2210 interface.

Figure 2-1. IBM 2210 Supported Routing and Bridging Protocols

Framing Methods	WANs					LANs			
	PPP	FR	X.25	SDLC	Serial and ISDN		Token-Ring	Ethernet	ATM
					Dial on Demand	Dial Backup			
<b>Protocols</b>									
Banyan VINES	yes	yes	yes	no	yes	yes	yes	yes	yes
TCP/IP	yes	yes	yes	no	yes	yes	yes	yes	yes
DECnet IV	yes	yes	yes	no	yes	yes	yes	yes	yes
DECnet V/OSI	yes	yes	yes	no	yes	yes	yes	yes	yes
BGP	yes	yes	yes	no	yes	yes	yes	yes	yes
NetBIOS	yes	yes	yes	no	yes	yes	yes	yes	yes
LNLM	yes	yes	yes	no	yes	yes	yes	no	yes
IPX	yes	yes	yes	no	yes	yes	yes	yes	yes <sup>2</sup>
AppleTalk	yes	yes	yes <sup>1</sup>	no	yes	yes	yes	yes	yes
SNA	yes	yes	yes	yes	yes	yes	yes	yes	yes
SRB	yes	yes	yes	no	yes	yes	yes	no	yes
TB	yes	yes	yes	no	yes	yes	no	yes	yes
SRT	yes	yes	yes	no	yes	yes	yes	yes	yes
SR/TB	yes	yes	yes	no	yes	yes	yes	yes	yes

**Notes:**

1. X.25 routing is accomplished using IP Bridging Tunnel over X.25.
2. IPX is supported using Token-Ring and Ethernet LAN emulation. In addition, IPX is supported between routers that support RFC 1483 encapsulation.

## Features Supported by 14T and 24x Models

The following features are supported only by the 14T and 24x Models.

### Second Service Port

This additional service port can provide another way to contact an IBM 2210 that is experiencing problems through a second line. The second service port can be a:

- 14.4 Kbps Modem Port Feature (North America Only)
- EIA 232 Service Port Feature

### Optional Adapter Feature

This feature allows you to use the 2210 with different transports. Available interface adapters include the:

- 1- and 4-port ISDN Basic Rate Interface Adapter
- E1 120-ohm ISDN PRI Adapter
- T1/J1 ISDN PRI Adapter
- 4-Port WAN Concentration Adapter
- 8-Port WAN Concentration Adapter
- 25-Mbps ATM Interface Adapter

To install the adapters, your IBM 2210 must be equipped with the Adapter Enablement Feature.

### Adapter Enablement Feature

This feature consists of the hardware items required to install an additional interface adapter in these models.

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## Chapter 3. Physical Planning and Prerequisites

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### Placement Options - Tabletop or Rack

The 1S4, 1S8, 1U4, and 1U8 models can only be placed on a tabletop. The other IBM 2210 models can be placed on a tabletop or in a rack.

### Tabletop Placement

If the IBM 2210 is placed on a tabletop, the table must meet the requirements for service and operating clearances listed under "Physical Requirements" on page 3-2.

### Rack Placement

If you choose rack-mounting, you must provide the rack; it is not provided with the 2210.

You can use any EIA standard 19-inch rack. The rack can be open or closed. However, if you choose a closed rack, you must make sure that enough air flows through the 2210. Covers on the front of the rack that would not let air reach the 2210 must be removed or modified to let air pass. Similarly, unvented rear rack covers that would not let air exit the 2210 or would cause back pressure to build up from several machines must not be used.

The attachment holes along each side of a rack are usually divided into units of measure called *EIA units*. Each EIA unit equals 44.5 mm (1.75 in.). See Figure 3-1 on page 3-2 for the approximate height of the various IBM 2210 models. There is no requirement for clearance between IBM 2210 units in a rack; multiple units can be spaced 1 EIA unit apart.

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### Hardware and Software Requirements for the configuration program

You can use the Multiprotocol Switched Services Configuration Program (configuration program) to prepare configuration files and then upload them to the IBM 2210. This method of configuration enables you to use the change management functions of the IBM 2210.

Box images that support the DIALs Server Function require the following PROM versions or higher to successfully perform a box reload:

**2210 Release 1 and Release 2**

boot/prom version 1.50

**2210 Release 3**

boot/prom version 2.20

**Note:** Using the configuration program is recommended for the initial configuration of the IBM 2210. The configuration program enables you to save and track configuration files. You can also make an ASCII copy of the completed configuration file to check its parameters before you download it to the IBM 2210.

Refer to *Configuration Program User's Guide for Nways Multiprotocol Access, Routing and Switched Services* for details of hardware and software operating environments in which the program will operate.

## Physical Specifications

This section describes the physical characteristics and specifications for the IBM 2210.

Figure 3-1. Physical Characteristics of the IBM 2210 Models

Model	Front	Side	Height	Weight
1Sx	279.4 mm (11 in.)	133 mm (5.25 in.)	41.4 mm (1.63 in.)	1.24 kg (2.75 lb.)
1Ux	279.4 mm (11 in.)	133 mm (5.25 in.)	41.4 mm (1.63 in.)	1.24 kg (2.75 lb.)
12x	439 mm (17.3 in.)	254 mm (10 in.)	43.7 mm (1.74 in.)	3.2 kg (7 lb.)
14T	440 mm (17.3 in.)	305 mm (12 in.)	87.4 mm (3.48 in.)	5.16 kg (11.4 lb.) without Adapter Enablement Feature  5.66 kg (12.5 lb.) with Adapter Enablement Feature
24x	440 mm (17.3 in.)	305 mm (12 in.)	88 mm (3.48 in.)	5.16 kg (11.4 lb.) without Adapter Enablement Feature  5.57 kg (12.5 lb.) with Adapter Enablement Feature

## Physical Requirements

This section describes the physical requirements for operating and servicing the IBM 2210.

### Environment

#### Operating Environment

Temperature<sup>1</sup> : 10° to 40° C (50° to 104° F)

Relative humidity: 8% to 80%

Maximum wet bulb<sup>2</sup> : 26.7° C (80° F)

<sup>1</sup> The upper temperature limit must be lowered 1° C for every 137 meters of elevation above 915 meters.

<sup>2</sup> The upper wet bulb temperature must be lowered 1° C for every 274 meters of elevation above 305 meters.



### **Power Source Loading**

0.2 kVA maximum

### **Maximum Current**

2 A at 100V

1 A at 240V

### **Power Supply**

35 watts

The second power supply that is provided as part of the Adapter Enablement Feature is the same as the base power supply.

### **Operating Voltage**

100 to 250 V ac

### **Heat Output**

32 watts/hr (113 BTUs) without Adapter Enablement Feature

39 watts/hr (137 BTUs) with Adapter Enablement Feature

## **Clearance**

### **Operating Clearance**

Front: 760 mm (30 in.)

Rear: 150 mm (6 in.)

### **Service Clearance**

*For placement with cables at the front*

Front: 760 mm (30 in.)

*For placement with cables at the rear*

Front: 760 mm (30 in.)

Rear: 760 mm (30 in.)

Left: 760 mm (30 in.)

Right: 760 mm (30 in.)



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## Chapter 4. Configuration and Monitoring Tools

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### IBM 2210 Access Methods

You can access the IBM 2210 locally or remotely.

Access the IBM 2210 locally by attaching an ASCII terminal directly to the primary service port or the secondary service port, if installed. The secondary service port could be either an EIA 232 Service Port Feature or a 14.4 Kbps Modem Port Feature.

Access the IBM 2210 remotely through:

- A Telnet session
- A modem-attached device

### Local Access

To access the IBM 2210 locally, attach an ASCII terminal or emulator (with the appropriate emulation software) to the service port. Local access to the IBM 2210 is typically used to:

- Perform an initial configuration
- Service the router when the IP network is not available
- Run hardware diagnostics during repair

**Note:** The IBM 2210 service port can be damaged by static electricity discharge. It is shipped with a plastic port cover to prevent such damage. Remove the plastic cover when you are attaching a terminal and store it in a safe place. When you disconnect the terminal, reinstall the plastic cover.

### Remote Access

After the IBM 2210 becomes active on the network, remote access may be the most convenient method of accessing the IBM 2210. Remote access can be used to:

- Modify the IBM 2210 configuration
- Perform operation and management tasks using the router user interface
- Enable remote IBM service

#### Remote Access Through Telnet

Telnet is a TCP/IP protocol that enables remote access and control of one workstation from another workstation on the IP network. The user at the requesting workstation can use the remote workstation as if it were directly connected to the user's terminal. To use Telnet, the user must know:

- The host name or IP address
- A user ID and password that have been configured for the IBM 2210

## Remote Access Through a Modem-Attached Terminal

The workstation must be an ASCII terminal or emulator that is attached to a modem and is listed in “Local Access” on page 4-1. The workstation and modem must be able to initiate the call.

**Requirements for the Modem:** The modem must be connected to the service port on the IBM 2210, use asynchronous operation, and be compatible with the Attention (AT) command set. A modem connected to a 2210 service port must be configured with the following characteristics:

- No echo
- Suppress results code
- Autoanswer
- Hardware (RTS/CTS) flow control
- Modem DTE speed fixed to match 2210 service port speed (9600 recommended).

Consult your modem documentation on how to configure and save these settings.

**Remote Connection for Service:** To resolve a problem with your IBM 2210, IBM service personnel may request permission to establish a temporary, remote connection to the IBM 2210. In most situations, the IBM service personnel will not be at a remote workstation that is connected to your IP network. Consequently, remote access must be established using a modem. Whenever you authorize IBM service personnel to establish such a remote connection, you must:

- Connect and configure the modem before the remote service session can begin
- Provide the service personnel with the telephone number of a modem connected to the service port of the target IBM 2210 or to a modem that is connected to the service port on an IBM 2210 that is on the same network as the target IBM 2210
- Provide service personnel with the password or other necessary information for access to any security protection features

---

## Configuration Methods

The IBM 2210 supports four types of configuration:

- Pre-configuration

You can choose to have the IBM 2210 pre-configured at the factory. At the time of ordering, you specify information that enables IP routing. After the IBM 2210 is set up, a complete configuration must be transferred to it using TFTP.

- Quick Configuration

Quick Configuration allows you to configure selected devices, bridging protocols, and routing protocols without entering a separate configuration environment to use the Configuration Program. After creating a minimal configuration, you must transfer a complete configuration to the IBM 2210 using TFTP. To use Quick Configuration, you must attach an ASCII terminal to the IBM 2210.

- EasyStart

EasyStart mode automatically downloads the configuration of the router from a BOOTP server. During the process the router displays the EasyStart> prompt

and ELS messages that track the process. See the *Software User's Guide for Multiprotocol Routing Services* for more information about EasyStart.

- Configuration Program

The Configuration Program allows you to configure the IBM 2210 completely once pre-configuration or Quick Configuration has taken place. The Configuration Program is run on a stand-alone workstation and has a graphical user interface. Once remote access to the IBM 2210 has been enabled, the complete configuration may be transferred to it using TFTP or the configuration program SNMP set facility. For more information, see the *Configuration Program User's Guide for Multiprotocol Routing Services*.

Use either the IBM Multiprotocol Routing Services command-line interface or the Configuration Program for Multiprotocol Routing Services to make changes to configuration parameters.



---

## Appendix A. Cable Specifications

This appendix describes the signals associated with the pins on the cable connectors for the service port and the WANs supported by the IBM 2210. This information will assist you in obtaining custom cables from your supplier.

LAN and ISDN ports use industry-standard cables.

**Disclaimer:** The information in this chapter does not guarantee function or compliance with radio frequency interference (RFI) or electromagnetic interference (EMI) regulations.

---

### Service Port

The service port provides an EIA 232/V.24-compatible DTE interface on a 9-pin male D connector with the following signal definitions:

*Figure A-1. Service Port Signal Definitions*

Pin No.	Signal	Driven by IBM 2210	Received by IBM 2210
1	Carrier Detect		x
2	Receive Data		x
3	Transmit Data	x	
4	Data Terminal Ready	x	
5	Ground		
6	Data Set Ready		x
7	Request To Send	x	
8	Clear To Send		x
9	Ring Indicate		x

A null modem adapter is required for attachment to a terminal having a male connector.

---

### Wide Area Networks (WANs)

For a custom cable, use a 26-pin dual slimline male connector (AMP P/N 750850-2 and 750833-1) and the appropriate connector for the DCE/DTE. The following list gives the conformity for the EIA and CCITT connectors:

- EIA 232-D/CCITT V.24 connector must conform to ISO 2110.2
- CCITT V.35 connector must conform to ISO 2593
- CCITT V.36 connector must conform to ISO 4902
- CCITT X.21 connector must conform to ISO 4903

Bulk cable consists of the appropriate numbers of 28 American Wire Gauge (AWG) tin-plated copper individually shielded pairs, with an overall shield. The nominal characteristic impedance of the bulk cable should be 85 ohms. The cable should meet the safety requirements of the appropriate local safety organization.

The length of the connection from the IBM 2210 to the attaching equipment should not exceed 15 m (50 ft.).

The same cable and interface is used for the WAN ports on the planar and the adapter slot.

## EIA 232-D/V.24

*Figure A-2. EIA 232/V.24 Connector Pin Assignments, 25-pin D, Male, Modem-Attach*

<b>Signal</b>	<b>Machine End Pin Number</b>	<b>DCE End Pin Number</b>
Send Data	16	2
Signal Ground	23,26,21,19	7
Receive Data	2	3
Data Set Ready	13	6
Transmit Clock	12	15
Receive Clock	4	17
Clear To Send	14	5
Local Loopback	15	18
Call Indicate	17	22
Data Terminal Ready	20	20
Request To Send	22	4
Data Carrier Detect	24	8
DTE Clock	18	24

*Figure A-3. EIA 232/V.24 Connector Pin Assignments, 25-pin, D, Female, Direct-Attach*

<b>Signal</b>	<b>Machine End Pin Number</b>	<b>DTE End Pin Number</b>
Send Data	2	2
Signal Ground	23,26,21,19	7
Receive Data	16	3
Data Set Ready	20	6
Transmit Clock	18	15
Receive Clock	18	17
Clear To Send	15	5
Data Terminal Ready	13	20
Request To Send	24	4
Data Carrier Detect	22,14	8



## V.35

Figure A-4. V.35 Connector Pin Assignments, 34-pin Block, Male, Modem-Attach

<b>Signal</b>	<b>Machine End Pin Number</b>	<b>DCE End Pin Number</b>
Send Data	6,5	P,S
Signal Ground	19,23,26	B
Receive Data	2,1	R,T
Data Set Ready	13	E
Send Timing	12,11	Y,AA
Receive Timing	4,3	V,X
Terminal Timing	8,7	U,W
Clear To Send	14	D
Local Loopback	15	L
Call Indicator	17	J
Data Terminal Ready	20	H
Request To Send	22	C
Data Carrier Detect	24	F

Figure A-5. V.35 Connector Pin Assignments, 34-pin Block, Female, Direct-Attach

<b>Signal</b>	<b>Machine End Pin Number</b>	<b>DTE End Pin Number</b>
Send Data	2,1	P,S
Signal Ground	19,23,26	B
Receive Data	6,5	R,T
Data Set Ready	13,20	E
Send Timing	8,7	Y,AA
Receive Timing	8,7	V,X
Clear To Send	15	D
Request To Send	24	C
Data Carrier Detect	22,14	F

## V.36

Figure A-6. V.36 Connector Pin Assignments, 37-pin D, Male, Modem-Attach

Signal	Machine End Pin Number	DCE End Pin Number
Send Data	6,5	4,22
Signal Return DCE	19	20
Signal Return DTE	23	25,30,37
Receive Data	2,1	6,24
Data Set Ready	13	11
Send Timing	12,11	5,23
Receive Timing	4,3	8,26
Clear To Send	14	9
Local Loopback	15	10
Call Indicator	17	15
Data Terminal Ready	20	12
Request To Send	22	7
Data Carrier Detect	24,26	13,31

## X.21

Figure A-7. X.21 Connector Pin Assignments, 15-pin D, Male

Signal	Machine End Pin Number	DCE End Pin Number
Send Data	6,5	2,9
Signal Ground	23	8
Receive Data	2,1	4,11
Control	10,9	3,10
Indicate	24,26	5,12
Signal (Clock)	4,3	6,13
Terminal Timing	8,7	7,14

---

## X.21 Direct Connect Cable

Figure A-8. X.21 Connector Pin Assignments, 26-pin D, Male to 15-pin Female

Signal	26-pin Connector	15-pin Connector
Receive Data A, B	6, 5	4, 11
Indicate A, B	10, 9	4, 12
Send Data A, B	2, 1	2, 9
Control A, B	24, 26	3, 10
Receive Timing A, B	4, 3	7, 14
Signal A, B	8, 7	6, 13
Ground	23, 19	8
Cable ID jumper	22, 13	

**Note:** Each line in the table is a twisted pair. Connect the first pin in the first column to the first pin in the second column.

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## T1, J1, and E1 Custom Cable Specifications

For a custom cable, use a 26-pin, three row, male connector (Positronics P/N ODD26F4R8NOX) and the appropriate connection at the network end; RJ-48C that meets ISO 8877, ANSI 408 and EIA/TIA 547 for T1 and J1; country specific for E1.

Bulk cable must have the following characteristics:

- Two twisted pairs
- Shielding on each twisted pair plus overall shielding
- Cable must meet the safety requirements of the appropriate local safety organization
- Twisted pair shielding carried through on connector as shown in appropriate tables.
- Maximum length depends on cable gauge and installation, contact your service provider.

---

## T1 Connector Pin Assembly

Figure A-9. T1 Connector Pin, 26-pin D, to RJ-48L

Signal	26-pin Connector	RJ-48L
Transmit Data	11,13	5,4
TransmitData Shield	Connector Shell	6
Receive Data	15,17	2,1
Receive Data Shield	Connector Shell	3

---

## J1 Connector Pin Assembly

*Figure A-10. J1 Connector Pin, 26-pin D, to RJ-48L*

<b>Signal</b>	<b>26-pin Connector</b>	<b>RJ-48L</b>
Transmit Data	11,13	6,3
Receive Data	15,17	5,4

---

## E1 Connector Pin Assembly

*Figure A-11. E1 Connector Pin, 26-pin*

<b>Signal</b>	<b>Machine End</b>	<b>Network End</b>
Transmit Data	11,13	Country Specific
Receive Data	15,17	Country Specific
Shield	Connector Shell	Country Specific

---

## Appendix B. Management of Routing Networks

This appendix describes the management of routing networks and covers the following topics:

- Network characteristics
- Basic principles
- The network organization
- Configuration management
- Router changes (configuration and hardware)
- Network changes

---

### Network Characteristics

The routing network includes many components and has the following characteristics:

- The network is an open system.
- There are many similar but different components.
- Each configuration file must complement many others.
- Many different approaches can be used.
- Each configuration file contains many parameters (1300+ available).
- Many failures are dependent on specific application loads.
- Some configuration errors appear to be box problems.
- One configuration error can bring down the network.

The network is a complex system that must be managed. There are:

- Many interdependencies
- Few absolutes

---

### Basic Principles

#### Configuration Control

Configuration control requires a consistent approach that is best achieved by one person, referred to in this appendix as the *Network Engineer*, or by a unified team. This person or team should work in conjunction with a central control point, referred to as the *Network Management Center (NMC)*.

#### The Network Engineer

To ensure consistency throughout the network, a single individual or a unified team must establish an approach and define or approve the configuration for each network box. Routing networks are defined by a large number of parameters specified in a number of different network boxes. The parameters specified in the different boxes must complement each other to form a unified and functioning network. The configuration program specifies these network parameters for the IBM 2210.

There is no “right” set of parameters and box configurations for a network. There are many possible configuration combinations.

## **Central Control Point (Network Management Center)**

All configurations and updates should be loaded and updated from a central control point, usually the Network Management Center (NMC). This allows a single individual (or team) to monitor, test, and coordinate activities at several locations or sites from a single location. This is easily accomplished using TCP/IP Telnet methods in combination with the remote access features in the IBM routers.

An exception to loading all configurations directly from a central control point is the initial configuration for a new router or the reconnection of a router to the network following a repair or hardware change. However, all these configurations should be supplied by, and controlled by, the NMC.

When problems occur, all activities should be coordinated with the Network Management Center. The NMC involves the Network Support Team, network engineer, and box support/service organizations as needed.

## **Step-by-Step Configurations**

Maintain a solid base by configuring the network step-by-step. The key factors are:

- IP connectivity (direct routes only)
- One protocol at a time
- Patience

### **IP Connectivity**

Each router should be configured initially with only IP direct routes. With this configuration installed, it is easy to verify that each port on the router is connected to the device specified. Simply “ping” through the port to the attached device. If the ping is not successful, it is clear that the link being pinged has a problem. If dynamic routing protocols are active, they may route the ping around the problem, making it difficult to detect and identify the problem.

### **One Protocol at a Time**

After IP connectivity has been established, enable one protocol at a time and test each to verify the router is functioning in the network as expected. This step-by-step approach applies to application protocols such as IPX and NetBIOS as well as network protocols such as OSPF and RIP.

In established well-controlled networks where step-by-step configurations have been applied consistently without corrections, you can combine several protocols into one step. However, if you encounter problems, return to a single protocol per step until consistency is reestablished.

### **Patience**

It may take considerable time for some configurations to load and become functional, especially if the advanced network protocols such as OSPF are used in a large network. For large networks with thousands of devices, it is not unusual for this to take from 15 minutes to an hour or more.

## Configuration and Network Debugging

Reestablishes a solid base:

- Expect many types of errors.
- Limit time attempting a “quick fix.”
- Generate new configurations from scratch.

### Many Types of Errors

Errors in the configuration program can cause many different types of problems. They may initially appear to be router hardware problems because the router will not complete booting or data will not flow through an adapter port. Also, configuration errors may not cause a problem initially, but will cause a problem when specific conditions are encountered.

### Generate New Configurations

If a problem is not resolved after you make a few changes to a configuration file, it is highly recommended that you generate a new configuration file from scratch following the step-by-step approach already defined.

A few changes to the configuration will often create additional errors which compounds the problem and requires a number of hours to debug and resolve. Also, some parameters may have been activated or changed by accident. It may take over an hour to check all 1300+ parameters in the questionable configuration file. A new configuration can usually be generated and tested step-by-step within an hour. Also, there is a high probability that this new configuration will function as desired or a defect in the network configuration or the network devices will be identified.

---

## The Network Organization

The key is to have structure and control. A typical organization consists of:

- The Network Management Center (NMC)
- The Network Engineer
- The Network Support Team
- The Network Manager

**Note:** Many other structures can be used, and these functions can be combined with others.

## Network Management Center

The Network Management Center (NMC) provides network monitoring, network coordination, and network control.

### Network Monitoring

For large networks, the NMC:

- Provides support 24 hours a day, 7 days a week, with operators present. This may be combined with the Help Desk.
- Uses NV/6000 or a similar tool.
- Monitors network capacity measurements.
- Takes all calls relative to network problems.

- Maintains network diagram and associated databases.
- Maintains data and service procedures for:
  - Network external connections (T1, Frame Relay, and so on)
  - Equipment used in the network
  - Service and support organizations

For small networks, the NMC:

- Provides support 24 hours a day, 7 days a week. This function may be combined with the Network Engineer function.
- Takes or records all calls relative to network problems.
- Maintains network diagram and associated data.
- Maintains data and service procedures as needed.

## Network Coordination

The NMC:

- Calls and dispatches the Network Support Team to investigate problems. The Network Engineer or IBM systems engineering operations specialist may replace the Support Team for small networks.
- Calls suppliers and others for problem resolution.
- Negotiates network down time between network users and the problem solvers or network changers.
- Coordinates and schedules planned network down time and maintenance.
- Coordinates requests for network improvements and expansions. This activity includes:
  - Receiving requests from users and management
  - Forwarding requests to the Network Engineer
  - Informing users and requesters of planned actions
- Schedules and coordinates network changes as defined by the Network Engineer.

## Network Control

The NMC:

- Implements and documents all changes to the network. The Network Support Team or Network Engineer make the changes, but the NMC controls and documents them.
- Coordinates all maintenance, test, and diagnostics activities:
  - Before activity starts
  - After activity is complete, with results reported even if previously scheduled and on-time
- Ensures that network procedures are followed ... “network police.”
  - For problem determination, maintenance, and changes
  - Procedures provided by the Network Engineer

**Note:** The Network Engineer must also follow the procedures.
- Escalates issues to the correct person:
  - Users to area coordinator or area management



- Service providers to their management
- Network support team to the Network Engineer
- Network Engineer to the Network Manager

## Network Engineer

The Network Engineer:

- May be replaced by a team of people that functions as single unit
- May be the IBM systems engineering operations specialist for small networks
- Obtains recommendations from many sources.

The Network Engineer is responsible for:

1. Network design, function, and cost:
  - Defines or approves all network changes
  - Tracks and analyzes network performance and issues
  - Defines NMC and other procedures associated with the network
2. Network problem resolution:
  - Resolves problems reported by the NMC, management, or network users
  - Coordinates all activity through the NMC
3. Training and education:
  - NMC personnel
  - Network support team personnel
  - Network users
  - Managers, both users and network support
  - Service and other related personnel
  - New network engineers

**Note:** Other agencies may actually deliver the training.

## Network Support Team

The Network Support Team is responsible for:

1. Network maintenance and debugging:
  - Box connectivity and interface connectors, converters, and adapters
  - Workstations, servers, terminals, printers
  - Bridges, routers
  - Facilities, space, and security as required for each item.
  - Location and access to each box, cable, and set of documentation.
2. Identification and correction of problems or concerns:
  - Resolves issues directly when possible
  - Requests support from component or box supplier when needed
  - Provides Network Engineer or others with data relative to the problem or concern
  - Implements tests or corrections as defined by Network Engineer or equipment supplier
  - Keeps NMC informed of all activities and results
3. Assistance and coordination of equipment suppliers:
4. Implementation of measurements, tests, and changes according to directions provided by the Network Engineer.

## Network Manager

The Network Manager is responsible for:

1. Network management and operation:
  - Sets priorities
  - Resolves disputes
  - Ensures quality
2. Finances:
  - Funding
  - Expense Recovery
3. Staffing:
  - Obtains the skills needed
  - Deals with personnel issues and evaluations
  - Responsible for organization and controls
4. Interfacing to the organization and users:
  - Ensures continued funding
  - Identifies changes in requirements
5. Supporting the “network police”

---

## Configuration Management

Configuration management involves:

- Configurations
- Configuration sets
- Naming conventions
- Router configuration changes
- Hardware changes that affect the network
- Hardware changes that do not affect the network
- Router code updates

## Configurations

These are maintained:

1. On the Configuration Workstation in the NMC for each router:
  - An IP direct route only configuration to verify router connectivity
  - A complete protocol configuration based on current functions
  - Individual protocol test configurations
  - A history of previous configurations

Different configuration files must be clearly labeled or named.

2. At each router:
  - PC terminal emulator and IP direct route diskettes
  - or
  - Data and instructions for configuring an IP direct route plus ASCII terminal, cables, and so on.

Alternatively, a telephone line and modem can be connected to a service port and the NMC can install configuration files as needed.

3. On additional configuration workstations or files:

- Backup files are needed for NMC configuration workstation
- Multi-configuration workstations may be needed for large or geographically dispersed networks, but must be closely coordinated and controlled.

## Configuration Sets

Configuration sets are maintained in configuration database (CDB) files created by configuration programs.

Different configuration sets can be maintained for:

- Current network operations (production)
- Previously-used CDBs
- Special applications or events
- Tests for special functions, performance, and so on
- Planned improvements and expansions

## Naming Conventions

### Concepts

Name each configuration file so that it can be quickly and directly identified relative to:

- Router
- Configuration type (IP only, IP routing protocols, and so on)
- Configuration set

A naming convention may be required to use special programs for configuration set transfer and import.

### Configuration Database Names

The following example is an approach used for AIX workstations. It uses an 8-character name with the following format:

xxxxxxx.CDB

Examples:

CURPROD_.CDB	Current production configuration set
CURIPDIR.CDB	Current IP Direct Route configuration set
H930814_.CDB	History production configuration from 8/14/93
E1103TST.CDB	Enhancement configuration set tested 11/03
BLDAPPN_.CDB	Building configuration set for APPN.



- Network engineer and others may observe or assist.

**Note:** If problems are encountered, obtain assistance from:

- The Network Support Specialist
- The Network Engineer
- The IBM 2210 Level II Support

---

## Changes to a Router

Changes to a router include hardware changes that do or do not affect the network, and router code updates.

## Hardware Changes that Affect the Network

These changes include:

- Adapter, port, or interface cable changes
- Connection of a new router into the network
- System board replacement

Make hardware changes that affect the network as follows:

1. The Network Engineer defines or approves all network changes, including:
  - Change instructions
  - Time and prerequisites for changes
  - Results and impact of changes
  - A “bail-out” plan, and when to implement it
2. The NMC schedules all changes to the network.
3. The service representative contacts the NMC and verifies planned activities, including the “bail-out” plan.
4. The service representative implements the hardware changes and runs diagnostics as needed.
5. The NMC and service representative verify that:
  - Cables are connected to the ports according to the configuration.
  - The operating system level and Configuration Program are compatible.
6. The service representative connects the router to the network by configuring an IP direct route to the network using the instructions and data provided.
7. The NMC completes the IP direct route configuration.
8. The NMC verifies network connectivity by testing connectivity to and from each attached port using the network diagram and change instructions.
9. The NMC installs IP routing protocol configurations and verifies them.

**Note:** The service representative may leave the site at this point.
10. The NMC installs application protocol configurations and verifies them.
11. The NMC documents the changes and their impact, and monitors function for a significant time.

## Hardware Changes that Do Not Affect the Network

These changes include, for example, replacement of a fan or power supply in a router that was functioning in the network prior to the hardware problem. Hardware changes that do not affect the network are made as follows:

1. The NMC schedules all changes to the network.
2. The service representative contacts the NMC and verifies planned activities:
  - “Bail-out” plan
  - Availability of hardware and configuration files
3. The service representative implements the hardware changes and runs diagnostics as needed.
4. The service representative informs the NMC that the router is ready for network reconnection.
5. The service representative connects the router to the network by plugging in the power cord and verifying that the system and ports are active without errors.
6. The NMC verifies that the router is functioning as before.
7. The NMC documents the changes.

## Router Code Updates

Update the router code as follows:

1. The Network Engineer defines or approves all network changes. The definition includes:
  - Update instructions
  - Time and prerequisites for update
  - Results and impact of update
  - A “Bail-out” plan, and when to implement it
2. The NMC loads PTFs to the router. If the update cannot be installed remotely by the NMC, the NMC controls the activity at the router.
3. If the current configuration is not compatible with updated router level:
  - Update the configuration files using the configuration program:
    - IP direct route only configuration
    - Functional configuration with all protocols
    - Test configurations such as IP routing protocol
  - Load configurations into the router
  - Update local configuration data sources (verify that instructions and data for configuring IP direct routes are available).
4. Commit PTFs according to instructions. The router reboots with the current configuration.
5. The NMC verifies that the router is functioning according to the update instructions and previous data, documents the update and results, and monitors function for a significant time.
6. New functional configurations are generated and installed by the NMC. After the network is verified as stable at new code level, configurations are changed to use the new capability.

---

## Network Changes

### Configuration Build Sequence

Use the following configuration build sequence:

1. Generate router configurations. A typical sequence is:
  - a. IP direct routes
  - b. IP routing protocols
  - c. IP filter and exports
  - d. Application 1 protocol
  - ⋮
  - e. Application *n* protocol
2. Test and/or analyze:
  - a. Test bed with load/traffic  
or  
Network engineer with direct experience
  - b. Non-critical subnets or segments
    - Implement according to procedure (NMC)
    - Operate for significant time
    - Do three segments without errors or problems
3. Schedule remaining subnets or segments:
  - The NMC implements the changes.
  - When problems occur, drop back to the test bed.

### Network Configuration Changes

Update the router code as follows:

1. The Network Engineer defines or approves each configuration.
  - Configurations are named according to established conventions.
  - Each configuration set is in the CDB file by router type.
  - Configuration change instructions are available.
  - A “bail-out” plan is available.
2. The NMC transfers configuration files to the routers. This may require a special feature<sup>1</sup> or shell scripts.
3. Import the configuration for each router. This requires a defined plan, including router sequence, to:
  - Maintain connectivity
  - Minimize exposure to significant network down time:
    - One router or subset at a time
    - One router every xxx minutes
    - All routers at same time
4. Monitor the network to verify the changes.

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<sup>1</sup> A Multi-Transmit Feature is included in V1R3 AIX Configuration Program.

5. Document configuration changes and effects.

## Network Code Updates

Apply network code updates as follows:

1. Test and/or analyze:
  - a. Test bed with load/traffic  
or  
Network engineer with direct experience
  - b. Non-critical subnet or segment
    - Implement according to procedure (NMC)
    - Operate for significant time
    - Do three segments without errors or problems
  - c. You may use special features or shell scripts:
    - To transmit PTFs to all routers
    - To apply and commit either one at a time (sequence important) or all at once.
2. Schedule remaining subnets or segments:
  - The NMC implements the changes.
  - When problems occur, drop back to the test bed.
3. Stabilize at single code level (single configuration level).

## Network Expansion Example

This example involves connecting additional LANs and WANs to the network.

Assumptions:

- This is a tested and established procedure.
- NMC personnel are experienced.
- This is a large network with hundreds of routers.

### 1. Preparation by the NMC

1. Network Change Instructions are available and approved.
2. The NMC verifies that:
  - Telco links are active between routers  $l_i$  and  $N_i$ .
  - Telco links are connected to correct ports in  $l_i$ .
  - The LAN connections are available and active for  $N_i$ .
  - The new routers ( $N_i$ ) are at the site.
3. The NMC schedules the service representative or network support specialists for each site. Each service representative or support specialist has:
  - A plan and procedures to be used, including information about what to use when.
  - Documentation needed:
    - Phone number for NMC
    - Network diagram and/or data needed
    - Installation and other procedures
    - Port locations



- Physical location data
- Equipment needed
  - IP direct route Configuration Diskette
  - Diagnostics diskettes
  - Modem and associated cables
  - Terminal and associated cables

**Note:** Some or all of these items may be available at the site.

## 2. Key Installation Steps

1. Each service representative (or support specialist) contacts the NMC from the site and verifies the plan.
2. Each service representative sets up the router at the site:
  - Verifies that ports are as specified
  - Runs diagnostics if required
  - Positions router in specified location
  - Connects network cables as specified
3. The NMC installs expansion configurations in the interface routers:
  - Previous functional configurations with new connections added.
  - They may be installed in advance or during previous change.
4. The service representative contacts the NMC to coordinate the connection of the router (Ni) to the network, and then:
  - Plugs in the power cord with the terminal connected.
  - Configures an IP direct route to the network according to the instructions and data provided.
5. The NMC completes the direct route configuration.
6. The NMC verifies connectivity for router (Ni):
  - Tests connectivity to and from each attached port.
  - Tests using network diagram and change instructions.
7. The NMC multiplexes with all sites to verify connectivity. Problems are debugged and resolved if possible. If problems are not resolved:
  - Expansion proceeds using the connections available.
  - Allowable delays are defined by change instructions.
  - Service call is initiated to resolve the problem.
8. The NMC installs IP Routing Protocols on each router:
  - Transfers and commits configurations for each router.
  - Tests to verify IP routing for the expanded network:
    - using the Network Change Instructions
    - Checking routing tables, processes running, and so on.

**Note:** The service representative may leave the site when IP routing is verified.
9. The NMC installs application protocols on each router, transfers and commits configurations for each router, and tests to verify that the expanded network is functioning.

10. The NMC documents the expansion and the effect, continues to monitor function for a significant time, and schedules further expansions when stability is verified.

### **3. Network Roll-Out Plan**

This plan summarizes the activities and costs for the network expansion example.

#### **NMC operator (1/2 day):**

Adds two to six routers to the network (number dependent on complexity).

Schedules future expansion project:

- Service representative and Telco activity
- Network cable availability

#### **Configuration specialist (1/2 day):**

Generates configuration files needed for project (most configurations are generated in advance).

Generates new configurations as needed to:

- Debug or verify a problem
- Correct problems identified

#### **Service representative for each router:**

Requires 2 to 5 person-hours per site (each router is at a different site).

#### **NMC user interface specialists (1/2 day x 2 specialists):**

- Coordinate new function or change with user groups.
- Prepares users for the change.
- Schedules the change.
- Handles questions and problems.

#### **Roll-out rate and costs:**

Based on 16 to 48 routers per week:

8 half-days for adding routers

2 half-days for follow-up problems

Four NMC personnel:

1 Operator

1 Configuration specialist

2 User interface specialists

#### **Total roll-out costs per router:**

3 to 10 NMC hours per router

2 to 5 service representative (or network specialist) hours per router

## **Network Expansion Requirements**

This section summarizes the network expansion requirements in terms of personnel experience and network controls that must be in place.

### **1. Experienced Network Installer/Designer**

- More than four networks designed, each supported for more than one year
- Hands-on full-time support for a time on each network

## **2. Experienced Network Installer for the NMC**

- More than 4 years hands-on full-time installation and maintenance
- Four different network types including network expansions
- Can quickly generate network diagram from routing tables
- Can recognize symptoms from many different types of problems

## **3. Network Controls in Place and Working**

- Approval of all network changes by the Network Engineer
- Coordination of all network support activity through the NMC
- Network police active and backed by network management
- Documented procedures and controls with flowcharts

## **4. Local Network Support**

- Support personnel with quick access to each node
- Can set up, test, and repair routers and related products
- Can assist network installer and the Network Engineer

# **Network Configuration Changes**

Make network configuration changes as follows:

1. The Network Engineer defines or approves each configuration.
  - Configurations are named according to established conventions.
  - Each configuration set is in the CDB file by router type.
  - Configuration change instructions are available.
  - A “bail-out” plan is available.
2. The NMC transfers configurations to the routers. This may require a special program or shell scripts.
3. Import configuration for each router using the special program.
4. Import the configuration for each router using the special program. This requires a defined plan, including router sequence, to:
  - Maintain connectivity
  - Minimize exposure to significant network down time:
    - One router or subset at a time
    - One router every xxx minutes
    - All routers at same time
5. Monitor the network to verify the changes:
  - Observe router status changing as configurations take effect.
  - Check routing tables and other parameters.
  - Check compliance with configuration change instructions.
6. The NMC documents the changes and their impact, and monitors function for a significant time.



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## Appendix C. Notices

References in this publication to IBM products, programs, or services do not imply that IBM intends to make these available in all countries in which IBM operates. Any reference to an IBM product, program, or service is not intended to state or imply that only IBM's product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any of IBM's intellectual property rights may be used instead of the IBM product, program, or service. Evaluation and verification of operation in conjunction with other products, except those expressly designated by IBM, are the user's responsibility.

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### Electronic Emission Notices

#### Notices for Models 12x, 14T, and 24x

##### **Federal Communications Commission (FCC) Statement**

**Note:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

##### **Industry Canada Class A Emission Compliance Statement**

This Class A digital apparatus meets the requirements of the Canadian Interference-Causing Equipment Regulations.

##### **Avis de conformité aux normes d'Industrie Canada**

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

## Notices for Models 1Sx and 1Ux

### Federal Communications Commission (FCC) Statement

**Note:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an IBM authorized dealer or service representative for help.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Proper cables and connectors are available from IBM authorized dealers. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

### Industry Canada Class B Emission Compliance Statement

This Class B digital apparatus meets the requirements of the Canadian Interference-Causing Equipment Regulations.

### Avis de conformité aux normes d'Industrie Canada

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

## Notices for All Models

### Japanese Voluntary Control Council for Interference (VCCI) Statement

This equipment is Class 1 Equipment (information equipment to be used in commercial and industrial districts) which is in conformance with the standard set by the Voluntary Control for Interference Council by Data Processing Equipment and Electronic Office Machines (VCCI) with an aim to prevent radio interference in commercial and industrial districts. This equipment could cause interference to radio and television receivers when used in and around residential districts. Please handle the equipment properly according to the instruction manual.

## 情報処理装置等電波障害自主規制協議会 (VCCI) 表示

この装置は、第一種情報装置(商工業地域において使用されるべき情報装置)で商工業地域での電波障害防止を目的とした情報処理装置等電波障害自主規制協議会(VCCI)基準に適合しております。

従って、住宅地域またはその隣接した地域で使用すると、ラジオ、テレビジョン受信機等に受信障害を与えることがあります。

取扱説明書に従って正しい取り扱いをして下さい。

### **European Community (CE) Mark of Conformity Statement**

This product is in conformity with the protection requirements of EC Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

Properly shielded and grounded cables and connectors must be used in order to reduce the potential for causing interference to radio and TV communications and to other electrical or electronic equipment. Such cables and connectors are available from IBM authorised dealers. IBM cannot accept responsibility for any interference caused by using other than recommended cables and connectors.

A Declaration of Conformity with the requirements of the Directive has been signed by IBM Spain, Division of Fabricacion, 46185 La Pobla de Vallbona, Valencia, Spain.

The product bears the Telecom CE mark (CE 168 X) for:

- V.24/V.28,V36 and X.21 electrical interfaces complying with NET 1 and with NET 2 physical level.
- ISDN Basic Rate complying with I-CTR3 (Bridging measures)

as per the European directive 91/263/EEC (TTE directive).

This product has been tested and found to comply with the limits for Class B Information Technology Equipment according to CISPR 22 / European Standard EN 55022. The limits for Class B equipment were derived for typical residential environments to provide reasonable protection against interference with licensed communication devices.

Dieses Gerät ist berechtigt in Übereinstimmung mit dem deutschen EMVG vom 9.Nov.92 das EG-Konformitätszeichen zu führen. Der Aufsteller der Konformitätserklärung ist die IBM Spain, Division of Fabricacion, 46185 La Pobla de Vallbona, Valencia, Spain.

Dieses Gerät erfüllt die Bedingungen der EN 55022 Klasse B.

## Notice about Lithium Battery

The IBM 2210 contains a non-replaceable lithium battery that, if disposed of improperly, can cause a fire, an explosion, or a severe burn. At the end of the life of this machine, return the IBM 2210 to IBM or dispose of it according to local regulations.

## U.K. Safety Approval

The IBM 2210 is manufactured to the International Safety Standard EN 60950 and as such is approved in the U.K. under the General Approval number NS/G/1234/J/100003 for indirect connection to the public telecommunication network.

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## Telecommunication Notices

### FCC Part 68 Compliance Information

Features and optional adapters for the IBM 2210 comply with Part 68 of the FCC rules. The label included on the bottom of the IBM 2210 and the top of the features and adapters contains, among other information, the FCC registration number and Ringer Equivalence Number (REN) for this equipment. If requested, provide this information to your telephone company.

The features and adapters include:

Part Number	Part Name
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<b>41H7096</b>	14.4 Kbps Modem Port Feature with REN # .6B and jack type RJ11.
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<b>41H7150</b>	T1/J1 ISDN PRI Adapter with interface code 04DU9-1SN, service code 6.0N and jack type RJ48C.
----------------	----------------------------------------------------------------------------------------------

<b>72H5062</b>	ISDN Quad BRI Adapter - U with interface code 021S5 service code 6.0F and jack type RJ49C
----------------	-------------------------------------------------------------------------------------------

The REN is useful to determine the quantity of devices you may connect to your telephone line and still have those devices ring when your number is called. In most, but not all areas, the sum of the RENs of all devices should not exceed five (5.0). To be certain of the number of devices you may connect to your line, as determined by the REN, you should call your local telephone company to determine the maximum REN for your calling area.

If the IBM 2210 causes harm to the telephone network, the Telephone Company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice isn't practical, you will be notified as soon as possible. You will be advised of your right to file a complaint with the FCC.

Your telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper operation of your equipment. If they do, you will be given advance notice so as to give you an opportunity to maintain uninterrupted service.

If trouble is experienced with this equipment, for repair or warranty information, in the United States, call IBM at **1-800-IBM-SERV**. In Canada, call IBM at **1-800-465-6600**.



No repairs can be performed by the customer.

## Industry Canada Information

**NOTICE:** The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

**CAUTION:** Users should not attempt to make such connections themselves, but should contact the appropriate electrical inspection authority, or electrician, as appropriate.

The load number assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the load numbers of all the devices does not exceed 100. The load number of the 14.4 Kbps Modem Port Feature is 05.

**AVIS :** L'étiquette d'Industrie Canada permet d'identifier un équipement homologué. Cette homologation signifie que cet équipement satisfait certaines exigences en matière de protection, d'exploitation et de sécurité du réseau de télécommunications. Industrie Canada n'offre aucune garantie que le fonctionnement de cet équipement soit à la satisfaction de l'utilisateur.

Avant d'installer cet équipement, l'utilisateur doit s'assurer qu'il a la permission de le raccorder aux installations de l'entreprise de télécommunications. L'installation de cet équipement doit aussi se faire selon un mode de raccordement acceptable. Dans certains cas, le câblage interne de l'entreprise associé au service individuel offert par une ligne d'abonné peut être prolongé au moyen d'un connecteur homologué (prolongateur de téléphone). Le client devrait être informé que la conformité de son équipement aux conditions susmentionnées n'est pas une prévention contre la dégradation du service dans certaines situations.

Toute réparation d'un équipement homologué devrait être effectuée par un service de maintenance canadien autorisé qui a été désigné par le fournisseur. Toute

réparation ou modification d'équipement faite par l'utilisateur, ou tout mauvais fonctionnement, pourrait entraîner la déconnexion de cet équipement par l'utilisateur à la demande de l'entreprise de télécommunications.

Pour sa protection personnelle, l'utilisateur devrait s'assurer que les mises à la terre des services publics électriques, des lignes téléphoniques et du système interne des canalisations d'eau à tuyaux métalliques, advenant leur présence, sont interconnectées. Dans les zones rurales, il s'agit-là d'une précaution particulièrement importante à prendre.

**ATTENTION :** Toute tentative de connexion par l'utilisateur est à déconseiller. Il est préférable de communiquer avec le responsable de l'inspection en électricité ou un électricien, selon le cas.

Le NUMÉRO DE CHARGE (LN) attribué à chaque dispositif du terminal sert à indiquer le pourcentage de la charge totale qui doit être connecté à une ligne d'abonné utilisée par ce dispositif, afin de prévenir toute surcharge. Par terminaison de ligne, on entend toute combinaison de dispositifs qui satisfait l'exigence selon laquelle le total des NUMÉROS DE CHARGE de tous les dispositifs n'est pas supérieur à 100.

NUMÉRO DE CHARGE DE CETTE UNITÉ (14.4 Kbps Modem Port Feature) : 05

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## Safety Notices



**Danger:** Before you begin to install this product, read the safety information in *Caution: Safety Information—Read This First*, SD21-0030. This booklet describes safe procedures for cabling and plugging in electrical equipment.

**Danger:**

Hazardous voltages exist inside this machine when it is powered on. Anytime you service this unit with the cover off, be sure to unplug the power cord.



**Gevaar:** Voordat u begint met de installatie van dit produkt, moet u eerst de veiligheidsinstructies lezen in de brochure *PAS OP! Veiligheidsinstructies—Lees dit eerst*, SD21-0030. Hierin wordt beschreven hoe u elektrische apparatuur op een veilige manier moet bekabelen en aansluiten.

**Gevaar:**

Er bevindt zich gevaarlijke spanning binnenin deze machine, wanneer ze is ingeschakeld. Telkens als u onderhoud uitvoert op deze eenheid, met de behuizing verwijderd, moet u het netsnoer loskoppelen.



**Pericolo:** prima di iniziare l'installazione di questo prodotto, leggere le informazioni relative alla sicurezza riportate nell'opuscolo *Attenzione: Informazioni di sicurezza — Prime informazioni da leggere* in cui sono descritte le procedure per il cablaggio ed il collegamento di apparecchiature elettriche.

**Pericolo:**

Quando la macchina è alimentata, vi sono tensioni pericolose all'interno. Ogni volta che si effettuano interventi di manutenzione, se il coperchio non è inserito, scollegare il cavo di alimentazione.



**Vorsicht:** Bevor mit der Installation des Produktes begonnen wird, die Sicherheitshinweise in *Achtung: Sicherheitsinformationen—Bitte zuerst lesen*, IBM Form SD21-0030. Diese Veröffentlichung beschreibt die Sicherheitsvorkehrungen für das Verkabeln und Anschließen elektrischer Geräte.

**Vorsicht:**

Bei eingeschaltetem Gerät liegen im Innern gefährliche Spannungen an. Sicherstellen, daß bei Arbeiten an der geöffneten Maschine der Netzstecker gezogen ist.



**Perigo:** Antes de iniciar a instalação deste produto, leia as informações de segurança *Cuidado: Informações de Segurança — Leia Primeiro*, SD21-0030. Este documento descreve como efectuar, de um modo seguro, as ligações eléctricas dos equipamentos.

**Perigo:**

Este equipamento, quando ligado, apresenta tensões perigosas no seu interior. Sempre que proceda a assistência nesta unidade com a cobertura retirada, certifique-se que o cabo de alimentação da unidade se encontra desligado.



**Peligro:** Antes de empezar a instalar este producto, lea la información de seguridad en *Atención: Información de Seguridad — Lea Esto Primero*, SD21-0030. Este documento describe los procedimientos de seguridad para cablear y enchufar equipos eléctricos.

**Peligro:**

Aun cuando está apagada, hay voltajes peligrosos en esta máquina. Siempre que dé servicio a esta máquina sin la cubierta, asegúrese de desenchufar el cable de alimentación.



**Fare:** Før du begynner å installere dette produktet, må du lese sikkerhetsinformasjonen i *Advarsel: Sikkerhetsinformasjon — Les dette først*, SD21-0030 som beskriver sikkerhetsrutinene for kabling og tilkobling av elektrisk utstyr.

**Fare:**

Det er farlig spenning inni maskinen når den er slått på. Hver gang du utfører service på maskinen mens dekselet er tatt av, må du huske på å trekke ut nettkabelen.



**VAARA:** Ennen kuin aloitat tämän tuotteen asennuksen, lue julkaisussa *Varoitus: Turvaohjeet—Lue tämä ensin*, SD21-0030, olevat turvaohjeet. Tässä kirjasessa on ohjeet siitä, miten sähkölaitteet kaapeloidaan ja kytketään turvallisesti.

**Vaara:**

Virran ollessa kytkettynä koneen sisällä on vaarallisia jännitteitä. Muista aina irrottaa verkkojohto, jos huollat konetta sen suojakannen ollessa irrotettuna.



**Fare!** Før du installerer dette produkt, skal du læse sikkerhedsforskrifterne i *NB: Sikkerhedsforskrifter—Læs dette først* SD21-0030. Vejledningen beskriver den fremgangsmåde, du skal bruge ved tilslutning af kabler og udstyr.

**Fare!**

Der er høj spænding i denne maskine, når den er tændt. Træk derfor altid netledningen ud, når enheden skal efterses.



**Varning — livsfara:** Innan du börjar installera den här produkten bör du läsa säkerhetsinformationen i dokumentet *Varning: Säkerhetsföreskrifter— Läs detta först*, SD21-0030. Där beskrivs hur du på ett säkert sätt ansluter elektrisk utrustning.

**Varning — livsfara:**

Farliga spänningar i maskinen när den är påslagen. Se till att nätkabeln är urkopplad innan du öppnar enheten.



危険： 導入作業を開始する前に、安全に関する小冊子SD21-0030 の「最初にお読みください」(Read This First)の項をお読みください。  
この小冊子は、電気機器の安全な配線と接続の手順について説明しています。

危険:

電源投入中は、内部に危険な電圧がかかっています。カバーを開けて保守作業をする場合は、必ず電源コードを抜いてから行ってください。



위험: 이 제품을 설치하기 전에 반드시 "주의: 안전 정보-시작하기 전에" (SD21-0030) 에 있는 안전 정보를 읽으십시오.

위험:

기계를 켤때 위험한 전압이 흐를 수 있으니 조심하십시오.



**Perigo:** Antes de começar a instalar este produto, leia as informações de segurança contidas em *Cuidado: Informações Sobre Segurança—Leia Isto Primeiro*, SD21-0030. Esse folheto descreve procedimentos de segurança para a instalação de cabos e conexões em equipamentos elétricos.

**Perigo:**

Existem voltagens perigosas no interior desta máquina quando ela está ligada. Toda vez que você for fazer a manutenção desta unidade com a tampa aberta, certifique-se de desconectar o cabo de força.



**Danger :** Avant d'installer le présent produit, consultez le livret *Attention : Informations pour la sécurité — Lisez-moi d'abord*, SD21-0030, qui décrit les procédures à respecter pour effectuer les opérations de câblage et brancher les équipements électriques en toute sécurité.

**Danger:**

Tension dangereuse à l'intérieur de la machine lorsque celle-ci est sous tension. Avant toute intervention à l'intérieur, débranchez le cordon d'alimentation.



**Upozornění:** než zahájíte instalaci tohoto produktu, přečtěte si nejprve bezpečnostní informace v pokynech „Bezpečnostní informace“ č. 21-0030. Tato brožurka popisuje bezpečnostní opatření pro kabeláž a zapojení elektrického zařízení.

**NEBEZPEČÍ!**

Když je zařízení připojeno k síti, je uvnitř nebezpečné napětí. Před každým zásahem do odkrytého zařízení je třeba se přesvědčit, že je přívodní kabel od sítě odpojen.



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Uwaga wysokie napięcie!

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危險：安裝本產品之前，請先閱讀 "Caution: Safety Information--Read This First" SD21-0030 手冊中所提供的安全注意事項。這本手冊將會說明使用電器設備的纜線及電源的安全程序。

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При включенном питании в устройстве имеется напряжение, опасное для жизни. При обслуживании устройства со снятой крышкой отсоедините кабель питания.



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## UL Notices

Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.

Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.

Use caution when installing or modifying telephone lines.

Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electrical shock from lightning.

Do not use the telephone to report a gas leak in the vicinity of the leak.

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# Glossary

This glossary includes terms and definitions from:

- The *IBM Dictionary of Computing* (New York; McGraw-Hill, Inc., 1994).
- The *American National Standard Dictionary for Information Systems*, ANSI X3.172-1990, copyright 1990 by the American National Standards Institute (ANSI). Copies may be purchased from the American National Standards Institute, 11 West 42nd Street, New York, New York 10036. Definitions are identified by the symbol (A) after the definition.
- The *Information Technology Vocabulary*, developed by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1). Definitions of published parts of this vocabulary are identified by the symbol (I) after the definition; definitions taken from draft international standards, committee drafts, and working papers being developed by ISO/IEC JTC1/SC1 are identified by the symbol (T) after the definition, indicating that final agreement has not yet been reached among the participating National Bodies of SC1.
- The Network Working Group Request for Comments: 1208.

The following cross-references are used in this glossary:

**Contrast with:** This refers to a term that has an opposed or substantively different meaning.

**Synonym for:** This indicates that the term has the same meaning as a preferred term, which is defined in its proper place in the glossary.

**Synonymous with:** This is a backward reference from a defined term to all other terms that have the same meaning.

**See:** This refers the reader to multiple-word terms that have the same last word.

**See also:** This refers the reader to terms that have a related, but not synonymous, meaning.

## A

**A.** Ampere.

**active.** (1) Operational. (2) Pertaining to a node or device that is connected or is available for connection to another node or device.

**agent.** A system that assumes an agent role.

**analog.** (1) Pertaining to data consisting of continuously variable physical quantities. (A) (2) Contrast with *digital*.

**AppleTalk.** A network protocol developed by Apple Computer, Inc. This protocol is used to interconnect network devices, which can be a mixture of Apple and non-Apple products.

**attachment unit interface (AUI).** In a local area network, the interface between the medium attachment unit and the data terminal equipment within a data station. (I) (A)

**AUI.** Attachment unit interface.

**autonomous system (AS).** A group of networks and routers that use the same interior gateway protocol and for which one administrative authority has responsibility.

## B

**bps.** Bits per second.

**bridge.** A functional unit that interconnects multiple LANs (locally or remotely) that use the same logical link control protocol but that can use different medium access control protocols. A bridge forwards a frame to another bridge based on the medium access control (MAC) address.

**bridging.** In LANs, the forwarding of a frame from one LAN segment to another. The destination is specified by the medium access control (MAC) sublayer address encoded in the destination address field of the frame header.

## C

**CCITT.** International Telegraph and Telephone Consultative Committee. This was an organization of the International Telecommunication Union (ITU). On 1 March 1993 the ITU was reorganized, and responsibilities for standardization were placed in a subordinate organization named the Telecommunication Standardization Sector of the International Telecommunication Union (ITU-TS). "CCITT" continues to be used for recommendations that were approved before the reorganization.

**circuit.** (1) One or more conductors through which an electric current can flow. See *physical circuit* and *virtual circuit*. (2) A logic device.

**circuit switching.** (1) A process that, on demand, connects two or more data terminal equipment (DTEs) and permits the exclusive use of a data circuit between them until the connection is released. (I) (A) (2) Synonymous with *line switching*.

**configuration.** (1) The manner in which the hardware and software of an information processing system are organized and interconnected. (T) (2) The devices and programs that make up a system, subsystem, or network.

**connection.** In data communication, an association established between functional units for conveying information. (I) (A)

## D

**data circuit.** (1) A pair of associated transmit and receive channels that provide a means of two-way data communication. (I) (2) See also *physical circuit* and *virtual circuit*.

### Notes:

1. Between data switching exchanges, the data circuit may include data circuit-terminating equipment (DCE), depending on the type of interface used at the data switching exchange.
2. Between a data station and a data switching exchange or data concentrator, the data circuit includes the data circuit-terminating equipment at the data station end, and may include equipment similar to a DCE at the data switching exchange or data concentrator location.

**data circuit-terminating equipment (DCE).** In a data station, the equipment that provides the signal conversion and coding between the data terminal equipment (DTE) and the line. (I)

### Notes:

1. The DCE may be separate equipment or an integral part of the DTE or of the intermediate equipment.
2. A DCE may perform other functions that are usually performed at the network end of the line.

**data link control (DLC).** A set of rules used by nodes on a data link (such as an SDLC link or a token ring) to accomplish an orderly exchange of information.

**data link switching (DLSw).** A method of transporting network protocols that use IEEE 802.2 logical link control (LLC) type 2. SNA and NetBIOS are examples of protocols that use LLC type 2. See also *encapsulation* and *spoofing*.

**data terminal equipment (DTE).** That part of a data station that serves as a data source, data sink, or both. (I) (A)

**data terminal ready (DTR).** A signal to the modem used with the EIA 232 protocol.

**DCE.** Data circuit-terminating equipment.

**device.** A mechanical, electrical, or electronic contrivance with a specific purpose.

**digital.** (1) Pertaining to data that consist of digits. (T) (2) Pertaining to data in the form of digits. (A) (3) Contrast with *analog*.

**DLS.** Data link switching.

**DTE.** Data terminal equipment. (A)

## E

**EIA.** Electronic Industries Association.

**EIA 232.** In data communications, a specification of the Electronic Industries Association (EIA) that defines the interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE), using serial binary data interchange.

**Electronic Industries Association (EIA).** An organization of electronics manufacturers that advances the technological growth of the industry, represents the views of its members, and develops industry standards.

**encapsulation.** In communications, a technique used by layered protocols by which a layer adds control information to the protocol data unit (PDU) from the layer it supports. In this respect, the layer encapsulates the data from the supported layer. In the Internet suite of protocols, for example, a packet would contain control information from the physical layer, followed by control information from the network layer, followed by the application protocol data. See also *data link switching (DLSw)*.

**Ethernet.** A 10-Mbps baseband local area network that allows multiple stations to access the transmission medium at will without prior coordination, avoids contention by using carrier sense and deference, and resolves contention by using collision detection and transmission. Ethernet uses carrier sense multiple access with collision detection (CSMA/CD).

## F

**flash memory.** A data storage device that is programmable, erasable, and does not require continuous power. The chief benefit of flash memory over other programmable and erasable data storage devices is that it can be reprogrammed without being removed from the circuit board.

**frame relay.** (1) An interface standard describing the boundary between a user's equipment and a fast-packet network. In frame-relay systems, flawed frames are discarded; recovery comes end-to-end rather than hop-by-hop. (2) A technique derived from the integrated services digital network (ISDN) D channel standard. It assumes that connections are reliable and dispenses with the overhead of error detection and control within the network.

**frequency.** The rate of signal oscillation, expressed in hertz.

## G

**gateway.** (1) A functional unit that interconnects two computer networks with different network architectures. A gateway connects networks or systems of different architectures. A bridge interconnects networks or systems with the same or similar architectures. (T) (2) In the IBM Token-Ring Network, a device and its associated software that connect a local area network to another local area network or a host that uses different logical link protocols.

## I

**IEEE.** Institute of Electrical and Electronics Engineers.

**impedance.** The combined effect of resistance, inductance, and capacitance on a signal at a given frequency.

**integrated services digital network (ISDN).** A digital end-to-end telecommunication network that supports multiple services including, but not limited to, voice and data.

**Note:** ISDNs are used in public and private network architectures.

**interface.** (1) A shared boundary between two functional units, defined by functional characteristics, signal characteristics, or other characteristics, as appropriate. The concept includes the specification of the connection of two devices having different functions. (T) (2) Hardware, software, or both, that links systems, programs, or devices.

**International Organization for Standardization (ISO).** An organization of national standards bodies from various countries established to promote development of standards to facilitate international exchange of goods and services, and develop cooperation in intellectual, scientific, technological, and economic activity.

**internet.** A collection of networks interconnected by a set of routers that allow them to function as a single, large network. See also *Internet*.

**Internet.** The internet administered by the Internet Architecture Board (IAB), consisting of large national backbone networks and many regional and campus networks all over the world. The Internet uses the Internet suite of protocols.

**Internet Protocol (IP).** A connectionless protocol that routes data through a network or interconnected networks. IP acts as an intermediary between the higher protocol layers and the physical network. However, this protocol does not provide error recovery and flow control and does not guarantee the reliability of the physical network.

**Internetwork Packet Exchange (IPX).** The network protocol used to connect Novell's servers, or any workstation or router that implements IPX, with other workstations. Although similar to the Internet Protocol (IP), IPX uses different packet formats and terminology.

**IP.** Internet Protocol.

**IPX.** Internetwork Packet Exchange.

**ISDN.** Integrated services digital network.

**ISO.** International Organization for Standardization.

## K

**kVA.** kilovolt amperes.

## L

**LAN.** Local area network.

**line switching.** Synonym for *circuit switching*.

**link.** The combination of the link connection (the transmission medium) and two link stations, one at each end of the link connection. A link connection can be shared among multiple links in a multipoint or token-ring configuration.

**link connection.** The physical equipment providing two-way communication between one link station and one or more other link stations; for example, a telecommunication line and data circuit-terminating equipment (DCE). Synonymous with *data circuit*.

**local.** Pertaining to a device accessed directly without use of a telecommunication line.

**local area network (LAN).** (1) A computer network located on a user's premises within a limited geographical area. Communication within a local area network is not subject to external regulations; however, communication across the LAN boundary may be subject to some form of regulation. (T) (2) A network in which a

set of devices are connected to one another for communication and that can be connected to a larger network. See also *Ethernet* and *token ring*. (3) Contrast with *metropolitan area network (MAN)* and *wide area network (WAN)*.

## M

**MAN.** Metropolitan area network.

**Management Information Base (MIB).** (1) A collection of objects that can be accessed by means of a network management protocol. (2) A definition for management information that specifies the information available from a host or gateway and the operations allowed. (3) In OSI, the conceptual repository of management information within an open system.

**metropolitan area network (MAN).** A network formed by the interconnection of two or more networks which may operate at higher speed than those networks, may cross administrative boundaries, and may use multiple access methods. (T) Contrast with *local area network (LAN)* and *wide area network (WAN)*.

**MIB.** (1) MIB module. (2) Management Information Base.

**modem (modulator/demodulator).** (1) A functional unit that modulates and demodulates signals. One of the functions of a modem is to enable digital data to be transmitted over analog transmission facilities. (T) (A) (2) A device that converts digital data from a computer to an analog signal that can be transmitted on a telecommunication line, and converts the analog signal received to data for the computer.

## N

**network.** (1) A configuration of data processing devices and software connected for information interchange. (2) A group of nodes and the links interconnecting them.

**network architecture.** The logical structure and operating principles of a computer network. (T)

**Note:** The operating principles of a network include those of services, functions, and protocols.

**network management.** The process of planning, organizing, and controlling a communication-oriented data processing or information system.

## P

**packet mode operation.** Synonym for *packet switching*.

**packet switching.** (1) The process of routing and transferring data by means of addressed packets so that a channel is occupied only during transmission of a packet. On completion of the transmission, the channel is made available for transfer of other packets. (I) (2) Synonymous with *packet mode operation*. See also *circuit switching*.

**physical circuit.** A circuit established without multiplexing. See also *data circuit*. Contrast with *virtual circuit*.

**Point-to-Point Protocol (PPP).** A protocol that provides a method for encapsulating and transmitting packets over serial point-to-point links.

**port.** (1) An access point for data entry or exit. (2) A connector on a device to which cables for other devices such as display stations and printers are attached. Synonymous with *socket*. (3) The representation of a physical connection to the link hardware. A port is sometimes referred to as an adapter; however, there can be more than one port on an adapter. There may be one or more ports controlled by a single DLC process. (4) In the Internet suite of protocols, a 16-bit number used to communicate between TCP or the User Datagram Protocol (UDP) and a higher-level protocol or application. Some protocols, such as File Transfer Protocol (FTP) and Simple Mail Transfer Protocol (SMTP), use the same well-known port number in all TCP/IP implementations. (5) An abstraction used by transport protocols to distinguish among multiple destinations within a host machine.

**PPP.** Point-to-Point Protocol.

**problem determination.** The process of determining the source of a problem; for example, a program component, machine failure, telecommunication facilities, user or contractor-installed programs or equipment, environmental failure such as a power loss, or user error.

## R

**ring.** See *ring network*.

**ring network.** (1) A network in which every node has exactly two branches connected to it and in which there are exactly two paths between any two nodes. (T) (2) A network configuration in which devices are connected by unidirectional transmission links to form a closed path.

**route.** (1) An ordered sequence of nodes and transmission groups (TGs) that represent a path from an origin node to a destination node traversed by the traffic exchanged between them. (2) The path that network traffic uses to get from source to destination.

**router.** (1) A computer that determines the path of network traffic flow. The path selection is made from several paths based on information obtained from specific protocols, algorithms that attempt to identify the shortest or best path, and other criteria such as metrics or protocol-specific destination addresses. (2) An attaching device that connects two LAN segments, which use similar or different architectures, at the reference model network layer. Contrast with *bridge* and *gateway*. (3) In OSI terminology, a function that determines a path by which an entity can be reached.

**routing.** (1) The assignment of the path by which a message is to reach its destination. (2) In SNA, the forwarding of a message unit along a particular path through a network, as determined by parameters carried in the message unit, such as the destination network address in a transmission header.

## S

**SDLC.** Synchronous Data Link Control.

**Simple Network Management Protocol (SNMP).** In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks. SNMP is an application layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB).

**SNA.** Systems Network Architecture.

**SNMP.** Simple Network Management Protocol.

**socket.** The abstraction provided by the University of California's Berkeley Software Distribution (commonly called Berkeley UNIX or BSD UNIX) that serves as an endpoint for communication between processes or applications.

**source route bridging.** In LANs, a bridging method that uses the routing information field in the IEEE 802.5 medium access control (MAC) header of a frame to determine which rings or token-ring segments the frame must transit. The routing information field is inserted into the MAC header by the source node. The information in the routing information field is derived from explorer packets generated by the source host.

**spoofing.** For data links, a technique in which a protocol initiated from an end station is acknowledged and processed by an intermediate node on behalf of the final destination. In IBM 6611 data link switching, for example, SNA frames are encapsulated into TCP/IP

packets for transport across a non-SNA wide area network, unpacked by another IBM 6611, and passed to the final destination. A benefit of spoofing is the prevention of end-to-end session timeouts.

**synchronous.** (1) Pertaining to two or more processes that depend upon the occurrence of specific events such as common timing signals. (T) (2) Occurring with a regular or predictable time relationship.

**Synchronous Data Link Control (SDLC).** A discipline conforming to subsets of the Advanced Data Communication Control Procedures (ADCCP) of the American National Standards Institute (ANSI) and High-level Data Link Control (HDLC) of the International Organization for Standardization, for managing synchronous, code-transparent, serial-by-bit information transfer over a link connection. Transmission exchanges may be duplex or half-duplex over switched or nonswitched links. The configuration of the link connection may be point-to-point, multipoint, or loop. (I) Contrast with *binary synchronous communication (BSC)*.

**system.** In data processing, a collection of people, machines, and methods organized to accomplish a set of specific functions. (I) (A)

**Systems Network Architecture (SNA).** The description of the logical structure, formats, protocols, and operational sequences for transmitting information units through, and controlling the configuration and operation of, networks. The layered structure of SNA allows the ultimate origins and destinations of information, that is, the end users, to be independent of and unaffected by the specific SNA network services and facilities used for information exchange.

## T

**TCP.** Transmission Control Protocol.

**TCP/IP.** Transmission Control Protocol/Internet Protocol.

**Trivial File Transfer Protocol (TFTP).** In the Internet suite of protocols, a protocol for file transfer that requires minimal overhead and minimal capability. TFTP uses the connectionless datagram delivery services of the User Datagram Protocol (UDP), which allows hosts that have no disk storage to implement TFTP in read-only memory (ROM) and use it to boot themselves.

**token.** (1) In a local area network, the symbol of authority passed successively from one data station to another to indicate the station temporarily in control of the transmission medium. Each data station has an opportunity to acquire and use the token to control the medium. A token is a particular message or bit pattern that signifies permission to transmit. (T) (2) In LANs, a

sequence of bits passed from one device to another along the transmission medium. When the token has data appended to it, it becomes a frame.

**token ring.** (1) According to IEEE 802.5, network technology that controls media access by passing a token (special packet or frame) between media-attached stations. (2) A FDDI or IEEE 802.5 network with a ring topology that passes tokens from one attaching ring station (node) to another. (3) See also *local area network (LAN)*.

**Transmission Control Protocol (TCP).** A communications protocol used in Internet and in any network that follows the U.S. Department of Defense standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packet-switched communications networks and in interconnected systems of such networks. It assumes that the Internet protocol is the underlying protocol.

**Transmission Control Protocol/Internet Protocol (TCP/IP).** A set of communications protocols that support peer-to-peer connectivity functions for both local and wide area networks.

**transparent bridging.** In LANs, a method for tying individual local area networks together through the medium access control (MAC) level. A transparent bridge stores the tables that contain MAC addresses so that frames seen by the bridge can be forwarded to another LAN if the tables indicate to do so.

## U

**UTP.** Unshielded twisted pair.

## V

**V.24.** In data communications, a specification of the CCITT that defines the list of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE).

**V.25.** In data communications, a specification of the CCITT that defines the automatic answering equipment and parallel automatic calling equipment on the General Switched Telephone Network, including procedures for disabling of echo controlled devices for both manually and automatically established calls.

**V.35.** In data communications, a specification of the CCITT that defines the list of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) at various data rates.

**V.36.** In data communications, a specification of the CCITT that defines the list of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) at rates of 48, 56, 64, or 72 kilobits per second.

**Vac.** Volts alternating current.

**version.** A separately licensed program that usually has significant new code or new function.

**virtual circuit.** (1) In packet switching, the facilities provided by a network that give the appearance to the user of an actual connection. (T) See also *data circuit*. Contrast with *physical circuit*. (2) A logical connection established between two DTEs.

## W

**WAN.** Wide area network.

**wide area network (WAN).** (1) A network that provides communication services to a geographic area larger than that served by a local area network or a metropolitan area network, and that may use or provide public communication facilities. (T) (2) A data communications network designed to serve an area of hundreds or thousands of miles; for example, public and private packet-switching networks, and national telephone networks. Contrast with *local area network (LAN)* and *metropolitan area network (MAN)*.

## X

**X.21.** An International Telegraph and Telephone Consultative Committee (CCITT) recommendation for a general-purpose interface between data terminal equipment and data circuit-terminating equipment for synchronous operations on a public data network.

**X.25.** An International Telegraph and Telephone Consultative Committee (CCITT) recommendation for the interface between data terminal equipment and packet-switched data networks. See also *packet switching*.



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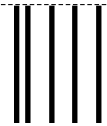
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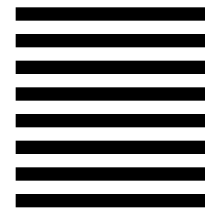
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Fold and Tape





Part Number: 86H0751



Printed in the United States of America  
on recycled paper containing 10%  
recovered post-consumer fiber.

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