

AS/400e series



LAN, Frame-Relay and ATM Support

Version 4

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Note

Before using this information and the product it supports, be sure to read the information in "Notices" on page xvii.

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About LAN, Frame-Relay and ATM Support (SC41-5404-01)

This book provides information needed to use the AS/400 support for the following network types:

- IBM token-ring networks
- Ethernet networks, including IEEE 802.3 and Ethernet Version 2 networks
- Asynchronous transfer mode (ATM) networks
- Wireless networks
- Frame-relay networks, including the use of these networks for local area network interconnection and for wide area networking.
- Distributed data interface (DDI) networks. Throughout this book, the terms *distributed data interface* and *DDI* are used to refer to the AS/400 support for both fiber distributed data interface (FDDI) and shielded twisted pair distributed data interface (SDDI) networks.

The terms *local area network* and *LAN* are used to refer generally to token-ring, DDI, Ethernet, ATM, wireless, and frame-relay networks. References to *Ethernet* support, when discussing the actual data transmitted on the network, should be understood to also apply to the AS/400 support for wireless networks. Wireless data is sent and received using the same Ethernet frame formats as are supported for cabled Ethernet networks.

This book includes discussion of the various network standards, the AS/400 functions used for problem determination, and network management.

This book should be used in conjunction with the *Communications Configuration* book, to configure your local area network. After configuration is complete, this book can be used to improve network performance.

This book does not include information about using the File Server IOP or LAN Server/400.

Who should read this book

This book is intended for the programmer who must understand the AS/400 implementation of local area networks. This book also can be used by the system administrator to improve local area network configuration and performance.

You should be familiar with general communications concepts and communications configuration on the AS/400 system. For more information on AS/400 communications configuration, see the *Communications Configuration* book. For more information about using the File Server IOP and LAN Server/400, see the *OS/2 Warp Server for AS/400 Administration* book.

Conventions and terminology used in this book

The AS/400 displays in this book could be shown as they are presented through Graphical Access for AS/400, which is part of Client Access on the personal computer. The example displays in this book could also be shown without Graphical Access for AS/400 available. Figure 0-1 shows both types of displays.

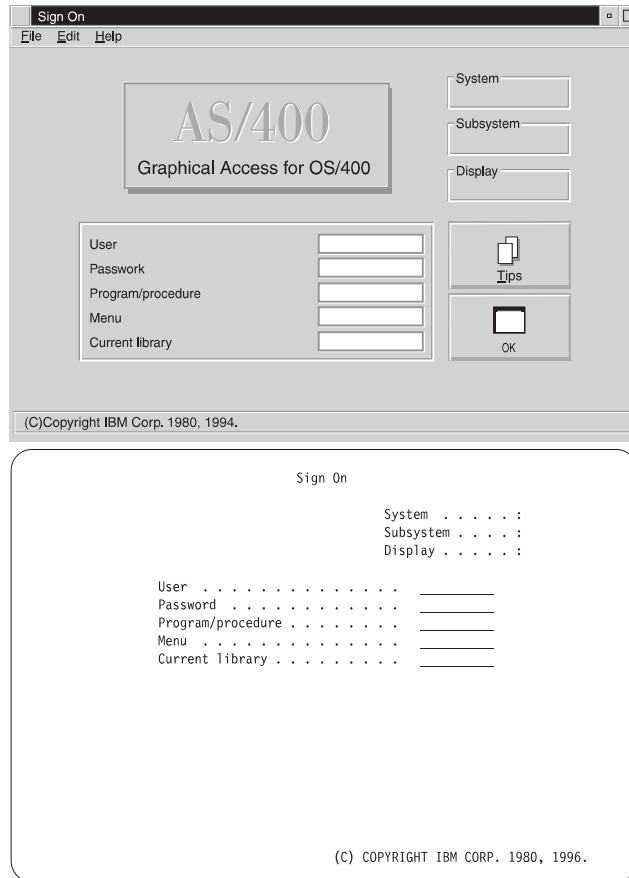


Figure 0-1. Types of AS/400 Displays

AS/400 Operations Navigator

AS/400 Operations Navigator is a powerful graphical interface for Windows 95/NT clients. With AS/400 Operations Navigator, you can use your Windows 95/NT skills to manage and administer your AS/400 systems. You can work with database administration, file systems, Internet network administration, users, and user groups. You can even schedule regular system backups and display your hardware and software inventory. Figure 0-2 on page xxi shows an example of the display.

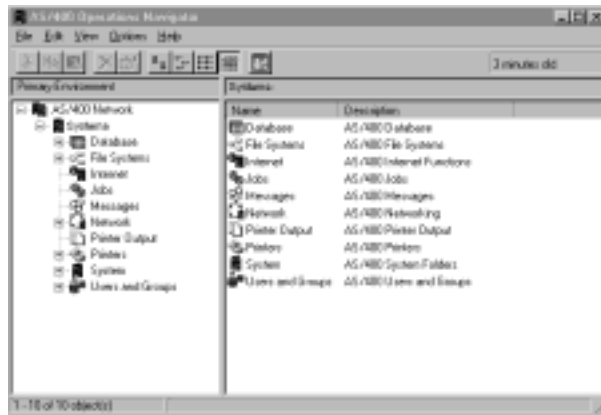


Figure 0-2. AS/400 Operations Navigator Display

IBM recommends that you use this new interface. It is simple to use and has great online information to guide you.

You can access the AS/400 Operations Navigator from the Client Access folder by double-clicking the AS/400 Operations Navigator icon. You can also drag this icon to your desktop for even quicker access.

While we develop this interface, you will still need to use the familiar AS/400 “green screens” to do some of your tasks. You can find information to help you in this book and online.

Prerequisite and related information

For information about Advanced 36 publications, see the *Advanced 36 Information Directory*, SC21-8292, in the AS/400 Softcopy Library.

For information about other AS/400 publications (except Advanced 36), see either of the following:

- The *Publications Reference*, SC41-5003, in the AS/400 Softcopy Library.
- The AS/400 online library is available on the World Wide Web at the following uniform resource locator (URL) address:

<http://as400bks.rochester.ibm.com/>

For a list of related publications, see the “Bibliography” on page X-1.

Information available on the World Wide Web

In addition to the AS/400 online library on the World Wide Web, you can access other information from the AS/400 Technical Studio at the following URL address:

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Summary of changes for LAN, Frame-Relay and ATM Support

Asynchronous transfer mode networks: A discussion on asynchronous transfer mode (ATM) has been added, including ATM concepts and terms, ATM network configuration examples, and ATM problem determination. For information, see "Asynchronous transfer mode networks" on page 1-8, "ATM networks" on page 6-23 and Appendix E, "ATM network error codes and cause codes" on page E-1.

Rearranged networking protocols chapters: The chapters in LAN, Frame-Relay and ATM Support are rearranged to reflect networking protocol preferences.

Ethernet group address: Information on Ethernet group addresses is included. See "Ethernet group addresses" on page 5-5.

Ethernet standard (ETHSTD) parameter considerations: A table showing the frame type received from the network, ETHSTD value, and frame type sent by the AS/400 is included in the Ethernet Standard (ETHSTD) Parameter Considerations section. See Table 5-1 on page 5-5.

LAN communications trace updates: Information on LAN communications trace is updated. See Appendix B, "LAN communications trace" on page B-1.

Verify communications (VFYCMN) command: An example of using the Verify Communications (VFYCMN) command to verify that the IOP, IOA, licensed internal code, cabling, and network switch are operational and configured properly is included in Appendix A, LAN Link Test. See "Verify communications command" on page A-4.

Miscellaneous changes: AS/400 systems, displays, and network device names are updated throughout the book.

A vertical line (|) to the left of the text indicates a change or addition.

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Chapter 1. Introduction to local area networks

A **LAN** (local area network) is a communications system that allows interconnection and the sharing of resources between independent devices within a moderately sized geographic area.

This chapter introduces the types of local area networks that are supported by the AS/400 system, and discusses the architectures and standards on which they are based. The AS/400 system supports the following types of local area networks:

- Token-ring networks
- Ethernet networks
- Asynchronous transfer mode (ATM) emulated local and wide area networks
- Frame-relay networks
- Frame-relay wide area networks
- Wireless networks
- DDI (distributed data interface) networks

The communications standards discussed in this chapter are defined by several standards organizations. The names of the standards, and of the organizations, are abbreviated as follows:

ANSI	American National Standards Institute
ITU-T ¹	International Telecommunications Union—Telecommunications Standardization Sector. This organization formerly was known as CCITT (Consultative Committee, International Telegraph and Telephone). Future standards issued by this organization will bear the ITU-T designation rather than CCITT.
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization

Local area network standards

The AS/400 system supports communications using Systems Network Architecture (SNA), open systems interconnection (OSI), Transmission Control Protocol/Internet Protocol (TCP/IP), and Internetwork Packet Exchange** (IPX**) support. These communications architectures are often represented as hierarchical models as shown in Figure 1-1. The architectures represented by these models define the functions performed at each layer.

¹

Application Layer	Transaction Services	Application	SPX Protocol MPTN IPX Protocol RIP, SAP, NLSP Medium Access Protocols: Token-Ring Frame Relay, Ethernet and X.25
Presentation Layer	Presentation Services		
Session Layer	Data Flow Control	Transport	
Transport Layer	Transmission Control	Internet	
Network Layer	Path Control	Network Access	
Data Link Layer	Data Link Control	Hardware	
Physical Layer	Physical Control		
OSI	SNA	TCP/IP	IPX

Figure 1-1. OSI, SNA, TCP/IP, and IPX Architecture Models

Each model describes system functions starting from the electromechanical interface used by the system (physical layer) to the interface used for communication between application programs (application layer). Local area network standards deal principally with the data link layer (layer 2) of the OSI model or the equivalent layer described by the SNA and TCP/IP models. Figure 1-2 shows the local area network standards supported by the AS/400 system at the data link layer of the OSI model.

IEEE 802.2 Logical Link Control (LLC)				Ethernet Version 2
ANSI T1.618 CCITT Q.922 Frame Relay MAC	IEEE 802.5 ISO 8802-5 Token Ring MAC	ANSI X3T9.5 ISO 9314 FDDI MAC	IEEE 802.3 ISO 8802-3 CSMA/CD MAC	

Figure 1-2. AS/400 Support of Local Area Networks (Data Link Layer View)

Except for Ethernet Version 2, the supported LAN types divide the data link layer into two sublayers:

Logical Link Control (LLC) Provides connection and disconnection of logical links, data flow control, flow-related error detection, and recovery.

Medium Access Control (MAC) Provides the interface between the LLC sublayer and the physical layer. The MAC sublayer is responsible for frame transmission and reception, adapter address and frame format recognition, and frame validity-related error detection.

The following topics provide overviews of the local area network and frame relay support provided by the AS/400 system. For more information about local area

network standards and related IBM products, see the *Token-Ring Network Architecture Reference*, *Local Area Network Concepts and Products*, and *FDDI Concepts and Products*.

Token-ring networks

A **token-ring network** is a LAN that uses the IEEE 802.5 standard for a token-passing ring MAC protocol and its physical attachments. Stations in a token-ring network are physically connected, usually in a star-wired ring topology, to a wiring concentrator such as the IBM 8228 Multistation Access Unit. The concentrator serves as a logical ring around which data is transmitted at 4 million or 16 million bits per second (Mbps). Each station is connected to the concentrator, typically by shielded twisted pair (STP) cabling.

Token-ring operation

The **token** controls access to the ring. A single bit, called the token bit, is used to indicate whether the token is free or in use (see Figure 1-3).

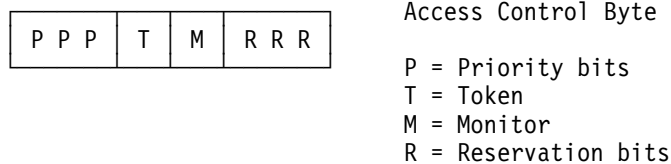


Figure 1-3. Token Format (Access Control Byte)

As the token circulates on the ring, each station examines the frame. If a station has no data to transmit when it receives a free token, it simply passes it on to the next station on the ring. When a station with data to transmit receives a free token, it sets the token bit to 1 (indicating that the token is in use), appends its data, and sends the frame onto the ring.

Each downstream station examines the transmitted frame to determine whether it is the station intended to receive the frame. When a station recognizes its address in an incoming frame, it sets the *address recognized* bit in the frame status field and copies the frame. If the frame is successfully copied, the receiving station also sets the *frame copied* bit (see Figure 1-4).

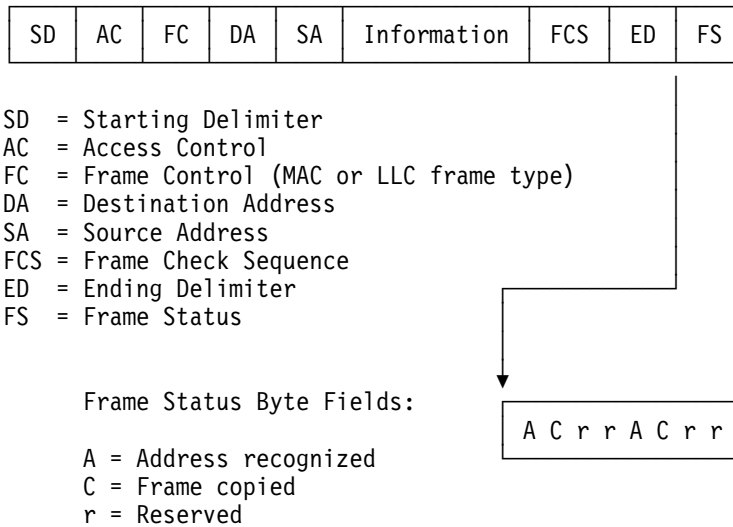


Figure 1-4. Token-Ring Frame Format and Frame Status Byte Fields

The receiving station also transmits the frame. The frame circulates until it returns to the station that originally sent it. The original sending station removes the token, verifies that the frame was copied by the receiving station, and sends out a new free token.

Full-duplex token ring

In **full-duplex token ring**, also called **DTR (dedicated token ring)**, switching hubs enable stations to send and receive data on the network simultaneously (see Figure 1-5 on page 1-5). A token-ring switching hub divides the network into smaller segments. When a station transmits its data packet, the token-ring switch reads the packet's destination address information and forwards the data directly to the receiving station. The switch then establishes a dedicated connection between the two stations, enabling data to be transmitted and received at the same time. In full-duplex token ring, the token-passing protocol is suspended. The network in effect becomes a 'tokenless' token ring. Full-duplex token ring provides increased sending and receiving bandwidth for connected stations, improving network performance.

For more information on token-ring switches, see the *IBM LAN Bridge and Switch Guide*, SB24-5000, and *Local Area Network Concepts and Products: LAN Architecture*, SG24-4753-00.

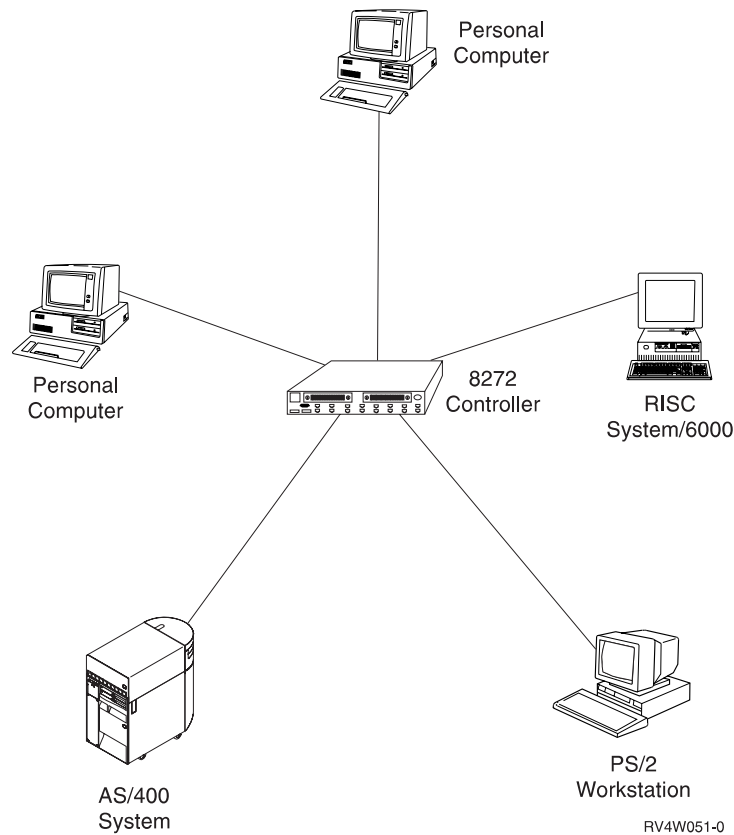


Figure 1-5. Token-Ring Network with a Switching Hub

See Chapter 3, “Token-ring networks” on page 3-1 for more information about token-ring networks. See Chapter 4, “Token-Ring Network Configuration Examples” on page 4-1 for examples of token-ring network configurations.

Ethernet networks

An **Ethernet network** is a LAN that uses the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol to provide fair media access for competing stations. The MAC mechanism that is embedded in each station’s Ethernet interface determines access to the shared media. The AS/400 system supports two types of Ethernet networks:

- **Ethernet Version 2:** This standard is defined by Digital Equipment Corporation**, Intel Corporation**, and the Xerox Corporation**(DIX).
- **IEEE 802.3 standard**

Half-duplex Ethernet

Generally, multiple stations in an Ethernet network share a single data path. Therefore, only one station may transmit data at a time. This is called **half-duplex Ethernet**. When a station has data to send, it checks the media to determine if it is available (no other stations are transmitting). When the media is available, the station begins to transmit data in the form of an **Ethernet frame**. The station then checks for collisions during the transmission. A **collision** occurs when two or more stations begin transmitting at the same time. If a collision is detected, both transmitting stations stop transmitting and wait a random length of time before transmitting again.

See “Ethernet frame formats” on page 1-6 for a description of the frame formats used in the various Ethernet environments.

Full-duplex Ethernet

Full-duplex Ethernet enables stations to simultaneously send and receive data on the network, eliminating collisions. This is accomplished through the use of a full-duplex LAN switch. Ethernet switching splits a large Ethernet segment into smaller segments. Full-duplex Ethernet requires the following:

- Twisted-pair cable transmission medium
- Ethernet network interface cards
- A full-duplex LAN switch

Full-duplex Ethernet provides a dedicated, 10 Mbps sending and 10 Mbps receiving bandwidth for data transmission. Ethernet switches are discussed in greater detail in “Switching hubs” on page 5-3.

Fast Ethernet

Fast Ethernet is a recently established standard (IEEE 802.3u) that increases Ethernet operating speeds from 10 Mbps to 100 Mbps, half or full duplex. AS/400 Ethernet adapters support 100BASE-TX network devices that use category 5 shielded and unshielded twisted-pair (STP, UTP) cable.

Autonegotiation

The **autonegotiation** function provides automatic self-configuration of 10BASE-T and 100BASE-TX Ethernet network devices to optimize operation. In autonegotiation, devices transmit information about their linespeed (10 Mbps or 100 Mbps) and duplex mode (half duplex or full duplex), to the hub in the form of **Ethernet fast-link pulses**. The hub reads the fast-link pulses, determines the devices' maximum common linespeed and duplex mode, and automatically self-configures the link mode.

Note: No autonegotiation occurs when the user sets both speed and duplex to values other than *AUTO. Selecting *AUTO for both duplex and speed starts autonegotiation initially at 100 Mbps full duplex. If you select *AUTO for linespeed and *FULL for duplex, autonegotiation occurs with 100Mbps full duplex and 10Mbps full duplex as the indicated capabilities. Selecting 10M (Mbps) linespeed and *AUTO duplex autonegotiates with 10 Mbps full duplex and 10 Mbps half duplex as the indicated capabilities.

If the hub does not support autonegotiation, the AS/400 will detect the linespeed and default accordingly. However, the AS/400 cannot detect duplex, and always defaults to half duplex. This may not be the correct default configuration in all instances. When this occurs, verify the correct duplex parameter, and reconfigure.

Ethernet frame formats

Ethernet IEEE 802.3 support: IEEE 802.3 Ethernet frames contain a logical link control (LLC) header. The LLC header is used by the IEEE 802.3 layer to support acknowledged (connection-oriented) service over an Ethernet network. Acknowledged service provides a link-level connection between communicating systems and includes frame sequencing, flow control, and error recovery capabilities. IEEE 802.3 frames can also be used for LLC unacknowledged (connectionless) services for protocol stacks such as TCP/IP.

Figure 1-6 shows the frame format used for IEEE 802.3 Ethernet networks.

SD	DA	SA	Len	LLC header	Information field	FCS
----	----	----	-----	------------	-------------------	-----

SD = Starting Delimiter 1 byte
 DA = Destination Address 6 bytes
 SA = Source Address 6 bytes
 Len = Length 2 bytes
 LLC header, information field 46-1500 bytes
 FCS = Frame Check Sequence 4 bytes

Figure 1-6. IEEE 802.3 Frame Format

Ethernet Version 2 support: The AS/400 system supports unacknowledged service using Ethernet Version 2 at the data link control level. Unacknowledged service supports the sending and receiving of frames only; no support is provided for flow control, sequencing, or error recovery. If these functions are needed, a higher-level protocol must provide them.

Figure 1-7 shows the frame format used for Ethernet Version 2 networks.

SD	DA	SA	Type	Information field	FCS
----	----	----	------	-------------------	-----

SD = Starting Delimiter 1 byte
 DA = Destination Address 6 bytes
 SA = Source Address 6 bytes
 Type = Type 2 bytes
 Information field 46-1500 bytes
 FCS = Frame Check Sequence 4 bytes

Figure 1-7. Ethernet Version 2 Frame Format

SNA support is provided over Ethernet Version 2 by placing the IEEE 802.2 logical link control (LLC) header and data into the Ethernet Version 2 frame. A special Ethernet type field (hex 80D5) is used to indicate that the Version 2 frame contains the LLC header. Although the AS/400 system does support SNA over Ethernet Version 2, IEEE 802.3 is recommended for SNA communications.

Figure 1-8 shows the frame format used for SNA data transmitted over Ethernet Version 2 networks.

SD	DA	SA	Type 80D5	--- Information field ---	FCS
				Len Pad LLC header Data	

SD = Starting Delimiter 1 byte
 DA = Destination Address 6 bytes
 SA = Source Address 6 bytes
 Len = Length 2 bytes
 Pad = Pad 1 byte
 LLC header, information field 46-1493 bytes
 FCS = Frame Check Sequence 4 bytes

Figure 1-8. Ethernet Version 2 Frame Format with Encapsulated SNA Data

See Chapter 5, Ethernet networks for more information about Ethernet networks. “Ethernet standard (ETHSTD) parameter considerations” on page 5-5 describes how the frame type sent by the AS/400 system is determined. See Chapter 6, Ethernet network configuration examples for examples of Ethernet configurations.

Asynchronous transfer mode networks

Asynchronous transfer mode (ATM) is a communications technology that incorporates the following features:

- **Network switches.** ATM switch-based networks provide varying node access speeds, easy scalability, and dedicated bandwidth. **Bandwidth** refers to transmission capacity, utilization, or requirements. It is measured in units of bits per second (bps), or megabits per second (Mbps).
- **Small, fixed length cells.** Each **cell** is a 53-byte data unit that consists of two parts: A 48-byte payload for data and voice traffic and a 5-byte header that contains information needed to route the cell to its proper destination (virtual circuit information). ATM cells are the fundamental unit of ATM transmissions. The network can easily adjust the flow pattern of such small cells. It can mix cells from many sources and route individual cells to different destinations.
- **Negotiated service connections.** The network negotiates requirements for each connection, which include traffic characteristics, peak and average cell rates, and quality of service.

On the AS/400, LAN emulation over ATM extends your local area network (LAN) to other locations. ATM adds flexibility to, and improves throughput over, existing LAN technologies.

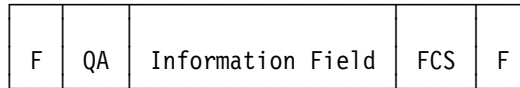
See Chapter 7, “Asynchronous transfer mode networks” on page 7-1 for more information about ATM networks. See Chapter 8, “ATM network configuration examples” on page 8-1 for examples of ATM network configurations.

Frame-relay networks

Frame relay is a protocol that defines how frames are routed through a fast-packet network based on the address field in the frame. Frame relay takes advantage of the reliability of data communications networks to minimize the error checking done by the network nodes. This provides a packet-switching protocol similar to, but much faster than, X.25.

The high speed that can be obtained through frame-relay networks makes it well suited for wide area network (WAN) connectivity. Frame relay is commonly used to connect two or more LAN bridges over large distances.

Figure 1-9 shows the frame format used by frame-relay networks. Detailed information about frame-relay frame formats and protocol headers is given in Chapter 9, “Frame-relay networks” on page 9-1.



F = HDLC or Q.922 flag
 QA = HDLC or Q.922 address field (2 bytes)
 FCS = HDLC or Q.922 frame check sequence (2 bytes)

Figure 1-9. Frame-Relay Frame Format

Frame-relay network architecture is based on the integrated systems digital network (ISDN) packet-mode bearer services. Table 1-1 shows the standards, either pending or approved, that are used to define the services and the user-to-network interface of frame-relay networks.

ANSI Standard	Equivalent CCITT Standard
T1.606, Frame Relay Bearer Services (FRBS) Architectural Framework	I.233, ISDN Frame Mode Bearer Service
T1.618, FRBS Core Aspects	Q.922, ISDN Extended Data Link (LAP-E)
T1.617, FRBS Signaling	Q.933, Frame Mode Bearer Services (FMBS) Signaling
T1.606 Addendum 1, FRBS Congestion Management	I.370, ISDN FMBS Congestion Management

The AS/400 implementation of frame-relay network support uses protocol headers as defined in the TCP/IP *Request for Comment 1490 (RFC-1490)*. See “Frame-relay protocol headers and frame formats” on page 9-7 for more information.

Frame-relay networks achieve their greater efficiency by minimizing the error checking done by nodes within the network. AS/400 frame-relay support uses IEEE 802.2 logical link control to provide flow control and error recovery functions (see Figure 1-10).

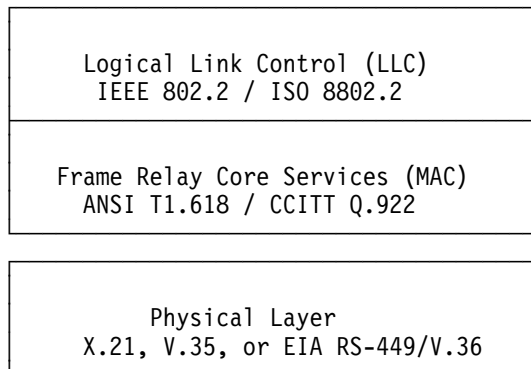


Figure 1-10. AS/400 Implementation of Frame-Relay Networking

As indicated in Figure 1-10, the connection between the AS/400 system and the frame-relay network can be made using X.21, V.35, or RS-449 physical interfaces. See “Frame-relay physical environment” on page 9-1 for further information.

Direct and bridged frame-relay network configurations

The AS/400 system provides support for the following types of frame-relay network connection:

Frame-relay direct: Allows communications using SNA, TCP/IP, or Internetwork Packet Exchange** (IPX) data over a frame-relay network at speeds of up to 2.048 Mbps. This support allows a network of systems to communicate using the frame-relay network as a backbone, without the need for multiple leased T1 lines. This function is also known as boundary network node (BNN) support.

Bridged frame-relay network: Allows the AS/400 system to communicate over a frame-relay network through a remote bridge, such as the IBM 6611 Network Processor or RouteXpander/2 using IPX communications, that is attached to a token-ring, Ethernet, or DDI network. Bridged frame-relay connections allow the AS/400 system to communicate with stations on the remote LAN as if they were attached locally to the LAN medium. This function is also known as boundary access node (BAN) support.

Figure 1-11 shows an example of a bridged frame-relay connection. In this example, AS/400 System A communicates through the frame-relay network and the bridge to AS/400 System B. Bridged frame-relay connections support SNA, TCP/IP and IPX data communications.

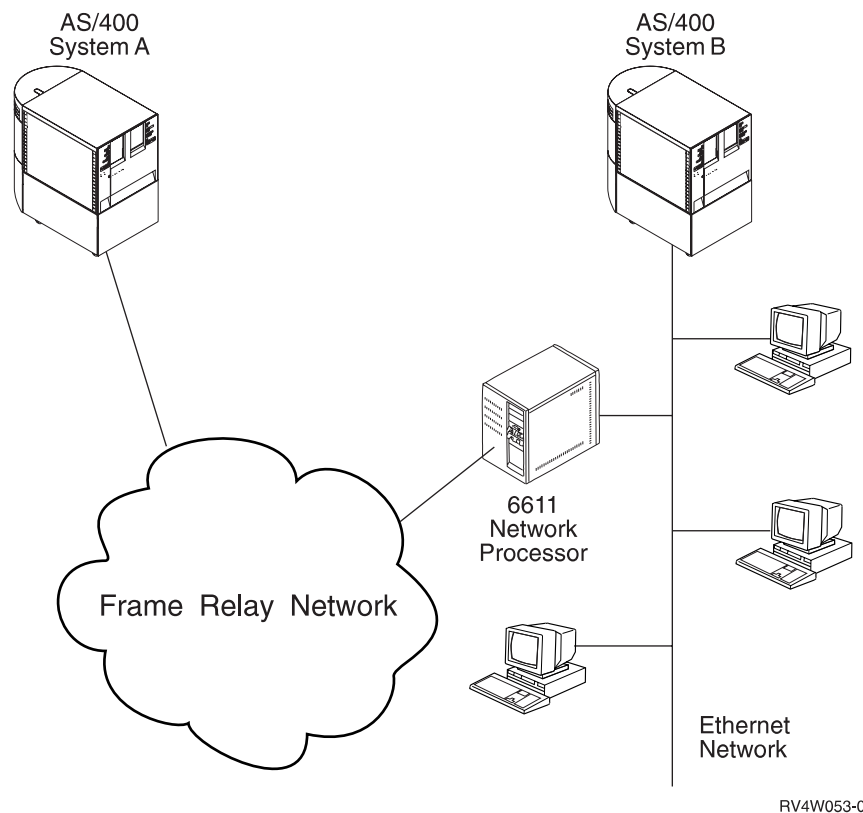


Figure 1-11. Example of a Bridged Frame-Relay Network Connection

See Chapter 9, "Frame-relay networks" on page 9-1 for more information about frame-relay networks. See Chapter 10, "Frame-relay network configuration examples" on page 10-1 for examples of bridged and direct frame-relay configurations.

Wireless networks

A **wireless network** is a LAN using a Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) protocol to provide media access to competing stations. AS/400 wireless communications uses spread-spectrum, direct sequence radio in the 2.4 gigahertz (GHz) band to provide connectivity between the AS/400 wireless LAN adapter and remote stations. Remote stations can be portable transaction computers (PTCs) running 5250 emulation or LAN-connected systems equipped with compatible wireless adapters.

Wireless network support uses the Ethernet frame formats described under “Ethernet frame formats” on page 1-6. See Chapter 5, “Ethernet networks” on page 5-1 for more information about considerations for Ethernet data. See Chapter 11, “Wireless IOP LANs” on page 11-1 for more information about wireless networks. See Chapter 12, “Wireless IOP LAN configuration examples” on page 12-1 for information about wireless network configuration and configuration examples.

Distributed data interface networks

A **distributed data interface (DDI) network** is a LAN based on the ANSI X3T9.5 standard. Stations, concentrators, and bridges in a DDI network are physically connected to one or both of a pair of counter-rotating rings operating at 100 Mbps.

Note: The term *DDI* is used to represent all LAN types based on the fiber distributed data interface (FDDI) specifications, regardless of the medium (optical fiber, copper, or shielded twisted pair). Figure 1-12 shows the standards used to define DDI networks at the physical and data link layers of the OSI model.

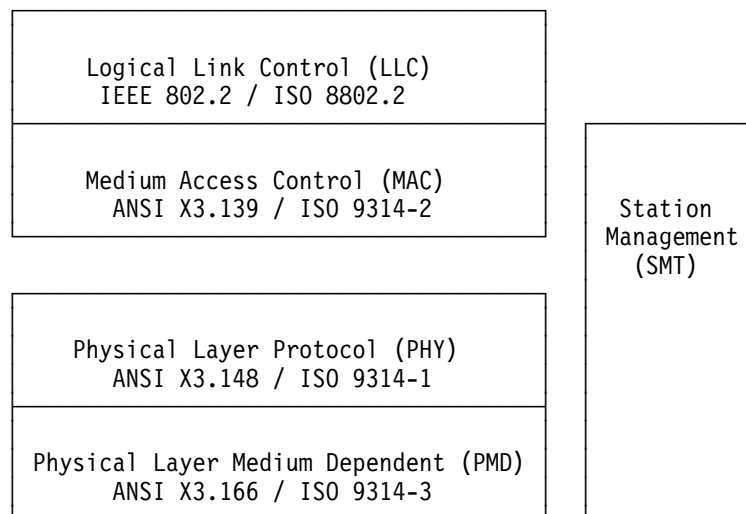


Figure 1-12. FDDI Standards, Including Station Management

DDI networks allow devices to be attached to one or both of the rings. Normally, only the primary ring in a DDI network is active. The secondary ring is used to maintain the network when a dual-access station or a concentrator becomes inactive.

Figure 1-13 on page 1-12 shows the frame format that is used for DDI networks.

PA	SD	FC	DA	SA	Information	FCS	ED	FS
----	----	----	----	----	-------------	-----	----	----

PA = Preamble (8 or more bytes)
 SD = Starting Delimiter 1 byte
 FC = Frame Control 1 byte
 DA = Destination Address 6 bytes
 SA = Source Address 6 bytes
 FCS = Frame Check Sequence 4 bytes
 ED = Ending Delimiter .5 byte
 FS = Frame Status 1.5 bytes

Figure 1-13. DDI Frame Format

See Chapter 13, "DDI networks" on page 13-1 for more information about DDI networks. See Chapter 14, "DDI network configuration examples" on page 14-1 for examples of DDI configurations.

Chapter 2. AS/400 implementation of local area networks

This chapter discusses general considerations for AS/400 local area network support, including local area network lines configured for bridged frame-relay networks. See Chapter 9, "Frame-relay networks" on page 9-1 for more information about both bridged and direct frame-relay considerations.

For more information about token-ring, Ethernet, ATM, wireless, and DDI networks, see the discussions of these network types in "Token-ring networks" on page 2-17, "Ethernet networks" on page 4-31, "ATM networks" on page 6-23, "Wireless networks" on page 10-13, and "DDI networks" on page 12-11 of this book.

The following topics are discussed in this chapter:

- Acknowledged and unacknowledged services
- Physical and logical addresses (adapter addresses and SAP values)
- Establishing connections
- Exchange identifiers (XIDs)
- LAN performance tuning parameters

Local area network concepts

The following discussion is intended to provide an understanding of some basic local area network concepts, how these concepts affect the configuration of your local area network line description and associated controller descriptions, and how they affect performance of the logical links to remote stations.

The AS/400 system allows you to attach to token-ring, Ethernet, wireless, and DDI networks using the appropriate LAN adapter. Connections to these networks can also be established using a frame-relay network connection to a bridge on a remote local area network. The AS/400 system can communicate using either Systems Network Architecture (SNA) or non-SNA protocols with other systems, controllers, and personal computers attached to that network. These systems, controllers, and personal computers are commonly referred to as **stations**.

In addition to the stations that support SNA protocols (**acknowledged service**¹), you can communicate with additional systems, personal computers, and controllers using non-SNA protocols (**unacknowledged service**²). Acknowledged service is discussed in "Acknowledged service" on page 2-2 and unacknowledged service is discussed in "Unacknowledged service" on page 2-2.

¹ Acknowledged service provides functions such as sequencing, flow control, and error recovery.

² Unacknowledged service allows for data transfer without the establishment of a data link connection.

Acknowledged service

SNA requires the use of a logical link control (LLC) layer for acknowledged services as provided by the IEEE 802.2 standard. The LLC layer governs the assembling of transmission frames and their exchange between stations. For token-ring, IEEE 802.3 Ethernet, and DDI networks, the use of the LLC layer is standard. Ethernet Version 2 does not define an LLC layer and requires special processing to run SNA over Ethernet Version 2. For information on LLC over Ethernet Version 2, see Chapter 5, "Ethernet networks" on page 5-1.

SNA connections between your AS/400 system and other systems, personal computers, or controllers use LLC acknowledged service. LLC acknowledged service maintains, at the data link control layer of the system, a logical link between two nodes on the local area network. This service also provides ensured, end-to-end delivery of data by use of sequence numbers and acknowledgements. It supports flow control between two nodes, and, through the use of timers and retries, provides an efficient way of transferring data between those nodes.

These connections are logically switched, similar to the switched virtual circuit support for X.25 packet-switching networks available on the AS/400 system. This means, for example, that a personal computer can connect to an AS/400 system, disconnect from that AS/400 system, and then make a connection to another system. Similarly, you can configure more than one local area network line description with which these controller descriptions are associated. This allows you to make connections with a station over more than one adapter at different times.

Unacknowledged service

LLC unacknowledged service does not guarantee delivery of data frames from one data link control layer to another data link control layer. The receiving layer does not reply with an acknowledgement that the data has been received, and unacknowledged services do not require a connection at the data link layer. The User Datagram Protocol (UDP) layer of TCP/IP and user-defined communications support are examples of LLC unacknowledged services.

TCP/IP and user-defined communications can be configured using any of the local area network line descriptions supported by the AS/400 system. Line descriptions used for unacknowledged services must specify appropriate service access points in the SSAP list (SSAP parameter). SSAP values used for LLC unacknowledged services must be in the range 02 through FE and be divisible by 2. For TCP/IP, specify AA.

For unacknowledged services, a network controller and device are configured for use with the Ethernet or token-ring line. These objects can be created using the Create Controller Description (Network) (CRTCTLNET) and Create Device Description (Network) (CRTDEVNET) commands. Normally, the network controller and device are automatically created. Each line used to provide an unacknowledged service (such as TCP/IP) can have only one network controller active at a time.

See the *TCP/IP Configuration and Reference* book for information on how to configure your system for TCP/IP. The *System API Reference* book contains information on how to configure your system for user-defined communications.

Assigning a physical address

Every system, controller, or personal computer is attached to a local area network by an adapter. Each adapter is identified in the network by its 6-byte **medium access control (MAC)**³

address (12 hexadecimal characters), simply referred to as an **adapter address**. No two adapters may have the same address in the same network. Each adapter is assigned a unique address when it is manufactured. This address is referred to as the **preset address**, burned-in address, or universally administered address. You can use the preset address or assign an address yourself when you configure the local area network line description, which contains information describing a particular communications line that is attached to the system.

To minimize configuration problems in the future, you should consider assigning your own address. If you assign your own address, and the adapter on your system needs to be replaced, you can replace that adapter and assign it the same adapter address. This avoids configuring other units again that currently communicate with your system over that adapter. If you use the preset address and the adapter needs to be replaced, the new adapter has its own unique preset address. Restrictions prevent you from assigning an address that can also be imprinted during manufacturing. You cannot assign the preset address of the replaced adapter to the new adapter.

The frame-relay adapter is not assigned a preset address. If LAN line descriptions are created for use in a bridged frame-relay environment, you must assign an adapter address to each line description that you create. This address is used by the bridge to recognize the AS/400 system in the network.

Finding a physical address

In general, all systems, controllers, and personal computers in a network must know the address of the adapter to communicate with it. If you are using a local area network, you need to know the address of your adapter so that you can configure the remote units with which you wish to establish connections.

To find the preset address (if you specified the preset address, ADPTADR(*ADPT), on the CRTLINTRN, CRTLINDDI, CRTLINETH, or CRTLINWLS command) or the address you assigned when you configured the line, enter the Display Line Description (DSPLIND) command after your line description has been successfully varied on.

Note for mixed environments

If your system is used in a mixed environment where connections exist between Ethernet and token-ring or DDI networks, you must pay special attention to how physical-level addresses are assigned. Ethernet addresses are represented differently than addresses used for token-ring and DDI networks. See Appendix D, "Address considerations for bridged environments" on page D-1 for information about address conversions for bridged connections between networks using different address types. See "Token-ring physical address format" on page 3-3 and

³ Medium access control is a method of determining which device has access to the transmission medium at any time.

“Ethernet physical address format” on page 5-4 for descriptions of these address formats.

Assigning a logical address

Associated with each adapter address is a set of logical addresses known as **service access points (SAPs)**. SAPs are used to route data with the same adapter address to the correct station or application program, thus allowing multiple communications paths between independent application programs on these systems. The SAP addresses are 1-byte hexadecimal values, several of which are defined for particular functions:

04	SNA
12	ASCII LAN printing
AA	TCP/IP
C8	High performance routing (HPR)

Other valid values of SNA service access points range from hex 04 to hex 9C and must be divisible by 4 (that is, end with 0, 4, 8, C). User-defined communications protocols can use any SAP from 02-FE, divisible by 2.

Data is sent from a source service access point (SSAP) to a destination service access point (DSAP). You can specify up to 24 SSAPs for your LAN adapter when you configure the line description. Another alternative is to let the system automatically create SSAPs. See Table 2-1 on page 2-5 for information about automatically created SSAP values.

Service access points

When you configure the controller descriptions that represent the remote system, controller, or personal computer that you will be communicating with, you are asked to specify the **source service access points (SSAP)** from which the data will be sent and the **destination service access point (DSAP)** for which the data was intended. The SSAP in the controller description must be one of the SSAPs specified in the local area network line description with which this controller description is associated. That is, the local area network line description must contain the complete list of SSAPs used by the controllers that include that local area network line description in their switched line list (SWTLINLST) parameter.

To configure the remote station, remember that the SSAP in the controller description, which represents that station, must match that unit's configured DSAP and vice versa. For example, if your controller description uses an SSAP of 04 and the description on the remote unit uses an SSAP of 08, you must configure your controller description with a DSAP of 08 and the remote unit with a DSAP of 04. Figure 2-1 on page 2-5 shows the relationship between the source service access point and the destination service access point.

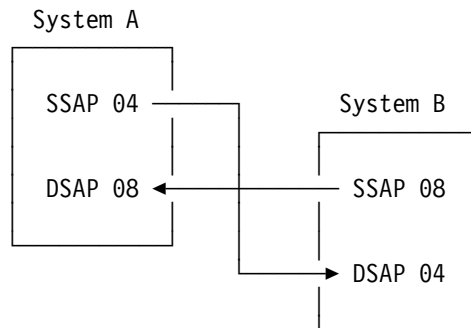


Figure 2-1. Relationship Between Service Access Points

Up to 24 unique SSAPs can be specified. If the default (*SYSGEN) is used when creating a LAN line description, up to four SSAPs are automatically created. Table 2-1 shows the SSAPs that are automatically created, depending on the type of line description.

Line Type		SSAP Values
Token Ring and DDI Lines		04, 12, AA, C8
Frame Relay Lines		04, AA, C8
Ethernet and Wireless Lines	ETHSTD(*IEE8023)	04, 12, AA, C8
	ETHSTD(*ALL)	04, 12, AA, C8
	ETHSTD(*ETHV2)	04, C8
SSAP Assignments:		
04	SNA	
12	ASCII LAN printing	
AA	TCP/IP	
C8	High performance routing (HPR)	

For SNA, the default of hex 04 is often sufficient. This is the default on all of the create controller description commands, and is the most commonly configured on remote units. Some cases where alternative service access points should be used are:

- The remote system is configured such that its SSAP or DSAP is not hex 04. In this case, configure your controller description's SSAP with the remote system's DSAP and your controller description's DSAP with the remote system's SSAP. Ensure that the SSAP configured in your controller description is included in the list of SSAPs you configured in each of the local area network line descriptions this controller has listed in its switched line list (SWTLINLST) parameter.
- You want parallel station-to-station connections between adapters. This may be desirable if you want to link two application programs that require different controller descriptions.
- If you wish to use both an APPC and multinode APPN connection to the same host system, parallel connections, which require multiple SAPs, are also required. An example of this type of network is a AS/400 system as an intermediate APPN node to the host system, but you have existing application pro-

grams that use System/38 communications files and must use a host controller description with APPN(*NO).

- You want to use the high performance routing (HPR) support. See the *APPN Support* book for information about HPR.
- You want station-to-station connections to the same adapters. For example, you may want to configure multiple SAPs to test an application program on a single system.

See “Configuring Different Service Access Points” on page 4-7 for an example of using different service access points to establish two parallel station-to-station connections between two adapters.

As previously mentioned, all adapter addresses in the network must be unique. Furthermore, because the DSAP, SSAP, and remote adapter address uniquely describe a connection to another station on the ring, all combinations of these three pieces of information must be unique for any controller that is varied on. These three pieces uniquely identify a connection to another station on the ring. The system enforces this uniqueness by not allowing two controller descriptions with the same remote adapter address, DSAP, and SSAP, to be varied on at the same time.

Establishing the connection

The AS/400 local area network support is logically switched; that is, the attachment to the network is permanent, such as a nonswitched synchronous data link control (SDLC) line, but a station-to-station connection may be configured as either dial or answer. Because the support is logically switched, you can configure as many controller descriptions as you wish. All descriptions are available for connection, but the number of varied-on or active controller descriptions allowed is based on the value specified for the MAXCTL parameter on the LAN line description. In the controller descriptions, you can specify more than one local area network line description in the SWTLINLST parameter. This allows you to dial stations using a different adapter address, if you like, or answer an incoming call from a remote system over two different adapters. This support provides more flexibility in connecting to your AS/400 system.

Most units use what is known as *last-one-up-on-the-network-calls-out* logic. This means that the systems attempt polling for a specified period of time before falling back into answer mode. This is the same approach that is taken by the AS/400 system for controller descriptions that are configured as *DIAL on their initial connection (INLCNN) parameter.

Dial mode

If you choose *DIAL for the initial connection (INLCNN) parameter on the controller description, this system attempts to poll the remote station to determine if any remote device on the line is ready to transmit, when the controller description is varied on. The frequency and persistence of this polling is configured on the controller description; the LAN connection retry (LANCNRRTY) value defines how many times the remote station is polled and the LAN connection timer (LANCNNTMR) value defines the amount of time between each poll. If the remote station answers the poll within LANCNRRTY-times-LANCNNTMR tenths of seconds, establishing a connection proceeds. If not, an inquiry message, CPA58E0 or CPA57EF, is sent to the system operator message queue indicating that a con-

nection attempt failed, and the system automatically puts the controller description in answer mode.

If you choose:

- The retry option, the system again attempts to contact the remote station.
- The cancel reply, the controller description remains in a vary on pending state waiting to answer a polling attempt by the remote station.

Answer mode

Similarly, other systems and controllers may attempt to establish a connection as soon as they are turned on, varied on, or the system has been loaded. Examples of this include the System/36 and the 3174 Subsystem Control Unit. If this system does not respond, the units listed previously go into answer mode. The 3725 Communication Controller also can be configured to either attempt establishing a connection, or simply wait for this system to try to contact it. Controller descriptions describing these systems should be configured as *DIAL on the INLCNN parameter. If the remote system is ready, the AS/400 system answers the poll. If not, the AS/400 system goes into answer mode, and the remote station contacts the polling system when it is varied on or turned on. Having both sides attempting to dial or poll simultaneously does not prevent the connection from being established. Call contention is resolved by architected retry sequences.

Dial initiation

If *DIAL was specified for INLCNN, the dial initiation parameter is allowed. This parameter allows you to determine when the call is made to the other system.

If you specify *IMMED, the call occurs immediately after the controller is varied on. *DELAY delays the dial to allow you to control when the call is made. *LINKTYPE is the default value and it determines when the dial connection is made by the type of link.

Note: For LAN connections *LINKTYPE is treated as *IMMED.

Unsuccessful connections

When using a controller description configured as INLCNN(*DIAL) and if no connection is established, a CPA58E0 Controller not replying or CPA57EF Contact not successful message can occur; this is not unusual. It may mean that the remote system or controller is not varied on or turned on. If the remote unit is in a state where it should be answering a poll from this system and successful contact is not being established, check the configuration on both sides to ensure that the adapter addresses, DSAP parameter, and SSAP parameter are correctly specified. You may also want to check and make sure that both the adapter for this system and the remote station are wired into the network correctly.

When using a controller description configured as INLCNN(*ANS), it is possible to receive the message CPI591A, Controller on line varied off or not recognized by local system. This message results when polling by a remote station does not satisfy the following conditions:

- The adapter address, DSAP, and SSAP match those configured for a varied on controller description.

- The local area network line description this poll used is contained in the switched line list.

If you have such a controller description, ensure that the adapter address is correct and that the local area network line description on which this polling occurred is listed in the SWTLINLST parameter. Also, make sure the controller is varied on and not in the recovery pending or recovery cancel state by using the Work with Configuration Status (WRKCFGSTS) command.

If the connection is of the answer type (*ANS for the INLCNN parameter), the system waits for the remote unit to poll. When the remote unit begins polling, an attempt to establish a connection is made.

Initial connection (INLCNN) parameter

Controller descriptions for personal computers or Personal System/2* workstations running OS/400 and using DOS should specify *ANS for the INLCNN parameter. These systems will not answer a connection attempt started by an AS/400 system. Systems running OS/400 and using the OS/2* Communications Manager will answer calls from the AS/400 system.

Check the error log to see if an error was logged for a line description with a system reference code of AF06 if the following occurred:

- The remote station is polling the AS/400 system
- The message, indicating the system is being polled, does not appear in the system operator message queue
- The connection is not established

You can check the error log by using the Start SST (STRSST) command. This may mean the remote station was sending to a DSAP that was not configured in the SSAP list on your local area network line description. If the AF06 reference code is absent, the error still may have occurred. Check the adapter addresses, SSAPs, and DSAPs to verify the connection.

Exchange identifier (XID)

To establish a connection, exchange identifiers (XIDs) are exchanged between the system and the remote unit.

For APPC and host controllers, a Format 3 exchange identifier (XID) is used to allow the remote station to properly identify the AS/400 system. Typically, the AS/400 system and other IBM systems conduct an initial poll with NULL XIDs to determine if the remote station is active on the network. If the station does not respond to the poll within the specified time period, another XID can be sent to the station. Typically, XID exchanges continue and a link is established.

Local exchange identifier (LCLEXCHID) parameter

The local exchange identifier (LCLEXCHID) parameter is used to identify the AS/400 system to the host system. This parameter is specified on the host controller description.

If *LIND is specified for the LCLEXCHID parameter, then the LCLEXCHID value is retrieved from the EXCHID value specified on the line description. If another value is specified, it overrides what was specified for EXCHID on the line description. For

example, if parallel connections are required between an AS/400 system and an SNA host system, then you need to override the EXCHID value. See “Example of Configuring Parallel Connections to the Host System” on page 4-21 for an example of parallel connections to the host.

Exchange identifier (EXCHID) parameter

The exchange identifier (EXCHID) parameter on the controller description specifies the block number and node identifier of the remote system. This parameter can be used to allow the local AS/400 system to identify the remote station.

If the EXCHID value is configured on the AS/400 controller description, the BLOCK identifier and the node identifier from the remote station are compared to the configured value before a connection is established. If no EXCHID is specified, no check is made. This check is optional because the remote unit has already been identified by its adapter address, SSAP, and DSAP.

Refer to the topic “LANCNTMR and LANCNRTY parameters” on page 2-11 for information on polling the remote system or controller.

Data link role

Local area network controller descriptions are always created with a data link role (ROLE parameter) of negotiable (*NEG). This means that any time a connection attempt is made to a remote unit, the systems determine their role to be primary or secondary by using an algorithm specified in the *SNA Format and Protocol Reference* book. Because the local area network uses a balanced and **duplex**⁴

protocol, this role is simply a matter of which system is chosen to send the Set Asynchronous Balanced Mode-Extended (SABME) command to the other station.

Automatic creation of APPC controllers on LANs

When local area network lines are configured with the option to create APPC controllers automatically (AUTOCTRL(*YES) is specified), the connection establishment and exchange identifier processing is handled differently on incoming calls. If a controller description with a matching adapter address, SSAP, and DSAP is varied on when an incoming call is received, the system processes the incoming call request as was described in “Establishing the connection” on page 2-6.

If the system does not have a controller description that is varied on and the line is configured as AUTOCTRL(*YES), the system will accept the call. After the remote system sends an exchange identifier, the system then causes a controller description to be created and varied on. The system dynamically determines the adapter address, SSAP, DSAP, RMTNETID, and RMTCPNAME used for the automatically created controller description based on the incoming call and the exchange identifier sent by the adjacent system. If a model controller is varied on for this line, the parameters, such as timers and retry limits, are copied from the model controller and used for the automatically created controller.

⁴ The duplex protocol allows either station to send at any time at the link level. Polling is not necessary to transfer information.

Automatic creation of controller descriptions is supported for locally attached LANs and bridged frame-relay configurations; it is not supported for SNA direct frame-relay configurations.

For more information on automatically creating controllers on LANs, see the *APPN Support* book.

Performance tuning parameters

When the controller descriptions are created, any type of local area network line can be specified in the switched line list (SWTLINLST parameter). At run time (dial or answer), the system can attach this LAN controller to any type of LAN line description. The first line description in the list that has the correct status is selected.

Because the AS/400 system does not know the type of line description that the controller will be attached to, you can specify values for parameters that do not apply to the environment you are using. Only at run time does the AS/400 system recognize that certain parameters are not needed for a particular environment. The AS/400 system ignores these parameters. For example, if you specify a value for the LANACCPTY parameter and you use Ethernet, the AS/400 system simply ignores that value.

SNA controller descriptions (APPC, SNA host, remote work station, finance, and retail) all have parameters that describe the behavior for the station. These parameters are the LANxxxxxx parameters, and are used for all local area network types.

If *CALC (the default) is specified for the LANxxxxxx parameters, the AS/400 system uses the values shown in Table 2-2. These values can be displayed by using the DSPCTLD command when the controller is active.

Note: Different values are calculated for lines that are attached to frame-relay network interfaces. See "Frame-relay performance tuning parameters" on page 9-13 for additional information.

Table 2-2 (Page 1 of 2). Summary of LAN Controller Description Performance Parameters

Parameter	Function	*CALC Value	Page
LANCNTMR	Sets wait time for polling remote station during connection establishment.	7 seconds	2-11
LANCNRTY	Sets number of poll retries sent to remote station during connection establishment.	10	2-11
LANRSPTMR	Sets wait time for frame retransmission.	1 second	2-11
LANFRMRTY	Sets number of frame retransmission attempts.	10	2-11
LANACKTMR	Sets wait time for acknowledgement to remote station.	0.1 second	2-12
LANACKFRQ	Sets number of frames received before sending acknowledgement.	1	2-12
LANINACTMR	Sets wait time for requesting response from remote station.	10 seconds	2-13

Table 2-2 (Page 2 of 2). Summary of LAN Controller Description Performance Parameters

Parameter	Function	*CALC Value	Page
LANMAXOUT	Sets number of outstanding frames allowed before requesting acknowledgment from remote station.	2	2-13
LANWDWSTP	Provides an alternative value equivalent to the LANMAXOUT parameter for use during periods of network congestion. The system provides an algorithm for returning the effective maximum outstanding frames value to that specified by the LANMAXOUT parameter as congestion subsides.	*NONE	2-14
LANACCPY	Sets priority of the station. Stations with higher priority have greater access to the token. (Used for token-ring only.)	0	2-14

LANCNTMR and LANCNRTY parameters

The LAN connection timer (LANCNTMR) and the LAN connection retry (LANCNRTY) parameters work together on the AS/400 system to define the frequency and persistence of polling the remote system or controller for the purpose of establishing a connection. The LANCNTMR specifies, in tenths of seconds, how long to wait before sending an exchange identifier (XID) or the Set Asynchronous Balanced Mode-Extended (SABME) command again. The LANCNRTY specifies how often this polling occurs when the LANCNTMR has ended. When the value specified for the LANCNRTY parameter is reached and no response is received from the remote station, the following occurs:

- The user is notified that contact with the station was unsuccessful.
- The system places the controller description in answer mode.
- If retry is the answer to the inquiry, the AS/400 system attempts to establish connection again.

The defaults for these parameters are intended for use on a single local area network. If a bridge is being used to communicate with a remote station on a remote network, you may want to consider increasing the values of the LANCNTMR and LANCNRTY parameters because a bridge may slow down line traffic enough for the timer to expire before the station is able to respond. **Line traffic** is the number of transmissions and the amount of data sent.

LANRSPTMR and LANFRMRTY parameters

The LAN response timer (LANRSPTMR) and the LAN frame retry (LANFRMRTY) parameters work together to determine how soon and how often a frame of data is transmitted again. Frames of data need to be transmitted again when one of the following occurs:

- A previous frame of data was lost or damaged.
- The remote station is so busy that it cannot copy or respond to the frame.
- The remote station is waiting to acknowledge the frame with an information frame of its own.

Refer to the topic “LANACKTMR and LANACKFRQ parameters” on page 2-12 for information about the LAN acknowledgement timer (LANACKTMR) parameter.

The LANRSPTMR parameter defines the time interval, in tenths of seconds, that the system waits before transmitting a frame to the remote station again. The LANFRMRTY value specifies how many times the frame is transmitted again before the system notifies the user that an error occurred and the logical link to the remote station is disconnected.

The defaults for these parameters are intended for use on a single local area network. If a bridge is being used to communicate with a remote station on a different local area network, you may want to consider increasing the values on both the local and remote systems, because a bridge may slow down traffic enough for the timer to end before the station is able to respond.

If the values chosen are too small, performance may be slower. Either too many frames are transmitted when acknowledgements are received after the LANRSPTMR ends or the logical link to the remote station may be disconnected. If the values are too large, the notification that a logical link failed may not be immediate.

LANACKTMR and LANACKFRQ parameters

The LAN acknowledgement timer (LANACKTMR) and the LAN acknowledgement frequency (LANACKFRQ) parameters work together to determine how often an acknowledgement is sent to the remote station. The LANACKTMR parameter specifies how long the system waits before sending an acknowledgement to a received frame. This allows the system, if it has any data to send to the remote controller, to use that frame to acknowledge the received frame. Similarly, the LANACKFRQ parameter specifies the maximum number of frames the system can receive before acknowledgement is sent to the remote station, independent of timers or having data to send. The system has a greater chance of sending a frame of data that includes an acknowledgement of the received frame if the LANACKFRQ value is large.

The values specified for the LANACKFRQ and LANACKTMR parameters must either both be zero or both be nonzero.

Large values may be desirable because unnecessary acknowledgements send additional frames and can contribute to heavier traffic on the LAN. If you are on a network where frame traffic is a problem, you may wish to increase either or both of these values.

However, in most cases where frame traffic is not a problem, and data tends to flow only one way on the logical link (file transfer), large values for these parameters introduce unnecessary delay in sending acknowledgements and slow response times.

The LAN acknowledgement values should be chosen with careful consideration for the response timer and maximum outstanding frame count of the remote station. For example, if LANACKTMR is set longer than the response timer of the remote station, and the local system does not regularly have data to send to the remote station, the remote response timer ends and transmits the frame again.

Similarly, if LANACKFRQ is set larger than the remote station's maximum outstanding frame count (LANMAXOUT), the remote station continuously waits for acknowledgement of the frames it has outstanding, while the local system waits for more frames of data. This can lead to poor performance for this logical link because more frames are being transmitted than actually necessary, and the remote station may wait longer than necessary before transmitting data again.

The LANACKFRQ parameter should be set less than or equal to the LANMAXOUT value for the remote station. If the local station LANACKFRQ parameter is smaller, the remote station LANMAXOUT value should be evenly divisible by the LANACKFRQ value.

LANINACTMR parameter

The LAN inactivity timer (LANINACTMR) parameter is used to determine how long the system should wait before requesting a response from the remote station. This request is made to determine if the remote station is still on the ring or if the logical link is disconnected. If the value is set too small, unnecessary traffic is created, which may lead to a performance throughput problem. If it is set too large, the system may not determine that the logical link is inoperable as quick as when the value is smaller. This timer is sensitive to whether the remote station is on the same local area network or not. If it is across a bridge, this value may need to be increased. If the value is set to 0 (no time-out), you may not be informed if the logical link is inoperable until a data transfer attempt occurs.

LANMAXOUT parameter

The LAN maximum outstanding data frames (LANMAXOUT) parameter specifies how many unacknowledged frames the system can have outstanding to the remote station without waiting for an acknowledgement. This parameter is highly sensitive to the ability of the remote station to copy and acknowledge frames, based on buffering capabilities and processing resource.

For optimal performance, it is essential to specify appropriate values for the LANMAXOUT and LAN acknowledgement frequency (LANACKFRQ) parameters on both the sending and receiving stations.

Some of the variables affecting which LANMAXOUT and LANACKFRQ values provide the best performance are:

- The characteristics of the application
- The amount of data being sent
- The rate that the application can present and accept data
- The data blocking characteristics
- The LAN adapter type
- The processing unit model
- The utilization of the line, the adapter, and the processing unit
- The internal buffering capabilities

In most environments, *CALC (LANACKFRQ=1 and LANMAXOUT=2) offers the best performance. However, for some environments, changing these values may provide a significant performance improvement.

You can change the LANMAXOUT and LANACKFRQ values to determine if performance improves. The following guidelines can be used as starting values which you can then change to determine the best values:

- For a large transfer environment when the frame size is:
 - 1994 bytes or less, use LANACKFRQ=4 and LANMAXOUT=8.
 - Between 1994 and 8156 bytes, use LANACKFRQ=2 and LANMAXOUT=4.
- For a mixed environment with both interactive and large transfer activity, follow the guidelines for a large transfer environment but keep LANACKFRQ=*CALC.
- When communicating with a PS/2* system Model 50 or above, follow the guidelines for a large transfer environment but keep LANACKFRQ=*CALC.
- If you decide to change the values from *CALC for LANACKFRQ and LANMAXOUT, here are some guidelines for determining new values:
 - LANACKFRQ should be about half the size of LANMAXOUT.
 - LANACKFRQ should be the same on sending and receiving systems.
 - LANMAXOUT should be the same on sending and receiving systems.

Note: If the LANACKFRQ and LANMAXOUT values are changed without a noticeable performance improvement, change the values back to *CALC.

LANWDWSTP parameter

The LAN window step (LANWDWSTP) parameter is used to determine whether the number of outstanding frames (those sent without receiving an acknowledgement from the remote system) should be reduced during periods of network congestion. If the value set is too small (or *NONE), congestion takes longer to subside. For more information on network congestion, see the discussion of the dynamic window algorithm in the *Token-Ring Network Architecture Reference*.

LANACCPTY parameter

The LAN access priority (LANACCPTY) parameter is set in each frame before being sent on the ring. This priority determines which tokens can be captured and used to send the frame. The greater the access priority value, the more tokens the station can capture and the greater chance the frame will be sent. This is important if the ring that your system is attached to is heavily used (not many free tokens available) and your application program needs priority treatment.

The adapters on most systems send a priority of 0, which is the default for LANACCPTY on the create controller commands. If your station requires more priority (for example, a personal computer which requires access to the token ring), you should set the LANACCPTY parameter to a greater value. This parameter is used only for token-ring network connections.

LAN bridge frame size considerations

If a frame is being transmitted to a station that resides on a different LAN, the frame must be copied and transmitted again by a bridge. If the bridge is not configured to support a frame size as large as that configured on the line description, the frame will be discarded. The frame may also be discarded if the frame size configured on a line description used for a bridged frame relay configuration is not supported by the network.

For SNA in the token-ring environment, the system originating the connection is informed of the frame size supported by the bridge, and will automatically retry with that frame size. The CPF5908 message Controller contacted that is sent to the QSYSOPR message queue gives the effective maximum frame size for that connection.

If it is not possible to configure the bridge to support larger frame sizes, you may need to adjust one of the following to a value acceptable to the bridge:

- MAXFRAME parameter on the controller description
- SSAP MAXFRAME parameter on the line description
- MAXFRAME parameter on the line description (except Ethernet lines)

If an adjustment is made, it is recommended that the MAXFRAME value on the controller description be adjusted.

Relationship of LAN parameters to token-ring network architecture

Table 2-3 shows how the AS/400 LAN controller description parameters relate to the parameters described in the *IBM Token-Ring Network Architecture Reference*.

<i>Table 2-3 (Page 1 of 2). AS/400 LAN Parameters. Relationship of LAN Controller Description Parameters to Parameters Used in the IBM Token-Ring Network Architecture Reference.</i>		
AS/400 Parameter	Short Term	Short Description
LANCNTMR	CT1	Connection Timer T1 (for link establishment)
LANCNRTY	CN2	Connection Retry Count N2 (for link establishment)
LANRSPTMR	T1	Response timer (waiting for remote acknowledgement)
LANFRMRTY	N2	Retry count (maximum number of resends on T1 expiration)
LANACKTMR	T2	Receiver acknowledgement timer
LANACKFRQ	N3	Acknowledgement frequency—must send acknowledgement after receiving N3 I-format frames (data frames)
LANINACTMR	Ti	Inactivity Timer (poll remote on expiration)
LANMAXOUT	TW (k)	Maximum number of outstanding I-Format LLC protocol data units (data frames)
LANWDWSTP	Nw	Dynamic Window Step
MAXFRAME on line and controller descriptions	N11	Maximum number of octets (bytes) in the information field. ²

Table 2-3 (Page 2 of 2). AS/400 LAN Parameters. Relationship of LAN Controller Description Parameters to Parameters Used in the IBM Token-Ring Network Architecture Reference.

AS/400 Parameter	Short Term	Short Description
<p>Note: TW may be referred to as MAXOUT because TW is perceived as the MAXimum OUTstanding frames transmitted to the other end. Similarly, N3 may be referred to as MAXIN because it is perceived as the MAXimum INbound frames received before sending an acknowledgement to the originator of the frames.</p>		
<p>1. N1 is the maximum length of an LLC Protocol Data Unit. The effective MAXFRAME value is the length excluding the LLC header. The LLC header is 3 to 4 bytes long. The setting of N1 on the AS/400 LAN adapter is the effective MAXFRAME + 4.</p>		
<p>2. For AS/400 Version 1 Release 3 and later, the effective MAXFRAME for the controller description is not necessarily the same as the MAXFRAME value on the controller description. Because LAN controller descriptions are logically switched, the effective MAXFRAME is the smallest of:</p>		
<ul style="list-style-type: none"> • The controller description MAXFRAME value. • The line description MAXFRAME value. • The SSAP maximum frame size on the line description. 		
<p>The effective maximum frame size may be set to a smaller value if the AS/400 system must communicate with the remote station through a source-routing bridge that requires a smaller frame size. For more information about source-routing bridge frame sizes, see the <i>IBM Token-Ring Architecture Reference</i>.</p>		

Token-ring networks

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Chapter 3. Token-ring networks

This chapter discusses token-ring network configuration and considerations.

Token-ring physical environment

Figure 3-1 shows the multistation access unit (MAU), which is the token-ring hardware needed to connect your device to a token ring. Each multistation access unit allows up to eight attached devices to have access to a ring. You can attach multiple multistation access units together for additional resources on the same token ring. All adapters on the token ring must run at the same speed, either 4 Mbps or 16 Mbps.

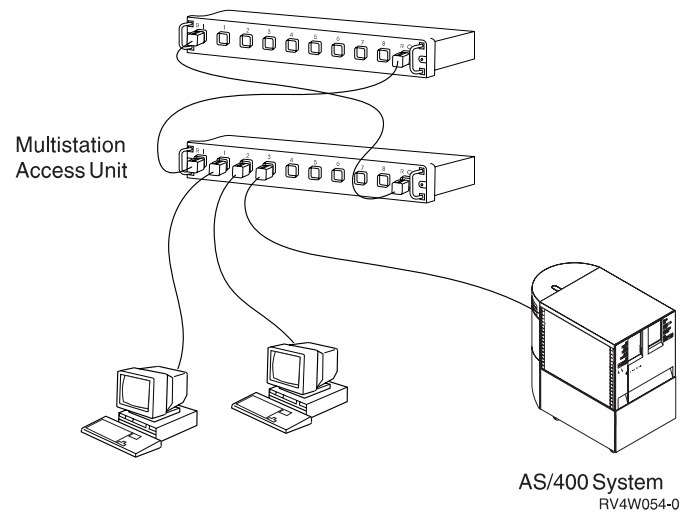


Figure 3-1. Multistation Access Unit

Figure 3-2 shows the necessary adapter cable to attach the IBM Token-Ring Network Adapter to the IBM Token-Ring Network. This adapter cable has a nine-pin D connector at the system end and a token-ring modular plug at the cabling end. You can purchase this IEEE 802.5-compliant cable from any vendor. IBM Token Ring uses baseband transmission at a rate of 4 Mbps or 16 Mbps.

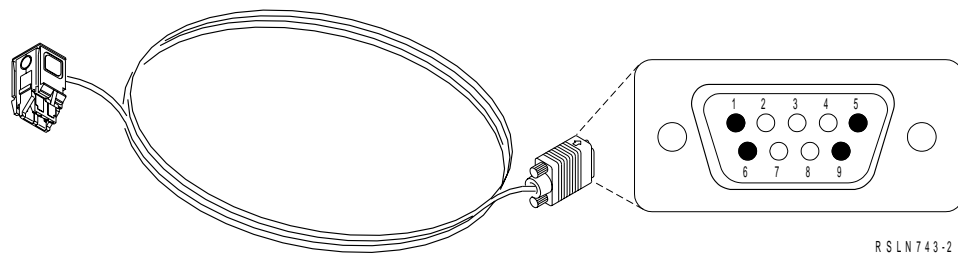


Figure 3-2. Token-Ring Adapter Cable

Ring configuration

The actual wiring of your network may have some bearing on performance. Rings may be linked together by adapters, which are called bridges. When this system attempts to establish a connection to a station, a frame is sent first around the local ring, and if no response is received, it is then sent to all rings that are connected by bridges to this system. If a station on a connected ring answers the poll, the routing information that the response carries is used in all subsequent transmissions to the remote station. Thus, only one route is ever used (source routing) when communicating with a station on a remote ring. Because all acknowledgements and retries are end to end, these bridges may become congested. This congestion can cause problems for your logical links if the correct values are not chosen for the timer parameters of the controller descriptions.

Notes:

1. The number of bridges through which token-ring frames can be routed is limited by the size of the routing information (RI) field in the token-ring frame. The maximum of 18 bytes allowed for the RI field supports routing through up to seven bridges.
2. More than one multistation access unit can be used in a single-ring network. They are linked together by wiring relays, not by bridges, and thus still constitute a single ring.

Early token release

The early token release (ELYTKNRLS parameter), available only with the 16 Mbps token-ring network, is used to reduce the time another adapter on the same ring has to wait for a free token. For early token release, the transmitting adapter releases a free token after sending its frame. The following figure demonstrates the concept of early token release.

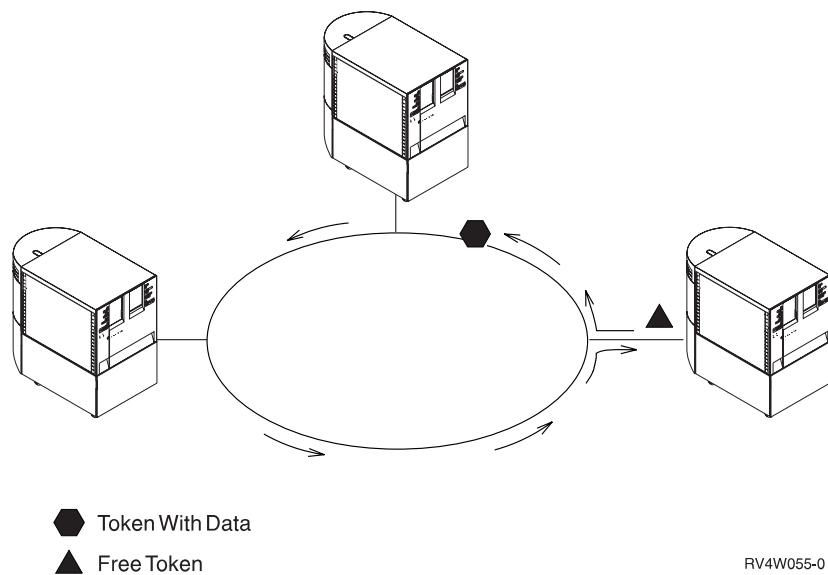


Figure 3-3. Early Token Release on the IBM Token-Ring Network

If early token release is not used and the frame is shorter than the ring length, a free token is not released until the transmitting adapter sees the header of its trans-

mitted frame. If the frame is shorter than the ring length, the ring is idle for the difference in time of the lengths. Early token release removes this idle time.

Token-ring physical address format

Every system, controller, or personal computer that is attached to a local area network has a physical address for its attachment adapter. This physical level is called the medium access control (MAC), and the IEEE architecture has defined the 48-bit (or 6-byte) MAC address formats to be used for IEEE 802.5 token-ring LANs.

Figure 3-4 and Figure 3-5 define how the MAC addresses are displayed on the AS/400 system for the token-ring LAN. The order of bit transmission on the medium starts with byte 0, bit 0 and ends with byte 5, bit 7. This order of transmission is called most significant bit because the most significant bit of each byte is transmitted first.

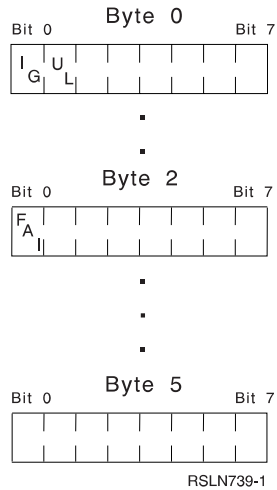


Figure 3-4. Token-Ring MAC Destination Address Format

- Bit 0 of byte 0 (called the I/G bit) indicates whether the destination address is an **individual address**, an address associated with a particular station on the network, (B'0'), or **group address**, a multidestination address associated with one or more stations on the network, (B'1').
- Bit 1 of byte 0 (called the U/L bit) indicates whether the address is universally administered (B'0') or locally administered (B'1').
- Bit 0 of byte 2 (called the functional address indicator (FAI)) indicates whether a locally administered group address is a functional address (B'0') or a group address (B'1').

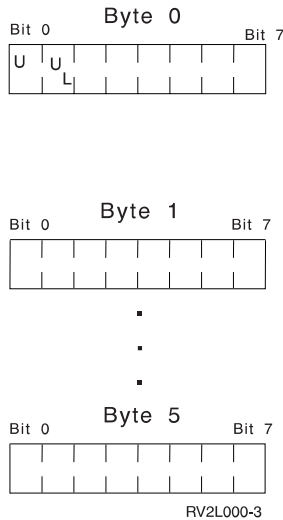


Figure 3-5. Token-Ring MAC Source Address Format

- Source addresses are always individual addresses. Bit 0 of byte 0 is set to 1 when a routing information field is present in the frame. It is set to 0 when no routing information field is present.
- Bit 1 of byte 0 is used to indicate whether the address is universally administered or locally administered as in the destination address.

The above indicators are an integral part of each station address and must be considered during address recognition.

Note the following:

- Byte 0, bit 0 = 0. This assignment controls the values of the local adapter address (ADPTADR parameter on the CRTLINTRN command) to the range of hex 7FFFFFFFFFFF and below. The remaining addresses (when byte 0, bit 0 = 1) are group addresses.
- Locally assigned addresses with byte 0, bit 1 = 1, are further restricted to values in the range hex 400000000000 to hex 7FFFFFFFFFFF. IEEE restrictions preclude the use of adapter preset addresses with values in the range of hex 000000000000 to hex 3FFFFFFFFFFF.

Other remote systems may have further restrictions on specifying the adapter address. For example, if your AS/400 system is communicating with FBSS controller, the locally assigned address is restricted to the range of hex 400000000000 to hex 400099999999. Only characters 0 through 9 are permitted.

Note: If you choose to assign your own address, ensure that the last 4 bytes (8 hexadecimal characters) are unique in the local area network. This is required by some adapters.

Bridged LAN addressing considerations

It is very important to note that MAC addresses are always displayed in the above format on all AS/400 token-ring configuration displays even if they represent stations on other LAN media, such as Ethernet stations reached through bridges. Refer to "Ethernet physical address format" on page 5-4 for more information on bridged LAN considerations.

Functional addresses

Functional addresses are bit-specific group addresses in a token-ring network. All functional addresses are locally administered. Functional addresses can be assigned using the FCNADR parameter on the CRTLINTRN command, or may be dynamically added by a TCP/IP multicast application. IP multicast addresses are mapped to the token-ring functional address C00000040000. See the *TCP/IP Configuration and Referencebook* for more information on IP and multicast.

For an address to be a functional address, the destination address must have both bit 0 and 1 of byte 0 set to 1, all the bits in byte 1 should be set to 0, and bit 0 of byte 2 set to 0. The remaining 7 bits of byte 2 and the 8 bits in byte 3, 4, and 5 are used to identify the specific functional address. This allows up to 31 functional addresses to be defined.

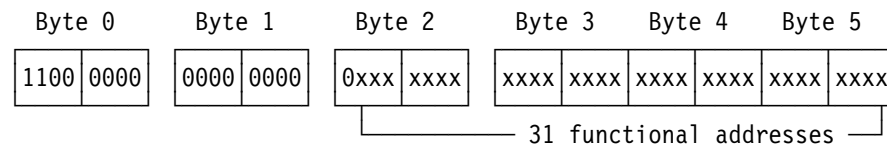


Figure 3-6. Token-Ring Functional Address Format

Note: Each x, when set to 1, represents a functional address.

For more information on functional addresses, see the *Communications Configuration* book, and the *Token-Ring Architecture Reference*.

For converting a token-ring functional address to an Ethernet group address, see "Token-ring-to-Ethernet address conversion" on page D-3.

Frame size considerations for token-ring networks

Data is transmitted to remote stations in frames, the basic unit of transmission for all data. Frame size indicates how large each transmission is.

A token-ring network provides an environment with few errors. Therefore, data transmission is more efficient if data is sent in as large a frame as possible. The largest frame size the AS/400 system sends (the MAXFRAME parameter on the CRTLINTRN command) can be set in any range from 265 through 16393.

Depending on the token-ring LAN adapter you are using, the maximum frame size will vary.

<i>Table 3-1. Token-Ring Adapter and Largest MAXFRAME Value</i>		
Resource Type	Largest MAXFRAME Value	
	Line Speed 16 Mbps	Line Speed 4 Mbps
2619, 2626, 6149, 2724	16393	4060
9175	4060	4060
6134, 2636	8156	4060
6034, 6160	N/A	1994 (default)
Note: Type WRKHDWRSC *CMN to view the LAN adapter (resource) types.		

The maximum value may not always be possible. For example, the station to which you are transmitting may not be able to accept as large a frame that configured on the AS/400 system token-ring line description. Typically, the largest frame size supported by both the AS/400 system and the remote station is exchanged in XIDs while establishing the connection, and the smaller of the frame sizes is then used by both the AS/400 system and the remote station. If this negotiation is not done, a frame reject (FRMR) condition results, and the message CPA58E2 is sent to the QSYSOPR message queue.

For example, when the AS/400 system is connected to a System/390 through a 3174 gateway on a token ring, maximum frame size is not negotiated. The 3174 uses a format 0 XID that provides no maximum frame size negotiation. The maximum frame size specified for the AS/400 system must be configured to match that of the 3174 gateway.

If the maximum frame size must be changed, use the appropriate change controller description command to change the AS/400 value, or change the maximum frame size in the remote system configuration.

General frame size considerations

On token-ring lines, the MAXFRAME parameter defines the maximum frame size to be used on that line. Maximum frame size can also be configured for each SAP associated with the line description. In addition, a controller description also has a MAXFRAME size. When the connection process begins, the frame size is the smaller of the three values: line MAXFRAME, SSAP MAXFRAME, or the controller MAXFRAME. However, the frame size may become even smaller because of the XID negotiations or bridge considerations.

LAN bridge frame size considerations

If a frame is being transmitted to a station that resides on a different LAN, the frame must be copied and transmitted again by a bridge. If the bridge is not configured to support a frame size as large as that configured on the token-ring or Ethernet line description, the frame will be discarded. For SNA in the token-ring environment, the system originating the connection is informed of the frame size supported by the bridge, and will automatically retry with that frame size. The CPF5908 message Controller contacted that is sent to the QSYSOPR message queue gives the effective maximum frame size for that connection.

If it is not possible to configure the bridge to support larger frame sizes, you may need to adjust one of the following to a value acceptable to the bridge:

- MAXFRAME parameter on the controller description

- SSAP MAXFRAME parameter on the line description
- MAXFRAME parameter on the line description

If an adjustment is made, it is recommended that the MAXFRAME value on the controller description be adjusted.

Chapter 4. Token-Ring Network Configuration Examples

Figure 4-1 shows an example of an AS/400 system on a token-ring network communicating with a 3745, a 3174 (Model 1L) Subsystem Control Unit, a System/36 using APPC, a 3174 (Model 3R or 53R) Subsystem Control Unit, a personal computer, and the same system routed back to itself (wrapped).

Token-ring network support is not limited to these systems. For example, the AS/400 system can also communicate with the RISC System/6000, ES/9000 systems, and Personal System/2 AIX.

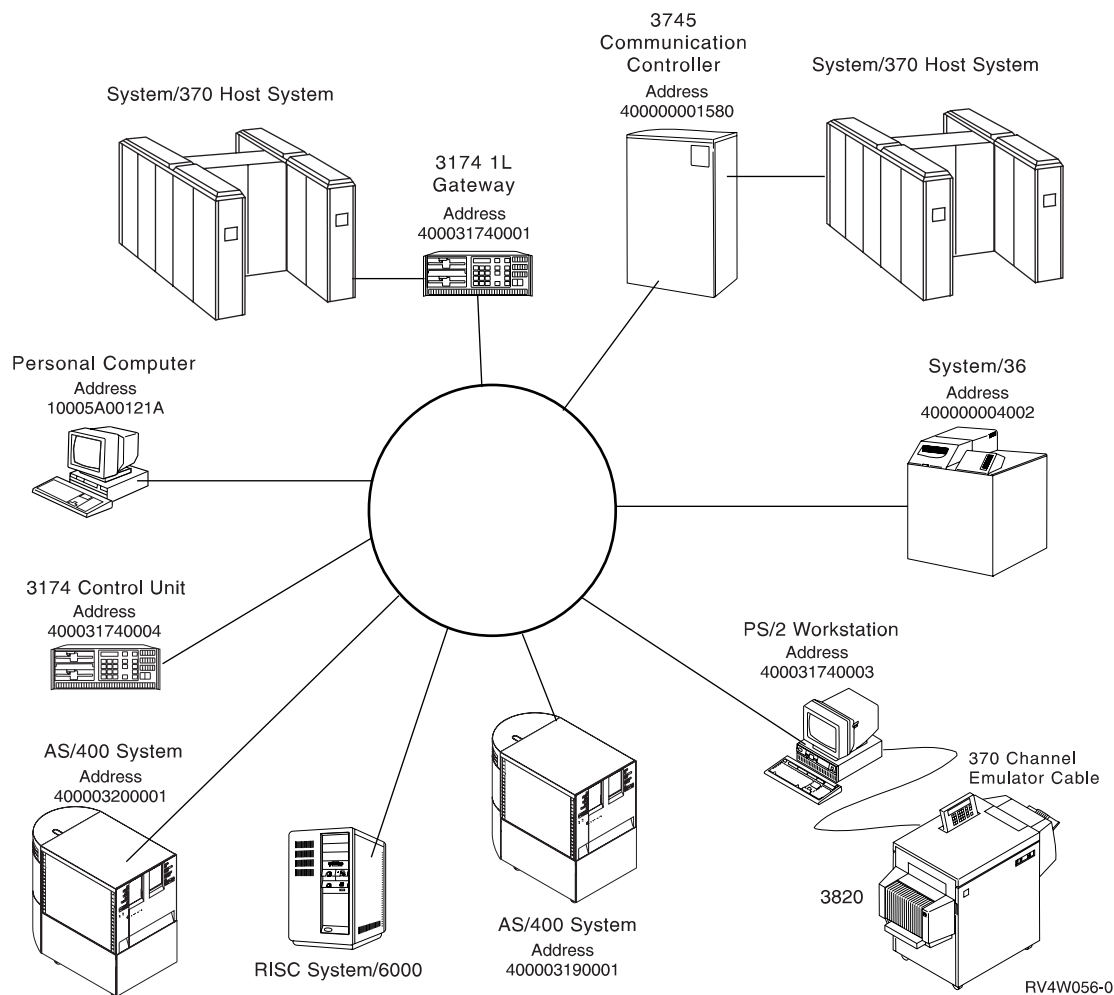


Figure 4-1. Token-Ring Network Configurations

Creating the Token-Ring Network Line Description

The token-ring network line description (TOKENRING1) created by the following displays has specified a user-assigned adapter address (400003190001), a maximum frame size of 16393 (allowed only for a 16M LAN adapter), and two SSAPs, hex 04 and hex 08. The maximum number of controllers (MAXCTL parameter) is set to 40; this means that no more than 40 controllers can be active on this line description at any one time.

```

Create Line Desc (Token-Ring) (CRTLINTRN)

Type choices, press Enter.

Line description . . . . . > TOKENRING1      Name
Resource name . . . . . > CMN01 1           Name, *NWID, *NWSD
Online at IPL . . . . . *YES                  *YES, *NO
Vary on wait . . . . . *NOWAIT                *NOWAIT, 15-180 (1 second)
Maximum controllers . . . . . 40              1-256
Line speed . . . . . > 16M                   4M, 16M, *NWI
Maximum frame size . . . . . > 16393          265-16393, 265, 521, 1033...
Local adapter address . . . . . > 400003190001  4000000000000-7FFFFFFF...
Exchange identifier . . . . . > 05600000 2    05600000-056FFFFF, *SYSGEN

                                                    More...
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

```

Create Line Desc (Token-Ring) (CRTLINTRN)

Type choices, press Enter.

SSAP list: 3
Source service access point . > 04           02-FE, *SYSGEN
SSAP maximum frame . . . . . > *MAXFRAME    *MAXFRAME, 265-16393
SSAP type . . . . . > *CALC                 *CALC, *NONSNA, *SNA

Source service access point . > 08           02-FE
SSAP maximum frame . . . . . *MAXFRAME      *MAXFRAME, 265-16393
SSAP type . . . . . *CALC                   *CALC, *NONSNA, *SNA
+ for more values
Text 'description' . . . . . > 'Token-ring line description'

Additional Parameters

Network controller . . . . . Name
TRLAN manager logging level . . *OFF      *OFF, *MIN, *MED, *MAX
                                                    More...
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

Figure 4-2. Prompt Displays for TOKENRING1 Token-Ring Line Description

Considerations for specifying the CRTLINTRN command:

- 1** For lines attached to network server descriptions (NWSDs), the resource value is *NWSD. This is for IPCS support. See the appropriate IPCS manual to learn more about token-ring lines attached on IPCS. For an example of *NWI for resource name, see “Bridged connections to remote token-ring networks” on page 10-8. (Difference in versions? The resource name for V4R7 or before will use LIN012 to make the connection to the adapter. For V4R1 or later, use the actual resource name of the port to which the line will connect).

- 2** The exchange identifier (EXCHID) parameter is the block number and node identifier of the local AS/400 system.
- 3** The source service access point (SSAP) specifies the logical channel addresses used to route incoming data from the token ring to the correct user. The hex 08 SSAP is used in a controller description, so it must be included in the TOKENRING1 line description.

Example of AS/400-to-AS/400 Configuration

The APPC controller description, created using the following prompt display, describes another AS/400 system at adapter address 400003200001. The TOKENRING1 line description created in “Creating the Token-Ring Network Line Description” on page 4-1 is used for the SWTLINLST parameter. The SSAP of hex 08 is one of the SSAPs included in the SSAP list in the line description, TOKENRING1.

```

Create Ctl Desc (APPC) (CRTCTLAPPC)

Type choices, press Enter.

Controller description . . . . . > TRLANS3X      Name
Link type . . . . . > *LAN          *ANYNW, *FAX, *FR, *IDLC...
Online at IPL . . . . . *YES          *YES, *NO
APPN-capable . . . . . *YES          *YES, *NO
Switched line list . . . . . > TOKENRING1      Name
      + for more values
Maximum frame size . . . . . *LINKTYPE     265-16393, 256, 265, 512...
Remote network identifier . . . *NETATR       Name, *NETATR, *NONE, *ANY
Remote control point . . . . . > LANAPPN2 1      Name, *ANY
Exchange identifier . . . . . 00000000-FFFFFFF
Initial connection . . . . . *DIAL         *DIAL, *ANS
Dial initiation . . . . . *LINKTYPE     *LINKTYPE, *IMMED, *DELAY
LAN remote adapter address . . . > 400003200001 2 000000000001-FFFFFFFFFFFF
APPN CP session support . . . . *YES          *YES, *NO
APPN node type . . . . . *ENDNODE      *ENDNODE, *LENNODE...
APPN transmission group number 1          1-20, *CALC

F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys
More...

```

Figure 4-3 (Part 1 of 3). Prompt Displays for TRLANS3X Controller Description

```

                                Create Ctl Desc (APPC) (CRTCTLAPPC)

Type choices, press Enter.

APPN minimum switched status . . *VRYONPND      *VRYONPND, *VRYON
Autocreate device . . . . . *ALL              *ALL, *NONE
Autodelete device . . . . . 1440              1-10000, *NO
User-defined 1 . . . . . *LIND                0-255, *LIND
User-defined 2 . . . . . *LIND                0-255, *LIND
User-defined 3 . . . . . *LIND                0-255, *LIND
Model controller description . . *NO              *NO, *YES
Text 'description' . . . . . > 'AS/400 at 400003200001'

```

Figure 4-3 (Part 2 of 3). Prompt Displays for TRLANS3X Controller Description

```

                                Create Ctl Desc (APPC) (CRTCTLAPPC)

Type choices, press Enter.

LAN DSAP . . . . . > 04 3                    04, 08, 0C, 10, 14, 18, 1C...
LAN SSAP . . . . . > 08 4                    04, 08, 0C, 10, 14, 18, 1C...
LAN frame retry . . . . . *CALC              0-254, *CALC
LAN connection retry . . . . . *CALC        0-254, *CALC
LAN response timer . . . . . *CALC          0-254 (0.1 seconds)
LAN connection timer . . . . . *CALC        0-254 (0.1 seconds)
LAN acknowledgement timer . . . *CALC      0-254 (0.1 seconds)
LAN inactivity timer . . . . . *CALC        0-255 (0.1 seconds)

```

Figure 4-3 (Part 3 of 3). Prompt Displays for TRLANS3X Controller Description

Considerations for specifying the CRTCTLAPPC command:

- 1** The remote control point name should match the local control point name of the remote AS/400 system. The local control point name can be determined by using the DSPNETA command.
- 2** The adapter address (ADPTADR parameter) of the CRTCTLAPPC command must match the ADPTADR parameter of the TOKENRING2 line description previously configured for the other system.
- 3** The destination service access point (DSAP parameter) of the CRTCTLAPPC command must match the source service access point (SSAP parameter) of the APPC controller description previously configured for the other system.
- 4** The SSAP parameter of the CRTCTLAPPC command must match the DSAP parameter of the APPC controller description previously configured for the other system.

The following command shows the device description created for communications with the SYS320 AS/400 system. The remote network identifier (RMTNETID parameter) should match the local network identifier of the remote AS/400 system. The local network identifier can be determined by using the DSPNETA command.

```
CRTDEVAPPC DEVD(TRLANS3XD) RMTLOCNAME(SYS320) LCLLOCNAME(SYS319) +  
RMTNETID(LANAPPN1) CTL(TRLANS3X) MODE(BLANK) +  
TEXT('APPC device for SYS320')
```

The following commands can be used to configure another AS/400 system communicate with this AS/400 system.

```
CRTLINTRN LIND(TOKENRING2) RSRNAME(LIN011) LINESPEED(16M) +  
MAXFRAME(16393) ADPTADR(400003200001) EXCHID(05600000) +  
SSAP((04 *MAXFRAME *CALC) (08 *MAXFRAME *CALC)) +  
TEXT('Line description for 400003200001')
```

The adapter address (ADPTADR parameter) specified for the CRTLINTRN command must match the ADPTADR parameter of the APPC controller description previously configured for the other system.

The following command shows the creation of the APPC controller description.

```
CRTCTLAPPC CTLD(TRLANS3X2) LINKTYPE(*LAN) SWTLINLST(TOKENRING2) +  
RMTCPNAME(LANAPPN) 1 ADPTADR(400003190001) 2 +  
DSAP(08) 3 SSAP(04) 4 TEXT('AS/400 at 400003200001')
```

Considerations for specifying the CRTCTLAPPC command:

- 1** The remote control point name should match the local control point name of the remote AS/400 system. The local control point name can be determined by using the DSPNETA command.
- 2** The adapter address (ADPTADR parameter) of the CRTCTLAPPC command must match the ADPTADR parameter of the TOKENRING1 line description previously configured for the other system.
- 3** The destination service access point (DSAP parameter) of the CRTCTLAPPC command must match the source service access point (SSAP parameter) of the APPC controller description previously configured for the other system.
- 4** The SSAP parameter of the CRTCTLAPPC command must match the DSAP parameter of the APPC controller description previously configured for the other system.

The following command shows the device description created for communications with the SYS319 AS/400 system. The remote network identifier should match the local network identifier of the remote AS/400 system. The local network identifier can be determined by using the DSPNETA command.

```
CRTDEVAPPC DEVD(TRLANS3XD2) RMTLOCNAME(SYS319) LCLLOCNAME(SYS320) +  
RMTNETID(LANAPPN) CTL(TRLANS3X2) MODE(BLANK) +  
TEXT('APPC device for SYS319')
```

Example of a Token-Ring Network-to-Personal Computer Configuration

The APPC controller description created by the Create Controller Description (APPC) (CRTCTLAPPC) command describes a personal computer that uses OS/400. Notice its adapter address (a preset address assigned by the adapter manufacturer) and the fact that it is an APPN controller, because APPN(*YES) is the default.

Notice that no device is created along with the controller. The system creates a device description for your use the first time a connection is made to the personal computer. For more information on automatically creating controller descriptions, see the discussion of the AUTOCRTCTL line description parameter in the *Communications Configuration* book. It is recommended that OS/400 automatically create a controller and device description for you.

```
CRTCTLAPPC CTLD(TRLANPC) LINKTYPE(*LAN) SWTLINLST(TOKENRING1) +  
RMTCPNAME(PC01) ADPTADR(10005A00121A) CPSSN(*NO) 1 +  
SWTDSC(*NO) 2 TEXT('Controller for PC on TOKENRING1')
```

Considerations for specifying the CRTCTLAPPC command:

- 1** By specifying the APPN CP session support (CPSSN parameter) as *NO, the automatic disconnect feature can be used.
- 2** The switched disconnect (SWTDSC) parameter is ignored unless CPSSN(*NO) is specified. These values indicate that the automatic disconnect feature is being used.

For more information on configuring the OS/400, refer to the appropriate OS/400 documentation.

When installing OS/400 on a personal computer, the location name for the personal computer must be set to the value specified as the remote control point name (RMTCPNAME) for the APPC controller description for this personal computer. This value must be unique for each personal computer in the token-ring network.

The system name is the local control point name (LCLCPNAME) specified in the Change Network Attributes (CHGNETA) command.

The system token-ring address must be set to the ADPTADR parameter of the TOKENRING1 line description.

The first part of the RTLN entry of the OS/400 configuration file, CONFIG.PCS, must match the RMTNETID parameter value on the AS/400 CRTCTLAPPC command. It is recommended that the value match what is specified as the current local network identifier in the network attributes. APPN is the default value. The OS/400 documentation contains information for tailoring the configuration record of your personal computer to match the local network identifier on your system.

Note: To change the value for the RTLN entry in the CONFIG.PCS file, you must use an editor.

It is recommended that you begin the name of the APPC controllers, which describe the personal computers you attach to the ring, with the letters PC. This allows you to display the status of the personal computers using the Work with

Configuration Status (WRKCFGSTS) command. See the *Communications Management* book for more information on the WRKCFGSTS command.

Configuring Different Service Access Points

The following APPC controller and device descriptions allow you to connect from the AS/400 system back to the same AS/400 system. You may wish to do this to test an application within your system before testing it over the network to a different system. This example also shows how different service access points are configured in the controller descriptions. Notice that the SSAP for TRLANCTL1 and the DSAP for TRLANCTL2 correspond, as do the DSAP for TRLANCTL1 and the SSAP for TRLANCTL2. This example has one controller description as a *DIAL and the other as *ANS.

Notice that because both controllers are communicating through the same adapter, they both list the adapter address that was listed when creating TOKENRING1. Data actually goes out and around the ring for token-ring. However, when Ethernet is used, there is an internal wrap in the input/output processor. This is the case only in a wrapped situation.

You can configure the controller and device descriptions using a CL program or CL commands as demonstrated here, or you can configure these objects through configuration displays as shown previously in this chapter.

```
CRTCTLAPPC CTLD(TRLANCTL1) LINKTYPE(*LAN) APPN(*NO)
              SWTLINLST(TOKENRING1) ADPTADR(400003190001)
              DSAP(04) SSAP(08)
              TEXT('AS/400 at address 400003190001, DSAP 04')
```

```
CRTDEVAPPC DEVD(TRLANDEV1) RMTLOCNAME(SOURCE)
              LCLLOCNAME(TARGET) CTL(TRLANCTL1)
              MODE(BLANK) APPN(*NO)
```

```
CRTCTLAPPC CTLD(TRLANCTL2) LINKTYPE(*LAN) APPN(*NO)
              INLCNN(*ANS) SWTLINLST(TOKENRING1)
              ADPTADR(400003190001) DSAP(08) SSAP(04)
              TEXT('AS/400 at address 400003190001, DSAP 08')
```

```
CRTDEVAPPC DEVD(TRLANDEV2) RMTLOCNAME(TARGET)
              LCLLOCNAME(SOURCE) CTL(TRLANCTL2)
              MODE(BLANK) APPN(*NO)
```

Example of Token-Ring Network-to-System/36 Using APPC Configuration

The following APPC controller description describes a system that uses adapter address 400000004002. The TOKENRING1 line description created in “Creating the Token-Ring Network Line Description” on page 4-1 is used for the SWTLINLST parameter. The SSAP and DSAP parameters are not included because the defaults of DSAP(04) and SSAP(04) are used. See the *APPN Support* book for configuration examples using APPN.

```

Create Ct1 Desc (APPC) (CRTCTLAPPC)

Type choices, press Enter.

Controller description . . . . . > TRLANS36      Name
Link type . . . . . > *LAN                      *ANYNW, *FAX, *FR, *IDLC...
Online at IPL . . . . . > *YES                      *YES, *NO
APPN-capable . . . . . > *NO                        *YES, *NO
Controller type . . . . . > *BLANK                  *BLANK, *FBSS, 3174, 3274...
Switched line list . . . . . > TOKENRING1          Name
      + for more values
Maximum frame size . . . . . > *LINKTYPE            265-16393, 256, 265, 512...
Remote network identifier . . . > *NONE              Name, *NETATR, *NONE, *ANY
Remote control point . . . . . > *ANY                Name, *ANY
Exchange identifier . . . . . > 03E00000           00000000-FFFFFFFF
Initial connection . . . . . > *DIAL                *DIAL, *ANS
Dial initiation . . . . . > *LINKTYPE              *LINKTYPE, *IMMED, *DELAY
LAN remote adapter address . . . > 400000004002      000000000001-FFFFFFFFFFFF
Autocreate device . . . . . > *ALL                  *ALL, *NONE

                                                    More...
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys

```

```

Create Ct1 Desc (APPC) (CRTCTLAPPC)

Type choices, press Enter.

Text 'description' . . . . . > 'APPC controller for System/36'

```

Figure 4-4. Prompt Display for TRLANS36 Controller Description

The following device description can be used to configure the APPC device description.

```

Create Device Desc (APPC) (CRTDEVAPPC)

Type choices, press Enter.

Device description . . . . . > TRLANS36D      Name
Remote location . . . . . > SYSTEM36         Name
Online at IPL . . . . . > *YES                *YES, *NO
Local location . . . . . > AS400              Name, *NETATR
Remote network identifier . . . > *NONE        Name, *NETATR, *NONE
Attached controller . . . . . > TRLANS36      Name
Mode . . . . . > BLANK                        Name, *NETATR
+ for more values
Message queue . . . . . QSYSOPR              Name, QSYSOPR
Library . . . . . *LIBL                      Name, *LIBL, *CURLIB
APPN-capable . . . . . > *NO                 *YES, *NO
Single session:
  Single session capable . . . . *NO          *NO, *YES
  Number of conversations . . . . 1-512
Location password . . . . . *NONE
Secure location . . . . . *NO                *NO, *YES
More...

F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

```

Create Device Desc (APPC) (CRTDEVAPPC)

Type choices, press Enter.

Text 'description' . . . . . > 'APPC device for System 36'

```

Figure 4-5. Prompt Displays for TRLANS36D Device Description

System/36 Configuration CNFIGICF Displays

A System/36 user must fill in the following displays to configure an APPC subsystem member and token-ring line member to communicate with the AS/400 system previously configured. To get to the first display, use the CNFIGICF command.

```

1.0          SSP-ICF CONFIGURATION MEMBER DEFINITION          W2

1. Configuration member name . . . . . TRNLINA
2. Library name . . . . . CNFIGLIB
3. Select one of the following:
   1. Create new member
   2. Edit existing member
   3. Create new member from existing member
   4. Remove a member
   5. Review a member
Option . . . . . 1-5 1

```

Figure 4-6. Prompt Display for SSP-ICF Configuration Member Definition

On display 2.0, specify the type of configuration member you want to define.

```
2.0                      SSP-ICF CONFIGURATION MEMBER TYPE          TRNLINA  W2

Select one of the following options:
  1. INTRA
  2. BSC
  3. SNA
  4. Async
  5. PC Support/36

Option: 3
```

Figure 4-7. Prompt Display for Configuration Member Type

Select one of the following options:

Select option 3 (SNA) to process an SNA member.

On display 4.0, specify the type of member you want to define.

```
4.0                      SNA CONFIGURATION MEMBER TYPE          TRNLINA  W2

1. SNA member type . . . . . 1-4  4
  1. SNA subsystem member
  2. SNA/SDLC line member
  3. SNA/X.25 line member
  4. SNA/IBM Token-Ring Network line member

2. Will APPC or APPN be used? . . . . . Y,N  Y
```

Figure 4-8. Prompt Display for Configuration Member Type

1. SNA member type

Specify option 4 (SNA/IBM Token-Ring Network line member).

2. Will APPC or APPN be used?

Specify a Y (Yes) to indicate that APPC or APPN is used on this line.

The prompts for display 12.0 are described below.

```

12.0          SNA LINE MEMBER ATTRIBUTES          TRNLINA  W2

6. Local system's station XID in hexadecimal. . . . . 00000
7. Source service access point (SSAP) value . . . . . 04

Cmd5-Restart CNFIGICF          Cmd7-End
Cmd19-Cancel                    COPR IBM Corp. 1986

```

Figure 4-9. Prompt Display for SNA Line Member Attributes

Note: Item 7 on display 12.0, SNA Line Member Attributes, describes the System/36 SSAP. This must be equal to the DSAP parameter on the APPC controller description on the AS/400 system.

On display 12.5, select the remote systems that this subsystem communicates with. If the protocol is primary or the line type is switched, up to 32 remote systems can be defined.

If no remote systems have been defined, only option 1 (Create) is shown.

```

12.5          REMOTE SYSTEM SELECTION          TRNLINA  W2

1. Select from the following options:
   1-Create    3-Create From Existing          5-Review
   2-Edit     4-Remove
Option . . . . .
2. Remote system name . . . . .
3. Existing remote system name . . . . .

-----
OPTION  REMOTE SYSTEM  OPTION  REMOTE SYSTEM  OPTION  REMOTE SYSTEM
          AS400

```

Figure 4-10. Prompt Display for Remote System Selection

1. Select from the following options:

Specify option 1 (Create).

2. Remote system name

Specify the name (up to 8 characters) by which the remote system is known in the line member. This value should match the AS/400 network attributes control point name, which you can display using the DSPNETA command.

On display 13.0, define the characteristics for the remote system selected on display 12.5.

```

13.0          REMOTE SYSTEM ATTRIBUTES          TRNLINA  W2
          Remote system AS/400
1. Remote system type . . . . . 2
          2-Peer

3. Remote system's block ID in hexadecimal. . . . . 056

4. Remote system's station XID in hexadecimal . . . . . 00000

```

Figure 4-11. Prompt Display for Remote System Attributes

1. Remote system type

Specify option 2 (Peer) for the remote system type.

3. Remote system's block ID in hexadecimal

Specify the 3-hexadecimal character block identifier of the remote system. This value can be from 000 to FFF and must be the same as the value assigned to the remote system by SNA. This is the XID that System/36 expects from the AS/400 system. This must equal the EXCHID parameter on the TOKENRING1 line description. Set this value to 056.

4. Remote system's station XID in hexadecimal

Specify the exchange identifier (XID) used to identify the remote system. This identifier is 5 hexadecimal characters from 00000 through FFFFF. This is the XID that System/36 expects from the AS/400 system. This must equal the EXCHID parameter on the TOKENRING1 line description. Set this value to 00000.

Display 13.5 is shown if you selected option 4 (IBM Token-Ring Network) for the SNA member type on display 4.0.

```

13.5          REMOTE SYSTEM ATTRIBUTES          TRNLINA  W2
          Remote system AS/400
1. Remote adapter address . . . . . 400003190001
2. Destination service access point (DSAP) value . . . . . 04

```

Figure 4-12. Prompt Display for Remote System Attributes

Remote adapter address

Specify the hexadecimal adapter address for this remote system for an SNA/IBM Token-Ring Network line member. Valid addresses are hex 0000000000001 through hex 7FFFFFFFFFFFF. This must equal the ADPTADR parameter on the TOKENRING1 line description on the AS/400 system. The remote adapter address is 400003190001.

Destination service access point DSAP value

Specify the hexadecimal logical channel address used for routing at the remote system for an SNA/IBM Token-Ring Network. This value must be nonzero, divisible by 4, and must match the remote system's source service access point

(SSAP). Valid values are hex 04 through hex EC. This must equal the SSAP parameter on the APPC controller description on the AS/400 system. Set this value to 04.

```
1.0          SSP-ICF CONFIGURATION MEMBER DEFINITION          W2

1. Configuration member name . . . . . TRNSBSA
2. Library name . . . . . CNFIGLIB
3. Select one of the following:
   1. Create new member
   2. Edit existing member
   3. Create new member from existing member
   4. Remove a member
   5. Review a member
Option . . . . . 1-5 1
```

Figure 4-13. Prompt Display for SSP-ICF Configuration Member Definition

On display 2.0, specify the type of configuration member you want to define.

```
2.0          SSP-ICF CONFIGURATION MEMBER TYPE          TRNSBSA  W2

Select one of the following options:
   1. INTRA
   2. BSC
   3. SNA
   4. Async
   5. PC Support/36

Option: 3
```

Figure 4-14. Prompt Display for Configuration Member Type

Select one of the following options:

Select option 3 (SNA) to process an SNA member.

On display 4.0, specify the type of member you want to define.

```
4.0          SNA CONFIGURATION MEMBER TYPE          TRNSBSA  W2

1. SNA member type . . . . . 1-4 1
   1. SNA subsystem member
   2. SNA/SDLC line member
   3. SNA/X.25 line member
   4. SNA/IBM Token-Ring Network line member
```

Figure 4-15. Prompt Display for SNA Configuration Member Type

1. SNA member type

Specify option 1 (SNA subsystem member).

On display 21.0, select the type of subsystem for which you want to create a subsystem member. Also, enter the name of the line member (previously defined) that you will use with this subsystem member.

```
21.0          SNA SUBSYSTEM MEMBER SELECTION          TRNSBSA  W2

1. Select subsystem type from the following options:
   1. Peer
   2. SNA Upline
   3. SNA 3270
   4. Finance
   5. SNA MSRJE
   6. APPC
   7. APPN
Option . . . . . 1-7  6

2. Line member name . . . . . TRNLINA
```

Figure 4-16. Prompt Display for SNA Subsystem Member Selection

1. Select subsystem type from the following options:

Specify option 6 (APPC) to indicate that the subsystem used is APPC.

2. Line member name

Specify the name of the *line member* with which this subsystem member is associated. The line member name is specified on display 1.0 during line member configuration (TRNLINA).

The prompt on display 22.0 is described as follows:

```
22.0          SUBSYSTEM MEMBER DEFINITION          TRNSBSA  W2

1. Local location name . . . . . SYSTEM36
```

Figure 4-17. Prompt Display for SNA Subsystem Member Definition

1. Local location name

Specify the local location name as SYSTEM36.

On display 29.0, select the remote locations that this subsystem communicates with.


```

29.0                                REMOTE LOCATION SELECTION                                TRNSBSA W2

1. Select from the following options:
   1-Create      3-Create From Existing      5-Review
   2-Edit       4-Remove
Option . . . . . 1
2. Remote location name . . . . . AS400
3. Remote system name . . . . . AS400
3. Existing location name . . . . .
-----
OPTION  REMOTE SYSTEM  OPTION  REMOTE SYSTEM  OPTION  REMOTE SYSTEM

```

Figure 4-18. Prompt Display for Remote Location Selection

On display 30.0, enter whether or not you want to activate communications with the remote location at the time this subsystem is enabled.

```

30.0                                REMOTE LOCATION DEFINITION                                TRNSBSA W2

Remote system AS400                    Remote location AS400

1. Activate location at ENABLE? . . . . . Y,N Y
2. Send alerts to this location? . . . . . Y,N N

```

Figure 4-19. Prompt Display for Remote Location Definition

1. Activate location at ENABLE?

Specify whether or not you want the subsystem, as soon as it is enabled, to allow communications with this remote location. Specify a Y (Yes), which is the default, to indicate that communications can start without having to specify the name of the remote location on an ENABLE procedure command.

2. Send alerts to this location?

Specify whether or not you want alerts sent. Specify an N (No) if you do not want alerts sent to this location.

Note: A separate location needs to be defined to send alerts to the remote system named AS400.

Display 42.0 lists the session groups that are defined for this remote location. You can create a new session group, edit an existing session group, remove a session group, create a new session group from an existing session group, or review a session group. In addition, you can specify the name of the session group that is to be used as the default.

System/36 has a default session group of *BLANK, and the AS/400 system has a default mode of BLANK.

```

42.0                      SESSION GROUP SELECTION                      TRNSBSA  W2
      Remote system AS400                      Remote location AS400
1. Select from the following options:
                                     5-Review
Option . . . . .
2. Session group name . . . . .
4. Default session group name . . . . . *BLANK
-----
OPTION  SESSION GROUP
      *BLANK

```

Figure 4-20. Prompt Display for Session Group Selection

1. Select from the following options:

Option 5 (Review) displays an existing session group. The configuration member cannot be changed.

2. Session group name

Each session group name must be unique within the remote location.

4. Default session group name

Specify that the default session group name is used by the APPC subsystem whenever a local application program does not specifically provide a session group name at the start of a session. The default session group name must be a session group name already configured for this remote location.

Display 43.0 is the first of a set of displays that you use to define the session groups. The remote system name, remote location name, and session group name are shown for reference.

```

43.0          APPC and APPN SESSION GROUP DEFINITION          TRNSBSA  W2
      Remote system AS400                      Remote location AS400
                                     Session group *BLANK
1. Session group type . . . . . 1
   1-Interactive          2-Batch
2. Maximum session limit . . . . . 1 - 64 08
3. Number of locally controlled sessions . . . . . 0 - 08 04
4. Number of pre-established sessions . . . . . 0 - 04 01

```

Figure 4-21. Prompt Display for Session Group Definition

1. Session group type

Specify whether or not the sessions are used for batch or interactive communications. This is used to select defaults at the local system for display 44.0. Type a 1 (Interactive) if the record exchange is in both directions, meaning that the systems alternate sending and receiving.

2. Maximum session limit

Specify the maximum number of sessions that are allowed for this session group. The maximum number of sessions for all session groups in a single remote location is 64. The default is 8.

3. Number of locally controlled sessions

Specify the number of locally controlled sessions that are requested for this session group. The range of available sessions is shown and the default is one-half of the maximum session limit. This value is actually negotiated with the remote system when the data link is established. Therefore, the number specified here is not a guaranteed value.

4. Number of pre-established sessions

Specify the number of sessions established and kept active while communications with the remote location is active. The default is 1 if the line type is nonswitched or switched without automatic disconnect. The default is 0 if the line type is switched with automatic disconnect.

Note: All values specified in this session group are the default values.

On display 44.0, define additional options that can affect performance for this session group. The remote system name, remote location name, and session group name are shown for reference.

```
44.0          APPC AND APPN SESSION GROUP ADDITIONAL OPTIONS          TRNSBSA W2
              Remote system AS400                      Remote location AS400
                          Session group *BLANK
1. Receive pacing value . . . . .1-63 07
2. Maximum receive RU size . . . . .8-16384 04096
3. Acquire remotely controlled sessions? . . . . . Y,N N
```

Figure 4-22. Prompt Display for APPC and APPN Session Group Additional Options

1. Receive pacing value

Specify that 7 request units (RUs) may be sent from the remote location without an intervening pacing response. The default is 7 if the type of session group is interactive.

2. Maximum receive RU size

Specify that the maximum RU size (in bytes) that can be received by the APPC subsystem is 1024. The default is 1024 if the type of session group is interactive.

3. Acquire remotely controlled sessions?

If there are no locally controlled sessions available, this prompt determines whether or not the subsystem attempts to acquire a session controlled by the remote system.

Note: All values specified in this session group are the default values.

Example of Token-Ring Network-to-3745 Host Configuration

The following host controller description is used to configure the connection to a 3745 controller at adapter address 400000001580. The SSAP and DSAP parameters are not included because the defaults of DSAP(04) and SSAP(04) are used.

```
CRTCTHHOST CTLD(TRLANHOST) LINKTYPE(*LAN) +  
  SWTLINLST(TOKENRING1) 1 RMTCPNAME(LANAPPN) 2 +  
  LCLEXCHID(*LIND) 3 ADPTADR(400000001580) +  
  NODETYPE(*LENNODE) TEXT('3745 controller')
```

Considerations for specifying the CRTCTHHOST command:

- 1** The TOKENRING1 line description created in “Creating the Token-Ring Network Line Description” on page 4-1 is used for the switched line list (SWTLINLST parameter).
- 2** The remote control point name (RMTCPNAME parameter) should match the local control point on the remote system. On the AS/400 system, you can verify this name by using the Display Network Attributes (DSPNETA) command.

On the host system, the local control point name is the SSCPNAME that is specified in the VTAM* Start Option list.
- 3** The local exchange identifier (LCLEXCHID) parameter is used to identify the AS/400 system to the host system.

The following device description commands are used to configure an emulation display and printer, and a distributed host command facility (DHCF) device.

```
CRTDEVHOST DEVD(TRLANEML) LOCADR(01) RMTLOCNAME(HOST) +  
  CTL(TRLANHOST) APPTYPE(*EML) +  
  TEXT('3270 emulation over TOKENRING1')
```

```
CRTDEVHOST DEVD(TRLANPRT) LOCADR(0C) RMTLOCNAME(HOST) +  
  CTL(TRLANHOST) APPTYPE(*EML) EMLDEV(3287) +  
  TEXT('3270 printer emulation over TOKENRING1')
```

```
CRTDEVDSP DEVD(TRLANDHCF) DEVCLS(*RMT) TYPE(3277) MODEL(*DHCF) +  
  LOCADR(02) CTL(TRLANHOST) TEXT('DHCF over TOKENRING1')
```

The Physical Configuration for the Host System

This is the network control program generation (NCP GEN) for the GROUP and LINE macroinstructions created by the system administrator to provide for connectivity between the AS/400 system and the 3745 Communication Controller. This NCP GEN is valid on Network Control Program (NCP) Version 4.2 and Virtual Telecommunications Access Method (VTAM) Version 3.1.1. Different NCP or VTAM levels may require different parameters.

```

R1G006P  GROUP  ECLTYPE=PHYSICAL
R1080P   LINE   ADDRESS=(080,FULL),LOCADD=(400000001580),PORTADD=01,ISTA*
          TUS=INACTIVE
R1080PA  PU     ADDR=01,ISTATUS=INACTIVE
R1080PA1 LU     LOCADDR=0,
          LUDR=NO
R1G006L  GROUP  ECLTYPE=LOGICAL,
          PHYPORT=80

R108000  LINE
R108000A PU     MAXLU=32
R108001  LINE
R108001A PU     MAXLU=32
R108002  LINE
R108002A PU     MAXLU=32
R108003  LINE
R108003A PU     MAXLU=32
R108004  LINE
R108004A PU     MAXLU=32
R108005  LINE
R108005A PU     MAXLU=32
R108006  LINE
R108006A PU     MAXLU=32
R108007  LINE
R108007A PU     MAXLU=32

```

Note: The location address (LOCADD) parameter on the LINE statement defines the adapter address of the 3745 Communication Controller, in this case 400000001580. This value must match the value specified for the adapter address (ADPTADR) parameter on the Create Controller (SNA Host) (CRTCTLHOST) command on the AS/400 configuration.

The Logical Configuration for the Host System

This is the NCP GEN for the switched major node created by the system administrator to provide for connectivity between the AS/400 system and 3745 Communication Controller. This GEN is valid on Network Control Program (NCP) Version 4.2 and Virtual Telecommunications Access Method (VTAM) Version 3.1.1. Different NCP or VTAM levels may require different parameters.

SW3270C	VBUILD	TYPE=SWNET, MAXNO=8, MAXGRP=5	REQUIRED PARAMETER	X *
S3270C	PU	ADDR=C1, DISCNT=NO, IDBLK=056, IDNUM=00000, MAXDATA=1994, MAXPATH=8, NETID=AS400, MAXOUT=7, PACING=7, PASSLIM=7, PUTYPE=2, ISTATUS=ACTIVE, MODETAB=LOGMOD38, SSCPFM=USSSCS, VPACING=7	8 BIT STATION UNIQUE ADDRESS ACCEPT DISCONTACT FROM PU (DEFAULT) 12 BIT BLOCK NUMBER FOR STATION 20 BIT ID NUMBER FOR AS/400 SYSTEM MAX OF 8 STATIONS MAY BE CALLED LOCAL NETWORK ID ON AS/400 7 PIUS TO STATION BEFORE RESPONSE NCP SENDS 7 TO LU AND MARKS FIRST 7 CONTIGUOUS PIUS MAX AT ONE TIME TYPE OF STATION CALLING IN ACTIVATE WITH MAJOR NODE I/S DEFINED TABLE VTAM TO STRIP/ADD MEDIA CONTROL CHAR VTAM SENDS 7 TO NCP AND MARKS FIRST	X X X X X X X X X X X *
S348L80	PATH	GRPNM=RIG006L,DIALNO=0104400003190001,PID=1	319-R1080	
SW327C01	LU	LOCADDR=1, ISTATUS=ACTIVE	AS/400 LOCADDR VALUE X'01' ACTIVATE WITH MAJOR NODE	X
SW327C02	LU	LOCADDR=2, ISTATUS=ACTIVE	AS/400 LOCADDR VALUE X'02' ACTIVATE WITH MAJOR NODE	X
SW327C12	LU	LOCADDR=12, ISTATUS=ACTIVE	AS/400 LOCADDR VALUE X'0C' ACTIVATE WITH MAJOR NODE	X

Notes:

1. The XID block number (IDBLK) and the ID number (IDNUM) concatenated together supply the XID that the 3745 Communication Controller requires from the AS/400 system for the connection to be established. This is configured on the AS/400 system on the TOKENRING1 line description EXCHID parameter if *LIND is specified for the LCLEXCHID parameter on the host controller description. IDBLK and IDNUM must be set so their concatenation is equivalent to the EXCHID parameter on the TOKENRING1 line description.
2. If the 3745 Communication Controller is to start a connection to the AS/400 system, it must know the adapter address and SSAP of the AS/400 system. This is defined in the PATH statement under dial number (DIALNO). The form for DIALNO is:

aabb4000cccccccc

Where:

- aa** Is the value from the PORTADD parameter specified in the NCP line definition for token-ring adapters.
- bb** Is the SAP address of the AS/400 system which is specified on the controller description (using the SSAP parameter).

4000cccccccc Is the remote adapter address specified in the line description.

The 3745 Communication Controller uses this addressing information to resolve the route to the AS/400 system. In this example, the DSAP is set to 04, corresponding to the SSAP parameter for the CRTCTLHOST command on the AS/400 configuration. The remote adapter address is set to 400003190001, corresponding to the adapter address specified on the ADPTADR parameter of the TOKENRING1 line description on the AS/400 configuration.

Notes:

1. Because NCP SAP cannot be specified or changed, it is always 04. Therefore, on the AS/400 controller description, the DSAP is always 04.
2. For bb on the DIALNO operand, only values of two decimal digit numbers between 04-94 may be specified.

Example of Configuring Parallel Connections to the Host System

The following SNA host controller descriptions, SWTRNCTL1A and SWTRNA002, set up parallel connections between an AS/400 system and a host system. This example configures two link-to-link connections through a 3745 communications controller to a host system. Each link-to-link connection has a separate instance of logical link control and a separate band width. As a result, it is possible for one link to be varied on and active if the other link goes down. Parallel connections allow you to establish an additional 254 device description per controller description.

```
CRTCTHHOST CTLD(SWTRNCTL1A) LINKTYPE(*LAN) APPN(*NO) +  
  SWTLINLST(TRNBGOUT) 1 LCLEXCHID(056A001A) 2 +  
  ADPTADR(400000001592) DSAP(04) 3 SSAP(08) 4 +  
  TEXT('Controller for XID 0056A001A')
```

The following panels establish the second controller description for the instance that runs in parallel to the controller description SWTRNCTL1A.

```
CRTCTHHOST CTLD(SWTRNA002A) LINKTYPE(*LAN) APPN(*NO) +  
  SWTLINLST(TRNBGOUT) 1 LCLEXCHID(056A002A) 2 +  
  ADPTADR(400000001592) DSAP(04) 3 SSAP(04) 4 +  
  TEXT('Controller for XID 0056A002A')
```

Considerations for specifying the CRTCTHHOST commands for a parallel connection:

- 1** Both controller descriptions specify the same line description for switched line list (SWTLINLST) parameter.
- 2** Local exchange identifiers (LCLEXCHID) must be specified to establish a parallel connection to the host.
- 3** The DSAP (remote SAP) for the 3745 communication controller must be 04. (Note that the DSAPs are the same on SWTRNCTL1A and SWTRNA002A.)
- 4** The SSAP value 04 has to be on the line TRNBGOUT. (Note that the SSAPs are different on SWTRNCTL1A and SWTRNA002A.)

The following commands are used to create the device descriptions for controller descriptions SWTRNCTL1A and SWTRNA002A.

```

CRTDEV DSP DEVD(DSPA001A02) DEVCLS(*RMT) TYPE(3279) MODEL(0) +
LOCADR(02) CTL(SWTRNCTL1A) APPTYPE(*NRF) +
TEXT('NRF device for XID 056A001A, LOCADDR 02')

CRTDEV DSP DEVD(DSPA001A03) DEVCLS(*RMT) TYPE(3279) MODEL(0) +
LOCADR(03) CTL(SWTRNCTL1A) APPTYPE(*NRF) +
TEXT('NRF device for XID 056A001A, LOCADDR 03')

CRTDEV HOST DEVD(EMLA001A04) LOCADR(04) RMTLOCNAME(SWXIDA04) +
CTL(SWTRNCTL1A) APPTYPE(*EML) +
TEXT('Emulation display for XID 056A001A, LOCADDR 04')

CRTDEV PRT DEVD(PRTA001A05) DEVCLS(*RMT) TYPE(3287) MODEL(0) +
LOCADR(05) CTL(SWTRNCTL1A) APPTYPE(*NRF) +
LOGON('LOGON APPLID(NRF2A07) LOGMODE(SCSTRYR)') +
TEXT('NRF printer for XID 056A001A, LOCADDR 05')

CRTDEV DSP DEVD(DSPA002A02) DEVCLS(*RMT) TYPE(3279) MODEL(0) +
LOCADR(02) CTL(SWTRNA002A) APPTYPE(*NRF) +
TEXT('NRF device for XID 056A002A, LOCADDR 02')

CRTDEV HOST DEVD(EMLA002A04) LOCADR(04) RMTLOCNAME(SWXIDB04) +
CTL(SWTRNA002A) APPTYPE(*EML) +
TEXT('Emulation display for XID 056A002A, LOCADDR 04')

CRTDEV PRT DEVD(PRTA002A05) DEVCLS(*RMT) TYPE(3287) MODEL(0) +
LOCADR(05) CTL(SWTRNA002A) APPTYPE(*NRF) +
LOGON('LOGON APPLID(NRF2A07) LOGMODE(SCSTRYR)') +
TEXT('NRF printer for XID 056A002A, LOCADDR 05')

```

Configuring Physical and Logical Parallel Connections for the Host System

This is the NCP GEN created by the system administrator to provide for connectivity between the AS/400 system and 3745 Communication Controller. This GEN is valid on Network Control Program (NCP) Version 5.4 and Virtual Telecommunications Access Method (VTAM) Version 3.3. Different NCP or VTAM levels may require different parameters.

```

SWXID  VBUILD TYPE=SWNET,      THIS IS A SWITCHED MAJOR NODE      X
        MAXNO=64,             MAXIMUM DIALNO PARAMETERS          X
        MAXGRP=64             MAXIMUM NUMBER OF LINE GROUPS
*****
*
* DEFINE ONE PU FOR EACH XID AND CTLD DEFINED AT AS/400
* XIDS ARE DEFINED INDIVIDUALLY AT THE AS/400, AND MUST MATCH BOTH
* IDBLK AND IDNUM VALUES IN THE PU MACRO
*
*****
SWXIDA  PU  ADDR=01,           NOT CHECKED IF TOKEN RING DEFINITION X
          DISCNT=NO,          ACCEPT DISCONTACT FROM AS/400      X
          IDBLK=056,          1 12 BIT BLOCK NUMBER FOR AS/400    X
          IDNUM=A001A,        2 20 BIT ID FOR THIS PU (AS/400 CTLD) X
          MAXDATA=1994,       MAX FOR 4M TOKEN RING              X
          MAXPATH=1,          ONLY NEED ONE PATH STATEMENT      X
          MAXOUT=7,           7 PIUS TO DEVICE BEFORE RESPONSE  X
          NETID=APPN,         NETID OF AS/400 (IF DIFFERENT)      X
          PACING=0,           PACING CAN BE ANY ACCEPTABLE VALUE X
          PASSLIM=7,          7 CONTIGUOUS PIUS MAX AT ONE TIME  X
          PUTYPE=2,           TYPE OF DEVICE CALLING IN         X
          ISTATUS=ACTIVE,     ACTIVATE WITH MAJOR NODE          X
          MODETAB=LOGMOD38,   ANY VALID LOGMODE TABLE          *
          SSCPFM=USSSCS,     VTAM TO STRIP/ADD MEDIA CONTROL CHAR *

```



```

                VPACING=0                VPACING CAN BE ANY ACCEPTABLE VALUE
*
* NOTE: MUST HAVE ENOUGH LOGICAL TOKEN RING LINES DEFINED TO ALLOW
*       ALL PUS TO BE DIALLED IN/OUT AT ONCE
*
PATHA  PATH  GRPNM=R3G092L,DIALNO=0508400071032004 3
*
* SAME NUMBER OF LUS ON HOST AS DEVICES ON AS/400
*
SWXIDA01 LU  LOCADDR=1,          FIRST AVAILABLE LOCAL ADDRESS      X
             ISTATUS=ACTIVE      ACTIVATE WITH MAJOR NODE
SWXIDA02 LU  LOCADDR=2,          FIRST AVAILABLE LOCAL ADDRESS      X
             ISTATUS=ACTIVE      ACTIVATE WITH MAJOR NODE
SWXIDA03 LU  LOCADDR=3,          FIRST AVAILABLE LOCAL ADDRESS      X
             ISTATUS=ACTIVE      ACTIVATE WITH MAJOR NODE
SWXIDA04 LU  LOCADDR=4,          FIRST AVAILABLE LOCAL ADDRESS      X
             ISTATUS=ACTIVE      ACTIVATE WITH MAJOR NODE
SWXIDA05 LU  LOCADDR=5,          FIRST AVAILABLE LOCAL ADDRESS      X
             ISTATUS=ACTIVE      ACTIVATE WITH MAJOR NODE
SWXIDA06 LU  LOCADDR=6,          FIRST AVAILABLE LOCAL ADDRESS      X
             ISTATUS=ACTIVE      ACTIVATE WITH MAJOR NODE

*****
*
* DEFINE ONE PU FOR EACH XID AND CTLD DEFINED AT AS/400
* XIDS ARE DEFINED INDIVIDUALLY AT THE AS/400, AND MUST MATCH BOTH
* IDBLK AND IDNUM VALUES IN THE PU MACRO, AND MUST BE UNIQUE IN THE
* NETWORK
* ADDR VALUE MUST BE UNIQUE IN THE SWITCHED MAJOR NODE
*
*****
SWXIDB  PU  ADDR=02,             NOT CHECKED IF TOKEN RING DEFINITION X
          DISCNT=NO,            ACCEPT DISCONTACT FROM AS/400      X
          IDBLK=056, 1         12 BIT BLOCK NUMBER FOR AS/400      X
          IDNUM=A002A, 2       20 BIT ID FOR THIS PU (AS/400 CTLD) X
          MAXDATA=1994,        MAX FOR 4M TOKEN RING              X
          MAXPATH=1,           ONLY NEED ONE PATH STATEMENT      X
          MAXOUT=7,            7 PIUS TO DEVICE BEFORE RESPONSE   X
          NETID=APPN,          NETID OF AS/400 (IF DIFFERENT)      X
          PACING=0,            PACING CAN BE ANY ACCEPTABLE VALUE X
          PASSLIM=7,          7 CONTIGUOUS PIUS MAX AT ONE TIME    X
          PUTYPE=2,           TYPE OF DEVICE CALLING IN      X
          ISTATUS=ACTIVE,      ACTIVATE WITH MAJOR NODE      X
          MODETAB=LOGMOD38,    ANY VALID LOGMODE TABLE      *
          SSCPFM=USSSCS,      VTAM TO STRIP/ADD MEDIA CONTROL CHAR *
          VPACING=0            VPACING CAN BE ANY ACCEPTABLE VALUE

*
* NOTE: SHOULD HAVE ENOUGH LOGICAL TOKEN RING LINES DEFINED TO ALLOW
*       ALL PUS TO BE DIALLED IN/OUT AT ONCE
*       LABEL ON PATH MACRO MUST BE UNIQUE, IF SPECIFIED
*
PATHB  PATH  GRPNM=R3G092L,DIALNO=0504400071032004 3
*
* SAME NUMBER OF LUS ON HOST AS DEVICES ON AS/400
*
SWXIDB01 LU  LOCADDR=1,          FIRST AVAILABLE LOCAL ADDRESS      X
             ISTATUS=ACTIVE      ACTIVATE WITH MAJOR NODE
SWXIDB02 LU  LOCADDR=2,          FIRST AVAILABLE LOCAL ADDRESS      X
             ISTATUS=ACTIVE      ACTIVATE WITH MAJOR NODE
SWXIDB03 LU  LOCADDR=3,          FIRST AVAILABLE LOCAL ADDRESS      X
             ISTATUS=ACTIVE      ACTIVATE WITH MAJOR NODE
SWXIDB04 LU  LOCADDR=4,          FIRST AVAILABLE LOCAL ADDRESS      X
             ISTATUS=ACTIVE      ACTIVATE WITH MAJOR NODE
SWXIDB05 LU  LOCADDR=5,          FIRST AVAILABLE LOCAL ADDRESS      X
             ISTATUS=ACTIVE      ACTIVATE WITH MAJOR NODE
SWXIDB06 LU  LOCADDR=6,          FIRST AVAILABLE LOCAL ADDRESS      X
             ISTATUS=ACTIVE      ACTIVATE WITH MAJOR NODE

*****
*
* REPEAT AS THE PREVIOUS DEFINITIONS AS NEEDED
*
*****

```

Considerations for NCP GENs for parallel connections to a host system:

- 1 2 The concatenation of IDBLK and IDNUM must match the value specified for the LCLEXCHID parameter in the AS/400 controller description.

- 3** In the DIALNO operand, the first two digits specify the PORTADDR on the NCP line definition, the second two digits specify the SSAP on the controller description on the AS/400 system, and the remaining digits specify the adapter address on the AS/400 line description.

Example of Token-Ring Network-to-3174 Model 1L Gateway Configuration

The following host controller description describes a 3174 Model 1L Subsystem Control Unit. The 3174 Model 1L is used to attach an ES/9000 host system to the token ring. In this example, the 3174 Control Unit is used as a **gateway** to bridge two systems with different network architectures. This configuration does not require a 3745 Communications Controller.

The 3174 1L is configured to use an adapter address of 400031740001. The TOKENRING1 line description created in "Creating the Token-Ring Network Line Description" on page 4-1 is used for the SWTLINLST parameter. The SSAP and DSAP parameters are not included because the defaults of DSAP(04) and SSAP(04) are used.

```
CRTCTHST CTLD(TRLANHOST2) LINKTYPE(*LAN) +
          SWTLINLST(TRNLINE) RMTCPNAME(*ANY) +
          ADPTADR(400031740001) TEXT('3174 Gateway')
```

Although the following device description example is not specific to token-ring networks, you can use it to configure an emulation display.

```
CRTDEVHOST DEVD(TRLANEML2) LOCADR(01) RMTLOCNAME(HOST2) +
           CTL(TRLANHOST2) APPTYPE(*EML) +
           TEXT('3270 emulation for Host2')
```

Example of the 3174 Model 1L Subsystem Control Unit Configuration

These displays must be filled in during customization of the 3174 Model 1L. See the *3174 Subsystem Control Unit Customizing Guide* for more information.

Model/Attach Display

This display contains information about the attachment of the 3174 gateway to the host processor.

```
_____ Model/Attach _____

99 - Identification

100 - 01L

101 - 5
```

Figure 4-23. Prompt Display for 3174 Gateway Attachment to Host Processor

Item 100 is the 3174 model designation, 01L.

Item 101 is the type of host attachment used. In this example, type 5 (Local SNA) is used because the 3174 gateway is locally attached to the host processor.

Local SNA Display

This display contains information about the attachment of the 3174 gateway to the host processor. Because item 101 on the Model/Attach display was set to local SNA, this display appears.

_____ Local SNA _____			
104 - B0	105 - B1	108 - A013700	116 - 0
121 - 01	125 - 00000000	127 - 0 0	
132 - 0 0 0 0	136 - 0 0 0 1	137 - 0 0 0 0	138 - 0
141 - A	165 - 0	166 - B	
173 - 11111111	175 - 000000		
213 - 1	215 - 00000	220 - 3	
222 - 0	226 - 10	224 - 2	225 - 4

Figure 4-24. Prompt Display for Local SNA

Each 3174 gateway must be configured for every AS/400 system, personal computer, or 3174 Control Unit that it will communicate with. Each is assigned a particular address on a following display. Items 104 and 105 define the first and last addresses assigned.

Token-Ring Gateway Display

This display contains information about the 3174 gateway's attachment to the token-ring network.

_____ Token-Ring Gateway _____		
900 - 400031740001	905 - 1	908 - IBMLAN

Figure 4-25. Prompt Display for Token-Ring Gateway

Item 900 is the local adapter address of the 3174 gateway being configured. This must equal the ADPTADR parameter of the host controller description on the AS/400 system.

Ring Address Assignment Display

This display contains information about the stations communicating with the 3174 gateway. Each system, controller, or personal computer that will communicate with the 3174 gateway must be configured here.

```

_____ 940: Ring Address Assignment _____
S@ Ring @      SAP@ T      S@ Ring @      SAP@ T
B0 400031740001 04
B1 400003190001 04 1      B2 N/A
B3 N/A          B4 N/A
B5 N/A          B6 N/A
B7 N/A          B8 N/A
B9 N/A          BA N/A
BB N/A          BC N/A
BD N/A          BE N/A
BF N/A          C0 N/A
C1 N/A          C2 N/A
C3 N/A          C4 N/A
C5 N/A          C6 N/A
C7 N/A          C8 N/A
C9 N/A          CA N/A
CB N/A          CC N/A

```

Figure 4-26. Prompt Display for Ring Address Assignment

The ring address of the first controller is that of the 3174 gateway itself.

The second controller is the AS/400 system. The ring address must equal the ADPTADR parameter of the token-ring line description for the AS/400 system. The SAP@ must be configured in the SSAP list of the token-ring line description and must equal the SSAP parameter of the host controller description on the AS/400 system. The type is set to 1 for the 3174 Control Unit because the AS/400 system appears to the host system as a remote 3174.

The S@ (station address) value must match the CUADDR parameter of the PU macroinstruction of the NCP/VTAM configuration.

Ring Transmission Definition Display

This display contains details about the transmission characteristics for each station the 3174 will communicate with. The maximum frame size and maximum number of outstanding frames are defined on this display.

941: Ring Transmission Definition							
S@	Ring @	SAP@	F	W	S@	Ring @	SAP@ F W
B0	400031740001	04	2	4			
B1	400003190001	04	2	4	B2	N/A	
B3	N/A				B4	N/A	
B5	N/A				B6	N/A	
B7	N/A				B8	N/A	
B9	N/A				BA	N/A	
BB	N/A				BC	N/A	
BD	N/A				BE	N/A	
BF	N/A				C0	N/A	
C1	N/A				C2	N/A	
C3	N/A				C4	N/A	
C5	N/A				C6	N/A	
C7	N/A				C8	N/A	
C9	N/A				CA	N/A	
CB	N/A				CC	N/A	

Figure 4-27. Prompt Display for Ring Transmission Definition

The values in column F are frame sizes. The value 2 corresponds to an information frame size of 1033. The MAXFRAME parameter on the host controller description on the AS/400 system should equal this.

The S@ (station address) value must match the CUADDR parameter of the PU macroinstruction of the NCP/VTAM configuration.

Example of the NCP/VTAM Configuration

This is the NCP GEN for the local controller created by the system administrator to provide for connectivity between the AS/400 system and the 3174 gateway. This GEN is valid on Network Control Program (NCP) Version 4.2 and Virtual Telecommunications Access Method (VTAM) Version 3.1.1. Different NCP or VTAM levels may require different parameters.

```

R13B1    VBUILD TYPE=LOCAL
R13B0A   PU    CUADDR=3B1,                                X
          DISCNT=(NO,F),                                  X
          ISTATUS=ACTIVE,                                  X
          PUTYPE=2,                                        X
          SPAN=(SYSPGMR),                                  X
          SSCPFM=USSSCS,                                   X
          VPACING=7
R13B102  LU    DLOGMOD=P6ES2,                              X
          ENCR=NONE,                                      X
          ISTATUS=ACTIVE,                                  X
          LOCADDR=2,                                       X
          LOGAPPL=SAMON,                                   X
          MODETAB=LOGMOD38,                                X
          SPAN=(SYSPGMR),                                  X
          SSCPFM=USSSCS,                                   X
          VPACING=7

```

The last two characters in the CUADDR parameter must match the Control Unit Address on the Ring Address Assignment and the Ring Transmission Definition displays of the 3174 1L configuration.

Example of Token-Ring Network-to-3174 Subsystem Control Unit Configuration

The remote work station controller description, created by the following displays, describes a 3174 (Model 3R or 53R) Subsystem Control Unit capable of attaching to a token-ring network. It uses adapter address 400031740004. The TOKENRING1 line description created in "Creating the Token-Ring Network Line Description" on page 4-1 is used for the SWTLINLST parameter.

```

Create Ctl Desc (Remote WS) (CRTCTLRWS)

Type choices, press Enter.

Controller description . . . . . > TRLAN3174      Name
Controller type . . . . . > 3174                3174, 3274, 5251, 5294...
Controller model . . . . . > 0                    0, 1, 0001, 2, 0002, 12, 0012
Link type . . . . . > *LAN                        *IDL, *LAN, *NONE, *SDLC...
Online at IPL . . . . . > *YES                      *YES, *NO
Switched line list . . . . . > TOKENRING1          Name
      + for more values
Maximum frame size . . . . . *LINKTYPE            265-1994, 256, 261, 265...
Exchange identifier . . . . . 00100000-FFFFFFF
Initial connection . . . . . *DIAL                *DIAL, *ANS
Dial initiation . . . . . *LINKTYPE              *LINKTYPE, *IMMED, *DELAY
LAN remote adapter address . . . > 400031740004  000000000001-FFFFFFFFFFFF
Autocreate device . . . . . *ALL                 *ALL, *NONE
Text 'description' . . . . . > 'RWS controller for 3174'

                                                    More...
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys

```

Figure 4-28. Prompt Display for TRLAN3174 Controller Description

Note: When tailoring the 3174 Control Unit that this controller description represents, you must set the maximum frame parameter greater than or equal to the MAXFRAME parameter on the TOKENRING1 line description to which this controller is attached.

Although the following device description examples are not specific to a token-ring network, you can use them to configure a 3279 display and a 3287 printer capable of attaching to a 3174.

```

Create Device Desc (Display) (CRTDEV DSP)

Type choices, press Enter.

Device description . . . . . > TRLAN3279      Name
Device class . . . . . > *RMT                *LCL, *RMT, *VRT, *SNPT
Device type . . . . . > 3279                3101, 3151, 3161, 3162...
Device model . . . . . > 0                  0, 1, 2, 4, 11, 12, 23...
Local location address . . . . . > 02          00-FE
Online at IPL . . . . . > *YES                *YES, *NO
Attached controller . . . . . > TRLAN3174      Name
Keyboard language type . . . . . *SYSVAL      *SYSVAL, AGB, AGI, ALI...
Drop line at signoff . . . . . *YES          *YES, *NO
Application type . . . . . *NONE              *NONE, *NRF, *CTLSSN...
Text 'description' . . . . . > '3279 attached to 3174'

```

Figure 4-29. Prompt Display for TRLAN3279 Display Device Description

```

Create Device Desc (Printer) (CRTDEV PRT)

Type choices, press Enter.

Device description . . . . . > TRNLAN3287      Name
Device class . . . . . > *RMT                *LCL, *RMT, *VRT, *SNPT, *LAN
Device type . . . . . > 3287                3287, 3812, 4019, 4201...
Device model . . . . . > 0                  0, 1, 2, 3, 4, 10, 13, 301...
Local location address . . . . . > 03          00-FE
Online at IPL . . . . . > *YES                *YES, *NO
Attached controller . . . . . > TRLAN3174      Name
Separator program . . . . . *NONE            Name, *NONE
Library . . . . . *LIBL                      Name, *LIBL, *CURLIB
Printer error message . . . . . *INQ         *INQ, *INFO
Message queue . . . . . QSYSOPR             Name, QSYSOPR
Library . . . . . *LIBL                      Name, *LIBL, *CURLIB
Application type . . . . . *NONE              *NONE, *NRF, *DEVINIT...
Text 'description' . . . . . > '3287 attached to 3174'

```

Figure 4-30. Prompt Display for TRLAN3287 Printer Device Description

The following display is used during customization of a 3174 Control Unit.

```

----- Token-Ring Network -----
106 - 4000 3174 0004   107 - 4000 0319 0001   108 - 0324000   116 - 0
121 - 01               125 - 00000000       127 - 0 0
132 - 0 0 0 0         136 - 1 1 1 1       137 - 0 0 0 0   138 - 0
141 - A               165 - 1              166 - C
173 - 00000000       175 - 000000
213 - 1               215 - 00000         220 - 3
380 - 1994           381 - 7              382 - 1994      383 - 4

```

Figure 4-31. Prompt Display for Token-Ring Network

Item 106, the adapter address of the 3174 Control Unit, must match the ADPTADR parameter on the Create Controller Description (Remote Work Station) (CRTCTLRWS) command.

Item 107 is the adapter address of the AS/400 system that this 3174 Control Unit connects with. This must be equal to the adapter address (ADPTADR) parameter on the TOKENRING1 line description.

Item 380 is the largest frame the 3174 Control Unit can accept. This should be set to 1994 so that the AS/400 system can send the largest possible frame to the 3174 Control Unit.

Item 382 is the largest frame the 3174 Control Unit sends. This can be no larger than the MAXFRAME parameter on the TOKENRING1 line description.

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Chapter 5. Ethernet networks

This chapter discusses considerations for Ethernet network configurations and describes some aspects of Ethernet hardware.

Ethernet physical environment

The Ethernet topology defines its physical environment. *Topology* refers to the manner in which network devices are interconnected. Examples of devices include servers, PCs, printers, repeaters, switches, and routers.

Ethernet topologies

Ethernet networks are configured in two general topologies: bus and star.

Bus topology

In a bus topology, the network devices connect in series to a transmission medium, called a **bus**. Examples of bus technology include 10BASE2 and 10BASE5. When a station transmits data on the bus, transmission occurs in both directions. The transmitted data is received by all other stations that are attached on the bus. Because all stations on a bus share a common transmission link, only one station can transmit at a time. This is called **half-duplex Ethernet**. A break at any point in the bus usually will disrupt the entire segment.

Figure 5-1 on page 5-2 shows an example of the hardware that is used to set up an Ethernet bus-topology network using coaxial cable. A device called a transceiver is part of or is attached to the coaxial cable. A transceiver cable connects the AS/400 controller to the transceiver, which transmits and receives data. You can purchase your IEEE 802.3-compliant transceiver cable, transceiver, and cable from any vendor.

Note: IEEE 802.3 and Ethernet Version 2.0 standards specify that compliant transceiver must support the signal-quality-error function. Although AS/400 Ethernet adapters can use transceivers with or without the signal-quality-error function, it is recommended that this function be active. If a cable or transceiver failure occurs, and this support is not active, the AS/400 system may not be able to isolate the failure to the cable or transceiver. In this case, a general application-generated message appears. The message states that a controller has lost contact, or a time-out to the host connection has occurred.

Ethernet uses baseband transmission at a rate of 10 Mbps.

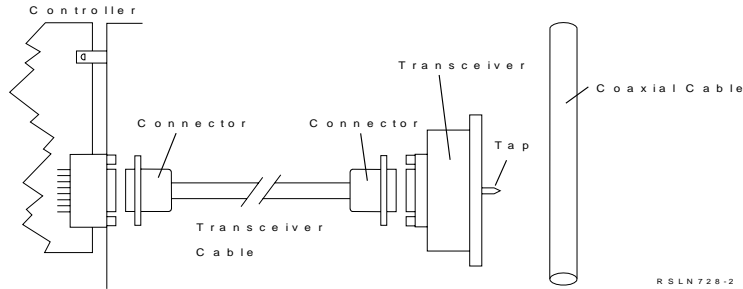


Figure 5-1. Ethernet Attachment Using Coaxial Cable

Bus configuration: The **Carrier Sense Multiple Access with Collision Detection (CSMA/CD)** protocol regulates access to the medium on Ethernet networks. On Ethernet networks that are configured in a bus topology, multiple stations share the transmission medium. When a station has data to send, it listens to the transmission medium to determine if it is available (no other stations are transmitting). If it is available, it begins to transmit. The station continues to listen during the transmission to determine if a **collision** occurs. A collision occurs when two or more stations begin transmitting at about the same time. If a collision occurs, the transmitting station stops its transmission, and waits a random length of time before it attempts to transmit again.

The load on the Ethernet bus will have some effect on performance. At light loads, very few collisions will occur, and performance will be good. As the load on the bus increases, the chance of a collision also increases. Increased collisions will result in degraded performance. Under extreme circumstances, heavy loads can cause severe performance problems.

Star topology

In an **Ethernet star topology**, a point-to-point link (segment) connects each station to a central hub. The hub consists of either a **switch** or a **repeater** (see Figure 5-2 on page 5-3). Ethernet switching hubs divide the network into separate collision domains. If one segment experiences a break, it generally does not effect the rest of the network. An Ethernet network that employs repeater hubs is a single transmission domain, and is subject to collisions. Hubs help extend Ethernet networks by providing multiple Ethernet ports.

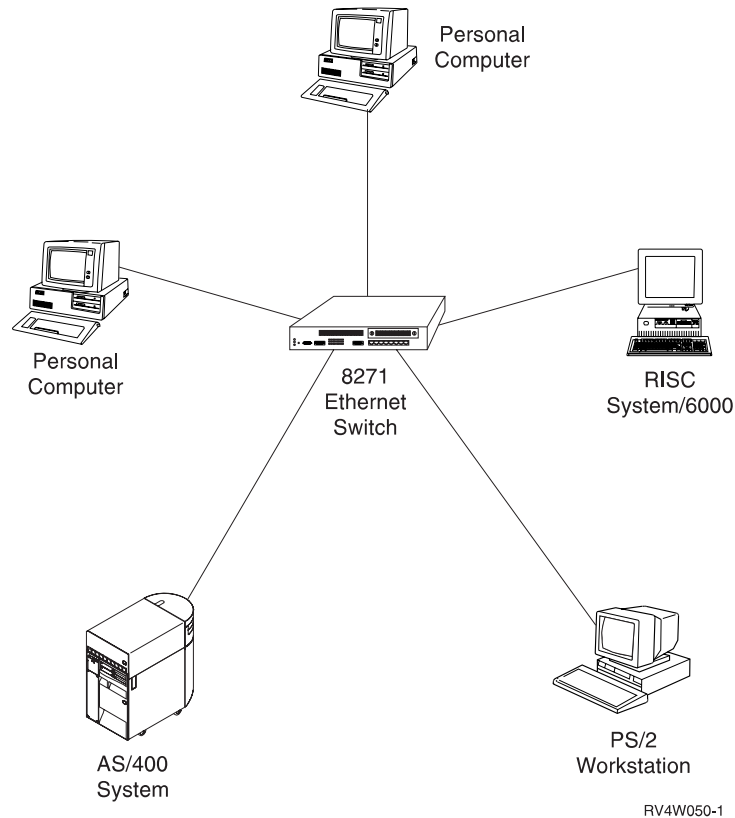


Figure 5-2. Example of Ethernet Network Star Topology with a Switching Hub

Repeater hubs: Repeater hubs link together multiple Ethernet media segments of various types to create a larger network that operates as a single Ethernet LAN. Repeater hubs provide signal amplification and retiming. This allows network segments to be extended a greater distance. The repeater receives the transmitted data, amplifies it, and forwards it to all the linked segments. Ethernet segments that are linked by repeater hubs operate at half duplex. Multiple stations must share the transmission medium and available network bandwidth. Segments that are linked by a repeater hub are susceptible to collisions.

Switching hubs: Switches divide a set of Ethernet media systems into multiple LANs, which are linked together by the switching hubs. When a station transmits data, the switch reads the destination address information and forwards the data to its destination segment. Stations that are linked by Ethernet switches can send and receive data simultaneously, using the entire medium bandwidth. This is called **full-duplex Ethernet**. Ethernet switches eliminate the possibility of collisions, and also improve network performance. Ethernet switches permit you to extend the maximum size of the network, without exceeding the maximum wire length, attached device count, or number of repeaters for a network segment.

For more information on Ethernet switches, see the *IBM LAN Bridge and Switch Guide*, SB24-5000, and *Local Area Network Concepts and Products: LAN Architecture*, SG24-4753.

Ethernet physical address format

As mentioned in Chapter 2, "AS/400 implementation of local area networks" on page 2-1, every system, controller, or personal computer that is attached to a local area network has a physical address for its attachment adapter. This physical level is called the MAC (medium access control). The IEEE architecture defines the 48-bit (6-byte) MAC address formats to be used for IEEE 802.3 Ethernet LANs. Figure 5-3 defines how the MAC addresses are displayed on the AS/400 system for the Ethernet LAN. The order of bit transmission on the medium starts with byte 0, bit 7 through bit 0, then byte 1, from bit 7 through bit 0, until byte 5, bit 0 is reached. This order of transmission is called least significant bit because the least significant bit is transmitted first. This ordering for Ethernet differs from the ordering for token ring, which starts with byte 0, bit 0 through bit 7 and ends with byte 5, bit 7.

The following figure describes the preferred IEEE format.

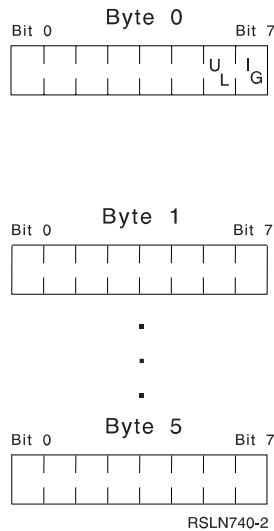


Figure 5-3. Ethernet Physical Address Format

- Bit 7 of byte 0 (called the I/G bit) indicates whether the destination address is an individual address (B'0') or group address (B'1').
- Bit 6 of byte 0 (called the U/L bit) indicates whether the address is universally administered (B'0') or locally administered (B'1').

The above indicators are an integral part of each station address.

Note the following:

- Byte 0, bit 7 = 0. This assignment controls the values of the local adapter address (ADPTADR parameter on the CRTLINETH command) to the range of individual addresses where byte 0 must be even numbers.
- Byte 0, bit 6 = 1 further restricts locally assigned addresses resulting in the address range of hex 020000000000 through hex FFFFFFFF0000. The second digit must be 2, 6, A, or E.
- IEEE standards reserve a range of adapter addresses for use as preset addresses. This results in byte 0, bit 6 = 0 occupying the remaining even values in the range of hex 000000000000 to FFFFFFFF0000.

Ethernet group addresses

An Ethernet group address is an address to which a subset of nodes on the Ethernet will respond in addition to their local adapter address. Assign group addresses by using the GRPADR parameter on the CRTLINETH command. Dynamically add group addresses by using a TCP/IP multicast application. A 4-byte IP multicast address is mapped to a 6-byte Ethernet group address by placing the low-order 23 bits of the IP multicast address into the low-order 23 bits of the Ethernet group address 01005E000000. For example, the IP multicast address 224.255.0.2 maps to 01005E7F002. See the *TCP/IP Configuration and Reference* book for more information on multicast.

Bridged LAN addressing considerations

It is important to note that MAC addresses are always displayed in the above format for AS/400 Ethernet configuration displays even if they represent stations on other LAN media, such as token-ring stations reached through bridges. The format of token-ring MAC addresses is described under "Token-ring physical address format" on page 3-3.

Ethernet standard (ETHSTD) parameter considerations

The type of Ethernet frames sent by the AS/400 system is determined on the type of frames received from the network and on the value specified for the Ethernet standard (ETHSTD) parameter on the line description. The AS/400 system can send Ethernet frames in any of the following formats:

- IEEE 802.3
- Ethernet Version 2 (DIX)
- Ethernet Version 2 with encapsulated SNA data

Table 5-1 shows the frame type sent by the AS/400 system, based on the type of frame received from the network and the value specified for the ETHSTD parameter.

Frame Type Received	ETHSTD Value	Frame Type Sent
IEEE 802.3, SNA or non-SNA	*IEEE8023	IEEE 802.3
	*ETHV2	Not sent
	*ALL1	IEEE 802.3
Ethernet Version 2, non-SNA	*IEEE8023	Not sent
	*ETHV2	Version 2
	*ALL1	Version 2
Ethernet Version 2, SNA	*IEEE8023	IEEE 802.3
	*ETHV2	Version 2, encapsulated SNA
	*ALL1	IEEE 802.3

¹When *ALL is configured as the ETHSTD value, all TCP/IP multicast packets will be sent as both 802.3 and Version 2 frames.

See “Ethernet frame formats” on page 1-6 for more information about frame formats.

Ethernet frame size considerations

Ethernet line descriptions do not have a maximum frame size (MAXFRAME) parameter. However, maximum frame sizes can be configured for each SAP associated with the line description. In addition, a controller description also has a MAXFRAME size. When the connection process begins, the frame size is the smaller of the three values: line description maximum frame size (see Table 5-2), SSAP MAXFRAME, or the controller MAXFRAME. However, the frame size may become even smaller because of the XID negotiations or bridge considerations.

The system determines the maximum frame size for the line description based on the value specified for the Ethernet standard (ETHSTD) parameter as shown in Table 5-2.

ETHSTD Parameter Value	Frame type	Maximum Frame Size
*ALL	IEEE 802.3	1496
	Ethernet Version 2	1500
*IEEE8023	IEEE 802.3	1496
*ETHV2	Ethernet Version 2, SNA data	1493
	Ethernet Version 2, non-SNA data	1500

Bridged LAN frame size considerations

If a frame is being transmitted to a station that resides on a different LAN, the frame must be copied and transmitted again by a bridge. If the bridge is not configured to support a frame size as large as that configured on the token-ring or Ethernet line description, the frame will be discarded.

In the Ethernet environment, no indication of a smaller frame size is received. This condition is detected when a connection is being established with the remote system and a CPA57A1 message is sent to the QSYSOPR message queue.

If it is not possible to configure the bridge to support larger frame sizes, you may need to adjust one of the following to a value acceptable to the bridge:

- MAXFRAME parameter on the controller description
- SSAP MAXFRAME parameter on the line description

If an adjustment is made, it is recommended that the MAXFRAME value on the controller description be adjusted.

Chapter 6. Ethernet network configuration examples

Figure 6-1 demonstrates a possible Ethernet network.

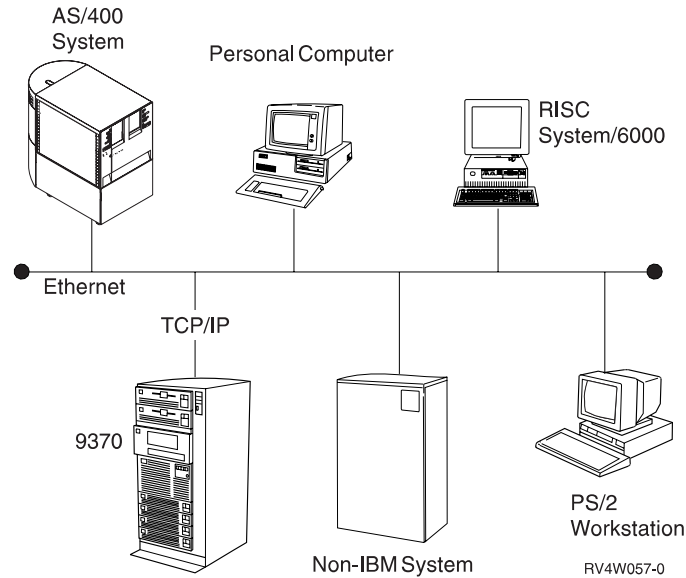


Figure 6-1. AS/400 Ethernet Network

The following configuration example covers two connections. The first part of the example shows how to run APPC to the same system over a single connection to the Ethernet network. The AS/400 system with a single connection to the Ethernet network can be useful in the initial testing of a connection, configuration, or application program. The adapter card handles the case where the destination address is the same as the source address.

The second part of this example shows the addressing considerations that must take place for Client Access and the AS/400 system to communicate over an Ethernet network.

For more information on TCP/IP configuration, see the *TCP/IP Configuration and Reference* book.

AS/400 system to an Ethernet line

The AS/400 system on the Ethernet network in this example uses the following line description to communicate.

```

Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

Line description . . . . . > ETHLINE      Name
Resource name . . . . . > CMN01 1      Name, *NWID, *NWS
Online at IPL . . . . . *YES                *YES, *NO
Vary on wait . . . . . *NOWAIT              *NOWAIT, 15-180 (1 second)
Local adapter address . . . . . > 020071032000 2 020000000000-FEFFFFFFF...
Exchange identifier . . . . . *SYSGEN      05600000-056FFFF, *SYSGEN
Ethernet standard . . . . . *ALL 3      *ETHV2, *IEEE8023, *ALL
Line speed . . . . . 10M                    Character value, 10M, 100M...
Duplex . . . . . *HALF                       Character value, *HALF...
SSAP list:
  Source service access point . > 04          02-FE, *SYSGEN
  SSAP maximum frame . . . . . *MAXFRAME     *MAXFRAME, 265-1496, 265...
  SSAP type . . . . . *CALC                  *CALC, *NONSNA, *SNA

  Source service access point . > 08 4      02-FE
  SSAP maximum frame . . . . . *MAXFRAME     *MAXFRAME, 265-1496, 265...
  SSAP type . . . . . *CALC                  *CALC, *NONSNA, *SNA
    + for more values
Text 'description' . . . . . > 'ETHLINE line description'

F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
F13=How to use this display  F24=More keys

```

```

Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

User-defined 3 . . . . . 128                0-255
Autocreate controller . . . . . *NO         *YES, *NO
Autodelete controller . . . . . 1440        1-10000 (minutes), *NONE
Recovery limits:
  Count limit . . . . . 2                   0-99, *SYSVAL
  Time interval . . . . . 5                 0-120 minutes
Authority . . . . . *LIBCRTAUT              Name, *LIBCRTAUT, *CHANGE...

```

Figure 6-2. Prompt Displays for ETHLINE Line Description

Considerations for specifying the CRTLINETH command:

- 1** For lines that are attached to Network Server Descriptions (NWS) the resource value is *NWS. This is for IPCS support. See the appropriate IPCS manual to learn more about Ethernet lines that are attached on IPCS. For an example of *NWI for resource name, see “Bridged connections to remote token-ring networks” on page 10-8.
- 2** This address is used to transmit and receive on the local area network. Specify either the preset address that is assigned to the card by the manufacturer or an address that is assigned by the user. All controllers that want to communicate with the AS/400 system must use this value in their configurations for the remote adapter address.
- 3** The Ethernet standard (ETHSTD) parameter cannot be changed on the CHGLINETH command. See “Ethernet standard (ETHSTD) parameter considerations” on page 5-5 for information about specifying the ETHSTD parameter.

- 4** To run APPC to the same system over one connection to the Ethernet network, an additional SNA SAP value must be defined in the line description. This is necessary to provide a unique LAN address in the form of SSAP/DSAP/MAC address.

The following controller descriptions are used to run APPC to the same system over one connection.

```

Create Ctl Desc (APPC) (CRTCTLAPPC)

Type choices, press Enter.

Controller description . . . . . > APPC1      Name
Link type . . . . . > *LAN          *ANYNW, *FAX, *FR, *IDLC...
Online at IPL . . . . . *YES          *YES, *NO
APPN-capable . . . . . > *NO          *YES, *NO
Controller type . . . . . *BLANK      *BLANK, *FBSS, 3174, 3274...
Switched line list . . . . . > ETHLINE 1      Name
      + for more values
Maximum frame size . . . . . *LINKTYPE  265-16393, 256, 265, 512...
Remote network identifier . . . *NETATR   Name, *NETATR, *NONE, *ANY
Remote control point . . . . . Name, *ANY
Exchange identifier . . . . . 00000000-FFFFFFF
Initial connection . . . . . *DIAL     *DIAL, *ANS
Dial initiation . . . . . *LINKTYPE *LINKTYPE, *IMMED, *DELAY
LAN remote adapter address . . . > 020071032000 2 000000000001-FFFFFFF
Autocreate device . . . . . *ALL       *ALL, *NONE

More...
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

```

Create Ctl Desc (APPC) (CRTCTLAPPC)

Type choices, press Enter.

Text 'description' . . . . . > 'APPC1 controller attached to ETHLINE'

```

```

Create Ctl Desc (APPC) (CRTCTLAPPC)

Type choices, press Enter.

Switched disconnect . . . . . *YES          *YES, *NO
Disconnect timer:
  Minimum connect timer . . . . 170          0-65535 seconds
  Disconnection delay timer . . 30           0-65535 seconds
SDLC poll priority . . . . . *NO          *NO, *YES
SDLC poll limit . . . . . 0              0-4
SDLC out limit . . . . . *POLLMT        0-4, *POLLMT
SDLC connect poll retry . . . . *CALC     0-65534, *CALC, *NOMAX
SDLC NDM poll timer . . . . . *CALC     *CALC, 0-3000 (0.1 seconds)
LAN DSAP . . . . . 04 3              04, 08, 0C, 10, 14, 18, 1C...
LAN SSAP . . . . . > 08 4            04, 08, 0C, 10, 14, 18, 1C...
LAN frame retry . . . . . *CALC     0-254, *CALC
LAN connection retry . . . . . *CALC     0-254, *CALC
LAN response timer . . . . . *CALC     0-254 (0.1 seconds)
LAN connection timer . . . . . *CALC     0-254 (0.1 seconds)
LAN acknowledgement timer . . . *CALC     0-254 (0.1 seconds)

More...
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

Figure 6-3. Prompt Displays for APPC1 Controller Description

Considerations for specifying the CRTCTLAPPC command:

- 1** Note that both the controller descriptions specify ETHLINE as the switched line list value. The line description that is specified for this parameter must exist before being specified.
- 2** The adapter address (ADPTADR parameter) specifies the address of the remote controller. Because this example is testing a connection to itself, the adapter address on the line description and the remote adapter address are the same. This is not the case if two remote systems are communicating.
- 3** The LAN destination service access point (DSAP parameter) is the logical address with which this controller communicates. This value must equal the LAN source service access point in the remote controller configuration.
- 4** The LAN source service access point (SSAP parameter) is the logical address that this system sends with any data to a remote system. This value must match the DSAP of the remote controller.

The preceding discussion of the CRTCTLAPPC command also relates to the APPC2 controller configuration below.

```
CRTCTLAPPC CTLD(APPC2) LINKTYPE(*LAN) APPN(*NO) SWTLINLST(ETHLINE) +
ADPTADR(020071032000) DSAP(08) SSAP(04) +
TEXT('AS/400 at address 020071032000, DSAP 08')
```

The following displays show the creation of the APPC device descriptions that are needed to complete the configuration. The remote location name (RMTLOCNAME parameter) is the name of the device with which your system is communicating. Note that the remote location name on device APPC1 matches the local location name on APPC2.

```
CRTDEVAPPC DEVD(APPC1) RMTLOCNAME(APPC2) LCLLOCNAME(APPC1) +
CTL(APPC1) APPN(*NO) TEXT('Device for APPC2 controller')
```

```
CRTDEVAPPC DEVD(APPC2) RMTLOCNAME(APPC1) LCLLOCNAME(APPC2) +
CTL(APPC2) APPN(*NO) TEXT('Device for APPC1 controller')
```

Client Access considerations

When you are using Client Access and the AS/400 system in an Ethernet network, you need to be aware of the Ethernet physical address format. This address format is discussed in “Ethernet physical address format” on page 5-4. Client Access uses the same addressing format as the token-ring physical address format, which is discussed in “Token-ring physical address format” on page 3-3.

Because these two address formats are in reversed bit order, the configured physical addresses will appear in reversed bit order when viewed on each system. For the following example, the addresses are viewed as follows:

<i>Table 6-1 (Page 1 of 2). Addresses from AS/400 View</i>	
AS/400 View	Address
AS/400 Address	020071032000

<i>Table 6-1 (Page 2 of 2). Addresses from AS/400 View</i>	
AS/400 View	Address
Personal Computer using Client Access	02000A000010

The following figure illustrates the addresses when viewed from the personal computer.

<i>Table 6-2. Addresses from Personal Computer View</i>	
Personal Computer View	Address
Personal Computer Address	400050000008
AS/400 System	40008EC00400

Client Access considerations for environments other than those that are described in this example are discussed in “Client Access configuration considerations” on page 6-21.

APPC controller description for Client Access

The APPC controllers and devices that are needed to communicate with the personal computer that is running Client Access can be created automatically. Automatic configuration is highly recommended when using Client Access. For more information on automatic creation of configuration objects, see the *Local Device Configuration* book.

The following controller description demonstrates the configuration parameters that need to correspond with values in the Client Access configuration.

```
CRTCTLAPPC CTLD(PCSUPPORT) LINKTYPE(*LAN) SWTLINLST(ETHLINE) +
      RMTNETID(RPC) RMTCPNAME(PC004) +
      ADPTADR(02000A000010) 1 +
      TEXT('APPC controller description for Client Access')
```

Consideration for specifying the CRTCTLAPPC command:

- 1** The adapter address that is specified in the controller description must correspond to the address of the personal computer that is using Client Access, which is specified in the CONFIG.SYS file. Notice that the address has been converted because the personal computer represents locally administered addresses in token-ring format.

DOS Client Access configuration

When using DOS Client Access to communicate in an Ethernet network, you should be aware of two files: CONFIG.SYS, and CONFIG.PCS. These two files designate the address of the personal computer that is using Client Access, and the address of the remote system with which to communicate.

The following is an example of the CONFIG.SYS file, which identifies the local address of the personal computer.

```
BREAK=ON
FILES=15
device=C:\ether\dxma0mod.sys
device=C:\ether\dxme0mod.sys 400050000008 1
DEVICE=C:\PCS\EIMPCS.SYS
DEVICE=C:\PCS\ECYDDX.SYS
```

- 1** Notice that the personal computer identifies itself as adapter address 400050000008. The adapter address is used to transmit and receive on the local area network. Notice that this adapter address is converted to 02000A000010 when the personal computer sends the address in a frame. Because the personal computer represents locally administered addressing in token-ring format, conversion of addresses is necessary.

For more information on address conversion, see “Token-ring-to-Ethernet address conversion” on page D-3. For more information on valid addresses, see the discussion of the ADPTADR parameter in the *Communications Configuration* book. All remote systems must use the adapter address value (or converted equivalent if using the 8229 LAN Bridge) in its configuration for the remote adapter address.

The next example is of the CONFIG.PCS file, which identifies the remote control point name (RTLN), the remote system address (TRLI), and the maximum frame size that is allowed (TRMF).

```
SFLR 1,I,QIWSFLR
RTLN RPC.PC004
TRLI RCHSX400,40008EC00400 1
RTYP ITRN
TRMF 1500 2
MDEF 1,1
MMRI 60
MTIM 60
```

- 1** The address that is given in the TRLI entry of the CONFIG.PCS file corresponds to the adapter address of the AS/400 line description. Because the personal computer represents locally administered addressing in token-ring format, conversion of addresses is necessary.
- 2** The TRMF value specifies the maximum frame size on the personal computer. For Ethernet, the maximum is 1500. The AS/400 value of *CALC on the SSAP parameter of the line description corresponds to this value.

OS/2 Client Access considerations

When using OS/2 Client Access to communicate in an Ethernet network, you should be aware of the locations of the different LAN addresses.

The personal computer LAN adapter address 400050000008 should be entered on the OS/2 configuration menu Local LAN Adapter Address. This field is the OS/2 equivalent of the entry in DOS CONFIG.SYS: Device=c:\ether\dxme0mod.sys 400500000008.

The AS/400 LAN adapter address 40008EC00400 should be entered in the LAN destination address field on the OS/2 configuration menu 5250 Work Station Feature LAN Defaults. This field is the OS/2 equivalent of the TRLI field in the DOS

CONFIG.PCS file. The address corresponds to the adapter address of the AS/400 line description. Because the personal computer represents locally administered addressing in token-ring format, conversion of addresses is necessary.

Client Access address conversion considerations

The example of Client Access demonstrated the configuration when using a locally administered address on the personal computer. Because this address is represented in token-ring format, the address conversion is necessary.

If the personal computer is configured to use the preset adapter address of the Ethernet adapter card in the personal computer itself, no address conversion is necessary when creating the controller description on the AS/400 system. No address conversion is needed because the address already corresponds to the personal computer preset adapter address. However, the addresses in the TRLI entry, which corresponds to the address of the AS/400 line description, must always be converted.

Token-ring-to-Ethernet bridge configuration example

Figure 6-4 on page 6-9 demonstrates a token-ring and an Ethernet network that is communicating through an 8229 LAN Bridge. The following configuration example shows AS/400 System 1, which is using the ETHERNET1 line description to communicate with the 3174 Control Unit and its attached devices.

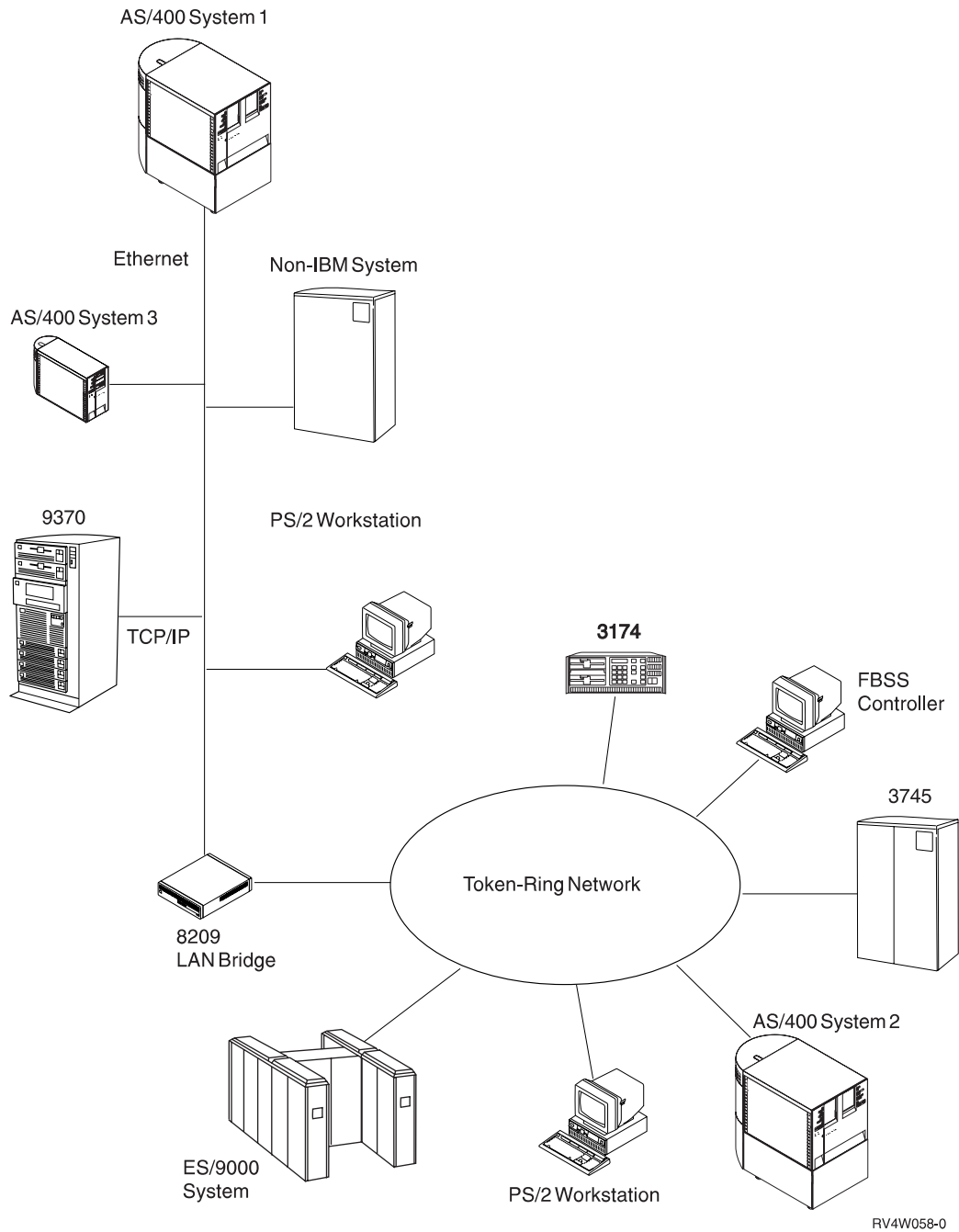


Figure 6-4. AS/400 Ethernet Bridged Environment

AS/400 System 1 is using the same line description to communicate with AS/400 System 2 on the token ring. AS/400 System 2 uses its own token-ring line description (TOKEN) to communicate with AS/400 System 1. AS/400 System 1 and AS/400 System 2 communicate using APPN. AS/400 System 3 uses the ETHNET line description to communicate with the FBSS controller and the 3745 communications controller on the token ring.

Address conversion for Ethernet bridged environment

Table 6-3 demonstrates the address conversion for the configuration that is shown in Figure 6-4 on page 6-9. A configuration example that shows the address conversion follows this topic.

System	TOKEN Address	ETHERNET1 Address
AS/400 1 on ETHERNET1	400003200001	0200C0040080
AS/400 2 on TOKEN	400010050001	020008A00080
3174 Control Unit	400031740004	02008C2E0020
3745 Communications Controller	400000001590	02000000A809
AS/400 3 on ETHNET	400000200099	020000040099
FBSS Controller	400011111111	020088888888

Creating the ETHERNET1 line description

This Ethernet line description connects AS/400 System 1 to the Ethernet network in Figure 6-4 on page 6-9.

```
CRTLINETH LIND(ETHERNET1) RSRNAME(LIN121) +  
          ADPTADR(0200C0040080) 1 +  
          ETHSTD(*ALL) 2 TEXT('ETHERNET1 line description')
```

Considerations for specifying the CRTLINETH command:

- 1** The adapter address is used to transmit and receive on the local area network. Either the preset address that is assigned to the card by the manufacturer, or an address that is assigned by the user, can be specified. This adapter address is converted to 400003200001 after it has gone through the 8229 LAN Bridge to the token-ring network. For more information on address conversion, see "Token-ring-to-Ethernet address conversion" on page D-3.

For more information on valid addresses, see the ADPTADR parameter description in the *Communications Configuration* book. All remote systems must use the adapter address value (or converted equivalent if using the 8229 LAN Bridge) in its configuration for the remote adapter address.

- 2** The Ethernet standard (ETHSTD) parameter cannot be changed on the CHGLINETH command. When ETHSTD(*ALL) is configured, the AS/400 system sends SNA data in IEEE 802.3 frames.

Creating the CTL3174 remote work station controller description

The following controller description associates the 3174 Control Unit with the ETHERNET1 line description.

```
CRTCTLRWS CTLD(CTL3174) TYPE(3174) MODEL(0) LINKTYPE(*LAN) +  
          SWTLINLST(ETHERNET1) 1 MAXFRAME(1496) 2 +  
          ADPTADR(02008C2E0020) 3 +  
          TEXT('3174 controller description')
```

Considerations for specifying the CRTCLRWS command:

- 1** The ETHERNET1 line description must exist before this value can be specified for the switched line list (SWTLINLST parameter). When this value is specified in the AS/400 controller description, the 3174 controller is recognized by AS/400 System 1 on the Ethernet network.
- 2** The maximum frame size (MAXFRAME parameter) for this controller is configured as 1496 because the remote system is on the other side of the bridge. The largest information field that can pass through the 8229 LAN Bridge is 1496 bytes.
- 3** The LAN remote adapter address (ADPTADR parameter) is the address the AS/400 system will send data to when it communicates with the remote controller. This adapter address is converted to 400031740004 after it has gone through the 8229 LAN Bridge to the token-ring network. Refer to Figure 4-31 on page 4-30 to see this address configured on the 3174 Control Unit.

For more information on address conversion, see “Token-ring-to-Ethernet address conversion” on page D-3. All remote systems must use the adapter address value (or converted equivalent if using the 8229 LAN Bridge) in its configuration for the remote adapter address.

Creating the DEV3277, DEV3279, and DEV3287 device descriptions

The following device descriptions associate 3277, 3278, and 3279 display stations and a 3287 printer with the 3174 controller description. Notice that all the device descriptions that are created here name CTL3174 as the attached controller. All of the following device descriptions have the same considerations for specifying the CRTDEV DSP and CRTDEV PRT commands.

```
CRTDEV DSP DEVD(DEV3277) DEVCLS(*RMT) TYPE(3277) MODEL(0) +  
          LOCADR(04) 1 CTL(CTL3174) +  
          TEXT('3277 display attached to 3174')
```

```
CRTDEV DSP DEVD(DEV3278) DEVCLS(*RMT) TYPE(3278) MODEL(0) +  
          LOCADR(05) 1 CTL(CTL3174) +  
          TEXT('3278 display attached to 3174')
```

```
CRTDEV DSP DEVD(DEV3279) DEVCLS(*RMT) TYPE(3279) MODEL(0) +  
          LOCADR(02) 1 CTL(CTL3174) +  
          TEXT('3279 display attached to 3174')
```

```
CRTDEV PRT DEVD(DEV3287) DEVCLS(*RMT) TYPE(3287) MODEL(0) +  
          LOCADR(03) 1 CTL(CTL3174) +  
          TEXT('3287 printer attached to 3174')
```

Considerations for specifying CRTDEV DSP and CRTDEV PRT commands:

- 1** The location address must be unique for each device that is attached to the same controller. For more information on valid values, see the discussion on the LOCADR parameter in the *Communications Configuration* book.

Configuring the 3174 controller

The following display is used during customization of a 3174 Control Unit.

```
----- Local Area Network -----  
  
106 - 4000 3174 0004   107 - 4000 0320 0001   108 - 0324000   116 - 0  
121 - 01              125 - 00000000          127 - 0 0  
132 - 0 0 0 0        136 - 1 1 1 1          137 - 0 0 0 0   138 - 0  
141 - A              165 - 1                166 - C  
173 - 00000000       175 - 000000  
213 - 1              215 - 00000          220 - 3  
380 - 2042           381 - 7                382 - 1496      383 - 4
```

Figure 6-5. Prompt Display for Ethernet Network

Item 106, the adapter address of the 3174 Control Unit, must match the converted form of the ADPTADR parameter on the Create Controller Description (Remote Work Station) (CRTCTLRWS) command. This adapter address is converted to 02008C2E0020 when it has gone through the 8229 LAN Bridge to the Ethernet network. Refer to “Creating the CTL3174 remote work station controller description” on page 6-10 to see this address configured on the AS/400 system.

Item 107 is the adapter address of the AS/400 system to which this 3174 Control Unit is connected. This must match the converted form of the adapter address (ADPTADR) parameter on the ETHERNET1 line description. This adapter address is converted to 0200C0040080 when it has gone through the 8229 LAN Bridge to the Ethernet network.

Item 380 is the largest frame the 3174 Control Unit can accept. This should be set to 2042 so that the AS/400 system can send the largest possible frame to the 3174 Control Unit.

Item 382 is the largest frame the 3174 Control Unit sends. This can be no larger than the SSAP maximum frame size on the ETHERNET1 line description. It should not be larger than the largest frame that the 8229 LAN Bridge can pass.

Creating the APPNETH APPC controller description

The following display shows the controller description needed to use APPN between two AS/400 systems: One on the Ethernet line description that was created previously, and the other on a token-ring system. This controller description automatically creates the necessary device descriptions when the controller is varied on because APPN is used.

```
CRTCTLAPPC CTLD(APPNETH) LINKTYPE(*LAN) SWTLINLST(ETHERNET1) 1 +  
MAXFRAME(1496) 2 RMTCPNAME(S1000005) 3 +  
ADPTADR(020008A00080) 4 +  
TEXT('APPN controller for token-ring-to-Ethernet')
```

Considerations for specifying the CRTCTLAPPC command:

- 1** Notice that the previously created ETHERNET1 line description is specified as the switched line list (SWTLINLST parameter). When this value is specified in the AS/400 controller description, the controller can recognize the AS/400 1 on the Ethernet network.
- 2** The maximum frame size (MAXFRAME parameter) for this controller is configured as 1496 because the remote system is on the other side of the bridge. The largest information field that can pass through the 8229 LAN Bridge is 1496 bytes.
- 3** The remote control point name (RMTCPNAME parameter) and remote network identifier (RMTNETID parameter) describe the adjacent system control point name and network identifier for APPN. These values must match the network attributes of the remote system. For more information, see the discussion of the RMTCPNAME parameter in the *Communications Configuration* book.
- 4** The LAN remote adapter address (ADPTADR parameter) is the address to which the AS/400 system sends data when it communicates with the remote controller. This adapter address is converted to 400010050001 after it has gone through the 8229 LAN Bridge to the token-ring network. This value matches the adapter address of the AS/400 system on the token-ring line in “Creating the TOKEN token-ring line description.”

For more information on address conversion, see “Token-ring-to-Ethernet address conversion” on page D-3. All remote systems must use the adapter address value (or converted equivalent if using the 8229 LAN Bridge) in its configuration for the remote adapter address.

Creating the TOKEN token-ring line description

The following line description describes the token-ring line on the AS/400 System 2.

```
CRTLINTRN LIND(TOKEN) RSRNAME(LIN031) ADPTADR(400010050001) 1 +  
TEXT('Token-ring line for APPN to Ethernet')
```

Considerations for specifying the CRTLINTRN command:

- 1** The LAN remote adapter address (ADPTADR parameter) is the address to which the AS/400 system sends data when it communicates with the remote controller. Either the preset address that is assigned to the card by the manufacturer, or an address that is assigned by the user, can be specified. This adapter address is converted to 020008A00080, which matches the address configured on the APPNETH controller in “Creating the APPNETH APPC controller description” on page 6-12, after it has gone through the 8229 LAN Bridge to the Ethernet network.

For more information on address conversion, see “Token-ring-to-Ethernet address conversion” on page D-3. All remote systems must use the adapter address value (or converted equivalent if using the 8229 LAN Bridge) in its configuration for the remote adapter address.

Creating the APPNTRLAN APPC controller description

The following controller description is used with the token-ring line description for the AS/400 system that is running APPN over the token ring. This controller description automatically creates APPC device descriptions for use when the controller is varied on.

```
CRTCTLAPPC CTLD(APPNTRLAN) LINKTYPE(*LAN) SWTLINLST(TOKEN) +  
MAXFRAME(1496) 1 RMTCPNAME(SYSAS400) +  
INLCNN(*ANS) ADPTADR(400003200001) 2 +  
TEXT('APPC controller attached to TOKEN')
```

Considerations for specifying the CRTCTLAPPC command:

- 1** The maximum frame size (MAXFRAME parameter) for this controller is configured as 1496 because the remote system is on the other side of the 8229 LAN Bridge. The largest information field that can pass through the 8229 LAN Bridge is 1496 bytes.
- 2** The LAN remote adapter address (ADPTADR parameter) is the address to which the AS/400 system sends data when it communicates with the remote controller. This adapter address is converted to 0200C0040080, which matches the adapter address of the ETHERNET1 line description on AS/400 System 1 (see “Creating the ETHERNET1 line description” on page 6-10) after it has gone through the 8229 LAN Bridge to the Ethernet network.

For more information on address conversion, see “Token-ring-to-Ethernet address conversion” on page D-3. All remote systems must use the adapter address value (or converted equivalent if using the 8229 LAN Bridge) in its configuration for the remote adapter address.

Creating the ETHNET Ethernet line description

The following Ethernet line description is for the 9404 System Unit on the Ethernet network.

```
CRTLINETH LIND(ETHNET) RSRNAME(LIN131) ADPTADR(020000040099) 1 +  
ETHSTD(*ALL) 2 TEXT('Ethernet line description')
```

Considerations for specifying the CRTLINETH command:

- 1** The local adapter address (ADPTADR parameter) is the address the AS/400 system uses when it sends data to the remote controller. This adapter address is converted to 400000200099 after it has gone through the 8229 LAN Bridge to the token-ring network. Notice that this address matches the address for the 3745 communications controller in “Creating the ETHCTL SNA host controller description” on page 6-15.
- 2** The Ethernet standard (ETHSTD) parameter cannot be changed on the CHGLINETH command. When ETHSTD(*ALL) is configured, the AS/400 system sends SNA data in IEEE 802.3 frames.

For more information on address conversion, see “Token-ring-to-Ethernet address conversion” on page D-3.

The ES/9000 host system requires the DIALNO VTAM parameter if the host system calls out. For this example, the DIALNO is 030440000200099, where:

- 03 is the NCP port number
- 04 is the source service access point
- 400000200099 is the AS/400 adapter address

The adapter address must match the adapter address (or its converted equivalent if a 8229 LAN Bridge is used) on the AS/400 system.

The LINE macroinstruction for the ES/9000 system must also be specified as follows:

- ECLTYPE=PHYSICAL.
- PORTADD=03: This must be the same value as the NCP port address specified in the DIALNO parameter.
- LOCADDR=400000001590: This value is the adapter address of the 3745 communications controller. This value must match the adapter address (or its converted equivalent if the 8229 LAN Bridge is used) on the AS/400 controller description.

Creating the ETHCTL SNA host controller description

The following SNA host controller description is used by AS/400 system 3 to communicate with the 3745 communications controller on the token ring.

```
CRTCTHST CTLD(ETHCTL) LINKTYPE(*LAN) SWTLINLST(ETHNET) 1 +
    MAXFRAME(1496) 2 RMTCPCNAME(RICDRM) +
    LCLEXCHID(056A001A) ADPTADR(02000000A809) 3
    NODETYPE(*LENNODE) TEXT('SNA host controller on Ethernet line')
```

Considerations for specifying the CRTCTHST command:

- 1** For this example, notice that the value that is specified for the switched line list is ETHNET, which is the Ethernet line description that was created for the AS/400 System 3.
- 2** The maximum frame size (MAXFRAME parameter) for this controller is configured as 1496 because the remote system is on the other side of the 8229 LAN Bridge. The largest information field that can pass through the 8229 LAN Bridge is 1496 bytes.
- 3** The LAN remote adapter address (ADPTADR parameter) is the address to which the AS/400 system sends data when it communicates with the remote controller. This adapter address is converted to 400000001590 after it has gone through the 8229 LAN Bridge to the token-ring network. Notice that this address matches the configuration in “Creating the ETHNET Ethernet line description” on page 6-14.

For more information on address conversion, see “Token-ring-to-Ethernet address conversion” on page D-3. All remote systems must use the adapter address value (or converted equivalent, if using the 8229 LAN Bridge) in its configuration for the remote adapter address.

Creating the ETHAPN1 APPC device description

The following APPC device description is an example of a device that is associated with the ETHCTL SNA host controller that was created previously. This APPC device description is created automatically and is shown here to illustrate parameter values.

```
CRTDEVAPPC DEVD(ETHAPN1) RMTLOCNAME(CICS) LCLLOCNAME(SWWSA01) +
          CTL(ETHCTL) TEXT('Automatically created by QLUS')
```

Creating the FBSETHCTL finance controller description

The following finance controller is attached to the 9404 System Unit on the Ethernet network in Figure 6-4 on page 6-9.

```

                                Create Ctl Desc (Finance) (CRTCTLFNC)

Type choices, press Enter.

Controller description . . . . . > FBSETHCTL      Name
Controller type . . . . . > *FBSS                *FBSS, 3694, 4701, 4702...
Controller model . . . . . > 0                    0
Link type . . . . . > *LAN                       *LAN, *SDLC, *X25
Online at IPL . . . . . > *YES                   *YES, *NO
Switched line list . . . . . > ETHNET 1          Name
      + for more values
Maximum frame size . . . . . > 521                265-1033, 256, 265, 512...
Exchange identifier . . . . . > 05712345 2       00000000-FFFFFFFF
Initial connection . . . . . > *DIAL              *DIAL, *ANS
LAN remote adapter address . . . > 020088888888 3 000000000001-FFFFFFFFFFFF
Text 'description' . . . . . > 'FBSS controller through 8209 bridge'
```

Figure 6-6. Prompt Display for FBSETHCTL Controller Description

Considerations for specifying the CRTCTLFNC command:

- 1** For this example, notice that the value that is specified for the switched line list is ETHNET, the Ethernet line description created for AS/400 System 3.
- 2** The exchange identifier on the AS/400 system must match the SNA XID block number and identification number on the FBSS controller as is shown in Figure 6-14 on page 6-19.
- 3** The LAN remote adapter address (ADPTADR parameter) is the address to which the AS/400 system sends data when it communicates with the remote controller. This adapter address is converted to 400011111111 after it has gone through the 8229 LAN Bridge to the Ethernet network.

For more information on address conversion, see “Token-ring-to-Ethernet address conversion” on page D-3. All remote systems must use the adapter address value (or converted equivalent, if using the 8229 LAN Bridge) in its configuration for the remote adapter address.

Creating the EFBSSLAN2, EFBSSLAN3, and EFBSS278A device descriptions

The following device descriptions for both the finance and display station devices are attached to the FBSSETHCTL finance controller.

```
CRTDEVFNC DEVD(EFBSSLAN2) TYPE(*FNCICF) LOCADR(02) +
          RMTLOCNAME(EFBSS2) CTL(FBSSETHCTL) +
          TEXT('ICF finance device at LU address 02')

CRTDEVFNC DEVD(EFBSSLAN3) TYPE(*FNCICF) LOCADR(03) +
          RMTLOCNAME(EFBSS3) CTL(FBSSETHCTL) MAXLENRU(4096) +
          TEXT('ICF finance device at LU address 03')

CRTDEVDSP DEVD(EFBSS3277A) DEVCLS(*RMT) TYPE(3277) MODEL(0) +
          LOCADR(07) CTL(FBSSETHCTL) +
          TEXT('3277 attached to FBSS at LU address 07')
```

Configuring the FBSS controller

The following displays show the configuration of an FBSS controller. The highlighted option on each display is the option you should select to configure your finance controller to communicate with the AS/400 system as in this example.

```
MEN0000          FINANCIAL BRANCH SYSTEM SERVICES
                  Functional Customization Areas

                  General System Customization
                  Communication Profiles and Emulators
                  Data Management and System Profiles
                  Banking Devices Customization
                  LAN and Communication Configuration
                  LAN Building and Distribution

                  DOS Access
                  FBSS Back-up and Start-up Options
```

Figure 6-7. Prompt Display for FBSS Functional Customization Areas

```
MEN5000          FINANCIAL BRANCH SYSTEM SERVICES
                  LAN and Communication Configuration

                  LAN Configuration
                  LAN and Communication Configuration
                  LAN Variable Data Generation
```

Figure 6-8. Prompt Display for FBSS LAN and Communication Configuration

```

MEN5200          FINANCIAL BRANCH SYSTEM SERVICES
                  Communication Configuration

                  SNA Parameters for User Applications

                  FBSS Communication Configuration

```

Figure 6-9. Prompt Display for FBSS Communication Configuration

```

COMBID          FINANCIAL BRANCH SYSTEM SERVICES
                 SNA Parameters for User Applications

PC Server ..... B1
Session initialization ... Application only Application or Host
BID command management ... SNA Server      Application

```

Figure 6-10. Prompt Display for FBSS SNA Parameters for User Applications

```

MEN5200          FINANCIAL BRANCH SYSTEM SERVICES
                  Communication Configuration

                  SNA Parameters for User Applications

                  FBSS Communication Configuration

```

Figure 6-11. Prompt Display for FBSS Communication Configuration

```

COMVER          FINANCIAL BRANCH SYSTEM SERVICES
                 Communication Servers
Path .....: C:\FNC\FBSSCUS\          Configuration .....: LAN01

PC Server ..... B1
Data Link Control ..... TRDLC 1
Number of buffers ..... 16

```

Figure 6-12. Prompt Display for FBSS Communication Servers

Consideration for specifying Communication Servers:

- 1 The data link control field of the FBSS controller must match the link type that is configured on the AS/400 system. For this example, LINKTYPE(*LAN) must be specified on the AS/400 controller description.

```
COMVER                FINANCIAL BRANCH SYSTEM SERVICES
                        SSCP Names
Path .....: C:\FNC\FBSSCUS\          Configuration .....: LAN01
PC Server...: B1

SSCP name01 ..... X'      ' 1 SSCP name02 ..... X'      '
SSCP name03 ..... X'      '    SSCP name04 ..... X'      '
SSCP name05 ..... X'      '    SSCP name06 ..... X'      '
SSCP name07 ..... X'      '    SSCP name08 ..... X'      '
SSCP name09 ..... X'      '    SSCP name10 ..... X'      '
SSCP name11 ..... X'      '    SSCP name12 ..... X'      '
SSCP name13 ..... X'      '    SSCP name14 ..... X'      '
SSCP name15 ..... X'      '    SSCP name16 ..... X'      '

```

Figure 6-13. Prompt Display for FBSS SSCP Names

Consideration for specifying SSCP Names:

- 1 If the SSCP name is used on the FBSS controller, the value that is specified for the AS/400 system SSCPID parameter must match.

```
COMTOK                FINANCIAL BRANCH SYSTEM SERVICES
                        Token Ring Communications
Path .....: C:\FNC\FBSSCUS\          Configuration .....: LAN01
PC Server...: B1

Service access point for PC ..... X'04' 1
Service access point for Host/37xx/4700 ... X'04' 2
PC address ..... X'11111111'
Host/37xx/4700 address ..... X'00200099' 3
SNA XID Block number ..... X'057' 4
SNA XID Identification number ..... X'12345' 5

```

Figure 6-14. Prompt Display for FBSS Token Ring Communications

Considerations for specifying Token Ring Communications:

- 1 The value for the service access point for PC must match the destination service access point (DSAP parameter) value in the controller description on the AS/400 system.
- 2 The value for the service access point for Host/37xx/4700 must match the source service access point (SSAP parameter) value in the controller description on the AS/400 system.
- 3 The value for the Host/37xx/4700 address must match the converted form of the last 8 digits of the remote LAN adapter address that is specified on the ETHNET line description. The first 4 digits of the address (4000) are automatically included. See "Creating the ETHNET Ethernet

line description" on page 6-14 for the configuration of the line description on the AS/400 system.

- 4 The SNA XID block number is a hexadecimal number to indicate the type of system to the host system.
- 5 The SNA XID identification number is a 5-digit hexadecimal number. The identification block number and the identification number are concatenated; the result forms the SNA exchange identifier (EXCHID parameter) on the AS/400 controller description.

```

COMSLU                FINANCIAL BRANCH SYSTEM SERVICES
                        Session-Id and LU Assignments
Path .....: C:\FNC\FBSSCUS\          Configuration .....: LAN01
PC Server...: B1                    Data Link Control ...: TRDLC
Circuit type .....: Switched        Permanent      Not applicable

                        <-----Application Session IDs----->


|           |    |     |     |    |    |    |    |    |    |    |    |    |    |    |    |
|-----------|----|-----|-----|----|----|----|----|----|----|----|----|----|----|----|----|
| PC Served | 01 | 02  | 03  | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 |
| B1        |    |     | 003 |    |    |    |    |    |    |    |    |    |    |    |    |
| B1        |    | 002 |     |    |    |    |    |    |    |    |    |    |    |    |    |


                        <-----Host Logical Unit Numbers----->

```

Figure 6-15. Prompt Display for FBSS Session-Id and LU Assignments

The logical units that are specified for the FBSS controller must match those that are defined for the AS/400 system. The logical units on the FBSS controller and the LOCADR parameter on the AS/400 system must match. The logical unit identifier must be unique.

```

COMEMU                FINANCIAL BRANCH SYSTEM SERVICES
                        LU Assignments for Display Emulators
Path .....: C:\FNC\FBSSCUS\          Configuration .....: LAN01
PC Server...: B1                    Data Link Control ...: TRDLC
Circuit type .....: Switched        Permanent      Not applicable



|           |          |          |          |          |          |
|-----------|----------|----------|----------|----------|----------|
| PC Served | Emu32701 | Emu32702 | Emu32703 | Emu32704 | Emu32705 |
| B1        | 007      |          |          |          |          |


                        <-----Host Logical Unit Numbers----->

```

Figure 6-16. Prompt Display for FBSS LU Assignments for Display Emulators

Creating the network controller and devices for TCP/IP

One network controller and device are adequate for communications with all TCP/IP systems in the Ethernet network. This configuration is done automatically by TCP/IP. For more information on TCP/IP configuration, see the *TCP/IP Configuration and Reference* book.

Client Access configuration considerations

The environment that the personal computer and AS/400 system exist in determines the address conversion that must be done. The following discussion demonstrates when address conversion is done.

Personal computer on a token-ring and AS/400 system in an Ethernet network

When you are using Client Access with a personal computer on a token ring and the AS/400 system on an Ethernet network, address conversion considerations (as discussed in "Client Access configuration considerations") always apply. Address conversion in this environment is not dependent on whether a locally administered address or the personal computer adapter burned-in address is used.

Personal computer in an Ethernet network and AS/400 system on a token-ring network

When using Client Access with a personal computer on an Ethernet network and the AS/400 system on a token ring, some special attention must be given to addresses. Because locally administered addresses on the personal computer are in token-ring format, the address is converted to Ethernet format when the personal computer sends the address. Because the address passes through an 8229 LAN Bridge, which then converts the address to the token-ring format, no conversion is necessary.

However, if the preset adapter address for the personal computer is used, address conversion considerations do apply. In this case, the AS/400 controller description must have the converted form of the personal computer preset address.

For DOS, the TRLI entry in the CONFIG.PCS file contains the address of the AS/400 line. Because the TRLI entry must be in token-ring format, no address conversion is necessary for this part of the configuration.

For OS/2 Client Access, the address is in the LAN destination address field on the Work Station Feature LAN Defaults menu.

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Chapter 7. Asynchronous transfer mode networks

This chapter describes the following asynchronous transfer mode (ATM) topics:

- ATM terms and concepts
- ATM standards
- AS/400 ATM capabilities
- AS/400 ATM commands, line descriptions, and parameters
- AS/400 ATM problem determination
- AS/400 ATM network management (performance and security)

On the AS/400, LAN emulation over asynchronous transfer mode (ATM) extends your local area network (LAN) to other locations. ATM adds flexibility to, and improves throughput over, existing LAN technologies.

What is LAN emulation?

LAN emulation allows devices that are connected to an ATM network to use the network as if it was an Ethernet-type or token-ring type LAN. It enables devices such as hosts, desktop computers, bridges, hubs, and routers with ATM interfaces to communicate, by means of an ATM switch, with devices on existing LANs. LAN emulation allows you to migrate existing LANs to an ATM environment. LAN emulation is similar to the operation of traditional LANs, and makes an ATM connection that is transparent to your existing LAN applications. A bridge extends your ATM LAN emulation network to communicate with devices on a traditional token-ring or Ethernet LAN.

LAN emulation service

LAN emulation service is the set of functions that coordinates connections between LAN emulation clients. It consists of the LAN emulation configuration server, the LAN emulation server, and the LAN emulation broadcast and unknown server. With LAN emulation service, an **emulated LAN** imitates the interface of traditional LANs. An emulated LAN is a group of ATM-attached devices with the shared-media characteristics of a traditional LAN. An emulated LAN is similar to a group of LAN stations that are attached to a single LAN segment. Each emulated LAN within an ATM network is a separate **LAN emulation domain**.

The AS/400 does not provide LAN emulation services. Therefore, these must reside in another device within the ATM network. Typically, this would be in a network switch such as the IBM 8260, or in a stand-alone device such as the IBM 2210 Multi-protocol Switched Services (MSS) product.

LAN emulation configuration server

The **LAN emulation configuration server** (LECS) provides configuration services to the clients. Only one LAN emulation configuration server may reside within the entire ATM network. The configuration server provides the clients with the ATM address of an appropriate LAN emulation server to become part of an emulated LAN. In this manner, the client need not have the ATM address of the server. It uses the LAN emulation configuration server to provide this address and dynamically create a LAN domain.

The LAN emulation configuration server may also provide some measure of security within the emulated LAN by controlling which clients to recognize and configure. The configuration server may refuse to configure the client, thereby preventing it from joining an emulated LAN.

The LAN emulation configuration server is not required for an emulated LAN to function properly. While it does make configuration of LAN emulation clients easier, they also may be configured to contact the LAN emulation server directly. This function is useful if the LAN emulation configuration server meets any of the following conditions:

- It is not present in the ATM network
- It is not functioning properly
- It does not recognize the LAN emulation client (LEC)

The LEC is configured to not use the LAN emulation configuration server by entering *NO for the Use LECS Address parameter on the CRTLINETH, CHGLINETH, CRTLINTRN and CHGLINTRN commands. See Chapter 8, "ATM network configuration examples" on page 8-1 and "ATM line description parameters" on page 7-10 for more information.

LAN emulation server

The **LAN emulation server** (LES) provides ATM address resolution and control-related services to its clients. Each LES is associated with one LAN emulation domain. The LES recognizes the clients that are either connected to or defined in its domain. The LES then translates LAN destinations to ATM addresses at the request of the clients. It also provides control services, as a part of maintaining a LAN environment.

Membership in an emulated LAN does not depend on the physical location of each device. You determine membership in a domain by specifying which LAN emulation server to associate with your clients. You can group your devices into a domain that is based on criteria you select. These devices may be connected at any point in the ATM network.

Broadcast and unknown server

The **broadcast and unknown server** (BUS) provides frame forwarding and broadcast-related services to the clients. Each LAN emulation domain must contain a BUS. It provides broadcast services and frame forwarding services that are essential to a LAN environment.

LAN emulation client

In an emulated LAN, a **LAN emulation client** is the access point where devices on the LAN use remote applications and data (see Figure 7-1 on page 7-3). A single LAN emulation client may serve as the ATM connection point for many devices or sessions. The LAN emulation client initiates the functions of the LAN protocol, either token-ring or Ethernet, over the ATM network. AS/400 allows one LAN emulation client on each input/output processor (IOP).

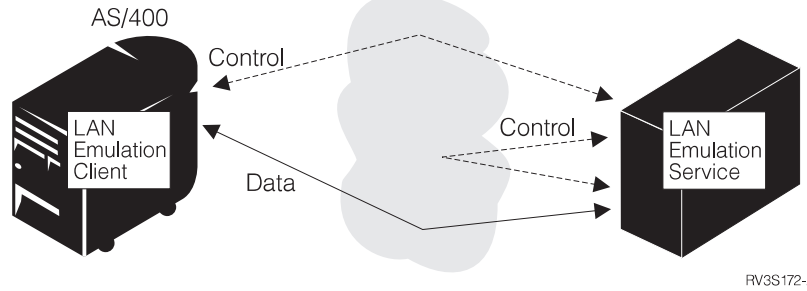


Figure 7-1. LAN Emulation Service and Clients in an ATM Network

A LAN emulation client uses the following LAN emulation services to find another client's ATM address:

- LAN emulation server
- LAN emulation broadcast and unknown server

Figure 7-2 shows the relationship between the LAN emulation service and the LAN emulation clients. The LAN emulation server matches LAN destinations to 20-digit ATM addresses for LAN emulation clients. The LAN emulation client uses the network as if it were a LAN. It does this by contacting the ATM address that correlates with the LAN destination with which it is attempting to exchange information.

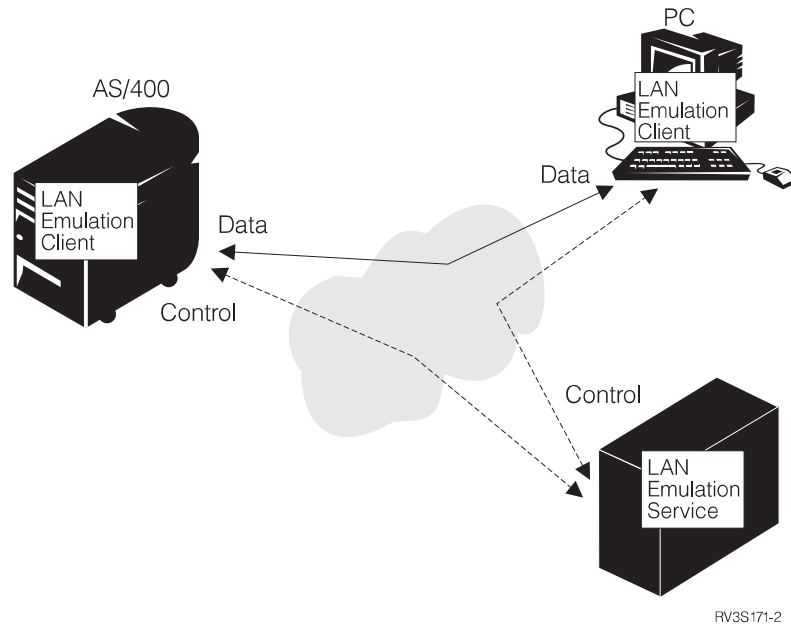


Figure 7-2. LAN Emulation Clients Use the LAN Emulation Service to Connect

Enabling the LAN emulation client

Enable the LAN emulation client (LEC) by creating the line description (Ethernet or token-ring). In ATM, all line descriptions represent the LAN emulation client. To enable the LEC with switched virtual circuits (SVCs), select *SVC as the access type parameter for the Create Line Ethernet (CRTLINETH) or Create Line Token Ring (CRTLINTRN) command. See Chapter 8, "ATM network configuration examples" on page 8-1 and "ATM line description parameters" on page 7-10 for more information.

LAN emulation protocol summary

Figure 7-3 shows the connections from an AS/400 LAN emulation client to the LAN emulation service. The solid lines represent the following connections:

- The data direct connection between the AS/400 LAN emulation client and another LAN emulation client
- The control direct connection between the LAN emulation client and the LAN emulation server

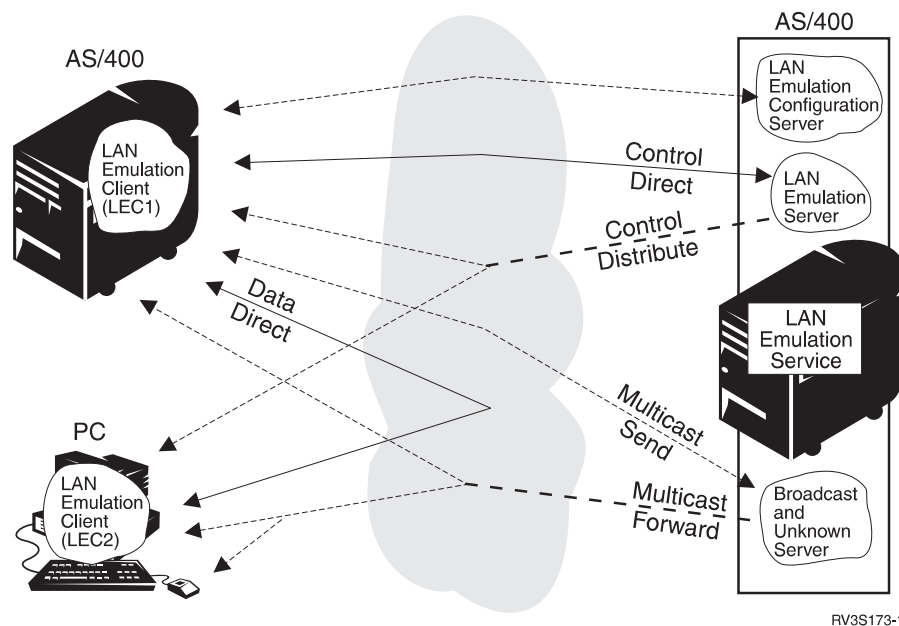


Figure 7-3. LAN Emulation Protocol

LAN emulation client 1 (LEC 1) uses the LAN emulation service to connect with the LAN emulation client 2 (LEC 2):

1. LEC 1 finds the address of the LAN emulation server from the LAN emulation configuration server.
2. LEC 1 calls the LAN emulation server through the control direct connection and requests to join the emulated LAN.
3. The LAN emulation server may optionally make the control-distribute connection.

4. LEC 1 calls the broadcast and unknown server to make the multicast-send connection.
 5. The broadcast and unknown server makes the multicast-forward connection. LEC 1 then requests the ATM address of LEC 2, which is already a member of the emulated LAN.
 6. Now that LEC 1 has received the appropriate ATM address from the LAN emulation server, it can make a data-direct connection to LEC 2.
- Note:** The LAN emulation service may be in a switch, a bridge, a router, a hub, or some other device. Also, except for the incoming multicast-forward and control-distribute links, the connections from LEC 2 to the LAN emulation service are not shown.

AS/400 supports one LAN emulation client within an input/output processor card. Additional cards in the AS/400 allow numerous clients to operate within a single system. Each card requires a unique LAN medium access control (MAC) address.

ATM address

An **ATM address** is a 20-digit hexadecimal number that uniquely identifies an end system in an ATM network. When the AS/400 receives the 13-digit network prefix from the switch, it registers an ATM address. For LAN emulation, a 6-digit LAN medium access control (MAC) address is added to a 1-digit selector byte. The 13-byte network prefix, 6-byte LAN MAC address, and selector byte combine to create the full ATM address.

Note: Each AS/400 ATM adapter has a unique preset MAC address. The user has the option of using the preset address, or of assigning an address when each line is configured. See “Assigning a physical address” on page 2-3, “Functional addresses” on page 3-5, “Ethernet physical address format” on page 5-4, and *LPS: Integration Services for FSIOP* for additional information.

End systems use the selector byte to resolve multiple entities within a single adapter card. The ATM switch does not use the selector byte and passes it unchanged when it completes the connection to the called party.

Before a LAN emulation client can send data to another client, it needs the ATM address of that client. To get the ATM address, it provides the remote client's 48-bit LAN medium-access control (MAC) address to the LAN emulation server. The LAN emulation server resolves the 20-digit ATM address that correlates with the MAC address, and returns the ATM address to the LAN emulation client. The LAN emulation client then uses the ATM address to contact and exchange data with the remote client.

ATM switching

ATM LAN emulation connects LAN clients at multi-megabit per second speeds over distances that previously were made possible only with a wide area network (WAN). LAN emulation makes client connections as they are needed, without configuring the physical path between the end systems. Switching is what makes this happen. **Switching** is the mechanism by which the network completes connections from one device to another.

The ATM Forum defines the Q.93B and Q.2931 signaling protocols to govern how this exchange takes place. The **ATM Forum** is a worldwide organization that aims to promote ATM within the industry and the end-user community. IBM is a member of the ATM Forum.

Signaling and interim local management interface standards

AS/400 supports the following standards of interoperability that are defined by the ATM Forum: user-to-network interface (UNI) 3.0 and UNI 3.1. The signaling and interim (or in some instances, integrated) local management interface (ILMI) code carries out these standards. For signaling, the standards specify how end systems and the switch create and manage calls. For ILMI, the standard specifies how end systems register ATM addresses with the switch. You may configure the AS/400 to use the same UNI standard as the switch. Use the CRTNWIATM and CHGNWIATM commands to specify the UNI version. See Chapter 8, “ATM network configuration examples” on page 8-1 and “ATM network interface parameters” on page 7-8 for additional information.

LAN emulation standards

AS/400 supports ATM Forum-compliant LAN emulation Version 1.0 only.

Industry compatibility standards

The University of New Hampshire Interoperability Lab provides an environment to test interoperability with equipment from many different vendors. The following AS/400 licensed internal code has been tested at the lab:

- Interim Local Management Interface (ILMI)
- ATM Adaptation Layer (QSAAL -- Q.2931)
- Signalling (Q.93B)
- Medium Access Control (MAC)
- LAN Emulation Client (LEC) and Logical Link Control (LLC)

Summary of AS/400 ATM capabilities

The following table summarizes the AS/400 ATM support capabilities. Further information on how to enable or disable these options is in Chapter 8, “ATM network configuration examples” on page 8-1, “ATM network interface parameters” on page 7-8, and “ATM line description parameters” on page 7-10.

Table 7-1 (Page 1 of 2). Summary of AS/400 ATM Support Capabilities

Category	Capability	Short description
Hardware	2809	PCI LAN/WAN/Workstation Input/Output Processor
	2810	High-speed Communications Input/Output Processor
	2811	25 Mbps (UTP-3) Input/Output Adapter
	2812	45 Mbps (DS-3) Input/Output Adapter
	2815	155 Mbps (UTP-5) Input/Output Adapter
	2816	155 Mbps (Multi-mode fiber) Input/Output Adapter
	2818	155 Mbps (Single-mode fiber) Input/Output Adapter
	2819	34 Mbps (E3) Input/Output Adapter
	Physical interface	25 Mbps UTP
34 Mbps Coax		34 megabits per second over coaxial cable, BNC connector
45 Mbps Coax		45 megabits per second over coaxial cable, BNC connector
155 Mbps UTP		155 megabits per second over UTP category-5, RJ-45 connector
155 Mbps SMF		155 megabits per second over single-mode fiber, SC connector
155 Mbps MM		155 megabits per second over multi-mode fiber, SC connector.
ATM Forum standards	LANE 1.0	LAN emulation Version 1.0, LAN emulation client only. The LAN emulation client does not support the full LAN emulation client management specification. AS/400 does not support LAN emulation configuration server, LAN emulation server or broadcast and unknown server. These functions, also known as the LAN emulation service, must be provided by an external device in the ATM network.
	UNI 3.0	AS/400 supports switched virtual circuits (SVC) and permanent virtual circuits (PVC) over the ATM user-to-network interface (UNI) version 3.0
	UNI 3.1	AS/400 supports switched virtual circuits (SVC) and permanent virtual circuits (PVC) over the ATM user to network interface (UNI) version 3.1
LAN emulation client support	Lines	AS/400 supports one line description for each LAN emulation client and one LAN emulation client per card.
	Controllers	AS/400 supports 256 SNA controllers for each line description. The line description supports TCP/IP and SNA simultaneously.
	Connections	The AS/400 LEC supports switched virtual circuits (SVC) or permanent virtual circuits (PVC) through a network switch, or a direct connection between two AS/400 systems without a network switch.

Table 7-1 (Page 2 of 2). Summary of AS/400 ATM Support Capabilities

Category	Capability	Short description
LAN protocols	Ethernet version 2	TCP/IP and APPC/APPN/HPR devices are supported.
	802.3	Both TCP/IP and APPC/APPN devices are supported.
	802.5	Both TCP/IP and APPC/APPN devices are supported.

Commands and line descriptions for configuration

This topic lists the commands that affect the configuration objects, and describes the configuration objects that you need for ATM.

Network interface commands

The network interface (NWI) describes everything that is common across the ATM physical interface. Each AS/400 Communication IOP (2809 or 2810) may have one network interface attached. A single line description—that defines a client connection that uses switched virtual circuits, permanent virtual circuits or direct connections—can be attached to each NWI. The following are commands for ATM NWIs:

Create Network Interface ATM (CRTNWIATM) Command This command creates a network interface for ATM. See “ATM network interface parameters” to view the network interface parameters.

Change Network Interface ATM (CHGNWIATM) Command This command changes an existing network interface for ATM.

Display Network Interface Description (DSPNWID) Command This command displays the network interface description for ATM.

ATM network interface parameters

The ATM network interface uses the following parameters:

Table 7-2. Network Interface Parameters

Parameter	Description
Maximum Point-to-Multipoint End Systems (MAXPMPYSYS)	This is the maximum number of end systems that can attach to a multipoint connection. This field currently is not used for LAN emulation.
Network Switch Time-out (NETSWTOUT)	The network switch time-out is the maximum amount of time (in minutes) to allow for the initial connection with the ATM switch. If the switch cannot be contacted within this time period, the network interface will fail to vary on, and an error will be posted.
Network Type (NETTYPE)	Network type is the interface standard that is used by the ATM network. It may be UNI 3.0, UNI 3.1, *AUTO, or *PVCONLY. *PVCONLY may be used when the attached line description has an access type of *PVC. However, it must be used when the attached line description has an access type of *DIRECT. Note: Since *PVCONLY does not use signaling protocols, problems such as disconnected cables will not be detected.
Physical Layer Options (PHYLYROPT)	The physical layer options identify characteristics when you attach to specific ATM network implementations. Do not use this field unless directed to by your AS/400 service provider.
Maximum Switched Virtual Connections (SVCCNN)	This is the maximum number of connections that may be active at one time for all entities that are associated with the network interface.

Virtual circuit connections

Ethernet and token-ring line descriptions define a LAN emulation client with switched virtual circuit (SVC) connections, direct connections, or permanent virtual circuit (PVC) connections that use AS/400 ATM input/output adapters. See Table 7-1 on page 7-7 for input/output adapter information.

For both types of LANs, the access type parameter determines the capabilities of that line description with one of the following values.

- *SVC** The *SVC value allows applications to exploit ATM through a LAN emulation client that uses switched virtual circuit connections. SVCs are created through a switch as they are needed, and are dropped when they no longer are required.
- *DIRECT** A direct connection is AS/400 card-to-card cabling that is always present and does not go through a switch. In this case, two AS/400 cards are plugged directly to each other through an ATM crossover cable. The crossover cable connects the cards' transmit lines to each other's receive lines. Note, however, that this crossover cable is different from the cable that is used for traditional Ethernet or token-ring local area networks. This type of connection uses LAN emulation frames, but no LAN emulation server or broadcast and unknown server, since only two clients may be connected.
- *PVC** A PVC is a specifically defined connection through an ATM switch that is always present. Therefore, LAN emulation does not have to make a call through the switch. PVCs require you to configure all physical paths to other LAN emulation clients in your ATM switch. This type of con-

nection uses no ATM LAN emulation server or BUS. It does, however, use LAN emulation clients.

Ethernet line description commands

The **Ethernet line description** describes the LAN emulation client that uses AS/400 ATM IOAs. The following commands either create or change your Ethernet connection.

Create Ethernet Line Description (CRTLINETH) Command This command creates an Ethernet line description for ATM when you set the network interface type parameter to *ATM.

Change Ethernet Line Description (CHGLINETH) Command This command changes an existing Ethernet line description.

Token-ring line description commands

The **token-ring line description** describes the LAN emulation client that uses AS/400 ATM IOAs. The following commands either create or change your token-ring connection:

Create Token-Ring Line Description (CRTLINTRN) Command This command creates a token-ring line description for ATM when you set the network interface type parameter to *ATM.

Change Token-Ring Line Description (CHGLINTRN) Command This command changes an existing token-ring line description.

ATM line description parameters

The following list identifies parameters that are used within ATM line descriptions:

Table 7-3 (Page 1 of 4). Line Description Parameters

Parameter	Description
ATM Access Type (ACCTYPE)	This is the type of entity that you wish to create within this line description. This may be a client entity using switched virtual connections (*SVC), permanent virtual connections (*PVC) or direct connections (*DIRECT).
ARP Retry Timer (ARPRYTMR)	This is the amount of time needed to wait for a response to an address resolution protocol (ARP) request. It is a display-only field.
ARP Cache Aging Timer (ARTPCCHAGE)	This is the amount of time an ARP entry remains in a client's ARP table without refresh or verification. If the entry is not used within this period, the entry is removed and requires an additional ARP if a frame is sent to that client. It is a display-only field.
ARP Retry Count (ARPRYCNT)	If no response is received from an ARP request, this is the number of times an ARP is retried. It is a display-only field.

Table 7-3 (Page 2 of 4). Line Description Parameters

Parameter	Description
Emulated LAN Name (EMLLANNAME)	<p>This specifies the emulated LAN name. When the line type is *SVC, this is the name of the emulated LAN to join. Specify a maximum of 32 characters. Specify *NONE if you do not want the emulated LAN name to be used.</p> <p>Note: This field is case sensitive, and values may be entered in uppercase, lowercase, or mixed case. However, lowercase or mixed-case values must be contained within quotes. If they are not, the value will be converted to uppercase. Values contained within quotes are passed to the server as entered. Therefore, the emulated LAN name must match the name that is used by the server. If *NONE is specified, the AS/400 will not include an emulated LAN name when sending a request to join an emulated LAN.</p>
Last Contacted LAN Emulation Server (LSTCONTLES)	<p>If the client (line description) is currently varied on, this is the address of the LAN emulation server to which the client is currently connected. If the client (line description) is not varied on, this is the address of the LAN emulation server to which the client was last connected. It is a display-only field.</p>
LEC Disconnect Time Out (LECDSTIMO)	<p>This value specifies the number of minutes, from 1-30, that a LAN emulation client waits before disconnecting an idle virtual circuit connection to another client. Specifying *NOMAX causes the LEC to wait indefinitely, with no disconnect.</p>
LEC Frame Size (LECFRAME)	<p>This specifies the LAN emulation client (LEC) frame size that can be transmitted and received on this line description. This value should match the frame size parameter of the LAN emulation server to which this line will connect.</p> <p>Note: This value must be at least 20 bytes more than the value specified in Maximum frame size.</p>
LES ATM Address (LESATMADR)	<p>This is the address of the LAN emulation server that the client contacts to join an emulated LAN. Specifying an address of all zeroes is equivalent to specifying *NONE. See also USELECS.</p> <p>Note: A value of *NONE requires that the USE LECS parameter is specified as *YES.</p> <p>Network prefix</p> <p>This is the network prefix of the switch to which the remote server is attached. To determine the network prefix, refer either to the configuration of the LAN emulation server used, or to the configuration of the switch to which the LAN emulation server is attached. This is 26 hexadecimal characters in length.</p> <p>End system identifier</p> <p>You may refer to the configuration of the LAN emulation server that you use to determine the end system identifier. This is 12 hexadecimal characters in length.</p> <p>Selector byte</p> <p>You may refer to the configuration of the LAN emulation server that you use to determine the selector byte. This is 2 hexadecimal characters in length.</p>

Table 7-3 (Page 3 of 4). Line Description Parameters

Parameter	Description
Local Adapter Address (ADPTADR)	This is the LAN medium access control (MAC) address used by the line description. It is also used as the 12 hexadecimal-digit end-system identifier (ESID) in the local ATM address. Each adapter is assigned a unique, preset address when it is manufactured. Use the preset address, or assign an address when you configure the line description. To change the local ATM address, you must change the local adapter address. For Ethernet, the valid range is 020000000000-7EFFFFFFFFFFFF. The valid range for token-ring is 400000000000-7FFFFFFFFFFFFF.
Local ATM Address (LCLATMADR)	<p>The local ATM address is specified in the description for the entity. This is the ATM address of the connection for the client.</p> <p>Network prefix</p> <p>The network prefix is obtained by interrogating the switch. Typically, each switch has a unique network prefix. This is 26 hexadecimal characters in length, and is a display-only field.</p> <p>End system identifier</p> <p>The end system identifier will be the same as the local adapter address. This is 12 hexadecimal characters in length, and is a display-only field.</p> <p>Selector byte</p> <p>The selector byte identifies the unique ATM address of each entity that resides within one resource. It is 2 hexadecimal characters in length, and is a display-only field.</p> <p>Note: For AS/400 token-ring LAN emulation clients, the selector byte value is always a hexadecimal "13". Ethernet clients have a value of hexadecimal "03".</p>
Maximum Address Resolution Protocol Entries (MAXARPENT)	This is the maximum number of LAN emulation ARP entries that the client maintains. It is a display-only field.
Maximum Frame Size (MAXFRAME)	<p>This specifies the maximum frame size for this line. Typically, this value is 4060 for a LEC frame size of 4544, and 16393 for a LEC frame size of 18190.</p> <p>Note: This value must be at least 20 bytes less than the value specified in LEC frame size.</p>
Network Interface Type (NWITYPE)	The network interface type must be set to *ATM to attach the line description to an ATM network interface.
Reported Emulated LAN Name	This shows the emulated LAN name that was returned by the LAN emulation server. This only is a Display Line Description (DSPLIND) parameter.

Table 7-3 (Page 4 of 4). Line Description Parameters

Parameter	Description
Use LECS Address (USELECS)	<p>If *YES, this client attempts to contact the LAN emulation configuration server to obtain the LAN emulation server address. If *NO, the client uses the LES ATM address to identify the appropriate LAN emulation server.</p> <p>Note: If Use LECS address is specified as *YES, and there is an error when the AS/400 client attempts to connect to the LECS, the client will use the Last Contacted LES Address to attempt to connect with the LAN emulation server. If there is no value for Last Contacted LES Address, the client will attempt to connect with the LAN emulation server specified in the line description by the LES ATM Address before reporting a failure.</p>

ATM problem determination instructions

The following instructions are in addition to information that is available in either the *AS/400 Service Functions* book or the *Communications Management* book.

Finding ATM errors

When you investigate errors, look in the job log queue that is associated with the job that runs the ATM adapter. You can find the error in the QSYSOPR message queue. You also can find solutions to errors by tracking their reference codes.

The Print Error Log command, QSYSOPR message queue, and job log are three ways to find error codes.

1. Enter the Print Error Log (PRTERLOG) command and press F4 to prompt the command parameters. Enter *ANZLOG in the type of log data list. Additional fields show the time when the error occurred. Enter the date and the default values for the other fields to print the log report. Enter the Work with All Spooled Files (WRKSPLF) command to view the printed report.
2. Check the QSYSOPR message queue to view logged system errors. Enter the Display Messages (DSPMSG) command. Look for any errors that are associated with the ATM function that you used.
3. Check the job log for errors that were logged as the job ran.

Note: When *PVCONLY value is specified in the Network Type (NETTYPE) ATM network interface parameter, problems such as disconnected cables will not be detected, since *PVCONLY does not use signalling protocols. See Table 7-2 on page 7-9 for additional information.

Internal system failure scenario

This topic explains line failures and what actions you can take to resolve these problems. Typically, messages will contain an eight-character hexadecimal error code that indicates the problem. The error code is found in the technical description of the message.

For example, consider the failure of a line under an ATM interface as is shown by the ATMLIN description on the following display:

```

                                Work with Configuration Status
                                11/21/97 13:35:47 S1070409
Position to . . . . . Starting characters

Type options, press Enter.
 1=Vary on  2=Vary off  5=Work with job  8=Work with description
 9=Display mode status 13=Work with APPN status...

Opt Description      Status      -----Job-----
--- ATMNWI           ACTIVE
--- ATMLIN           RCYPND
--- ATMLINET         RCYPND
--- ATMLITCP         RCYPND

Parameters or command
===>
F3=Exit  F4=Prompt  F12=Cancel  F23=More options  F24=More keys
                                Bottom

```

Figure 7-4. Work with Configuration Status Display

To view the logged system error, do the following:

1. Enter DSPMSG QYSYOPR on the command line.
2. Locate the "Internal system failure on line ATMLIN." message.

```

                                Display Messages
                                System: S1070409
Queue . . . . . : QSYSOPR           Program . . . . . : *DSPMSG
Library . . . . : QSYS              Library . . . . . :
Severity . . . . : 60               Delivery . . . . . : *HOLD

Type reply (if required), press Enter.
line running.
Device QPADEV0001 no longer communicating.
Adapter has inserted or left the ring on line TSTLAN2.
Adapter has inserted or left the ring on line TSTLAN2.
Adapter has inserted or left the ring on line TSTLAN2.
Adapter has inserted or left the ring on line TSTLAN2.
Adapter has inserted or left the ring on line TSTLAN2.
Device QPADEV0001 no longer communicating.
Device QPADEV0001 no longer communicating.
Network interface ATMNWI varied on successfully.
Line ATMLIN failed. Automatic recovery started.
Internal system failure on line ATMLIN. (C G R)
Reply . . .

F3=Exit      F11=Remove a message      F12=Cancel
F13=Remove all  F16=Remove all except unanswered  F24=More keys
                                Bottom

```

Figure 7-5. Display Messages Display

3. Place the cursor on the message.
4. Press the help function key to view the help message.

Here, message CPA59F1 shows as an Internal system failure on line ATMLIN.

```

Additional Message Information

Message ID . . . . . : CPA59F1      Severity . . . . . : 99
Message type . . . . . : Inquiry
Date sent . . . . . : 08/05/96     Time sent . . . . . : 13:34:05

Message . . . . . : Internal system failure on line ATMLIN. (C G R)
Cause . . . . . : The following may have caused the problem:
-- OS/400 Licensed Program not working correctly.
-- Vertical Licensed Internal Code not working correctly.
-- I/O card Licensed Internal Code not working correctly.
Recovery . . . . . : Reply to the message.
-- Type C to cancel recovery. This informs any application waiting for an
operation that recovery has been canceled.
-- Type G to start the automatic communications recovery defined by the
systems communications recovery limit (CMNRCYLMT) for line ATMLIN.
-- Type R to retry the operation.
-- Use the Vary Configuration (VRYCFG) command to vary off line ATMLIN, then

More...

Type reply below, then press Enter.
Reply . . . .

F3=Exit  F6=Print  F9=Display message details  F12=Cancel
F21=Select assistance level
```

Figure 7-6. Additional Message Information Display 1 of 2

5. For more specific information on ATMLIN, page down to the technical description where the error code of "X'1EC0800D" is displayed.

```

Additional Message Information

Message ID . . . . . : CPA59F1      Severity . . . . . : 99
Message type . . . . . : Inquiry

vary on the network interface.
-- Report the problem (ANZPRB command).
Possible choices for replying to message . . . . . :
C -- Cancel recovery and inform any applications that are waiting for an
operation that the recovery has been canceled.
G -- Start the automatic communications recovery again as defined by the
communications recovery limit (CMNRCYLMT) parameter configured for line
ATMLIN.
R -- Try the operation one more time.
Technical description . . . . . : The error log identifier is
X'800004BC'. The error code is X'1EC0800D': internal system failure. If
line ATMLIN is X.25, the X.25 cause code is: *N (X.25 cause code not

More...

Type reply below, then press Enter.
Reply . . . .

F3=Exit  F6=Print  F9=Display message details  F12=Cancel
F21=Select assistance level
```

Figure 7-7. Additional Message Information Display 2 of 2

The error code is important to determine corrective actions or problem isolation. Additional information on specific error codes may be found in “ATM network error codes” on page E-1.

Error codes for ATM

Many of the messages concerning the operation of ATM contain error codes that aid in problem analysis. Error codes are listed in “ATM network error codes” on page E-1. If your code is not listed in the error code table, please contact your service representative.

ATM performance tips, security, and network management

This topic describes AS/400 ATM LAN emulation performance, network security, and network management.

Performance tips for an emulated LAN

End-user performance varies with the asynchronous transfer mode (ATM) network topology, applications used, system loading and configuration, network speed, and numerous other variables. However, in general, emulated LAN performance over an ATM network is faster than the performance of a traditional LAN of the same type.

To maximize performance of the emulated LAN over an ATM network, consider the following factors:

Table 7-4 (Page 1 of 2). ATM Performance Tips

Higher-speed connections	Connection speeds between the LAN emulation clients and the network switch determine the fastest rate that data may be transferred. Higher-speed connections, such as a 155 Mbps connection, enable more data to travel in a given period of time than a 25 Mbps connection. Note, however, that the maximum transfer rate will be limited by the slowest connection. For example, a client using a 155 Mbps connection to the switch, which is sending data to a client using a 25 Mbps connection, will be limited to the 25 Mbps that the second client is using.
Larger data packets	Each frame must be processed, either before being sent out or after being received on the ATM interface. The frame processing overhead is effectively constant regardless of the amount of data in the frame. Therefore, a 16 kB frame incurs the same amount of processing overhead as a 1.5 kB frame but contains far more data. If the emulated LAN does not bridge to a traditional LAN, you can increase performance by using an emulated LAN topology with larger data units.
Larger frame sizes	The maximum frame size defined in the line description determines the amount of application data that is transferred in each frame. Increasing this enables more data to be sent in each frame, thereby increasing throughput. Frame size will be limited by data packet size, which must be large enough to contain the frame. See Chapter 8, “ATM network configuration examples” on page 8-1 for additional information on configuring line descriptions to maximize frame size.

Table 7-4 (Page 2 of 2). ATM Performance Tips

Larger record sizes	Larger record sizes incur less processing overhead than smaller record sizes. This will improve throughput, especially during large transfers. For smaller transfers that are close to the data packet size, this will have little or no effect.
Discarded frames	When the network becomes overloaded or "saturated" frames may be discarded due to the overutilization of resources, either in the network switch or in the clients. Duplicate frames must then be sent which will reduce overall throughput. If devices are discarding frames, decreasing frame size may alleviate this problem. The communications line trace facility may be used to determine if frames are being discarded. See "Analyzing data flows on the physical interface" on page B-6 for further information on obtaining trace information.
Smaller networks	If the client has insufficient resources to maintain all required connections, it will drop connections to one client in order to connect with another. This causes additional overhead in setting up and releasing connections. Typically, this is not a factor in performance because most clients have ample resources. However, if one client acts as a server to the network, (for example, a file server), this could be a problem when serving a large number of users. AS/400 supports a maximum of 512 active clients.

OS/400 system security considerations

ATM, operating under either a token-ring LAN or an Ethernet LAN, has the same security protections as a normal token-ring LAN or Ethernet LAN. OS/400 security provides these security protections. AS/400 ATM LAN emulation has no special protections or considerations.

Network security

ATM communications have no defined standardized security protocols. ATM LAN emulation support does not add any additional proprietary security mechanisms. Therefore, you need to consider this when you assess the overall security of the ATM network. In this respect, the security of the ATM network would be analogous to that of an unencrypted wide area network (WAN) connection.

Network management

The AS/400 ATM LAN emulation currently does not support network management as it is defined by the ATM Forum LAN emulation client management specification.

Chapter 8. ATM network configuration examples

This chapter provides configuration examples to help you with the initial setup of your asynchronous transfer mode (ATM) network. This chapter also provides an introduction to common elements of AS/400 ATM LAN emulation. To understand these examples, you should be familiar with general AS/400 configurations, which include Ethernet and token-ring local area networks.

Configuration considerations unique to LAN emulation

AS/400 ATM uses LAN emulation to operate like a traditional LAN. Therefore, the basics of ATM configurations are similar to other AS/400 LAN configurations. However, you also need to consider the following before you configure your ATM network as an Ethernet or token-ring local area network:

- The network interface contains information to configure the general aspects of the ATM network (everything that is common across the ATM physical interface.)
- The line description defines the LAN emulation client (LEC) that uses the AS/400 ATM input/output adapters (IOAs.) The LEC will connect to other ATM devices by using switched virtual circuit (SVC) connections, permanent virtual circuit (PVC) connections, or direct connections.
- Controller descriptions and device descriptions for an ATM network are identical to those that are used in traditional Ethernet and token-ring networks. See Chapter 4, "Token-Ring Network Configuration Examples" on page 4-1 and Chapter 6, "Ethernet network configuration examples" on page 6-1 for additional information on configuring controllers and devices.

Note: The creation of a network interface requires that you use the Create Network Interface ATM (CRTNWIATM) command. Create the line descriptions by using the create commands for either Ethernet or token-ring lines (CRTLINETH or CRTLINTRN.)

Overview: Configuring an ATM network

Use the following steps to configure your ATM network:

1. Using the Create Network Interface ATM (CRTNWIATM) command, specify the general ATM network, which includes the following:
 - Network interface type
 - Maximum number of connections that can be active at one time
 - Maximum amount of time allowed for retrying connections to the switch
2. Using the Create Line Ethernet (CRTLINETH) or Create Line Token-Ring (CRTLINTRN) commands, define the type of entity to start on the network, as well as its characteristics, including the following:
 - The client connection type; either SVC, PVC or direct
 - Whether the client should use the LAN emulation configuration server
 - The LAN emulation server (LES) ATM address

- The connection definitions (protocol, speed, and so on)
- The time-out values

Identifying the adapter

Before you configure your ATM network, you must identify the ATM adapter. To display the communication resources, enter the Work with Hardware Resource (WRKHDWRSC) command and *CMN as the value. Figure 8-1 is an example of the display that is shown when you enter this command.

```

Work with Communication Resources
System:  SYSNAMxxx
Type options, press Enter.
  5=Work with configuration descriptions  7=Display resource detail

Opt Resource      Type Status      Text
-   CC01          2619 Operational Combined function IOP
-   LIN01         2619 Operational LAN Adapter
-   CMN01         2619 Operational Token-Ring Port
-   LIN02         605A Operational Virtual Controller
-   CC03          2810 Operational Comm Processor
-   LIN03         2816 Operational LAN Adapter
-   CMN03         2816 Operational 155 Mbps ATM Port

F3=Exit  F5=Refresh  F6=Print  F12=Cancel
Bottom

```

Figure 8-1. Work with Communications Resources Display

In this example, the ATM I/O processor (IOP) card has a type number of 2810. The ATM I/O adapter (IOA) card has a type number of 2816. Locate the associated port under the 2816 adapter. This is the resource that you need to enter when you configure the network interface (in this case, it is CMN03.)

Note: A list of supported ATM cards and their type numbers may be found in Table 7-1 on page 7-7.

Configuring AS/400 Ethernet LAN emulation client

This topic describes the configuration of an Ethernet LAN emulation client on AS/400. The line description defines a single end device in the ATM network, as is shown in Figure 8-2 on page 8-3. The LAN emulation client allows this AS/400 to exchange data with any other LAN emulation client in the emulated LAN, as if it was a device in an Ethernet LAN.

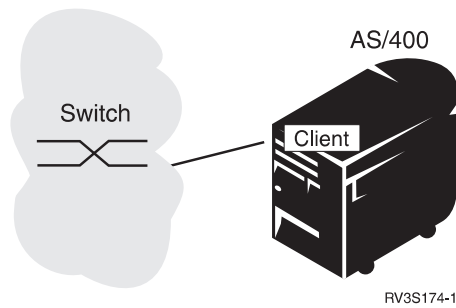


Figure 8-2. AS/400 Ethernet LAN Emulation Client (Example 1)

Defining the network (example 1)

This configuration example describes how to create an ATM LAN emulation client that conforms to the following specifications:

- ATM should function without intervention after an IPL sequence.
- The ATM LEC should attach to an ATM switch that uses an ATM interface that conforms to the UNI 3.0 standard.
- The ATM LEC should use switched virtual connections.
- The emulated LAN will have a maximum of 128 stations (or clients.)
- The ATM switch is located outside the building but within the campus of this company, so the latency to the switch should be minimal.
- The ATM LEC will not use locally administered addresses.
- The ATM LEC should join an Ethernet emulated LAN that uses both Ethernet Version 2 and IEEE 802.3, with an emulated LAN name of ETHERNET1
- The ATM LEC should use the LAN emulation configuration server (LECS) to find the proper LAN emulation server (LES.)
- The ATM network demonstrates occasional congestion and contains several emulated LANs. Therefore, inactive connections to other clients should be dropped to free resources in the network.

Creating the network interface (example 1)

1. To determine the correct resource name for the ATM port, enter the Work with Hardware Resource (WRKHDWRSC) command, and specify *CMN as the value, on the AS/400 Main Menu selection or command line. Figure 8-1 on page 8-2 shows the communication resources.
2. Enter the Create Network Interface ATM (CRTNWIATM) command. Press the Enter key. Figure 8-3 on page 8-4 shows an example of this display.

```

                                Create NWI ATM (CRTNWIATM)

Type choices, press Enter.

Network interface description . _____ Name
Resource name . . . . . _____ Name
Online at IPL . . . . . *YES *YES, *NO
Vary on wait . . . . . *NOWAIT *NOWAIT, 15-180 seconds
Network type . . . . . *UNI30 *AUTO, *UNI30, *UNI31...
Text 'description' . . . . . *BLANK
_____

F3=Exit F4=Prompt F5=Refresh F10=Additional parameters F12=Cancel
F13=How to use this display F24=More keys
Parameter NWID required. Bottom
+

```

Figure 8-3. Create NWI ATM (Example 1) Display 1 of 4

3. Enter an appropriate network interface description name.
4. Enter an appropriate ATM resource name.
5. Accept the default for Online at IPL (*YES.)
6. Specify the network type as *UNI30 (*AUTO, *UNI31, and *PVCONLY are additional valid values.) The ATM switch specifies which of the two UNI standards that it uses. If PVC connections are to be used, or a direct connection between two AS/400 systems is to be used, specify *PVCONLY. See "Signaling and interim local management interface standards" on page 7-6 for more information.

Figure 8-4 on page 8-5 shows an example of this display.

Press F10 for additional parameters.

```

                                Create NWI ATM (CRTNWIATM)

Type choices, press Enter.

Network interface description . LOSANGELES   Name
Resource name . . . . . CMN03             Name
Online at IPL . . . . . *YES              *YES, *NO
Vary on wait . . . . . *NOWAIT          *NOWAIT, 15-180 seconds
Network type . . . . . *UNI30           *AUTO, *UNI30, *UNI31...
Text 'description' . . . . . Los Angeles ATM system

_____

                                                                    Bottom
F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
F13=How to use this display  F24=More keys
Parameter NWID required.

```

Figure 8-4. Create NWI ATM (Example 1) Display 2 of 4

7. Leave the default for Maximum PMP end systems as zero. This field defines the maximum number of leaves that are created within a multipoint tree. The LAN emulation client creates only point-to-point connections and does not use this value.
 8. For the number of switched virtual connections, type 132 (128 direct connections to other clients, plus 4 connections to servers.)
 9. Specify the amount of time (in minutes) for the network switch time-out. In this case, the default of 2 minutes is adequate since we are expecting minimal latency to the switch.
 10. Leave the physical layer options as *NONE. The ATM network may require a specific value for compatibility reasons, but this should be done only as instructed by your hardware or software service provider.
- Page down to see the remaining fields.

```

                                Create NWI ATM (CRTNWIATM)

Type choices, press Enter.

Network interface description . > LOSANGELES      Name
Resource name . . . . . > CMN03                  Name
Online at IPL . . . . . *YES                       *YES, *NO
Vary on wait . . . . . *NOWAIT                     *NOWAIT, 15-180 seconds
Network type . . . . . *UNI30                       *AUTO, *UNI30, *UNI31...
Text 'description' . . . . . > 'Los Angeles ATM system'

-----

                                Additional Parameters

Maximum PMP end systems . . . . 0                   0-2048
Switched virtual connections . . 132                 16-2064
Network switch timeout . . . . . 2                   *NOMAX, 1-30 minutes
Physical layer options . . . . . *NONE                *NONE, 0000-FFFF
Attached lines . . . . . _____                 Name
+ for more values                _____

                                                                More...

F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

Figure 8-5. Create NWI ATM (Example 1) Display 3 of 4

11. The recovery limits and authority fields may be left as defaulted.

```

                                Create NWI ATM (CRTNWIATM)

Type choices, press Enter.

Recovery limits:
  Count limit . . . . . 2                           0-99, *SYSVAL
  Time interval . . . . . 5                           0-120 minutes
  Authority . . . . . *LIBCRTAUT                     Name, *LIBCRTAUT, *CHANGE...

                                                                Bottom

F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

Figure 8-6. Create NWI ATM (Example 1) Display 4 of 4

After you press the Enter key, a message appears on the AS/400 Main Menu display that verifies that you created the network interface description properly.

Creating the line description (example 1)

Next, create the line description to define the LAN emulation client.

1. Enter the Create Line Description (Ethernet) (CRTLINETH) command to create the line description (in this case, an Ethernet client). Press Enter.
2. Enter an appropriate name for the line description.
3. Specify the resource name as *NWID, and press Enter.

Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

Line description	<u>LALINE</u>	Name
Resource name	<u>*NWID</u>	Name, *NWID, *NWSD

Bottom

F3=Exit F4=Prompt F5=Refresh F10=Additional parameters F12=Cancel
F13=How to use this display F24=More keys

Parameter LIND required. +

Figure 8-7. Create Line Description (Example 1) Display 1 of 5

4. Specify Online at IPL as *YES. Specifying *NO requires the line description to be varied on manually after IPL.
5. Enter the attached NWI name which is the name of the network interface description that was just created with the CRTNWIATM command.
6. Specify the NWI type as *ATM.
Press the Enter key to display the next set of parameters.

```

                                Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

Line description . . . . . > LALINE      Name
Resource name . . . . . > *NWID         Name, *NWID, *NWS
Online at IPL . . . . . *YES          *YES, *NO
Vary on wait . . . . . *NOWAIT       *NOWAIT, 15-180 seconds
Attached NWI . . . . . LOSANGELES    Name, *NONE
NWI type . . . . . *ATM             *FR, *ATM

                                Bottom
F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
F13=How to use this display  F24=More keys

```

Figure 8-8. Create Line Description (Example 1) Display 2 of 5

7. Here the adapter address is entered as *ADPT to use the burned-in address. To use a locally administered address, enter your own address in the 020000000000 to 7FFFFFFF hex range. See "Assigning a physical address" on page 2-3, "Token-ring physical address format" on page 3-3, and "Ethernet physical address format" on page 5-4 for additional information on LAN adapter addresses.
 8. Specify the Ethernet version that is appropriate for this line. In this example, use *ALL as the Ethernet standard.
 9. Specify the ATM access type as *SVC. This line will now use switched virtual circuits to connect with other devices. Permanent virtual circuits or direct connections are also valid choices. However, *DIRECT access type requires an NWI network type of *PVCONLY.
- Press the F10 key to show the additional parameters.

```

Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

Line description . . . . . > LALINE      Name
Resource name . . . . . > *NWID         Name, *NWID, *NWS
Online at IPL . . . . . *YES             *YES, *NO
Vary on wait . . . . . *NOWAIT         *NOWAIT, 15-180 seconds
Attached NWI . . . . . > LOSANGELES    Name, *NONE
NWI type . . . . . > *ATM             *FR, *ATM
Local adapter address . . . . . *ADPT     020000000000-7EFFFFFFF...
Exchange identifier . . . . . *SYSGEN     05600000-056FFFFF, *SYSGEN
Ethernet standard . . . . . *ALL         *ETHV2, *IEEE8023, *ALL
SSAP list:
  Source service access point . . . . . *SYSGEN 02-FE, *SYSGEN
  SSAP maximum frame . . . . .          *MAXFRAME, 265-1496, 265...
  SSAP type . . . . .                  *CALC, *NONSNA, *SNA, *HPR
  + for more values
ATM access type . . . . . *SVC         *SVC, *DIRECT, *PVC

F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
F13=How to use this display  F24=More keys

Bottom

```

Figure 8-9. Create Line Description (Example 1) Display 3 of 5

10. Specify *YES for the Use LECS field. The client uses the LAN emulation configuration server to obtain the ATM address of the appropriate LAN emulation server for its emulated LAN. However, this requires the services of a LAN emulation configuration server to be available somewhere within the ATM network. Press Page Down to show the next panel.

```

Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

Line description . . . . . > LALINE      Name
Resource name . . . . . > *NWID         Name, *NWID, *NWS
Online at IPL . . . . . *YES             *YES, *NO
Vary on wait . . . . . *NOWAIT         *NOWAIT, 15-180 seconds
Attached NWI . . . . . > LOSANGELES    Name, *NONE
NWI type . . . . . > *ATM             *FR, *ATM
Local adapter address . . . . . *ADPT     020000000000-7EFFFFFFF...
Exchange identifier . . . . . *SYSGEN     05600000-056FFFFF, *SYSGEN
Ethernet standard . . . . . *ALL         *ETHV2, *IEEE8023, *ALL
SSAP list:
  Source service access point . . . . . *SYSGEN 02-FE, *SYSGEN
  SSAP maximum frame . . . . .          *MAXFRAME, 265-1496, 265...
  SSAP type . . . . .                  *CALC, *NONSNA, *SNA, *HPR
  + for more values
ATM access type . . . . . *SVC         *SVC, *DIRECT, *PVC
Use LECS address . . . . . *YES         *YES, *NO

F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

More...

```

Figure 8-10. Create Line Description (Example 1) Display 4 of 5

11. No LES ATM address is required when you specify *YES for the Use LECS field. In this example, the LES ATM address is specified as *NONE.
 12. The emulated LAN name should be ETHERNET1. The LAN emulation client uses this value to request connection to the emulated LAN with this name. If the LAN emulation configuration server cannot find an emulated LAN by this name, it will determine any suitable substitute. It will direct the LEC to that LAN emulation server.
 13. Set the LEC disconnect time to 5 minutes and allow the LEC to free inactive connections after that period.
- Press the Enter key to create the line description.

Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

LES ATM address:

Network prefix	*NONE	
End system identifier	_____	Hexadecimal value
Selector byte	_____	Hexadecimal value
Emulated LAN name	ETHERNET1	
LEC disconnect time out	5	*NOMAX, 1-30 minutes
Text 'description'	Los Angeles Ethernet LAN Emulation Client	

Additional Parameters

Network controller	_____	Name
Group address	*NONE	010000000000-FDFFFFFFF...
	+ for more values	
Maximum controllers	40	1-256
Error threshold level	*OFF	*OFF, *MIN, *MED, *MAX

More...

F3=Exit F4=Prompt F5=Refresh F12=Cancel F13=How to use this display
F24=More keys

Figure 8-11. Create Line Description (Example 1) Display 5 of 5

Displaying the configuration objects (example 1)

You can display the network interface and line descriptions by using the Display Network Interface Description (DSPNWID) command, and the Display Line Description (DSPLIND) command.

1. Enter the Display Network Interface Description (DSPNWID) command to view the network interface.

```

                                Display Network Interface Description (ATM)
                                SYSNAMxx 11/21/97 12:20:01
Network interface description . . . : LOSANGELES
Category of NWI . . . . . : *ATM
Option . . . . . : *BASIC

Resource names . . . . . : CMN03
Online at IPL . . . . . : *YES
Vary on wait . . . . . : *NOWAIT
Network type . . . . . : *UNI30
Maximum PMP end systems . . . . . : 0
Switched virtual connections . . . . : 132
Network switch timeout . . . . . : 2
Physical layer options . . . . . : *NONE
Recovery limits:
  Count limit . . . . . : 2
  Time interval . . . . . : 5
Text . . . . . :

                                Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

```

Figure 8-12. Display NWI Description (Example 1) Display 1 of 2

```

                                Display Network Interface Description (ATM)
                                SYSNAMxx 11/21/97 12:20:01
Network interface description . . . : LOSANGELES
Category of NWI . . . . . : *ATM
Option . . . . . : *LINELIST
Attached lines . . . . . :

-----Attached lines-----
LALINE

                                Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

```

Figure 8-13. Display NWI Description (Example 1) Display 2 of 2

2. Enter the Display Line Description (DSPLIND) command to view the line description.

Note that the local adapter address contains a valid value, not *ADPT. When the line has been varied on, the actual adapter address that is used will be displayed in this field. The ATM address fields contain actual values after vary on, as well.

```

                                Display Line Description
                                11/21/97  12:17:21  SYSNAMxx
Line description . . . . . : LALINE
Option . . . . . : *BASIC
Category of line . . . . . : *ELAN

Resource name . . . . . : *NWID
Online at IPL . . . . . : *YES
Vary on wait . . . . . : *NOWAIT
Attached NWI . . . . . : LOSANGELES
NWI type . . . . . : *ATM
Local adapter address . . . . . : 002035E2412F
Exchange identifier . . . . . : 0563FD50
Ethernet standard . . . . . : *ALL
Maximum controllers . . . . . : 4
Generate test frame . . . . . : *YES
ATM access type . . . . . : *SVC
Use LECS address . . . . . : *YES

                                More...

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

```

Figure 8-14. Display Line Description (Example 1) Display 1 of 8

```

                                Display Line Description
                                11/21/97  12:17:21  SYSNAMxx
Line description . . . . . : LALINE
Option . . . . . : *BASIC
Category of line . . . . . : *ELAN

Local ATM address:
  Network prefix . . . . . : 47000580FFE1000000F21511FC
  End system identifier . . . . . : 002035E2412F
  LEC selector byte . . . . . : 03
LES ATM address:
  Network prefix . . . . . : 47000580FFE1000000F21511FC
  End system identifier . . . . . : 000077865A0E
  Selector byte . . . . . : 20
Last contacted LES ATM address:
  Network prefix . . . . . : 47000580FFE1000000F21511FC
  End system identifier . . . . . : 000077865A0E
  Selector byte . . . . . : 20
Emulated LAN name . . . . . : ETHERNET1

                                More...

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

```

Figure 8-15. Display Line Description (Example 1) Display 2 of 8

```

                                Display Line Description
                                11/21/97  SYSNAMxx 12:17:21
Line description . . . . . : LALINE
Option . . . . . : *BASIC
Category of line . . . . . : *ELAN

Reported emulated LAN name . . . . . : ETHERNET1
LEC disconnect time out . . . . . : 5
Maximum ARP entries . . . . . : 512
Text . . . . . : *BLANK

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel
                                Bottom

```

Figure 8-16. Display Line Description (Example 1) Display 3 of 8

```

                                Display Line Description
                                11/21/97  SYSNAMxx 12:17:21
Line description . . . . . : LALINE
Option . . . . . : *ACTSWCTL
Category of line . . . . . : *ELAN

-----Active Switched Controllers-----

(No active switched controllers attached)

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel
                                Bottom

```

Figure 8-17. Display Line Description (Example 1) Display 4 of 8

```

                                Display Line Description
                                11/21/97  12:17:21  SYSNAMxx
Line description . . . . . : LALINE
Option . . . . . : *SSAP
Category of line . . . . . : *ELAN

-----Source Service Access Points-----
SSAP      Maximum Frame  Type
04        *MAXFRAME     *SNA
12        *MAXFRAME     *NONSNA
AA        *MAXFRAME     *NONSNA
C8        *MAXFRAME     *HPR

-----Source Service Access Points-----
SSAP      Maximum Frame  Type

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

                                Bottom

```

Figure 8-18. Display Line Description (Example 1) Display 5 of 8

```

                                Display Line Description
                                11/21/97  12:17:21  SYSNAMxx
Line description . . . . . : LALINE
Option . . . . . : *GRPADR
Category of line . . . . . : *ELAN

-----Group Addresses-----

(No group addresses found)

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

                                Bottom

```

Figure 8-19. Display Line Description (Example 1) Display 6 of 8


```

                                Display Line Description
                                11/21/97  SYSNAMxx 12:17:21
Line description . . . . . : LALINE
Option . . . . . : *APPN
Category of line . . . . . : *ELAN

Link speed . . . . . : 10M
Cost/connect time . . . . . : 0
Cost/byte . . . . . : 0
Security for line . . . . . : *NONSECURE
Propagation delay . . . . . : *LAN
User-defined 1 . . . . . : 128
User-defined 2 . . . . . : 128
User-defined 3 . . . . . : 128
Autocreate controller . . . . . : *NO

                                Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

```

Figure 8-20. Display Line Description (Example 1) Display 7 of 8

```

                                Display Line Description
                                11/21/97  SYSNAMxx 12:17:21
Line description . . . . . : LALINE
Option . . . . . : *TMRRTY
Category of line . . . . . : *ELAN

LEC cache aging time . . . . . : 300
ARP retry timer . . . . . : 1
ARP retry count . . . . . : 1
Recovery limits:
  Count limit . . . . . : 2
  Time interval . . . . . : 5

                                Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

```

Figure 8-21. Display Line Description (Example 1) Display 8 of 8

At this point, ATM is configured and can be varied on. You now can attach controller descriptions to the line description, if the following conditions have been met:

- All attachments to an appropriate ATM switch have been made
- The switch is properly configured

Use the line descriptions as you would use any other token-ring or Ethernet line description.

Configuring an AS/400 token-ring LAN emulation client

This topic describes the configuration of a token-ring LAN emulation client on AS/400. The line description defines a single end device in the ATM network, as is shown in Figure 8-22. The LAN emulation client allows AS/400 to exchange data with any other LAN emulation client in the emulated LAN, as if it was a device in a token-ring LAN.

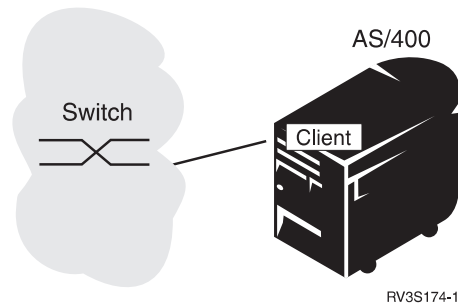


Figure 8-22. AS/400 16M LAN Emulation Client (Example 2)

Defining the network (example 2)

Again, this configuration will provide connection to an ATM network with a set of specific requirements.

- This system provides a test bench for new technology, so ATM should not be operational after an IPL sequence unless specifically varied on.
- Attach to an ATM switch by using the UNI 3.1 standard.
- Use switched virtual connections.
- Join a token-ring emulated LAN.
- Consider performance an impartation aspect of the planned testing. This means that the largest frame size possible should be used.
- The emulated LAN will have a minimum number of clients. However, since the test network will have ample resources, no limitation on the number of clients is necessary.
- The ATM test network is relatively small so minimum delays are expected between the system and the switch. Such a simple network does not require the services of a LECS.
- Use locally administered addresses to prevent confusion with production network addresses.
- Since this ATM network testing causes no contention for resources, an average amount of time should be allowed before the LEC drops inactive connections to other clients.

Creating the network interface (example 2)

1. To determine the correct resource name for the ATM port, enter the Work with Hardware Resource (WRKHDWRSC) command, with *CMN as the value, on the AS/400 Main Menu selection or command line. Figure 8-1 on page 8-2 shows the communication resources.
2. Enter the Create Network Interface ATM (CRTNWIATM) command. Press the Enter key. Figure 8-23 shows an example of this display.

```

                                Create NWI ATM (CRTNWIATM)

Type choices, press Enter.

Network interface description . _____ Name
Resource name . . . . . _____ Name
Online at IPL . . . . . *YES *YES, *NO
Vary on wait . . . . . *NOWAIT *NOWAIT, 15-180 seconds
Network type . . . . . *UNI30 *AUTO, *UNI30, *UNI31...
Text 'description' . . . . . *BLANK

_____

                                                                 Bottom
F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
F13=How to use this display  F24=More keys
Parameter NWID required.                                     +

```

Figure 8-23. Create NWI ATM (Example 2) Display 1 of 4

3. Enter an appropriate network interface description name.
4. Enter an appropriate ATM resource name.
5. Online at IPL should be *NO. A value of *NO requires the user or operator to specifically vary on the network interface.
6. Specify the network type as *UNI31.
Press F10 for additional parameters.

```

                                Create NWI ATM (CRTNWIATM)

Type choices, press Enter.

Network interface description . TESTSYS      Name
Resource name . . . . . CMN03      Name
Online at IPL . . . . . *NO      *YES, *NO
Vary on wait . . . . . *NOWAIT     *NOWAIT, 15-180 seconds
Network type . . . . . *UNI31      *AUTO, *UNI30, *UNI31...
Text 'description' . . . . . Test system ATM connection
_____

                                                                 Bottom
F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
F13=How to use this display  F24=More keys
Parameter NWID required.
+

```

Figure 8-24. Create NWI ATM (Example 2) Display 2 of 4

7. Leave the default for Maximum PMP end systems as zero.
 8. Accept the default for switched virtual connections as 516.
 9. Specify the amount of time (in minutes) for the network switch time-out. In this case the minimum of 1 minute is used.
 10. Leave the physical layer options as *NONE.
- Press Page Down to see the next panel.

```

                                Create NWI ATM (CRTNWIATM)

Type choices, press Enter.

Network interface description . > TESTSYS      Name
Resource name . . . . . > CMN03      Name
Online at IPL . . . . . *NO      *YES, *NO
Vary on wait . . . . . *NOWAIT     *NOWAIT, 15-180 seconds
Network type . . . . . *UNI31      *AUTO, *UNI30, *UNI31...
Text 'description' . . . . . > 'Test system ATM connection'
_____

                                Additional Parameters

Maximum PMP end systems . . . . 0      0-2048
Switched virtual connections . . 516  16-2064
Network switch timeout . . . . . 1      *NOMAX, 1-30 minutes
Physical layer options . . . . . *NONE  *NONE, 0000-FFFF
Attached lines . . . . . _____ Name
+ for more values _____

                                                                 More...
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

Figure 8-25. Create NWI ATM (Example 2) Display 3 of 4

11. Set the recovery limits to minimum values to eliminate retries and identify problems immediately.
12. The authority fields may be left as defaulted.

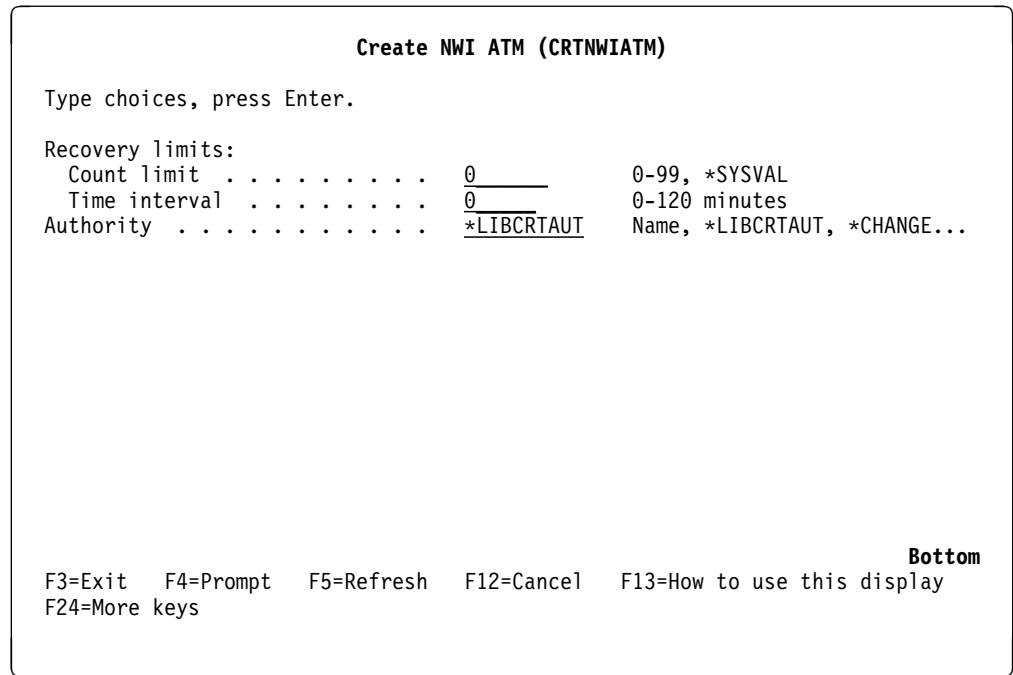


Figure 8-26. Create NWI ATM (Example 2) Display 4 of 4

After you press Enter, a message appears on the AS/400 Main Menu display that verifies that you created the network interface description properly.

Creating the line description (example 2)

Next, create the line description to define the LAN emulation client.

1. Enter the Create Line Description (Token-Ring) (CRTLINTRN) command to create the line description, and press Enter.
2. Enter an appropriate name for the line description.
3. Specify the resource name as *NWID and the NWI type as *ATM, and press Enter.

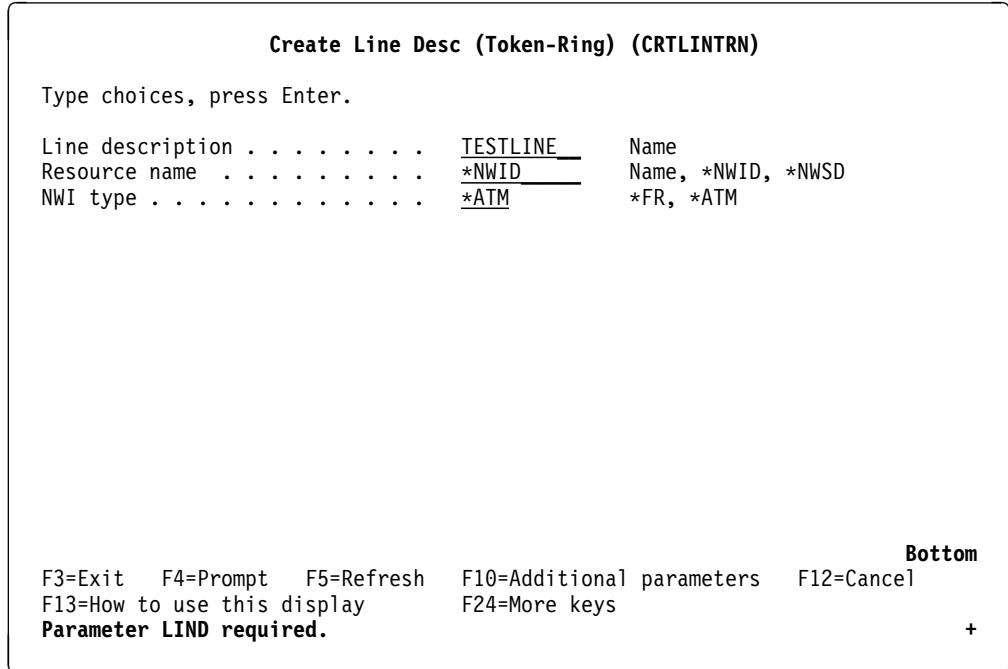


Figure 8-27. Create Line Description (Example 2) Display 1 of 4

4. Specify Online at IPL as *NO.
5. Enter the attached NWI name, which is the name of the network interface description that is created with the CRTNWIATM command (TESTSYS in this example.)
6. Because performance measurements will be made with this line, for maximum throughput, set the maximum frame size to the largest value that is allowed (16393).

Note: This value must be at least 20 bytes less than the specified LEC frame size.
7. Enter the LEC frame size. In this example, set the LEC frame size to the largest value that is allowed (18190).
8. Specify the adapter address as 4000000000FF for testing purposes.

Press Page Down to show the next page.

```

                                Create Line Desc (Token-Ring) (CRTLINTRN)

Type choices, press Enter.

Line description . . . . . > TESTLINE      Name
Resource name . . . . . > *NWID           Name, *NWID, *NWS
NWI type . . . . . > *ATM              *FR, *ATM
Online at IPL . . . . . *NO            *YES, *NO
Vary on wait . . . . . *NOWAIT        *NOWAIT, 15-180 seconds
Maximum controllers . . . . . 40        1-256
Attached NWI . . . . . TESTSYS       Name, *NONE
Maximum frame size . . . . . 16393    265-16393, 265, 521, 1033...
LEC frame size . . . . . 18190      1516, 4544, 9234, 18190
Local adapter address . . . . . 4000000000FF 400000000000-7FFFFFFF...
Exchange identifier . . . . . *SYSGEN  05600000-056FFFFF, *SYSGEN
SSAP list:
  Source service access point . *SYSGEN  02-FE, *SYSGEN
  SSAP maximum frame . . . . . _____ *MAXFRAME, 265-16393
  SSAP type . . . . . _____      *CALC, *NONSNA, *SNA, *HPR
                                + for more values
                                _____
                                More...

F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
F13=How to use this display  F24=More keys

```

Figure 8-28. Create Line Description (Example 2) Display 2 of 4

Page down to show the next screen.

9. Specify the ATM access type as *SVC.

Press F10 to show the additional parameters.

10. Specify *NO for the Use LECS field.

11. The LES ATM address is required when you specify *NO for the Use LECS field. Determine the correct LES ATM address by consulting the configuration of the LES to which this client will attach.

12. Here the emulated LAN name of TOKENRINGEMULATION has been used.

13. Leave the LEC disconnect time as the default (20 minutes).

Press Page Down to scroll to the next panel.

```

Create Line Desc (Token-Ring) (CRTLINTRN)

Type choices, press Enter.

ATM access type . . . . . *SVC          *SVC, *DIRECT, *PVC
Use LECS address . . . . . *NO           Character value
LES ATM address:
  Network prefix . . . . . 47000580FFE100000F21511FC
  End system identifier . . . . . 000077865A0E Hexadecimal value
  Selector byte . . . . . 23           Hexadecimal value
Emulated LAN name . . . . . TOKENRINGEMULATION
LEC disconnect time out . . . . . 20       *NOMAX, 1-30 minutes
Text 'description' . . . . . Test system token-ring LAN emulation client

-----

Additional Parameters

Network controller . . . . . _____ Name
Activate LAN manager . . . . . *YES       *YES, *NO
TRLAN manager logging level . . . . . *OFF     *OFF, *MIN, *MED, *MAX
                                                    More...

F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

Figure 8-29. Create Line Description (Example 2) Display 3 of 4

14. Press Enter to create the line description.

```

Create Line Desc (Token-Ring) (CRTLINTRN)

Type choices, press Enter.

TRLAN manager mode . . . . . *OBSERVING  *OBSERVING, *CONTROLLING
Log configuration changes . . . . . *LOG       *LOG, *NOLOG
Token-ring inform of beacon . . . . . *YES       *YES, *NO
Functional address . . . . . *NONE           *NONE, C00000000001...
      + for more values
Early token release . . . . . *LINESPEED  *YES, *NO, *LINESPEED
Error threshold level . . . . . *OFF       *OFF, *MIN, *MED, *MAX
Link speed . . . . . 16M           *MIN, 1200, 2400, 4800...
Cost/connect time . . . . . 0         0-255
Cost/byte . . . . . 0             0-255
Security for line . . . . . *NONSECURE  *NONSECURE, *PKTSWTNET...
Propagation delay . . . . . *LAN       *MIN, *LAN, *TELEPHONE...
User-defined 1 . . . . . 128       0-255
User-defined 2 . . . . . 128       0-255
User-defined 3 . . . . . 128       0-255
Autocreate controller . . . . . *NO     *YES, *NO
                                                    More...

F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

Figure 8-30. Create Line Description (Example 2) Display 4 of 4

Displaying the configuration objects (example 2)

You can display the network interface and line descriptions by using the Display Network Interface Description (DSPNWID) command, and the Display Line Description (DSPLIND) command.

1. Enter the Display Network Interface Description (DSPNWID) command to view the network interface.

```

                                Display Network Interface Description (ATM)
                                11/21/97  SYSNAMxx 12:20:01
Network interface description . . . : TESTSYS
Category of NWI . . . . . : *ATM
Option . . . . . : *BASIC

Resource names . . . . . : CMN03
Online at IPL . . . . . : *NO
Vary on wait . . . . . : *NOWAIT
Network type . . . . . : *UNI31
Maximum PMP end systems . . . . . : 0
Switched virtual connections . . . . . : 516
Network switch timeout . . . . . : 1
Physical layer options . . . . . : *NONE
Recovery limits:
  Count limit . . . . . : 0
  Time interval . . . . . : 0
Text . . . . . :

                                Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel
Already at bottom of area.
```

Figure 8-31. Display NWI Description (Example 2) Display 1 of 2

```

                                Display Network Interface Description (ATM)
                                11/21/97  SYSNAMxx 12:20:01
Network interface description . . . : TESTSYS
Category of NWI . . . . . : *ATM
Option . . . . . : *LINELIST
Attached lines . . . . . :

-----Attached lines-----
TESTLINE

                                Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel
```

Figure 8-32. Display NWI Description (Example 2) Display 2 of 2

2. Enter the Display Line Description (DSPLIND) command to view the line description.

```

                                Display Line Description
                                SYSNAMxx
                                11/21/97 10:30:52
Line description . . . . . : TESTLINE
Option . . . . . : *BASIC
Category of line . . . . . : *TRLAN

Resource name . . . . . : *NWID
Online at IPL . . . . . : *NO
Vary on wait . . . . . : *NOWAIT
Maximum controllers . . . . . : 40
Attached NWI . . . . . : TESTSYS
NWI type . . . . . : *ATM
Maximum frame size . . . . . : 16393
LEC frame size . . . . . : 18190
Local adapter address . . . . . : 4000000000FF
Exchange identifier . . . . . : 056FA170
ATM access type . . . . . : *SVC
Use LECS address . . . . . : *NO

                                More...

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel
```

Figure 8-33. Display Line Description (Example 2) Display 1 of 8

Note that in Figure 8-34 on page 8-25 the Local ATM address and the Last contacted LES ATM address display as *NONE. The local ATM address will be valid only while the line is varied on. The Last contacted LES ATM address will display a valid value only after the line has been varied on, and this client has successfully joined an emulated LAN.

```

                                Display Line Description
                                11/21/97  SYSNAMxx 10:30:52
Line description . . . . . : TESTLINE
Option . . . . . : *BASIC
Category of line . . . . . : *TRLAN

Local ATM address:
  Network prefix . . . . . : *NONE
LES ATM address:
  Network prefix . . . . . : 47000580FFE1000000F21511FC
  End system identifier . . . . . : 000077865A0E
  Selector byte . . . . . : 23
Last contacted LES ATM address:
  Network prefix . . . . . : *NONE
Emulated LAN name . . . . . : *NONE
LEC disconnect time out . . . . . : 20
Maximum ARP entries . . . . . : 512
Text . . . . . : *BLANK

                                Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

```

Figure 8-34. Display Line Description (Example 2) Display 2 of 8

```

                                Display Line Description
                                11/21/97  SYSNAMxx 12:18:33
Line description . . . . . : TESTLINE
Option . . . . . : *BASIC
Category of line . . . . . : *TRLAN

Emulated LAN name . . . . . : TESTLINE
LEC disconnect time out . . . . . : 20
MTU size . . . . . : 18190
Maximum ARP entries . . . . . : 512
Text . . . . . : *BLANK

                                Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

```

Figure 8-35. Display Line Description (Example 2) Display 3 of 8

```

                                Display Line Description
                                11/21/97 12:18:33  SYSNAMxx
Line description . . . . . : TESTLINE
Option . . . . . : *ACTSWTCTL
Category of line . . . . . : *TRLAN

-----Active Switched Controllers-----

(No active switched controllers attached)

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

Bottom

```

Figure 8-36. Display Line Description (Example 2) Display 4 of 8

```

                                Display Line Description
                                11/21/97 12:18:33  SYSNAMxx
Line description . . . . . : TESTLINE
Option . . . . . : *SSAP
Category of line . . . . . : *TRLAN

-----Source Service Access Points-----
SSAP      Maximum Frame  Type
04        *MAXFRAME      *SNA
12        *MAXFRAME      *NONSNA
AA        *MAXFRAME      *NONSNA
C8        *MAXFRAME      *HPR

-----Source Service Access Points-----

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

Bottom

```

Figure 8-37. Display Line Description (Example 2) Display 5 of 8

```

                                Display Line Description
                                11/21/97  SYSNAMxx 12:18:33
Line description . . . . . : TESTLINE
Option . . . . . : *APPN
Category of line . . . . . : *TRLAN

Link speed . . . . . : 16M
Cost/connect time . . . . . : 0
Cost/byte . . . . . : 0
Security for line . . . . . : *NONSECURE
Propagation delay . . . . . : *LAN
User-defined 1 . . . . . : 128
User-defined 2 . . . . . : 128
User-defined 3 . . . . . : 128
Autocreate controller . . . . . : *NO

                                Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

```

Figure 8-38. Display Line Description (Example 2) Display 6 of 8

```

                                Display Line Description
                                11/21/97  SYSNAMxx 12:18:33
Line description . . . . . : TESTLINE
Option . . . . . : *TMRRTY
Category of line . . . . . : *TRLAN

LEC cache aging time . . . . . : 300
ARP retry timer . . . . . : 1
ARP retry count . . . . . : 1
Recovery limits:
  Count limit . . . . . : 1
  Time interval . . . . . : 1

                                Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

```

Figure 8-39. Display Line Description (Example 2) Display 7 of 8

```

                                Display Line Description
                                SYSNAMxx
                                11/21/97 12:18:33
Line description . . . . . : TESTLINE
Option . . . . . : *FCNADR
Category of line . . . . . : *TRLAN

-----Functional Addresses-----

(No functional addresses found)

                                Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

```

Figure 8-40. Display Line Description (Example 2) Display 8 of 8

You have now completed configuring this LAN emulation client. At this point you may configure controller descriptions and attach them to this line description.

Configuring AS/400 Ethernet LAN emulation client with PVC

This topic describes the configuration of an Ethernet LAN emulation client on AS/400. The line description defines a single end device in the ATM network, as is shown in Figure 8-41. The LAN emulation client allows AS/400 to exchange data with any other LAN emulation client in the emulated LAN, as if it was a device in an Ethernet LAN.

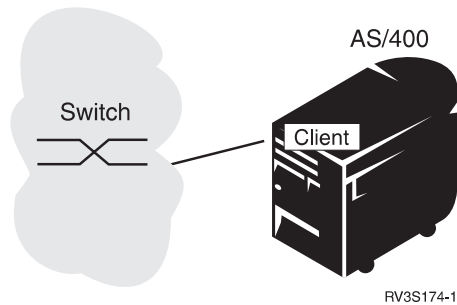


Figure 8-41. AS/400 Ethernet LAN Emulation Client (Example 4)

Defining the network (example 3)

This configuration example will create an ATM LAN emulation client with the following characteristics:

- ATM should function without intervention after an IPL sequence.
- Attach to an ATM switch but use permanent virtual circuits (PVCs.)
- The emulated LAN will have a maximum of 2 stations (or clients.)
- The ATM switch is located on the premises of the service provider.
- Use Ethernet LAN emulation supporting both Ethernet Version 2 and IEEE 802.3.
- The LAN emulation configuration server (LECS) is not required for PVC connections.
- The ATM network connects only two clients so this client should maintain any inactive connections.

Creating the network interface (example 3)

1. To determine the correct resource name for the ATM port, enter the Work with Hardware Resource (WRKHDWRSC) command, and *CMN as the value, on the AS/400 Main Menu selection or command line. Figure 8-1 on page 8-2 shows the communication resources.
2. Enter the Create Network Interface ATM (CRTNWIATM) command. Press the Enter key. Figure 8-42 shows an example of this display.

Create NWI ATM (CRTNWIATM)

Type choices, press Enter.

Network interface description .	_____	Name
Resource name	_____	Name
Online at IPL	<u>*YES</u>	*YES, *NO
Vary on wait	<u>*NOWAIT</u>	*NOWAIT, 15-180 seconds
Network type	<u>*UNI30</u>	*AUTO, *UNI30, *UNI31...
Text 'description'	<u>*BLANK</u>	

Bottom

F3=Exit F4=Prompt F5=Refresh F10=Additional parameters F12=Cancel
F13=How to use this display F24=More keys

Parameter NWID required. +

Figure 8-42. Create NWI ATM (Example 3) Display 1 of 4

3. Enter an appropriate network interface description name.
4. Enter an appropriate ATM resource name.
5. Accept the default for Online at IPL (*YES.)

6. Specify the network type as *PVCONLY.

Figure 8-43 shows an example of this display.

Press F10 for additional parameters.

```

                                Create NWI ATM (CRTNWIATM)

Type choices, press Enter.

Network interface description . PVCNWI      Name
Resource name . . . . . CMN03           Name
Online at IPL . . . . . *yes           *YES, *NO
Vary on wait . . . . . *NOWAIT        *NOWAIT, 15-180 seconds
Network type . . . . . *PVCONLY       *AUTO, *UNI30, *UNI31...
Text 'description' . . . . . PVC NWI

-----

F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
F13=How to use this display  F24=More keys
Parameter NWID required.
                                Bottom
                                +

```

Figure 8-43. Create NWI ATM (Example 3) Display 2 of 4

7. Specify the Maximum PMP end systems as zero.

8. Set the switched virtual connections to 16, the minimum.

9. For a network type of *PVCONLY the network switch time-out serves no function.

10. Leave the physical layer options as *NONE.

Page down to see remaining fields.


```

                                Create NWI ATM (CRTNWIATM)

Type choices, press Enter.

Network interface description . > PVCNWI      Name
Resource name . . . . . > CMN03      Name
Online at IPL . . . . . > *YES      *YES, *NO
Vary on wait . . . . . > *NOWAIT  *NOWAIT, 15-180 seconds
Network type . . . . . > *PVCONLY  *AUTO, *UNI30, *UNI31...
Text 'description' . . . . . > 'PVC NWI'

-----

                                Additional Parameters

Maximum PMP end systems . . . . 0      0-2048
Switched virtual connections . . 16     16-2064
Network switch timeout . . . . . 2      *NOMAX, 1-30 minutes
Physical layer options . . . . . *NONE  *NONE, 0000-FFFF
Attached lines . . . . . _____ Name
                                + for more values
                                _____

                                More...

F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

Figure 8-44. Create NWI ATM (Example 3) Display 3 of 4

11. The recovery limits and authority fields may be left as defaulted.

```

                                Create NWI ATM (CRTNWIATM)

Type choices, press Enter.

Recovery limits:
  Count limit . . . . . 2      0-99, *SYSVAL
  Time interval . . . . . 5     0-120 minutes
  Authority . . . . . *LIBCRTAUT Name, *LIBCRTAUT, *CHANGE...

                                Bottom

F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

Figure 8-45. Create NWI ATM (Example 3) Display 4 of 4

After you press Enter, a message appears on the AS/400 Main Menu display, which verifies that you created the network interface description properly.

Creating the line description (example 3)

Next, create the line description to define the LAN emulation client.

1. Enter the Create Line Description (Ethernet) (CRTLINETH) command to create the line description (in this case, an Ethernet client.) Press the Enter key.
2. Enter an appropriate name for the line description.
3. Specify the resource name as *NWID. Press the Enter key.

Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

Line description	<u>PVCLINE</u>	Name
Resource name	<u>*NWID</u>	Name, *NWID, *NWS

Bottom

F3=Exit F4=Prompt F5=Refresh F10=Additional parameters F12=Cancel
F13=How to use this display F24=More keys

Parameter LIND required. +

Figure 8-46. Create Line Description (Example 3) Display 1 of 6

4. Specify Online at IPL as *YES.
 5. Enter the attached NWI name, which is the name of the network interface description that was just created — PVCNWI.
 6. Specify the NWI type as *ATM.
- Press the Enter key to display the next set of parameters.

```

                                Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

Line description . . . . . > PVCLINE      Name
Resource name . . . . . > *NWID          Name, *NWID, *NWS
Online at IPL . . . . . *YES           *YES, *NO
Vary on wait . . . . . *NOWAIT       *NOWAIT, 15-180 seconds
Attached NWI . . . . . PVCNWI        Name, *NONE
NWI type . . . . . *ATM             *FR, *ATM

                                Bottom
F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
F13=How to use this display  F24=More keys

```

Figure 8-47. Create Line Description (Example 3) Display 2 of 6

7. Accept the default of *ADPT to use the burned-in address.
 8. Specify the Ethernet version as *ALL.
 9. Specify the ATM access type as *PVC. This line will now use permanent virtual circuits to connect with other devices. Permanent virtual circuits require specifying each path through the network by configuring each network switch that is traversed.
- Press the Enter key to show additional parameters and then press Page Down to see the next panel.

```

                                Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

Line description . . . . . > PVCLINE      Name
Resource name . . . . . > *NWID          Name, *NWID, *NWS
Online at IPL . . . . . > *NO           *YES, *NO
Vary on wait . . . . . > *NOWAIT       *NOWAIT, 15-180 seconds
Attached NWI . . . . . > PVCNWI        Name, *NONE
NWI type . . . . . > *ATM           *FR, *ATM
Local adapter address . . . . . *ADPT    020000000000-7EFFFFFFF...
Exchange identifier . . . . . *SYSGEN    05600000-056FFFF, *SYSGEN
Ethernet standard . . . . . *ALL       *ETHV2, *IEEE8023, *ALL
SSAP list:
  Source service access point . . . *SYSGEN 02-FE, *SYSGEN
  SSAP maximum frame . . . . . _____ *MAXFRAME, 265-1496, 265...
  SSAP type . . . . . _____ *CALC, *NONSNA, *SNA, *HPR
    + for more values
ATM access type . . . . . *PVC       *SVC, *DIRECT, *PVC

                                Bottom
F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
F13=How to use this display  F24=More keys

```

Figure 8-48. Create Line Description (Example 3) Display 3 of 6

10. Enter the virtual path identifier (VPI) and virtual circuit identifier (VCI) for this PVC. The VPI and VCI are determined as a result of configuring the network switch to which this AS/400 attaches.
Press F10 to show the remaining parameters.

```

                                Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

PVC identifiers:
  Virtual path identifier . . . 0          0-7
  Virtual circuit identifier . . 64         32-4095
  Text 'description' . . . . . PVC line
  _____

                                Bottom
F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
F13=How to use this display  F24=More keys

```

Figure 8-49. Create Line Description (Example 3) Display 4 of 6

11. Default values are acceptable for the remaining parameters.
Press the Enter key to create the line description.

```

Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

PVC identifiers:
  Virtual path identifier . . . > 0          0-7
  Virtual circuit identifier . . . > 64      32-4095
  Text 'description' . . . . . > 'PVC line'
-----

Additional Parameters

Network controller . . . . . _____ Name
Group address . . . . . *NONE_____ 010000000000-FDFFFFFFF...
+ for more values
Maximum controllers . . . . . 40_____ 1-256
Error threshold level . . . . . *OFF_____ *OFF, *MIN, *MED, *MAX
Generate test frame . . . . . *YES_____ *YES, *NO
Link speed . . . . . 10M_____ *MIN, 1200, 2400, 4800...
Cost/connect time . . . . . 0_____ 0-255

F3=Exit F4=Prompt F5=Refresh F12=Cancel F13=How to use this display
F24=More keys
More...

```

Figure 8-50. Create Line Description (Example 3) Display 5 of 6

```

Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

Cost/byte . . . . . 0_____ 0-255
Security for line . . . . . *NONSECURE_____ *NONSECURE, *PKTSWTNET...
Propagation delay . . . . . *LAN_____ *LAN, *MIN, *TELEPHONE...
User-defined 1 . . . . . 128_____ 0-255
User-defined 2 . . . . . 128_____ 0-255
User-defined 3 . . . . . 128_____ 0-255
Autocreate controller . . . . . *NO_____ *YES, *NO
Autodelete controller . . . . . 1440_____ 1-10000 (minutes), *NONE
Recovery limits:
  Count limit . . . . . 2_____ 0-99, *SYSVAL
  Time interval . . . . . 5_____ 0-120 minutes
Authority . . . . . *LIBCRTAUT_____ Name, *LIBCRTAUT, *CHANGE...

F3=Exit F4=Prompt F5=Refresh F12=Cancel F13=How to use this display
F24=More keys
Bottom

```

Figure 8-51. Create Line Description (Example 3) Display 6 of 6

Displaying the configuration objects (example 3)

Display the network interface and line descriptions by using the Display Network Interface Description (DSPNWID) command, and the Display Line Description (DSPLIND) command.

1. Enter the Display Network Interface Description (DSPNWID) command to view the network interface.

```
Display Network Interface Description (ATM)          SYSNAMxx
                                                    11/21/97 14:05:06
Network interface description . . . : PVCNWI
Category of NWI . . . . . : *ATM
Option . . . . . : *BASIC

Resource names . . . . . : CMN03
Online at IPL . . . . . : *YES
Vary on wait . . . . . : *NOWAIT
Network type . . . . . : *PVCONLY
Maximum PMP end systems . . . . . : 0
Switched virtual connections . . . . . : 16
Network switch timeout . . . . . : 2
Physical layer options . . . . . : *NONE
Recovery limits:
  Count limit . . . . . : 2
  Time interval . . . . . : 5
Text . . . . . : PVC NWI

                                                    Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel
```

Figure 8-52. Display NWI Description (Example 3) Display 1 of 2

```
Display Network Interface Description (ATM)          SYSNAMxx
                                                    11/21/97 14:05:06
Network interface description . . . : PVCNWI
Category of NWI . . . . . : *ATM
Option . . . . . : *LINELIST
Attached lines . . . . . :

-----Attached lines-----
PVCLINE

                                                    Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel
```

Figure 8-53. Display NWI Description (Example 3) Display 2 of 2

2. Enter the Display Line Description (DSPLIND) command to view the line description.

```

                                     Display Line Description
                                     SYSNAMxx
                                     11/21/97 14:05:28
Line description . . . . . : PVCLINE
Option . . . . . : *BASIC
Category of line . . . . . : *ELAN

Resource name . . . . . : *NWID
Online at IPL . . . . . : *YES
Vary on wait . . . . . : *NOWAIT
Attached NWI . . . . . : PVCNWI
NWI type . . . . . : *ATM
Local adapter address . . . . . : *ADPT
Exchange identifier . . . . . : 0563FD50
Ethernet standard . . . . . : *ALL
Maximum controllers . . . . . : 40
Generate test frame . . . . . : *YES
ATM access type . . . . . : *PVC
LEC frame size . . . . . : 1516

                                     More...

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel
```

Figure 8-54. Display Line Description (Example 3) Display 1 of 7

```

                                     Display Line Description
                                     SYSNAMxx
                                     11/21/97 14:05:28
Line description . . . . . : PVCLINE
Option . . . . . : *BASIC
Category of line . . . . . : *ELAN

PVC identifiers:
  Virtual path identifier . . . . . : 0
  Virtual circuit identifier . . . . . : 64
Text . . . . . : PVC line

                                     Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel
```

Figure 8-55. Display Line Description (Example 3) Display 2 of 7

```

                                Display Line Description
                                11/21/97 14:05:28  SYSNAMxx
Line description . . . . . : PVCLINE
Option . . . . . : *ACTSWCTL
Category of line . . . . . : *ELAN

-----Active Switched Controllers-----

(No active switched controllers attached)

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

                                Bottom

```

Figure 8-56. Display Line Description (Example 3) Display 3 of 7

```

                                Display Line Description
                                11/21/97 14:05:28  SYSNAMxx
Line description . . . . . : PVCLINE
Option . . . . . : *SSAP
Category of line . . . . . : *ELAN

-----Source Service Access Points-----
SSAP      Maximum Frame  Type
04         1496           *SNA
12         1496           *NONSNA
AA         1496           *NONSNA
C8         1496           *HPR

-----Source Service Access Points-----

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

                                Bottom

```

Figure 8-57. Display Line Description (Example 3) Display 4 of 7


```

                                Display Line Description
                                11/21/97  SYSNAMxx 14:05:28
Line description . . . . . : PVCLINE
Option . . . . . : *GRPADR
Category of line . . . . . : *ELAN

-----Group Addresses-----

(No group addresses found)

Press Enter to continue.
F3=Exit  F11=Display keywords  F12=Cancel

                                Bottom

```

Figure 8-58. Display Line Description (Example 3) Display 5 of 7

```

                                Display Line Description
                                11/21/97  SYSNAMxx 14:05:28
Line description . . . . . : PVCLINE
Option . . . . . : *APPN
Category of line . . . . . : *ELAN

Link speed . . . . . : 10M
Cost/connect time . . . . . : 0
Cost/byte . . . . . : 0
Security for line . . . . . : *NONSECURE
Propagation delay . . . . . : *LAN
User-defined 1 . . . . . : 128
User-defined 2 . . . . . : 128
User-defined 3 . . . . . : 128
Autocreate controller . . . . . : *NO

Press Enter to continue.
F3=Exit  F11=Display keywords  F12=Cancel

                                Bottom

```

Figure 8-59. Display Line Description (Example 3) Display 6 of 7

```

                                Display Line Description
                                11/21/97  SYSNAMxx 14:05:28
Line description . . . . . : PVCLINE
Option . . . . . : *TMRRTY
Category of line . . . . . : *ELAN

Recovery limits:
  Count limit . . . . . : 2
  Time interval . . . . . : 5

                                Bottom

Press Enter to continue.

F3=Exit  F11=Display keywords  F12=Cancel

```

Figure 8-60. Display Line Description (Example 3) Display 7 of 7

ATM is configured and can be varied on.

Frame-relay networks

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Chapter 9. Frame-relay networks

This chapter discusses the physical environment, frame formats, and configuration considerations for frame-relay networks.

Frame-relay physical environment

The equipment that is used to attach to a frame-relay network (such as an AS/400 system) is referred to as the terminal equipment (TE). A frame-relay network node is referred to as a frame handler (FH).

The connection from the TE to the FH is normally made through a data service unit (DSU) and channel service unit (CSU) pair. The DSU/CSU converts the TE physical interface to the FH interface that is used by the frame-relay network.

The AS/400 system supports three physical interface types for attachment to the DSU/CSU:

- EIA RS-449, CCITT V.36
- CCITT X.21
- CCITT V.35

The physical interface (INTERFACE parameter) and data transmission rate (LINESPEED parameter) are both specified using the CRTNWIFR command. The type of physical interface that is specified depends on the cable that is used. Table 9-1 and Table 9-2 on page 9-2 list the supported physical interfaces, cable lengths, NWI (network interface) clock parameters and the maximum data transmission speed available for each interface.

Physical Interface	Cable Length	NWI Clock Parameter	Maximum Data Transmission Rate
*RS-449	20 ft. (6.1 m)	*MODEM, *LOOP1	2048000 bps
	80 ft. (24.4 m)	*MODEM	64000 bps
		*LOOP1	2048000 bps
	150 ft. (45.7 m)	*MODEM	64000 bps
*LOOP1		2048000 bps	
*V.35	20 ft. (6.1 m)	*MODEM, *LOOP1	2048000 bps
	80 ft. (24.4 m)	*MODEM, *LOOP1	64000 bps
*X.21	20 ft. (6.1 m)	*MODEM	2048000 bps

Table 9-2. 2629-2699 and 2809-2721 High-Speed Communications IOP. (2629-2699 LAN/WAN/Workstation IOP—Two-Line WAN IOA and 2809-2721 PCI LAN/WAN/Workstation IOP—PCI Two-Line WAN IOA)

Physical Interface	Cable Length	NWI Clock Parameter	Maximum Data Transmission Rate
*RS-449	20 ft. (6.1 m)	*MODEM, *LOOP1, *INVERT	2048000 bps ²
	50 ft. (15.2 m)		
	80 ft. (24.4 m)		
	150 ft. (45.7 m) ³	*MODEM	64000 bps
	50 ft. (15.2 m)		
	80 ft. (24.4 m)		
*V.35	150 ft. (45.7 m) ³	*LOOP1	2048000 bps ²
	20 ft. (6.1 m)	*MODEM, *LOOP1, *INVERT	2048000 bps ²
	50 ft. (15.2 m)		
*X.21	80 ft. (24.4 m)	*MODEM, *LOOP1, *INVERT	64000 bps
	20 ft. (6.1 m)	*MODEM	2048000 bps ²
	50 ft. (15.2 m)	*MODEM, *INVERT	64000 bps

Notes:

1. *LOOP requires DCE support for looped clocking.
2. Data transmission rates greater than 512000 bps may require *LOOP or *INVERT clocking.
3. The 150 ft. (45.7 m) RS-449 cable is available only for the 2809-2721 PCI configuration.

On frame-relay-supported hardware, the value that is specified for the INTERFACE parameter must match the physical interface and cable that are attached to the IOA.

The CLOCK parameter on the CRTNWIFR command specifies the method by which the clocking function is provided for the network interface. Possible values are:

- *MODEM** The default value. The modem provides the clocking.
- *LOOP** Indicates that the data circuit-terminating equipment (DCE) received clock is looped back to the DCE on the data terminal equipment (DTE) transmit clock. This value can be used to improve high-speed data transmission, but is valid only if supported by the modem.
- *INVERT** The transmit clock provided by the modem DCE is inverted before use. Use this option when experiencing problems with high-speed data transmission, and the modem (DCE) does not support looped clocking. The valid interfaces for *INVERT are *X.21, *V.35, and *RS-449.

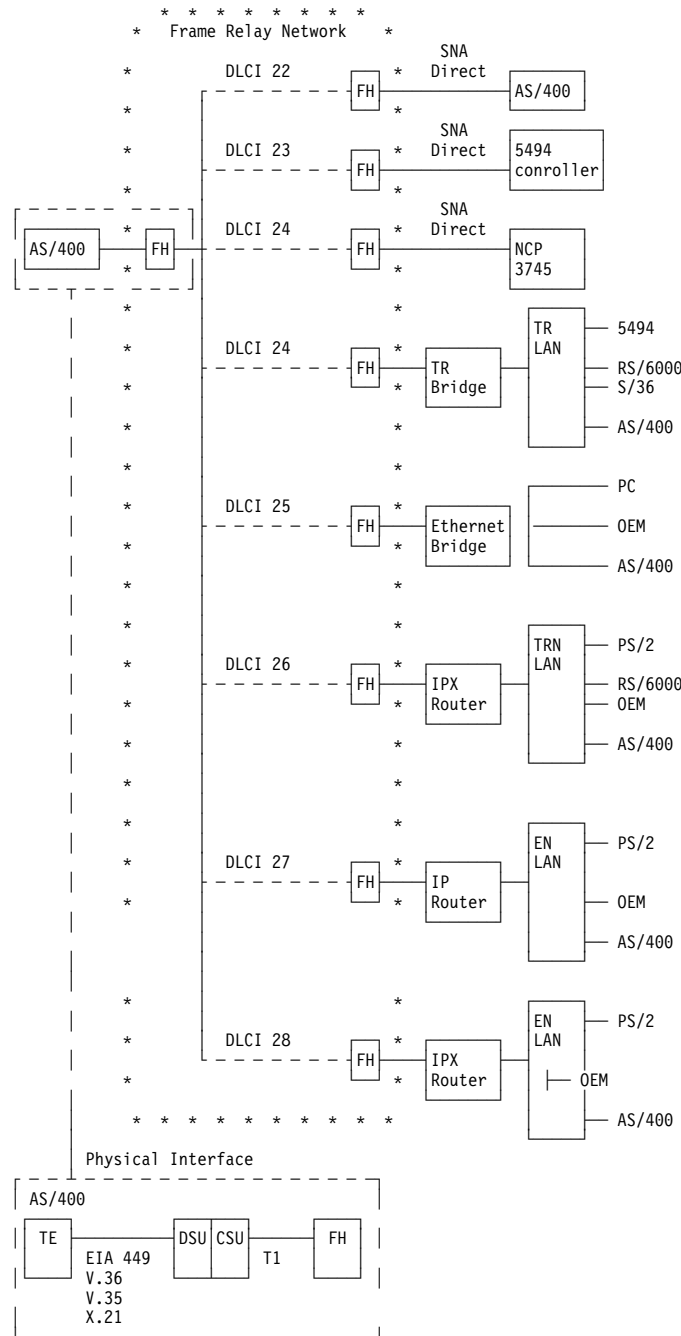


Figure 9-1. Example of a Frame-Relay Network

SNA direct configurations

The AS/400 system allows frame-relay connections to remote systems that support the SNA direct format that is defined by Frame-Relay Forum IA 3.1. In this format, SNA data is encapsulated within the frame-relay packets.

Figure 9-1 shows an example of SNA direct connections to a remote AS/400 system, a 5494 Remote Control Unit, and to a 3745 Communications Controller, on DLCIs 22, 23 and 24. The frame format used for SNA direct connections is described under "Frame-relay protocol headers and frame formats" on page 9-7.

For more information on configuring a 5494 Remote Control Unit in a frame-relay environment, see the *5494 Remote Control Unit User's Guide* and the *5494 Remote Control Unit Planning Guide*.

IP direct configurations

The AS/400 system allows frame-relay connections to remote systems that support the IP direct format that is defined by Frame-Relay Forum IA 3.1. In this format, TCP/IP data is encapsulated within the frame-relay packets.

Figure 9-1 on page 9-3 shows an example of an IP direct connection to a remote LAN on DLCI 27. The frame format used for IP direct connections is described under "Frame-relay protocol headers and frame formats" on page 9-7.

Internetwork Packet Exchange (IPX) direct configurations

The AS/400 system allows frame-relay connections to routers that support the IPX direct format that is defined by Frame-Relay Forum IA 3.1. In this format, IPX data is encapsulated within the frame-relay packets.

Figure 9-1 on page 9-3 shows an example of an IPX direct connection to a remote LAN on DLCI 26 and DLCI 28. The frame format that is used for IPX direct connections is described under "Frame-relay protocol headers and frame formats" on page 9-7.

For more information about IPX support, see the *Internetwork Packet Exchange (IPX) Support* book.

Bridged frame-relay configurations

The AS/400 system allows frame-relay connections to remote local area networks that support the bridged frame-relay formats as it is defined by Frame-Relay Forum IA 3.1. Bridges that support these formats include the IBM 6611 Network Processor and the RouteXpander/2.

Note: The AS/400 system can be used to bridge APPN networks, and the integrated frame-relay support may eliminate the need for a bridge between the AS/400 system and the frame-relay network. However, the AS/400 system does not provide a complete, integrated bridging function.

Bridged frame-relay connections support both SNA and TCP/IP data traffic by encapsulating the token-ring, Ethernet, or DDI frames within the frame-relay packet.

Figure 9-1 on page 9-3 shows an example of bridged frame-relay connections to remote systems on DLCIs 24, 25, and 26. The frame formats used for bridged frame-relay connections are described under "Frame-relay protocol headers and frame formats" on page 9-7.

Connecting systems without a frame-relay network

Frame-relay connections can be established without a frame-relay network, similar to the X.25 DTE-to-DTE mode. This type of configuration supports both SNA direct and bridged frame-relay formats.

For example, by configuring one of a pair of AS/400 systems as a frame handler (LMIMODE(*FH) on the network interface description) and the other as terminal equipment (LMIMODE(*TE)), the two systems can be connected using a modem

eliminator or a high-speed communications line. In this configuration, the system configured as the FH responds to LMI polls received from the TE and reports the status of PVCs configured on the FH system.

See “Local management interface (LMI)” on page 9-14 for more information about LMI modes.

Frame-relay configuration objects

The configuration objects used for frame-relay communications include the following:

Network Interface Description: The network interface description (NWI) defines the characteristics of the physical connection, including:

- The physical interface used
- LMI mode
- LMI timer and retry values
- DLCI numbers assigned to the virtual connections

One network interface description is created for each frame-relay port (IOP) by using the Create Network Interface Description (Frame Relay) (CRTNWIFR) command.

Line Descriptions: The line description defines the logical connection to the network. Up to 256 line descriptions can be attached to each frame-relay network interface. One line description must be created for each DLCI used. The following CL commands can be used to create line descriptions attached to frame-relay network interface descriptions:

CRTLINFR SNA direct connections to remote systems, such as the AS/400 system, 3745 Communications Controller, or other systems that support the SNA direct format

CRTLINTRN Bridged token-ring network connections

CRTLINDDI Bridged DDI network connections

CRTLINETH Bridged Ethernet network connections

Controller Descriptions: The controller description is used to define the remote system or controller. Up to 256 controller descriptions can be attached to each line description. However, the network interface description is limited to support of no more than 256 active controllers; controller descriptions are normally spread across a number of line descriptions. The following CL commands can be used to create controller descriptions for frame-relay communications:

CRTCTLAPPC

APPC controllers are used to represent systems that support APPC or APPN communications. AS/400 systems and personal computers are typically represented by APPC controllers.

CRTCTLHOST

SNA host controllers are used to represent controllers such as the 3745 controller running NCP.

The value specified for the LINKTYPE parameter on the controller description determines the type of line description to which the controller can be attached:

- Controller descriptions that specify LINKTYPE(*FR) can attach only to frame-relay line descriptions.
- Controller descriptions that specify LINKTYPE(*LAN) can attach to token-ring, DDI, or Ethernet lines.

Both APPC and SNA host controllers can be configured as APPN(*YES). If the controllers configured as APPN(*NO), APPC or SNA host device descriptions must also be created for each session that the remote system will support.

Figure 9-2 shows an example of objects configured for frame-relay communications, including the network interface, line descriptions (LINDs), and controller descriptions (CTLDs).

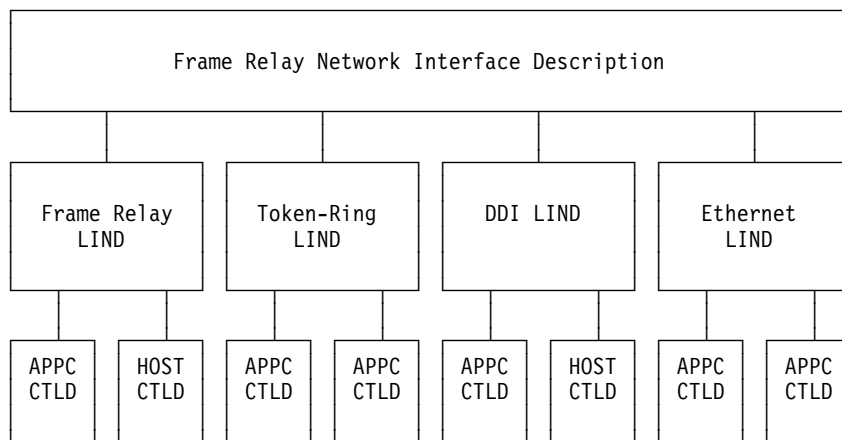


Figure 9-2. Example of Objects Configured for Frame-Relay Communications

Frame-relay addressing considerations

Frame-relay addressing is provided through data link connection identifiers and, for bridged connections, LAN adapter addresses.

Data link connection identifiers (DLCIs)

Data link connection identifiers (DLCIs) are used to identify the logical connections between nodes.

A single physical connection to the frame-relay network is used to support multiple logical, or virtual, connections. Each virtual connection, called a permanent virtual circuit (PVC), is identified by a DLCI number assigned by the frame-relay network. The AS/400 system supports up to 256 virtual circuits for each physical connection.

The DLCI number used to identify a virtual circuit is assigned by the frame-relay network provider, usually at subscription time. The DLCI number applies only to the connection between nodes (TE-to-FH or FH-to-FH). Figure 9-3 shows an example of DLCI assignments for a frame-relay connection.

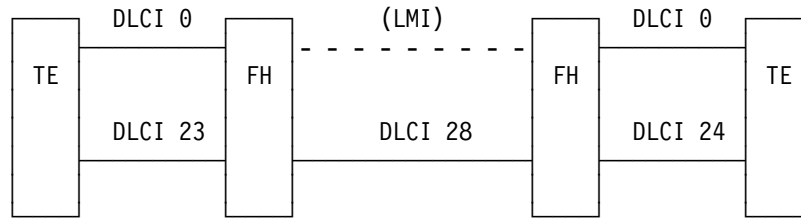


Figure 9-3. Example of DLCI Assignments for PVC Connections

DLCI values are configured for the AS/400 system by specifying the NWIDLCI parameter on the line description commands (for frame-relay and bridged LAN line descriptions) or by specifying the DLCI number and line description name on the the DLCI parameter of the CRTNWIFR command.

The AS/400 system uses DLCI 0 for the local management interface (LMI). This corresponds to the ANSI Annex-D standard. The LMI is used to manage the physical and virtual connections between the terminal equipment (TE) and the frame handler (FH). DLCIs 1 through 1018 can be used to identify logical connections to remote TEs.

See “Local management interface (LMI)” on page 9-14 for more information about the LMI.

Frame-relay adapter addresses

The frame-relay communications IOP is not given a preset (burned-in) adapter address. This address must be specified for the local adapter address (ADPTADR parameter) on token-ring, DDI, and Ethernet line descriptions used for bridged frame-relay connections. The frame-relay adapter address is configured the same as for locally attached LAN lines. The local adapter address is not required for SNA direct configurations.

The remote adapter address (ADPTADR parameter on the controller description) must be configured to match the adapter address of the remote system.

SNA direct frames do not include adapter addresses. The SNA direct frames do not need to be configured for frame-relay line descriptions or for controllers that specify LINKTYPE(*FR).

Frame-relay protocol headers and frame formats

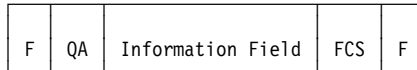
The frame-relay network routes frames through the network by examining the DLCI field and then routing the frame to an outgoing link. It is assumed that the network will deliver frames to the remote TE in the same sequence as they were provided to the network by the local TE.

At each node within the frame-relay network, the frame format and size are checked and the frame check sequence (FCS) is verified. If the frame is valid, the DLCI and FCS are replaced and the frame is routed to the next node. If the frame is invalid or damaged, it is discarded. The network node provides no error recovery.

The following topics describe the frame format used for frame-relay communications, including the various protocol headers used for SNA direct, IP direct, bridged LAN, address resolution protocol (ARP), and LMI frames.

Frame-relay core services (FRCS) frame format

Figure 9-4 shows the basic frame format used for frame-relay communications.



F = HDLC or Q.922 flag
 QA = HDLC or Q.922 address field (2 bytes)
 FCS = HDLC or Q.922 frame check sequence (2 bytes)

Figure 9-4. Frame-Relay Frame Format

The frame-relay core services (FRCS) portion of the frame is used to route the frame through the frame-relay network. The frame structure is based on the CCITT Q.922 protocol. Figure 9-5 shows the FRCS frame format and the fields within the 2-byte Q.922 address field (QA). The protocol headers used within the frame are described under “Frame-relay protocol headers and frame formats.”

DLCI0 = DLCI high order bits (6 bits)
 DLCI1 = DLCI low order bits (4 bits)
 C/R = Command/Response bit (not used)
 EA0/1 = Extended address indicators
 CC = Congestion control (3 bits)

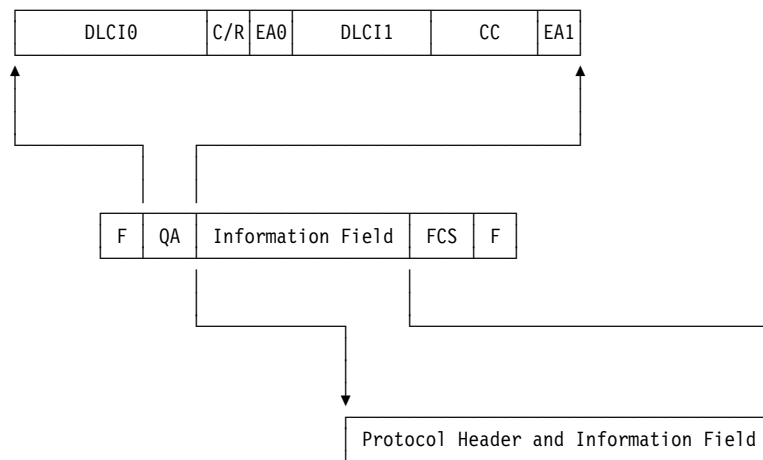


Figure 9-5. Frame Format for Frame-Relay Core Services (FRCS)

Frame-relay protocol headers and frame formats

Frame-relay protocol headers are used by the end nodes (TEs) to provide routing for frames, assure data integrity, and to perform recovery when frames are corrupted or lost. AS/400 frame-relay support uses protocol headers that is defined in *Frame-Relay Forum IA 3.1*.

Figure 9-6 shows the protocol header formats used by the AS/400 system for SNA direct, bridged LAN, and LMI connections. These headers and information fields (protocol data units or IP packets) are contained in the information field of the frame-relay core services frame (see “Frame-relay core services (FRCS) frame

format"). Table 9-3 on page 9-9 describes the protocol header fields shown in Figure 9-6.

SNA Direct Frame Format

C	NLPID	L2	L3	DSAP	SSAP	Ct1	Information Field (FID2 PDU)
---	-------	----	----	------	------	-----	------------------------------

IP Direct Frame Format

C	NLPID	IP Packet
---	-------	-----------

IPX Direct Frame Format

C	NLPID	OUI	PID	IP Packet
---	-------	-----	-----	-----------

High Performance Routing (HPR) Frame Format

C	NLPID	L2	L3	HPR Network Layer Protocol
---	-------	----	----	----------------------------

Bridged Token-Ring and DDI LAN Frame Format (Frame Relay Forum IA 3.1)

C	PAD	NLPID	OUI	PID	AC	FC	DA	SA	RI	DSAP	SSAP	Ct1	Information Field
---	-----	-------	-----	-----	----	----	----	----	----	------	------	-----	-------------------

Bridged IEEE 802.3 Ethernet LAN Frame Format (Frame Relay Forum IA 3.1)

C	PAD	NLPID	OUI	PID	AC	FC	DA	SA	Lth	DSAP	SSAP	Ct1	Information Field
---	-----	-------	-----	-----	----	----	----	----	-----	------	------	-----	-------------------

Bridged Ethernet Version 2 LAN Frame Format (Frame Relay Forum IA 3.1)

C	PAD	NLPID	OUI	PID	DA	SA	Type	Information Field
---	-----	-------	-----	-----	----	----	------	-------------------

LMI Messages Frame Format

C	PD	Null	Type	LMI Information Elements
---	----	------	------	--------------------------

Address Resolution Protocol (ARP) Format

C	NLPID	OUI	PID	ARP Packet
---	-------	-----	-----	------------

Figure 9-6. Formats for the Frame-Relay Protocol Header

Table 9-3 (Page 1 of 3). Format Fields for the Frame-Relay Protocol Header		
Field	Description	Values/Notes
C	Q.922 (HDLC) control field	
PAD	Pad characters	Pad characters (hex 00) are permitted between the control field and the NLPID field. Pad characters are used for boundary alignment.
NLPID	Network-level protocol identifier	08 CCITT Q.931 (SNA direct and HPR) 80 IEEE Subnetwork Access Protocol (SNAP) for bridged LAN connections CC Internet protocol (IP) direct.
PD	Protocol discriminator	LMI frames use hex 08
OUI	Organization-unique identifier	0080C2 IEEE 802.1 000000 ARP and IPX

Table 9-3 (Page 2 of 3). Format Fields for the Frame-Relay Protocol Header

Field	Description	Values/Notes
PID	Protocol identifier	<p>The AS/400 system supports the following formats not using frame check sequence (FCS):</p> <ul style="list-style-type: none"> 0007 Ethernet 0009 Token-ring network 000A DDI network 0806 ARP 8137 Internetwork Packet Exchange (IPX) <p>The AS/400 system provides receive-only support for the following formats using FCS:</p> <ul style="list-style-type: none"> 0001 Ethernet 0003 Token-ring network 0004 DDI network
L2	Layer 2 protocol	<p>For AS/400 systems using SNA direct connections, 4C80 is placed in the L2 field.</p> <p>Byte 1</p> <ul style="list-style-type: none"> 4C IEEE 802.2 (ISO 8802/2) 4E Q.922 (IDLC) 46 LAP-B (X.25) 4A HDLC NRM (SDLC) 51 ISO 7776 70 Without IEEE 802.2 (ISO 8802/2) header <p>Byte 2</p> <ul style="list-style-type: none"> 80 Undefined 81 MAC address included (IEEE 802.2, ISO 8802/2) or HDLC address included (ISO 7776)
L3	Layer 3 protocol	<p>For AS/400 systems using SNA direct connections, 7082 is placed in the L3 field.</p> <p>Byte 1</p> <ul style="list-style-type: none"> 66 CCITT X.25 67 ISO 8208 (X.25 PLC) 70 User-specified <p>Byte 2</p> <ul style="list-style-type: none"> 81 SNA subarea (FID4) 82 SNA peripheral (FID2) 83 APPN (FID2) 85 HPR Network Layer Protocol (FID5)
	Information field	<p>AS/400 support for SNA direct frame relay connections requires the information field to contain a FID2 protocol data unit (PDU).</p> <p>Information fields sent over bridged connections may contain FID2 PDUs or Internet Protocol (IP) packets.</p>

Table 9-3 (Page 3 of 3). Format Fields for the Frame-Relay Protocol Header

Field	Description	Values/Notes
Other Protocol Header Field Abbreviations:		
AC	Access control	
FC	Frame control	
DA	Destination address	
SA	Source address	
RI	Routing information	
Lth	Length	
Type	Ethernet type	
DSAP	Destination service access point	
SSAP	Source service access point	
Ctl	IEEE 802.2 control field	

Frame-relay frame size considerations

The frame-relay network provider will define and usually establish a tariff for the frame information field size provided. This size is referred to as N203. The N203 value is used to determine the value specified for the AS/400 maximum frame size (MAXFRAME parameter).

The MAXFRAME parameter specifies the maximum protocol data unit (PDU) that can be transmitted or received. The AS/400 system supports MAXFRAME values from 262 to 8192 bytes. The common N203 frame size that must be supported by all networks and attached equipment is 1600 bytes.

The MAXFRAME value configured must take into account the amount of overhead required for the various line types and their associated protocol headers. The length of these headers varies, depending on the type of frame-relay connection. For example, bridged connections typically require a longer header than that used for SNA direct since these headers must include source and destination adapter addresses. DDI and token-ring connections also include up to 18 bytes of routing information.

Table 9-4 shows the number of bytes required for the various frame-relay header types.

Table 9-4. Lengths for 802.2, Remote LAN, and Frame-Relay Headers

Connection Type and Protocol	802.2 LLC Header	Remote LAN Headers				Frame Relay Headers			Total Bytes
		RI	AC/AF	Type/Length	DA/SA	C/NLPID	OUI/PID	L2/L3	
SNA direct	4					2		4	10
IP direct						2			2
IPX direct						2			2
HPR						2		4	6
Bridged token-ring	4	18	2		12	3	5		44
Bridged DDI	4	18	2		12	3	5		44
Bridged IEEE 802.3	4			2	12	3	5		26
Bridged Ethernet V2				2	12	3	5		22

Abbreviations Used:

- RI** Routing information
- AC/FC** Access control (AC) and frame control (FC)
- DA/SA** Destination address (DA) and source address (SA)
- C/NLPID** Q.922 control field (C), Network Level Protocol Identifier (NLPID), and optional PAD
- OUI/PID** Organization Unique ID (OUI) and Protocol Identifier (PID)
- L2/L3** Layer 2 (L2) and Layer 3 (L3) Protocol

Figure 9-6 on page 9-9 shows the formats used by these protocol headers.

The MAXFRAME value configured for the line description should be equal to the N203 value subscribed to from the network minus the total length of the header for the connection type and protocol shown in Table 9-4. For example:

- If the N203 subscription is 1600 and you are configuring for SNA direct communications, the MAXFRAME value specified on the CRTLINFR command should be set to 1590 (1600 – 10 bytes).
- If the N203 subscription is 8192 and you are configuring a bridged frame relay connection to a token-ring network, the MAXFRAME value specified on the CRTLINTRN command should be set to 8148 (8192 – 44 bytes).

Additional MAXFRAME parameter considerations

The maximum frame size specified on the AS/400 system must be based on the following:

- N203 value (see “Frame-relay frame size considerations” on page 9-11)
- Maximum frame size supported by the protocol or connection type
- Maximum frame size supported by the remote station

The minimum of these values, minus the adjustment for the protocol header, is used to configure the MAXFRAME parameter for frame-relay connections.

Table 9-5 on page 9-13 shows the maximum frame size limits for supported connection types.

<i>Table 9-5. Maximum Frame Size Limits for Connection Types</i>	
Connection Type	Maximum Frame Size (MAXFRAME Parameter) Limits
SNA direct	8182
IP direct	8190 ¹
IPX direct	8190 ¹
HPR	8186 ¹
Bridged token-ring	8148
Bridged DDI	4444
Bridged Ethernet	1496 for ETHSTD(*IEEE8023) 1500 for non-SNA data using ETHSTD(*ETHV2) 1493 for SNA data using ETHSTD(*ETHV2)
¹ At this time, the largest value allowed for the MAXFRAME parameter on the CRTLINFR command is 8182.	

The maximum frame size used for a connection can be configured at several levels of the AS/400 configuration:

Line Description MAXFRAME Parameter

The maximum frame size used for an individual PVC (DLCI) is specified on the MAXFRAME parameter of the frame-relay, token-ring, or DDI line description.

The MAXFRAME parameter cannot be configured on Ethernet line descriptions. Ethernet LANs normally use a frame size of 1500 bytes. An N203 value of 1600 is recommended for Ethernet connections to accommodate the standard 1500-byte frame size. For an N203 value less than 1600, the maximum frame size must be configured on the line description SSAP parameter or on the controller description.

Line Description SSAP Parameter

The maximum frame size for an individual SSAP can be specified for the maximum frame size element of the line description SSAP parameter.

Controller Description MAXFRAME Parameter

Maximum frame size for connections to individual remote stations can be specified on the controller description MAXFRAME parameter.

The AS/400 system uses the smallest of the above values when selecting the maximum frame size used for connection to the remote station. For SNA connections, the frame size may also be negotiated downward based on the XID exchange with the remote station.

Frame-relay performance tuning parameters

APPC and SNA host controller descriptions allow specification of a group of LANxxxxxx parameters to provide performance tuning capabilities for both LAN and frame-relay connections. Because frame-relay networks operate at slower speeds than local area networks, it may be necessary to adjust some of these parameters when the controller description is used for frame-relay connections.

If *CALC (the default) is specified for the LANxxxxxx parameters, the AS/400 system will automatically use the values recommended for frame-relay connections. These values are adjusted to allow for network delays; they may be reduced when using a high speed network running at J1/T1/E1 speeds. Reducing these values allows quicker error detection but also reduces the time allowed for error recovery.

The values chosen by the system can be displayed by using the DSPCTLD command when the controller is active. Table 9-6 shows the values used for frame-relay connections when *CALC is specified for the LANxxxxxx parameters.

*Table 9-6. *CALC Values for Controller Description Performance Parameters*

Parameter	Function	*CALC Value
LANCNTMR	Sets wait time for polling remote station	20 seconds
LANCNRRTY	Sets number of poll retries sent to remote station	10
LANRSPTMR	Sets wait time for frame retransmission	20 seconds
LANFRMRTY	Sets number of frame retransmission attempts	10
LANACKTMR	Sets wait time for acknowledgement to remote station	1 second
LANACKFRQ	Sets number of frames received before sending acknowledgement	1
LANINACTMR	Sets wait time for requesting response from remote station	25 seconds
LANMAXOUT	Sets number of outstanding frames allowed before requesting acknowledgement from remote station	2
LANWDWSTP	Provides an alternative value equivalent to the LANMAXOUT parameter for use during periods of network congestion. The system provides an algorithm for returning the effective maximum outstanding frames value to that specified by the LANMAXOUT parameter as congestion subsides.	*NONE

Local management interface (LMI)

The local management interface (LMI) is used to exchange status information between the frame-relay network (or the frame handler system) and systems attached to the network (terminal equipment). The LMI uses DLCI 0 to provide verification of the physical connection and status for logical connections.

LMIMODE parameter

The LMIMODE parameter on the network interface description is used to specify the type of LMI exchange done by the AS/400 system. The AS/400 system can be configured as the terminal equipment (*TE), as the frame handler (*FH), or it can be configured to exchange no LMI information (*NONE).

Use the default value, LMIMODE(*TE), when connecting to a frame-relay network. When connection is made without a network (using a modem eliminator or non-switched line), the AS/400 system can be configured as a frame handler (LMIMODE(*FH)). In this configuration, the AS/400 system responds to LMI messages as an FH.

POLLITV and FULLINQITV parameters

The polling interval (POLLITV) and full inquiry interval (FULLINQITV) parameters are used to control the exchange of information over the LMI.

- The POLLITV parameter represents the frame-relay T391 timer. The POLLITV parameter sets the interval at which the TE sends a status inquiry message to the FH. POLLITV can be set to any value between 5 and 30 seconds; the default value is 10 seconds.
- The FULLINQITV parameter represents the frame-relay N391 count. The FULLINQITV parameter sets the interval at which the TE requests full status from the FH. The FULLINQITV parameter can be set to any value between 1 and 255 cycles; the default value is 6.

LMI exchanges

The POLLITV and FULLINQITV parameters are used to control the keep-alive and PVC status exchanges over the LMI.

Keep-alive exchange

The keep-alive exchange is used to maintain contact between the TE and FH. It consists of an exchange of sequenced messages.

At intervals specified by the POLLITV parameter, the TE sends Status Inquiry messages to the FH. The FH is expected to respond with a Status message that includes the correct sequence number (both Status Inquiry and Status messages include sequence numbers).

PVC status exchange

After the number of Status Inquiry messages specified by the FULLINQITV parameter have completed, the TE requests a full status from the FH. The FH responds with a Status message that includes a list of the PVCs (DLCIs) assigned to the physical connection and the status of each PVC.

You can use the Display Network Interface Description (DSPNWID) command to show the PVC status reported by the network (see Figure 9-7).

```

                                Display NWI Description (Frame Relay)
                                03/13/97  SYSNAMxx 15:35:50
Network interface description . . : FR1
Category of NWI . . . . . : *FR
Option . . . . . : *DLCIENTRY

Data link connection ID . . . . . :

   DLCI      Active or      DLCI
Number    Attached      Status
16          FR1ETH1    ACTIVE
17          FR1DDI1    ACTIVE
18          FR1DIR1    ACTIVE
19          FR1TRN1    AVAILABLE

                                                                    Bottom

Press Enter to continue.

F3=Exit  F5=Refresh  F11=Display keywords  F12=Cancel

```

Figure 9-7. Display NWI Description Display

Chapter 10. Frame-relay network configuration examples

This chapter provides examples of SNA direct and bridged frame-relay configurations.

SNA direct frame-relay configuration examples

This topic includes configuration examples of SNA direct connections. The examples include:

- Connecting two AS/400 systems over a frame-relay network
- Connecting two AS/400 systems using a modem eliminator
- Connecting an AS/400 system to a 3745 host controller over a frame-relay network

SNA direct connection of two AS/400 systems

In the example shown in Figure 10-1, an AS/400 system in Minneapolis is connected to an AS/400 system in Madison over a frame-relay network. The two systems have an APPN connection configured on the frame-relay DLCI. Note that the frame-relay link in Minneapolis has much more traffic and is operating at 1536000 bps. The link in Madison is operating at 64000 bps. The frame-relay network allows for this difference in subscriptions at the two sites.

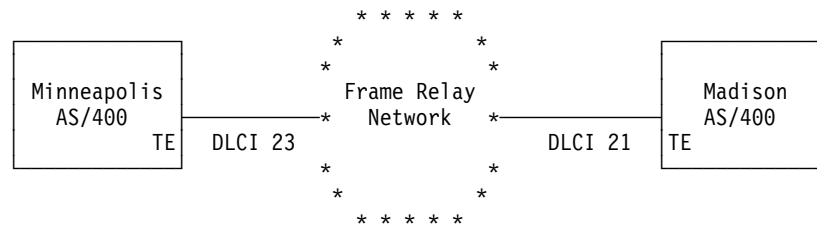


Figure 10-1. SNA Direct Connection between Minneapolis and Madison Systems

The Minneapolis connection to the network uses DLCI 23; in Madison, the DLCI number is 21. If a frame-relay network is being used, the DLCI numbers have only local (TE-to-FH) significance and may be different on the two interfaces. The network is responsible for setting up the connection between the DLCIs at administration time.

If more than one APPC connection is required between the two sites, additional SSAP and DSAP values would need to be defined on the lines, and the additional controllers would need different SSAP/DSAP combinations.

Configuration for the AS/400 system in Minneapolis

Figure 10-2 on page 10-2 shows the prompt display for the CRTNWIFR command used to create the network interface description on the Minneapolis system.

```

Create Network Interface Desc (CRTNWIFR)

Type choices, press Enter.

Network interface description . > FRMINNEAP Name
Resource name . . . . . > LIN211 Name
Online at IPL . . . . . > *YES *YES, *NO
Vary on wait . . . . . > *NOWAIT *NOWAIT, 15-180 (1 second)
Data link connection ID:
  DLCI number . . . . . *NONE 1-1018, *NONE
  Line description . . . . . Name
    + for more values
NRZI data encoding . . . . . *NO *NO, *YES
Physical interface . . . . . *RS449V36 1 *RS449V36, *V35, *X21
Clocking . . . . . *MODEM *MODEM, *LOOP, *INVERT
Line speed . . . . . 1536000 1 56000-2048000, 56000...
LMI mode . . . . . *TE 2 *TE, *FH, *NONE
Polling interval . . . . . 10 5-30
Full inquiry interval . . . . . 6 1-255

More...
F3=Exit F4=Prompt F5=Refresh F10=Additional parameters F12=Cancel
F13=How to use this display F24=More keys

```

```

Create Network Interface Desc (CRTNWIFR)

Type choices, press Enter.

Text 'description' . . . . . > 'Frame relay NWI at Minneapolis'

```

Figure 10-2. Prompt Display for Create Network Interface Description (Frame Relay)

- 1** The INTERFACE and LINESPEED parameter values must match the network subscription.
- 2** Specify LMIMODE(*TE) when communicating over a frame-relay network. The LMI uses DLCI 0.

Figure 10-3 on page 10-3 shows the prompt display for the CRTLINFR command used to create the frame-relay line description on the Minneapolis system.

```

Create Line Desc (FR) (CRTLINFR)

Type choices, press Enter.

Line description . . . . . > FRMADISON      Name
Attached nonswitched NWI . . . . . > FRMINNEAP  Name, *NONE
DLC identifier . . . . . > 23 1             1-1018, *NONE
Online at IPL . . . . . *YES                 *YES, *NO
Vary on wait . . . . . *NOWAIT              *NOWAIT, 15-180 (1 second)
Maximum controllers . . . . . 40             1-256
Maximum frame size . . . . . 1590 2         265-8182, 1590
Exchange identifier . . . . . > 05601300     05600000-056FFFFF, *SYSGEN
SSAP list:
  Source service access point . . *SYSGEN    02-FE, *SYSGEN
  SSAP maximum frame . . . . . *MAXFRAME, 265-8182
  SSAP type . . . . . *CALC, *NONSNA, *SNA
  + for more values
Text 'description' . . . . . > 'Frame relay DLCI to Madison Branch'

                                                    Bottom
F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
F13=How to use this display   F24=More keys

```

Figure 10-3. Prompt Display for Create Line Description (Frame Relay)

- 1** The DLCI specified for the line must match the network subscription.
- 2** The maximum frame size is 1600. Because ten bytes of overhead are needed for frame-relay SNA direct addresses, a frame size of 1590 is configured for the MAXFRAME parameter.

Figure 10-4 on page 10-4 shows the prompt display for the CRTCTLAPPC command used to create the APPC controller description on the Minneapolis system.

```

Create Ct1 Desc (APPC) (CRTCTLAPPC)

Type choices, press Enter.

Controller description . . . . . > FRMADISON      Name
Link type . . . . . > *FR 1                *ANYNW, *FAX, *FR, *IDLC...
Online at IPL . . . . . *YES                    *YES, *NO
APPN-capable . . . . . *YES                    *YES, *NO
Switched line list . . . . . > FRMADISON          Name
      + for more values
Maximum frame size . . . . . *LINKTYPE          265-16393, 256, 265, 512...
Remote network identifier . . . *NETATR        Name, *NETATR, *NONE, *ANY
Remote control point . . . . . > MADISON         Name, *ANY
Exchange identifier . . . . . > 05633966         00000000-FFFFFFF
Initial connection . . . . . *DIAL           *DIAL, *ANS
Dial initiation . . . . . *LINKTYPE          *LINKTYPE, *IMMED, *DELAY
APPN CP session support . . . . *YES            *YES, *NO
APPN node type . . . . . *ENDNODE           *ENDNODE, *LENNODE...
APPN transmission group number  1              1-20, *CALC
APPN minimum switched status . . *VRYONPND     *VRYONPND, *VRYON

                                                    More...
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

```

Create Ct1 Desc (APPC) (CRTCTLAPPC)

Type choices, press Enter.

Autocreate device . . . . . *ALL              *ALL, *NONE
Autodelete device . . . . . 1440             1-10000, *NO
User-defined 1 . . . . . *LIND               0-255, *LIND
User-defined 2 . . . . . *LIND               0-255, *LIND
User-defined 3 . . . . . *LIND               0-255, *LIND
Text 'description' . . . . . > 'APPN frame relay connection to Madison'

```

Figure 10-4. Prompt Display for Create Controller Description (APPC)

1 LINKTYPE(*FR) is specified for SNA direct connections.

Note: The default values for SSAP and DSAP are both 04. These values must match the remote system. If more controllers are to be created using the same line description (DLCI), they must specify a unique SSAP/DSAP pair. This may require more SAPs to be configured on the frame-relay line description.

Configuration for the AS/400 system in Madison

The following commands can be used to create the frame-relay configuration for the AS/400 system in Madison.


```

CRTNWIFR  NWID(FRMADISON) RSRNAME(LIN121) NRZI(*NO) INTERFACE(*RS449V36) +
          CLOCK(*MODEM) LINESPEED(64000) LMIMODE(*TE) +
          TEXT('Frame Relay NWI in Madison')

CRTLINFR  LIND(FRMINNEAP) NWI(FRMADISON) NWIDLCI(21) MAXFRAME(1590) +
          EXCHID(05633966) TEXT('Frame Relay DLCI to Minneapolis +
          Branch')

CRTCTLAPPC CTLD(FRMINNEAP) LINKTYPE(*FR) SWTLINLST(FRMINNEAP) +
          RMTCPNAME(MINNEAP) EXCHID(05601300) DSAP(04) SSAP(04) +
          TEXT('APPN Connection to Minneapolis Central Office')

CRTDEVAPPC DEVD(FRMINNEAP) RMTLOCNAME(MINNEAP) CTL(FRMINNEAP) +
          LOCADR(00) TEXT('APPC connection to AS/400 in Minneapolis')

```

Figure 10-5. Configuration for the Madison AS/400 System

SNA direct connection using a modem eliminator

The following example shows the configuration of two AS/400 systems for SNA direct frame-relay communications without a frame-relay network.

In the example that is shown in Figure 10-6, AS/400 system SYSTEM1 connects to AS/400 system SYSTEM2 through an X.21 modem eliminator. The modem eliminator operates at a speed of 1.536 Mbps. One data link connection identifier (DLCI) is defined between the two systems. Both SYSTEM1 and SYSTEM2 are defined as APPN end nodes. You must create the APPC controller descriptions, but the device descriptions creates automatically.

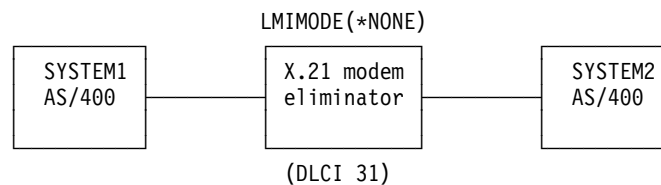


Figure 10-6. SNA Direct Connection Using a Modem Eliminator

Configuration for the SYSTEM1 system

Use the following commands to configure the SYSTEM1 AS/400 system.

```

CRTNWIFR  NWID(SYSTEM1) RSRNAME(LIN301) INTERFACE(*X21) 1 +
          LINESPEED(1536000) 1 LMIMODE(*NONE) 2 +
          TEXT('Frame relay connection through modem eliminator')

CRTLINFR  LIND(SYSTEM2FR) NWI(SYSTEM1) NWIDLCI(31) 3 MAXCTL(40) +
          MAXFRAME(1590) 4 EXCHID(05610441) LINKSPEED(1536000) 5 +
          TEXT('Frame Relay direct line to SYSTEM1')

CRTCTLAPPC CTLD(SYSTEM2FR) LINKTYPE(*FR) 6 APPN(*YES) +
          SWTLINLST(SYSTEM1FR) RMTNETID(*NETATR) +
          RMTCPNAME(SYSTEM1) EXCHID()5600033) DSAP(04) 7 SSAP(04) +
          TEXT('FR direct controller for SYSTEM1')

```

Figure 10-7. Configuration on SYSTEM1 System

- 1** The INTERFACE and LINESPEED parameter values must match modem eliminator.
- 2** LMIMODE is *NONE, meaning that the systems will not exchange LMI data. The LMI is not needed for attachments without a network.
- 3** The DLCI used for the line must match the DLCI configured on the remote system for this connection. If multiple lines are configured, all DLCIs must match the remote system.
- 4** The maximum frame size is 1600. Because ten bytes of overhead are needed for frame-relay SNA direct addresses, a frame size of 1590 is configured for the MAXFRAME parameter.
- 5** APPN link speed (LINKSPEED parameter) is set according to the speed specified on the NWI.
- 6** LINKTYPE(*FR) is specified for SNA direct connections.
- 7** SSAP is 04 and DSAP is 04. These values must match the values specified for the remote system. If more controllers are to be created using the same line description (DLCI), they must specify a unique SSAP/DSAP pair. This may require more SAPs to be configured on the frame-relay line description.

Configuration for the SYSTEM2 system

Use the following commands to configure the SYSTEM2 AS/400 system.

```

CRTNWIFR  NWID(SYSTEM2) RSRNAME(LIN291) +
           INTERFACE(*X21) LINESPEED(1536000) LMIMODE(*NONE) +
           TEXT('Frame Relay Interconnect through modem eliminator')

CRTLINFR  LIND(SYSTE1FR) NWI(SYSTEM2) NWIDLICI(31) MAXCTL(40) +
           MAXFRAME(1590) EXCHID(05600033) LINKSPEED(1536000) +
           TEXT('Frame Relay direct line to SYSTEM1')

CRTCTLAPP CTLD(SYSTE1FR) LINKTYPE(*FR) APPN(*YES) +
           SWTLINLST(STSTE1FR) RMTNETID(*NETATR) +
           RMTCPNAME(SYSTEM2) EXCHID(05610441) DSAP(04) SSAP(04) +
           TEXT('FR direct controller for SYSTEM2')

```

Figure 10-8. Configuration on SYSTEM2 System

SNA direct connection to host system

The following example shows the configuration of an AS/400 system for frame-relay communications with a 3745 Host Controller. As shown in Figure 10-9, the 3745 is providing frame-relay network (frame handler) function, and the AS/400 is configured as a TE.

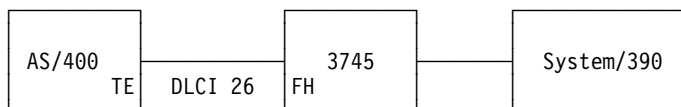


Figure 10-9. SNA Direct Connection to 3745 Host Controller

A 64000 bps V.35 line is between the AS/400 and the 3745. The AS/400 system may also have DLCI connections to multiple 3745s, 6611s, and RouteXpanders

through the 3745. However, these configurations are not shown as part of this example.

There is a single PVC connection between the AS/400 and the host system. This connection supports a 3270 emulation device used to access applications on the host. It also includes a distributed host command facility (DHCF) session.

Configuration for the AS/400 system

The following commands are used to configure the AS/400 system using an SNA direct connection with the 3745 and the host system.

```
CRTNWIFR    NWID(FR3745) RSRNAME(LIN121) +  
            INTERFACE(*V35) 1 LINESPEED(64000) 1 +  
            LMIMODE(*TE) 2 TEXT('Frame relay connection to 3745')  
  
CRTLINFR 3 LIND(FR3745) NWI(FR3745) NWIDLCI(26) 4 +  
            EXCHID(05636759) TEXT('DLCI connection to the host')  
  
CRTCTHHOST  CTLD(FRHOST) LINKTYPE(*FR) APPN(*NO) +  
            SWTLINLST(FR3745) MAXFRAME(8182) +  
            SSCPID(050000000001) SWTDSC(*YES) +  
            TEXT('Remote Host system')  
  
CRTDEVVSP   DEVD(FRDHCF) DEVCLS(*RMT) TYPE(3277) +  
            MODEL(*DHCF) LOCADR(02) CTL(FRHOST) +  
            TEXT('Remote host system dhcf device')  
  
CRTDEVHOST  DEVD(FREML) LOCADR(01) RMTLOCNAME(HOSTSYS) +  
            CTL(FRHOST) APPTYPE(*EML) +  
            TEXT('Emulation device to remote host')
```

Figure 10-10. Configuration for the AS/400 System

- 1** The INTERFACE and LINESPEED parameters must match the characteristics of the line to the 3745.
- 2** The LMI mode is *TE (the default), which means that the AS/400 acts as the terminal equipment. The 3745 must be configured as the frame handler (FH) using ANSI Annex D (DLCI 0).
- 3** By creating a frame-relay line description (CRTLINFR), you are indicating that the DLCI you are configuring is connected to another device. The device supports the frame-relay SNA direct frame format of RFC-1490, such as the 3745.
- 4** The DLCI used for the line must match the DLCI assigned in the configuration of the 3745.

Bridged frame-relay configuration examples

This topic includes configuration examples of bridged frame-relay connections. The examples include:

- Connecting an AS/400 system on a frame-relay network to systems on two remote token-ring networks. The 6611 Network Processor and PS/2-based RouteXpander/2 are used as bridges between the frame-relay network and the remote LANs.

- Connecting an AS/400 system to an Ethernet LAN using a 6611 Network Processor. The 6611 is used both as the frame-relay frame handler and as a bridge.

The configurations of the 6611 and the RouteXpander/2 are not included, but some general considerations for configuring them are provided.

Bridged connections to remote token-ring networks

The following examples show the configuration of an AS/400 system for frame-relay communications with devices on two different token-ring networks. One token-ring network is connected using a 6611 Network Processor as a bridge. The other is connected using a RouteXpander/2.

The T1 connection into the frame-relay network is configured using two DLCIs, each providing a link to one of the bridges. DLCI 32 defines a PVC to the RouteXpander/2 and DLCI 33 defines a PVC to the 6611. (See Figure 10-11.)

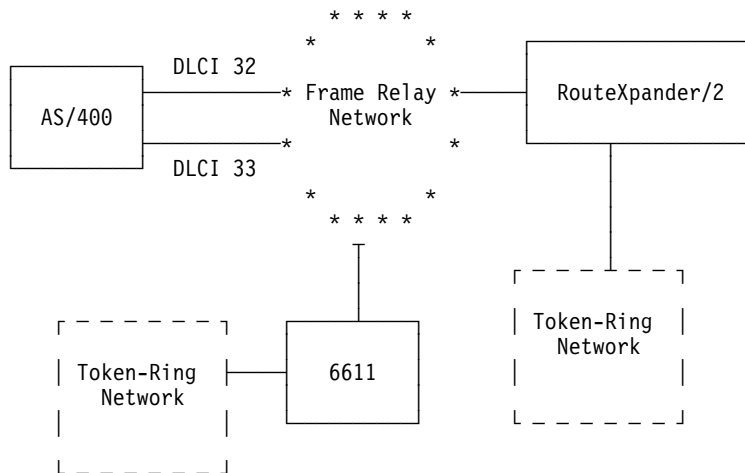


Figure 10-11. Bridged Connections to Remote Token-Ring Networks

The source route bridging protocol is implemented on both bridges in this configuration. Both SNA APPC/APPN and TCP/IP traffic are possible in these configurations. The TCP/IP configuration for lines ROUTE6611 and ROUTEEX is done similarly to the way all token-ring network lines are configured for TCP/IP on the AS/400 system.

Creating the frame-relay network interface description

The following command is used to configure the AS/400 system connection to the frame-relay network.

```
CRTNWIFR  NWID(FRMRLY)  RSRcname(LIN031)  INTERFACE(*RS449V36) 1 +
          LINESPEED(1536000) 1 LMIMODE(*TE) 2 +
          TEXT('T1 link to frame relay network')
```

Figure 10-12. Network Interface Description for Bridged LAN Connections

- 1** Values specified for the INTERFACE and LINESPEED parameters must match the frame-relay services supplied by the network provider.

- 2** LMI mode is *TE, which means that the AS/400 system exchanges information with the network on DLCI 0. If the network does not support the LMI on DLCI 0, then the LMIMODE parameter must be configured to *NONE, and the network provider must configure the frame-relay switch to not perform LMI functions on the line.

Bridged token-ring configuration through the 6611 network processor

The following commands are used to configure the AS/400 connection to a remote token-ring network through a 6611 Network Processor. This configuration can be used to communicate using either SNA or TCP/IP data.

```
CRTLINTRN 1 LIND(ROUTE6611) RSRNAME(*NWID) NWI(FRMRLY) +  
NWIDLCI(33) 2 LINESPEED(*NWI) MAXFRAME(8148) 3 +  
ADPTADR(400000036760) 4 EXCHID(05636760) +  
AUTOCTRL(*YES) 5 TEXT('DLCI to the 6611')
```

```
ADDCPIFC 6 INTNETADR('59.1.2.222') LIND(ROUTE6611)
```

```
CRTCTLAPP CTLD(PC3) LINKTYPE(*LAN) SWTLINLST(ROUTE6611) +  
RMTNETID(APPN) RMTCPNAME(PC3) ADPTADR(400000051718) +  
TEXT('PC3 on 6611 Token Ring Network')
```

```
CRTDEVAPP DEVD(PC3) RMTLOCNAME(PC3) LCLLOCNAME(SYS320) CTL(PC3) +  
TEXT('PC3 on 6611 Token Ring Network')
```

```
CRTCTLAPP CTLD(PC4) LINKTYPE(*LAN) SWTLINLST(ROUTE6611) +  
RMTNETID(APPN) RMTCPNAME(PC4) ADPTADR(400000564318) +  
TEXT('PC4 on 6611 Token Ring Network')
```

```
CRTDEVAPP DEVD(PC4) RMTLOCNAME(PC4) LCLLOCNAME(SYS320) CTL(PC4) +  
TEXT('PC4 on 6611 Token Ring Network')
```

Figure 10-13. Bridged Configuration through 6611 Network Processor

- 1** By creating a token-ring line (CRTLINTRN), you are indicating that the DLCI for which you are configuring connects to a token-ring bridge. The bridge provides RFC-1490 bridging and performs source route bridging.
- 2** The DLCI configured for the line must match that which is supplied by the network provider. At administration time, the network provider must establish a PVC connection to the location of the bridge. If more than one bridge is being connected, multiple DLCIs and token ring line descriptions need to be configured.
- 3** The MAXFRAME values for each line may be different. The values selected must take into account the maximum size supported by the network and the maximum size supported by the bridge. See "Frame-relay frame size considerations" on page 9-11 for information about determining a frame size to configure in the line descriptions.
- 4** An adapter address (ADPTADR) must be generated for each line description that is configured for bridging over frame-relay. The frame-relay adapter does not have a preset address.
- 5** AUTOCTRL is configured so that any devices that dial in to the AS/400 will have controller and device descriptions automatically created.

6 The ADDTCPIFC command is used to define a new interface to the TCP/IP configuration.

Note: If the 6611 Network Processor is used to pass TCP/IP data from a frame-relay network to a token-ring or Ethernet network, you must ensure that the 6611 does not filter data for SAP AA. Filtering for SAP AA must be turned off on both the frame-relay port and on the token-ring or Ethernet port.

Bridged token-ring configuration through RouteXpander/2

The following commands are used to configure the AS/400 connection to a remote token-ring network through a RouteXpander/2. This configuration can be used to communicate using either SNA or TCP/IP data.

```
CRTLINTRN LIND(ROUTEEX) RSRNAME(*NWID) NWI(FRMRLY) NWIDLCI(32) +
LINESPEED(*NWI) MAXFRAME(4052) ADPTADR(400000036759) +
EXCHID(05636759) AUTOCRTCTL(*YES) +
TEXT('DLCI to RouteXpander/2')

ADDTCPICF INTNETADR('59.1.2.211') LIND(ROUTEEX)

CRTCTLAPPC CTLD(PC1) LINKTYPE(*LAN) SWTLINLST(ROUTEEX) RMTNETID(RPC) +
RMTCPNAME(PC1) ADPTADR(400000049605) TEXT('PC1 on +
RouteXpander/2 Token Ring Network')

CRTDEVAPPC DEVD(PC1) RMTLOCNAME(PC1) LCLLOCNAME(SYS320) CTL(PC1) +
TEXT('PC1 on RouteXpander/2 Token Ring Network')

CRTCTLAPPC CTLD(PC2) LINKTYPE(*LAN) SWTLINLST(ROUTEEX) RMTNETID(RPC) +
RMTCPNAME(PC2) ADPTADR(400000047605) TEXT('PC2 on +
RouteXpander/2 Token Ring Network')

CRTDEVAPPC DEVD(PC2) RMTLOCNAME(PC2) LCLLOCNAME(SYS320) CTL(PC2) +
TEXT('PC2 on RouteXpander/2 Token Ring Network')
```

Figure 10-14. Bridged Configuration through RouteXpander/2.

Bridged connection to an Ethernet network

The following example shows the configuration of an AS/400 system for frame-relay communications with devices on an Ethernet network. The Ethernet LAN is connected using a 6611 bridge and transparent bridging. The bridge is connected to the AS/400 using a T1 link.

As shown in Figure 10-15, no frame-relay network exists in the connection between the AS/400 and the 6611. In this example, the AS/400 is providing the frame handler (FH), or DCE function; the 6611 bridge is the terminal equipment (TE). Both SNA APPC/APPN and TCP/IP traffic are possible in this configuration. The TCP/IP configuration for line ETHER6611 is done similarly to the way all Ethernet lines are configured for TCP/IP on the AS/400.

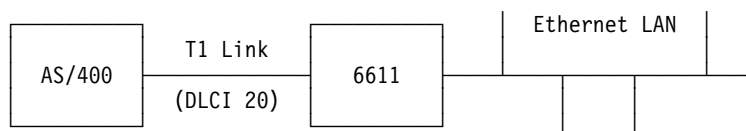


Figure 10-15. Bridged Configuration to the Ethernet Network

Bridged configuration to the Ethernet network

The following commands are used to configure the AS/400 connection to the Ethernet network through a 6611 Network Processor. This configuration can be used to communicate using either SNA or TCP/IP data.

```
CRTNWIFR    NWID(FRT1) RSRNAME(LIN231) NRZI(*YES) 1 +
            INTERFACE(*RS449V36) 2 LINESPEED(1536000) 2 +
            LMIMODE(*FH) 3 +
            TEXT('Network Interface for T1 link to Ethernet Bridge')

CRTLINETH 4 LIND(ETHER6611) RSRNAME(*NWID) NWI(FRT1)
            NWIDLDCI(20) 5 ADPTADR(020000036759) 6 +
            EXCHID(05636759) LINKSPEED(1536000) AUTOCRTCTL(*YES) 7 +
            TEXT('DLCI to the 6611 Ethernet LAN')

ADDTCPIFC 8 INTNETADR('59.1.2.201') LIND(ETHER6611)

CRTCTLAPPC  CTLD(PC5) LINKTYPE(*LAN) SWTLINLST(ETHER6611) RMTNETID(RPC) +
            RMTCPNAME(PC5) ADPTADR(020000043405) TEXT('PC5 on +
            6611 Ethernet Network')

CRTDEVAPPC  DEVD(PC5) RMTLOCNAME(PC5) LCLLOCNAME(SYS320) CTL(PC5) +
            TEXT('PC5 on 6611 Ethernet Network')

CRTCTLAPPC  CTLD(PC6) LINKTYPE(*LAN) SWTLINLST(ETHER6611) RMTNETID(RPC) +
            RMTCPNAME(PC6) ADPTADR(400000455405) TEXT('PC6 on +
            6611 Ethernet Network')

CRTDEVAPPC  DEVD(PC6) RMTLOCNAME(PC6) LCLLOCNAME(SYS320) CTL(PC6) +
            TEXT('PC6 on 6611 Ethernet Network')
```

Figure 10-16. Bridged Configuration to the Ethernet Network

- 1 NRZI(*YES) must be configured when communicating directly with a 6611 without a frame-relay network (such as on a T1 link). The 6611 must also be configured to use NRZI.
 - 2 The INTERFACE and LINESPEED parameters must match the characteristics of the T1 line being used.
 - 3 The LMI mode is *FH, which means that the AS/400 acts as the frame handler and the 6611 acts as the terminal equipment. LMI is exchanged on DLCI 0.
 - 4 By creating an Ethernet line (CRTLINETH), you are indicating that the DLCI for which you are configuring connects to an Ethernet bridge. The Ethernet bridge has implemented RFC-1490 bridging and performs transparent bridging.
 - 5 The AS/400 system is communicating with the 6611 bridge on DLCI 20.
- Note:** If the 6611 Network Processor is used to pass TCP/IP data from a frame-relay network to a token-ring or Ethernet network, you must ensure that the 6611 does not filter data for SAP AA. Filtering for SAP AA must be turned off on both the frame-relay port and on the token-ring or Ethernet port.

- 6** An adapter address (ADPTADR) must be generated for each line description that is configured for bridging over frame relay. The frame-relay adapter does not have a preset address.
- 7** AUTOCRCTL is configured so that any devices that dial in to the AS/400 will have controller and device descriptions automatically created.
- 8** The ADDTCPIFC command is used to define a new interface to the TCP/IP configuration.

Wireless networks

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Chapter 11. Wireless IOP LANs

This chapter describes the wireless network physical environment and general considerations for configuring a wireless network.

Wireless network physical environment

Wireless communications is based on the propagation of radio waves between a base, or access point, and wireless workstations. The area in which wireless communications takes place, called a **cell**, can be understood as a sphere, with the access point typically at its center. The actual location of the access point in relation to the cell, and the shape of the cell itself, is dependent on a number of factors:

- Antenna type (omni-directional or directional radiation pattern)
- Antenna location with respect to surfaces that either absorb or reflect radio waves
- Surfaces within the cell that either absorb or reflect radio waves
- Radio frequency noise

There are two types of wireless networks:

Single Cell Network

In a single cell network, wireless devices communicate with the AS/400 system (or an external access point connected to the AS/400 system) within a single cell. The wireless devices can be stationary or mobile, but must remain within the area of the cell.

Figure 11-1 shows an example of a single cell wireless network.

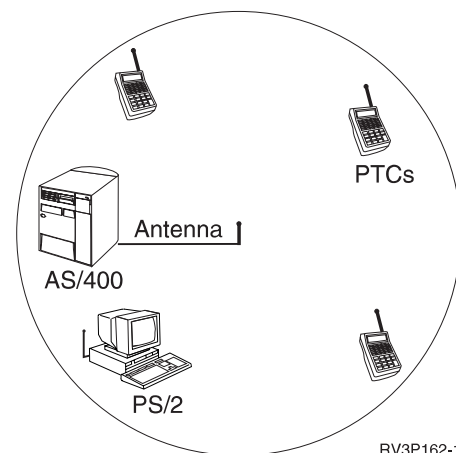


Figure 11-1. Example of a Single-Cell Wireless Network

Multiple Cell Network

A multiple cell network consists of a number of cells, each containing an access point, with each access point able to communicate with one or more other cells. In this configuration, data is transmitted from a wireless device to an access point, then routed, possibly through a number of other access points, to the

AS/400 system. Multiple cell networks allow mobile users to move from the area of one cell to another while maintaining communications with the base.

Figure 11-2 shows an example of a multiple cell wireless network using an AS/400 system and three 2480 Model RS Access Points. Two of the access points communicate with the AS/400 system using a wired RS-485 bus; the third uses a radio frequency connection to the AS/400 system.

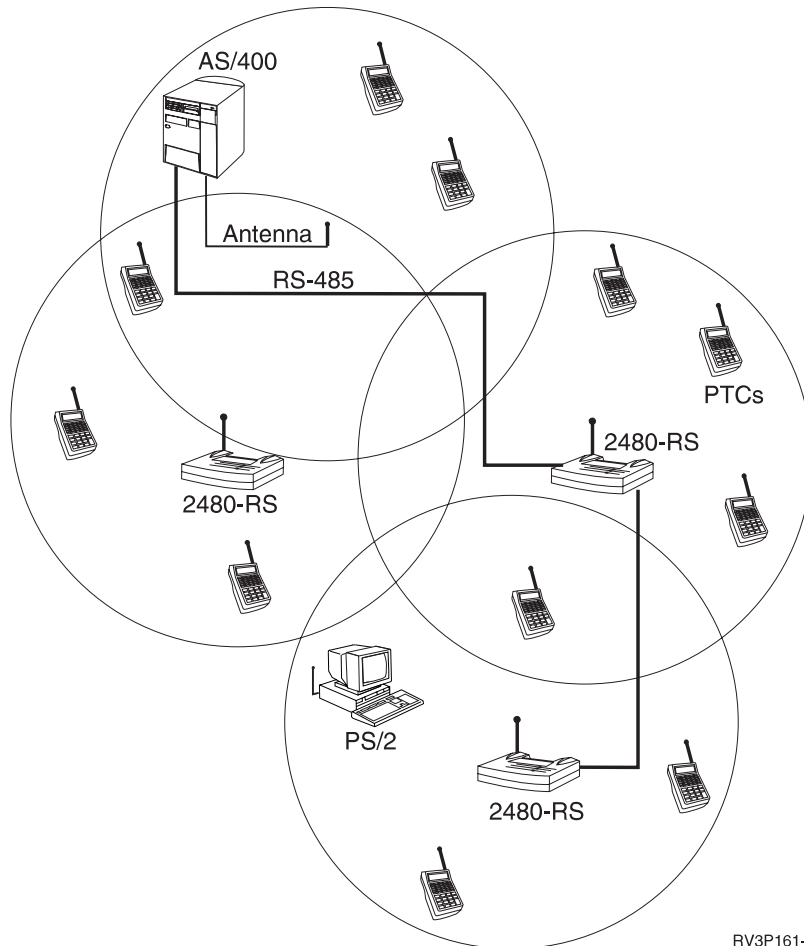


Figure 11-2. Example of a Multiple-Cell Wireless Network

AS/400 wireless LAN adapter

The 2668 Wireless LAN Adapter includes a coaxial connector used to attach an antenna cable for radio frequency communications and an RS-485 port for wired connections to external access points. The adapter can be configured to use wired, radio frequency, or both wired and radio frequency communications. Each 2668 adapter is packaged with a 2663 Input/Output Attachment Processor.

The wireless adapter can be configured to use a data rate of 1 Mbps or 2 Mbps. This data rate is shared among all active network nodes.

Wireless network site survey

Before the wireless network is installed, a site survey must be performed. The site survey is used to determine the characteristics of the area in which the network will operate, what equipment is necessary, and where the equipment (such as access points) will be located.

See the *IBM AS/400 Wireless LAN Installation and Planning Guide*, G571-0303, for more information about wireless network concepts.

Wireless network configuration

Two types of wireless network configuration are used by the AS/400 system.

- 5250 emulation sessions (LU7 data) for portable transaction computers (PTCs)
- LAN connections to PS/2 and AS/400 systems

Both types of connections can be configured and run concurrently.

Figure 11-3 on page 11-4 shows the commands used to configure PTC- and LAN-type connections. See “Wireless configuration objects” for more information about these commands.

Wireless configuration objects

The objects used to configure wireless networks include line, controller, and device descriptions and a set of extended configuration objects. The following list provides a brief explanation of the function of each configuration object and the name of the CL command used to create the object.

Objects used for both LAN and PTC configurations

Wireless Line Description (CRTLINWLS)

Specifies characteristics of the wireless LAN, including the resource name of the 2668 wireless adapter and the names of the source file and member used to store configuration data for the wireless adapter.

Extended Wireless Line Member (ADDEWLM)

Specifies the adapter configuration, radio frequency, data rate, and addressing information for the wireless adapter.

Objects used for PTC configurations only

Local Work Station Controller Description (CRTCTLLWS)

Specifies the resource name of the 266A virtual controller and the source file and member used to store configuration data for PTC connections. The 266A virtual workstation controller represents the 5250 emulation function of the 2668 adapter.

Extended Wireless Controller Member (ADDEWCM)

Specifies the destination ID of the wireless adapter.

Extended Wireless Controller PTC Entry (ADDEWCPTCE)

Specifies the characteristics of a group of PTCs, including display characteristics and addressing information.

Extended Wireless Controller Bar Code Entry (ADDEWCBCDE)

Specifies the bar code scanning characteristics of PTCs included in the bar code group.

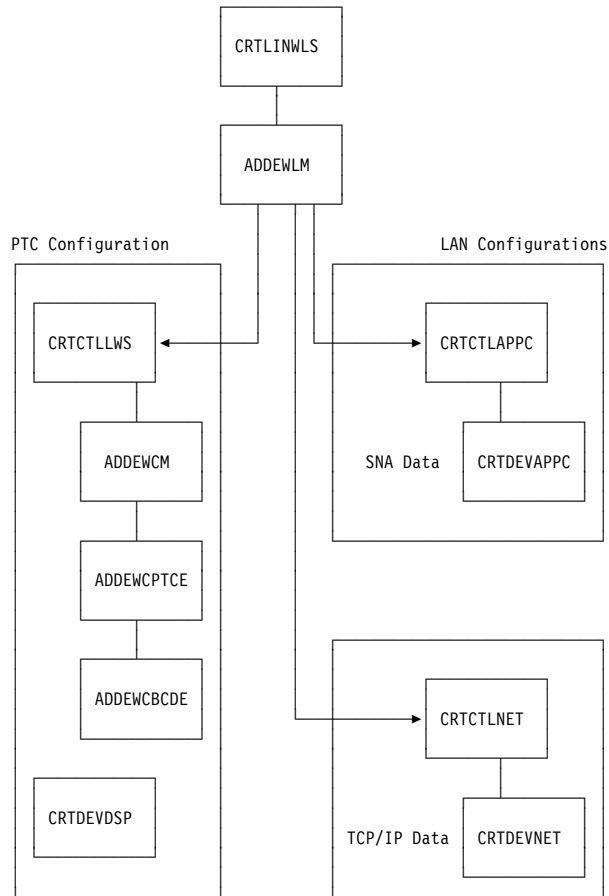


Figure 11-3. Commands Used for PTC and LAN Wireless Configurations

Display Device Description (CRTDEVDSP)

Device descriptions are automatically created for PTCs when communications is established with the wireless adapter. The device descriptions appear as 3476 display devices locally attached to the 266A virtual controller.

In addition to the commands listed above, configuration for LAN (non-PTC) connections use the same APPC and network controller and device descriptions used for wired networks. See Ethernet networks for more information about using these objects.

Extended configuration objects

The following are considered *extended configuration* objects:

- Extended Wireless Line Member
- Extended Wireless Controller Member
- Extended Wireless Controller PTC Entry
- Extended Wireless Controller Bar Code Entry

Configuration data contained in these objects is downloaded to the wireless adapter when the AS/400 line and controller descriptions are varied on. See “Downloading configuration data to the wireless adapter” on page 11-8 for more information.

Wireless configuration CL command summary

The following is a summary of the CL commands used to configure wireless networks. Controller and device descriptions used for LAN-type connections are not included in this list.

CRTLINWLS Create Line Description (Wireless)
CHGLINWLS Change Line Description (Wireless)
DSPLIND Display Line Description
ADDEWLM Add Extended Wireless Line Member
CHGEWLM Change Extended Wireless Line Member
DSPEWLM Display Extended Wireless Line Member
CRTCTLLWS Create Controller Description (Local Work Station)
CHGCTLLWS Change Controller Description (Local Work Station)
DSPCTLD Display Controller Description
ADDEWCM Add Extended Wireless Controller Member
CHGEWCM Change Extended Wireless Controller Member
DSPEWCM Display Extended Wireless Controller Member
ADDEWCPTCE Add Extended Wireless Controller PTC Entry
CHGEWCBCDE Change Extended Wireless Controller PTC Entry
DSPEWCBCDE Display Extended Wireless Controller PTC Entry
RMVEWCBCDE Remove Extended Wireless Controller PTC Entry
ADDEWCBCDE Add Extended Wireless Controller Bar Code Entry
CHGEWCBCDE Change Extended Wireless Controller Bar Code Entry
DSPEWCBCDE Display Extended Wireless Controller Bar Code Entry
RMVEWCBCDE Remove Extended Wireless Controller Bar Code Entry

Resource name parameters

Resource name (RSRCNAME) parameters are used to associate configuration objects with the hardware in the system rack. All wireless configurations must specify a resource name on the CRTLINWLS command. PTC configurations must specify a second resource name on the CRTCTLLWS command. Figure 11-4 shows how the resource names associated with the wireless LAN adapter are used by the configuration commands.

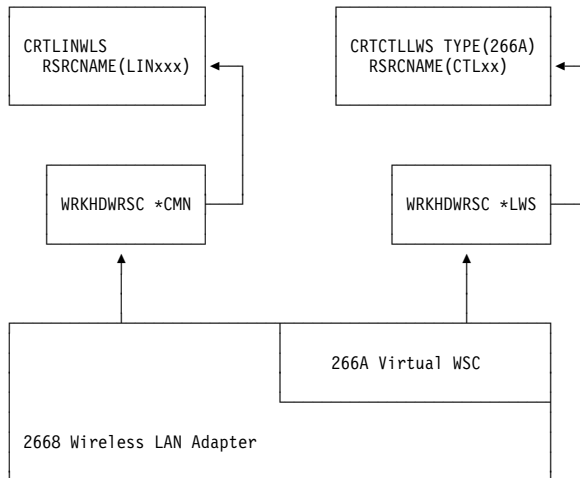


Figure 11-4. Resource Names Used for Wireless Configurations

CRTLINWLS

The RSRNAME parameter on the line description describes the location of the 2668 Wireless LAN Adapter. Use the WRKHDWRSC *CMN command to find the resource name for the *2668 Wireless Connection*. The resource name specified for the line description should be in the form LINxxx, where xxx are three numeric digits.

On the Work with Communications Resources display, this value is indented under entries for the 2663 Combined Function IOP (CMBxx) and the 2668 LAN Adapter (LINxx).

CRTCTLLWS

The RSRNAME parameter on the local work station controller description represents the virtual controller attachment to the PTCs. Use the WRKHDWRSC *LWS command to find the resource name for the *266A Virtual Controller*. The resource name specified for the controller description should be in the form CTLxx, where xx are two numeric digits.

On the Work with Local Work Station Resources display, this value is indented under an entry for the 2663 Combined Function IOP (CMBxx). If no 266A controller is listed, vary on the line description and try the WRKHDWRSC *LWS command again.

Wireless network addressing parameters

Wireless network configurations use a number of addressing parameters to identify different functions of the 2668 wireless adapter and the 266A virtual workstation controller.

Figure 11-5 shows the relationship of the ADPTADR, HOPID, TXPADR, and TXPPORT parameters to the AS/400 Wireless LAN Adapter. These parameters are discussed in the following topics.

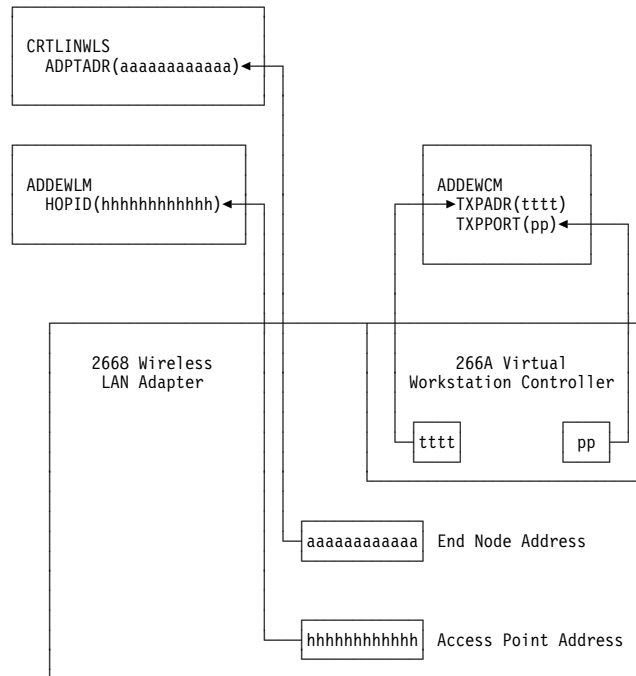


Figure 11-5. Relationship of Addressing Parameters to Wireless Adapter

ADPTADR and HOPID parameters

The local adapter address (ADPTADR parameter) on the Create Line Description (Wireless) (CRTLINWLS) command and the hop identifier (HOPID parameter) on the Add Extended Wireless Line Member (ADDEWLM) command are both 12-digit hexadecimal adapter addresses. However, these parameters represent different functions of the wireless adapter:

ADPTADR

The ADPTADR parameter represents the 2668 Wireless LAN Adapter. This value is used as the destination address for all devices in the network that want to communicate with the AS/400 system. The default value, *ADPT, uses the preset address assigned by the manufacturer.

HOPID

The HOPID parameter on the ADDEWLM command represents the local access point function of the wireless adapter. The default value for this parameter, *ADPT, generates an address based on the value specified for the ADPTADR parameter.

This value is not used as a destination address. Depending on whether this wireless adapter is the root node of the network, data received at the HOPID address is either passed up to the local destination address (identified by the ADPTADR parameter) or relayed to another access point. The ROOT parameter on the ADDEWLM command specifies whether this adapter serves as a root node or as a repeater.

See "Ethernet physical address format" on page 5-4 for information about the physical address format used for wireless networks.

TXPADR and TXPPORT parameters

The destination ID (TXPADR) and transport port (TXPPORT) parameters on the Add Extended Wireless Controller Member (ADDEWCM) command are used to identify the 266A virtual workstation controller in PTC configurations:

TXPADR

The TXPADR parameter is a four-digit hexadecimal address that is used to identify the 266A controller to the network.

TXPPORT

The TXPPORT parameter specifies the application being run on the PTCs communicating with the 266A controller.

Downloading configuration data to the wireless adapter

Configuration data specified using the extended configuration commands is stored in source files on the AS/400 system. This data is downloaded to the wireless adapter when the line and controller descriptions are varied on.

The line description, controller description, and each of the extended configuration commands includes initialization file (INZFILE) and initialization member (INZMBR) parameters to identify where the information is stored. The following topics describe how to specify the INZFILE and INZMBR parameters, and how to use the QZXCINZ initialization program.

INZFILE and INZMBR parameters

Two source files are supplied with the AS/400 system, QEWSRC and QEWCSRC. These files are used to store extended configuration information:

QEWSRC

Extended wireless line member source file. QEWSRC stores information specified on the extended wireless line member (xxxEWLM) commands. The source file and source member names specified for the extended wireless line member must match the names specified for the wireless line description. This information is downloaded to the wireless adapter when the line description is varied on.

QEWCSRC

Extended wireless controller member source file. QEWCSRC stores information specified on the extended wireless controller (xxxEWCM), PTC entry (xxxEWCPTCE), and bar code entry (xxxEWCBCDE) commands. The source file and source member names specified for the extended configuration objects must match the names specified for the local work station controller description. This information is downloaded to the wireless adapter when the controller description is varied on.

The name you specify on the INZMBR command is the name of the source member within the source file. If the member does not exist, the system creates a member with that name in the specified source file.

Specify the same INZMBR name for all of the extended wireless controller commands used for a given configuration. For example, if the controller description specifies INZFILE(QEWCSRC) and INZFILE(EWC001), you must specify these same names for the extended wireless controller member, PTC entry, and bar code entry commands.

If the QZXCINZ initialization program is specified on the INZPGM parameter, the names of the initialization source file and source member are passed to the command called by the program. See “QZXCINZ initialization program” on page 11-9 for more information about using QZXCINZ.

Notes:

1. If the INZFILE and INZMBR parameters are not specified, system-defined defaults are used by the wireless adapter.
2. Configuration data created using the extended configuration commands is validated by the system when the line or controller description is varied on. If errors are found, the vary on operation fails.

If configuration data is created using a method other than using the extended configuration commands, the data is downloaded to the adapter without validation.

QZXCINZ initialization program

The wireless line description commands (CRTLINWLS and CHGLINWLS) and local work station controller commands (CRTCTLLWS and CHGCTLLWS) each include an initialization program parameter, INZPGM. The IBM-supplied initialization program, QZXCINZ, can be specified for both line and controller description commands.

QZXCINZ causes the system to automatically prompt for the related extended wireless line or controller member command, depending on which command called the QZXCINZ program. For example, if the CRTLINWLS command is run with INZPGM(QZXCINZ), a prompt display for the ADDEWLM command will be shown automatically. The INZFILE and INZMBR names specified on the CRTLINWLS command are passed through QZXCINZ and filled in on the ADDEWLM prompt display.

Notes:

1. The extended wireless line and controller member commands (xxxEWLM and xxxEWCM) do not require the use of QZXCINZ. These commands can be run directly from the command line.
2. If you specify an initialization program, you must also specify file and member names for the INZFILE and INZMBR parameters.
3. The extended wireless controller PTC entry and bar code entry commands are not called by QZXCINZ. When specifying these commands you must ensure that the source file and source member names specified match those specified for the controller description and extended wireless controller member.

Example of configuration object and source file relationships

Figure 11-6 on page 11-11 shows an example of the relationship between the configuration objects and initialization source files used to create a PTC configuration. Most of the commands used in this example (boxes at the left in Figure 11-6) specify initialization source files and source members used to store wireless configuration data:

CRTLINWLS

The CRTLINWLS command is specified with INZFILE(QGPL/QEWSRC) and INZMBR(EWL021). When the line

description (WLSLIN) is varied on, the contents of member EWL021 in source file QEWSRC are downloaded to the wireless adapter.

When the CRTLINWLS command is run, initialization program QZXCINZ calls the prompt display for the ADDEWLM command.

ADDEWLM

The source file and source member names specified on the CRTLINWLS command are passed to the ADDEWLM command by QZXCINZ. Configuration information specified on the ADDEWLM command is stored in member EWL021, in file QEWSRC.

CRTCTLLWS

The CRTCTLLWS command is specified with INZFILE(QGPL/QEWSRC) and INZMBR(EWC021). When the controller description (WLSCTL) is varied on, the contents of member EWC021 in source file QEWSRC are downloaded to the wireless adapter.

When the CRTCTLLWS command is run, initialization program QZXCINZ calls the prompt display for the ADDEWCM command.

ADDEWCM

The source file and source member names specified on the CRTCTLLWS command are passed to the ADDEWCM command by QZXCINZ. Configuration information specified on the ADDEWCM command is stored in member EWC021, in file QEWSRC.

ADDEWCPTCE

The source file and source member names specified on the CRTCTLLWS command must also be specified on the ADDEWCPTCE command. Information specified on the ADDEWCPTCE command is appended to the data specified by the ADDEWCM command in source member EWC021. The ADDEWCPTCE command also includes the name of a bar code group used to describe the bar code scanning characteristics of the PTCs.

ADDEWCBCDE

The source file and source member names specified on the CRTCTLLWS command must also be specified on the ADDEWCBCDE command. Information specified on the ADDEWCBCDE command is appended to the data in source member EWC021.

CRTDEV DSP

The last of the PTC configuration objects, the device description, is automatically created when communications with the PTCs begins. Device descriptions are created as TYPE(3476) display devices

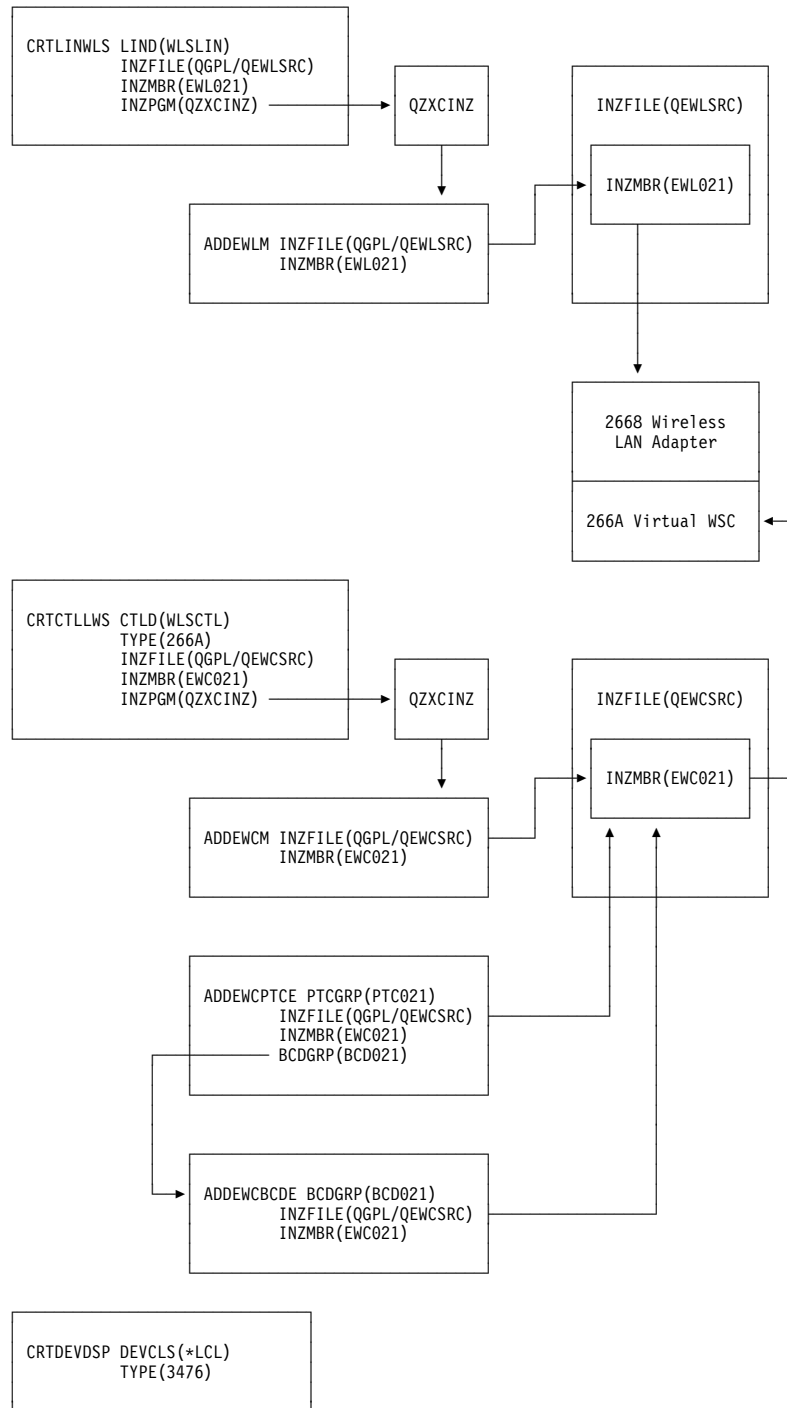


Figure 11-6. Relationship of PTC Configuration Objects and Initialization Source Files

Wireless network physical address format

The AS/400 wireless LAN adapter uses the same 48-bit adapter address format that is used for Ethernet adapters. See “Ethernet physical address format” on page 5-4 for more information.

PTC polling parameters

The ADDEWCPTCE and CHGEWCPTCE commands include a group of parameters used to define the polling characteristics of PTCs in the PTC group. Polling intervals are adjusted to conserve battery power when the PTCs are not transmitting data.

Table 11-1 lists the PTC polling parameters and the value used when *DEV, the default value, is specified for these parameters.

Parameter	Function	*DEV Value
POLL	Sets the fast poll interval for the PTC. This interval is used when the poll delay (POLLDLY) value expires.	125 milliseconds (ms)
POLLDLY	Sets the length of time that polling is suspended following the start of a transaction or transmission of an acknowledged datagram.	0 ms
POLLDECAY	Controls the poll decay process. POLLDECAY specifies the number of times the PTC polls at a given rate before slowing to half that rate.	2
SLOWPOLL	Sets the polling interval used to maintain the radio frequency link when the PTC is powered on but not actively sending or receiving data.	200 ms

The following list describes how these parameters are used in a sequence of polling events:

1. When a transaction is started, polling is suspended for the length of time specified on the POLLDLY parameter.
2. When POLLDLY expires, polling resumes at the fast poll interval specified on the POLL parameter.
3. After the number of polls specified by the POLLDECAY parameter, the polling rate is reduced to half the fast poll rate.
4. Poll decay continues until the polling interval is reduced to the value specified by the SLOWPOLL parameter.

Problem determination for wireless networks

The link test and wireless network management utility (WNMU) options on the Verify Communications (VFYCMN) command can be used to check connections between wireless network nodes. WNMU can also be used to display the network topology and analyze the activity on the network.

See Appendix A, "LAN link test" on page A-1 for information about link test.

Chapter 12. Wireless IOP LAN configuration examples

This chapter provides an example of a wireless input/output processor local area network configuration. See Chapter 11, "Wireless IOP LANs" on page 11-1 for general information about wireless networks and configuration considerations. See the *CL Reference* for detailed descriptions of the extended wireless configuration commands.

Configuration for PTC connections on a wireless IOP LAN

The following example shows the prompt displays used to configure the AS/400 system for wireless communications with a number of portable transaction computers (PTCs). This example creates the following configuration objects:

- Wireless line description (CRTLINWLS command)
- Extended wireless line member (ADDEWLM command)
- Local work station controller (CRTCTLLWS command)
- Extended wireless controller member (ADDEWCM command)
- Extended wireless controller PTC entry (ADDEWCPTCE command)
- Extended wireless controller bar code entry (ADDEWCBCDE command)

The CRTLINWLS and CRTCTLLWS commands both require you to specify resource names that identify the location of the wireless IOP LAN adapter in the AS/400 system rack. You should determine the resource names before configuring the line and controller descriptions. See "Resource name parameters" on page 11-5 for detailed information.

Some configuration information, such as PTC and bar code entry information, must be coordinated with the configuration for the PTC devices. See the documentation for the PTC device for information about defining PTC display and bar code scanning characteristics.

Network nodes between the AS/400 wireless adapter and the PTCs (such as 2480 Access Points) are not configured at the AS/400 system and are not identified by any of the AS/400 configuration objects. See the documentation for the access points for information about their configuration.

Line description and extended wireless line member configuration

Figure 12-1 shows the prompt displays used to create the wireless line description.

```

Create Line Desc (Wireless) (CRTLINWLS)

Type choices, press Enter.

Line description . . . . . > WLSLIN      Name
Resource name . . . . . > LIN241 1      Name
Online at IPL . . . . . *YES             *YES, *NO
Vary on wait . . . . . *NOWAIT          *NOWAIT, 15-180 (1 second)
Local adapter address . . . . . > 024096004002 2 020000000000-FEFFFFFFF...
Exchange identifier . . . . . *SYSGEN    05600000-056FFFFF, *SYSGEN
Ethernet standard . . . . . *ALL        *ETHV2, *IEEE8023, *ALL
SSAP list:
  Source service access point . . . *SYSGEN    02-FE, *SYSGEN
  SSAP maximum frame . . . . . *MAXFRAME, 265-1496, 265...
  SSAP type . . . . . *CALC, *NONSNA, *SNA
    + for more values
Initialization source file . . . > QEWSRC 3      Name, *NONE
  Library . . . . . *LIBL              Name, *LIBL, *CURLIB
Initialization source member . . . > EWL021 3      Name, *NONE

                                                    More...
F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
F13=How to use this display  F24=More keys

```

```

Create Line Desc (Wireless) (CRTLINWLS)

Type choices, press Enter.

Initialization program . . . . . > QZXCINZ 4      Name, *NONE
  Library . . . . . *LIBL              Name, *LIBL, *CURLIB
Text 'description' . . . . . > 'Wireless line description'

```

Figure 12-1. Prompt Display for CRTLINWLS Command

- 1** Use the WRKHDWRSC *CMN command to find the resource name for the 2668 Wireless Connection.
- 2** This address, sometimes called the node address or NID, is used to send and receive data on the wireless LAN. You can use the preset address assigned to the card by the manufacturer (*ADPT) or specify an adapter address.
- 3** Specify the initialization source file and source member that will contain wireless configuration data associated with the line description and line member. Information contained in the specified source member is downloaded to the wireless adapter when the line description is varied on.
- 4** By specifying the QZXCINZ initialization program on the CRTLINWLS command, the AS/400 system will automatically prompt for the Add Extended Wireless Line Member command.

Figure 12-2 shows the prompt display for the ADDEWLM command. The ADDEWLM command is prompted automatically because the QZXCINZ initialization program was specified on the CRTLINWLS command. The values specified for the

initialization source file and source member are passed to the ADDEWLM command by QZXCINZ.

```

Add Wireless Line Member (ADDEWLM)

Type choices, press Enter.

Initialization source member . . > EWL021      Name

                                Additional Parameters

Initialization source file name.  QEWSRC      Name, QEWSRC
  Library . . . . .                *LIBL      Name, *LIBL, *CURLIB
Adapter configuration . . . . .    *ALL        *ALL, *RADIO, *WIRED
Hop indentifier . . . . .         *ADPT 1   020000000000-FEFFFFFFF...
Root or repeater cell. . . . .    *YES 2   *YES, *NO
Frequency . . . . . > 2 3        1, 2, 3, 4, 5
Data rate . . . . .                2M        2M, 1M
Radio system indentifier . . . .  000002 4  000002-FFFFFE
Text 'description' . . . . . > 'Extended wireless line member'

                                Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys

```

Figure 12-2. Prompt Display for ADDEWLM Command

- 1** The hop identifier specifies the internal access point address for this AS/400 wireless LAN adapter. The default value, *ADPT, generates an address based on the adapter address (ADPTADR parameter) specified on the wireless line description.
- 2** Specify *YES if the AS/400 is to serve as the root node of the wireless network.
- 3** Specify the center frequency that is used for radio communications within the wireless network. 2 indicates that a center frequency of 2.442 GHz is used.
- 4** The radio system identifier (SYSID parameter) is used as a network identifier to exclude radio transmissions from adjacent wireless networks using different system identifiers. All nodes in this wireless network must specify the same SYSID (or SID) value.

Controller description and extended wireless controller member configuration

Figure 12-3 shows the prompt displays for the CRTCTLLWS command.

```

                                Create Ctl Desc (Local WS) (CRTCTLLWS)

Type choices, press Enter.

Controller description . . . . . > WLSCTL      Name
Controller type . . . . . > 266A 1          2637, 2638, 2661, 6040...
Controller model . . . . . > 1              1, 0001
Resource name . . . . . > CTL22 2          Name
Online at IPL . . . . . *YES                *YES, *NO
Initialization source file . . . > QEWC SRC 3   Name, *NONE
  Library . . . . . *LIBL                    Name, *LIBL, *CURLIB
Initialization source member . . > EWC021 3   Name, *NONE
Initialization program . . . . . > QZXCINZ 4   Name, *NONE
  Library . . . . . *LIBL                    Name, *LIBL, *CURLIB
Text 'description' . . . . . > 'Wireless controller description'

                                                                 Bottom
F3=Exit  F4=Prompt  F5=Refresh  F10=Additional parameters  F12=Cancel
F13=How to use this display  F24=More keys

```

Figure 12-3. Prompt Display for CRTCTLLWS Command

- 1** Specify 266A for the controller type.
- 2** Use the WRKHDWRSC *LWS command to determine the resource name for the 266A Virtual Controller.
- 3** Specify the initialization source file and source member that will contain wireless configuration data associated with the controller description, extended wireless controller member, PTC and bar code entries. Information contained in the specified source member is downloaded to the wireless adapter when the controller description is varied on.
- 4** By specifying the QZXCINZ initialization program on the CRTCTLLWS command, the AS/400 system will automatically prompt for the Add Extended Wireless Controller Member command.

Figure 12-4 shows the prompt display for the ADDEWCM command. The ADDEWCM command is prompted automatically because the QZXCINZ initialization program was specified on the CRTCTLLWS command. The values specified for the initialization source file and source member are passed to the ADDEWCM command by QZXCINZ.

```

Add Wireless Ctl Member (ADDEWCM)
Type choices, press Enter.
Initialization source member . . > EWC021      Name
                                     Additional Parameters
Initialization source file . . . QEWC SRC      Name, QEWC SRC
Library . . . . . *LIBL      Name, *LIBL, *CURLIB
Destination ID . . . . . > 4001 1      4001-4FFE
Transport port . . . . . 0 2      0-15
Text 'description' . . . . . > 'Extended wireless controller member'

                                     Bottom
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

Figure 12-4. Prompt Display for ADDEWCM Command

- 1** The destination ID is used to identify this wireless adapter to the wireless network.
- 2** The transport port number is used to define the application running on the PTC. Port 0 indicates that the application is 5250 emulation.

PTC and bar code entry configuration

PTC and bar code entries define the characteristics of PTCs and the bar code scanning capabilities of those PTCs.

The QZXCINZ initialization program does not automatically prompt for these entries. You must ensure that the initialization source file and source member names specified for the PTC and bar code entry commands match the names specified on the controller description.

Figure 12-5 on page 12-6 shows the prompt displays for the ADDEWCPTCE command. This PTC entry defines the characteristics for a group of PTC configured with addresses 0001 through 0020.

```

Add EWC PTC Entry (ADDEWCPTCE)

Type choices, press Enter.

PTC group name . . . . . > PTC021
Initialization source member . . > EWC021 1 Name

Additional Parameters

Initialization source file . . QEWC SRC 1 Name, QEWC SRC
Library . . . . . *LIBL Name, *LIBL
PTC ID range: 2
Begin id . . . . . > 0001 0001-1022
End id . . . . . > 1022 0001-1022
Intensity . . . . . *NORMAL *NORMAL, *INVERSE
Status line . . . . . *YES *YES, *NO
Cursor type . . . . . *UNDERLINE *UNDERLINE, *BLOCK
Inactivity timer . . . . . *DEV 0-9999, *DEV
Backlight timer . . . . . *DEV 0-9999, *DEV
Backlight key . . . . . *ON *ON, *OFF

More...
F3=Exit F4=Prompt F5=Refresh F12=Cancel F13=How to use this display
F24=More keys

```

Figure 12-5 (Part 1 of 3). Prompt Display for ADDEWCPTCE Command

```

Add EWC PTC Entry (ADDEWCPTCE)

Type choices, press Enter.

Bypass exit . . . . . *YES *YES, *NO
Automatic run . . . . . *YES *YES, *NO
Printer . . . . . *SYSTEM *SYSTEM, *PTC
Wand type . . . . . *NONE *NONE, *PENCIL, *LASER...
Wand pecking rate . . . . . *DEV *DEV, 2, 4, 8, 16, 32, 48
Laser read timer . . . . . *DEV *DEV, 1440, 2880, 4320, 5760
Barcode function keys . . . . . *OFF *OFF, *ON
Auto Enter . . . . . *OFF *OFF, *ON
Cursor location . . . . . *HOLD *HOLD, *FIRST
Short scan . . . . . *YES *YES, *NO
Scan end of file . . . . . *YES *YES, *NO
Fast poll interval . . . . . *DEV 0-9999, *DEV
Fast poll delay . . . . . *DEV 0-9999, *DEV
Fast poll decay . . . . . *DEV 0-255, *DEV
Slow poll interval . . . . . *DEV 0-99999, *DEV

More...
F3=Exit F4=Prompt F5=Refresh F12=Cancel F13=How to use this display
F24=More keys

```

Figure 12-5 (Part 2 of 3). Prompt Display for ADDEWCPTCE Command

```

Add EWC PTC Entry (ADDEWCPTCE)

Type choices, press Enter.

Destination hops: 3
  Destination ID . . . . . > 4001          4001-4FFE
  Frequency . . . . . > 2                1, 2, 3, 4, 5, 900, 9001...
  Data rate . . . . . > 2M                1M, 2M, *NONE
  Radio system identifier . . . > 000002   000002-FFFFFF
    + for more values
Barcode group name . . . . . > BCD021 4
    + for more values
Text 'description' . . . . . > 'PTC entry PTC021'

F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys
Bottom

```

Figure 12-5 (Part 3 of 3). Prompt Display for ADDEWCPTCE Command

- 1 Specify the initialization source file and source member used to store the information in this PTC entry. These names must match the names specified on the CRTCTLLWS and ADDEWCM commands. Information contained in the specified source member is downloaded to the wireless adapter when the controller description is varied on.
- 2 Specify the range of PTC addresses for which this PTC entry is used. Characteristics defined in this PTC entry are applied to all PTCs with addresses within the specified range.
- 3 The destination hop parameter consists of four elements used to specify the addresses of systems with which the PTCs in this group attempt to communicate. This parameter allows up to eight destinations to be specified. If the PTC is unable to contact the first destination listed, it attempts to contact the next destination on the list.

For networks using one or more AS/400 wireless LAN adapters as root nodes, the values specified for this parameter must match the following values at the destination AS/400 system:
 - *Destination ID* must match the value specified for the extended wireless controller member on the host system.
 - *Frequency*, *Data rate*, and *Radio system identifier* must match the values specified on the extended wireless line member on the host system.
 Normally, address information for the primary destination is programmed into the PTC. This parameter is optional.
- 4 Specify the name of the bar code entry used to define bar code scanning capabilities for this group of PTCs. Up to 6 bar code group names can be specified for each PTC entry.

Figure 12-6 shows the prompt displays for the ADDEWCBCDE command.

```

Add EWC Barcode Entry (ADDEWCBCDE)

Type choices, press Enter.

Barcode group name . . . . . > BCD021 1
Initialization source member . . > EWC021 2 Name

                                Additional Parameters

Initialization source file . . . QEWCSRC 2   Name, QEWCSRC
Library . . . . .                *LIBL       Name, *LIBL, *CURLIB
Barcode type . . . . .           > *PLESSEY
Label length . . . . .          32           0-64
First check digit . . . . .     *NO         *NO, *YES
Second check digit . . . . .    *NO         *NO, *YES
All zeros . . . . .             *NO         *NO, *YES
Alpha display . . . . .         *NO         *NO, *YES
Add on 2 . . . . .              *NO         *NO, *YES
Add on 5 . . . . .              *NO         *NO, *YES
System 1 UPC-E . . . . .        *NO         *NO, *YES

                                                                More...

F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

Figure 12-6 (Part 1 of 2). Prompt Display for ADDEWCBCDE Command

```

Add EWC Barcode Entry (ADDEWCBCDE)

Type choices, press Enter.

System 0 UPC-E . . . . .        *NO         *NO, *YES
UPC-E . . . . .                 *NO         *NO, *YES
EAN 13 . . . . .                *NO         *NO, *YES
Extended Character Set . . . .  *NO         *NO, *YES
Add on . . . . .                 *BIDIRECTIONAL
Drop begin . . . . .            0           0-64
Drop end . . . . .               0           0-64
Text 'description' . . . . .    > 'Bar code entry BCD021'

                                                                Bottom

F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

Figure 12-6 (Part 2 of 2). Prompt Display for ADDEWCBCDE Command

- 1** The bar code group name specified must match one of the bar code group names specified in the PTC entry.

- 2 Specify the initialization source file and source member used to store the information in this bar code entry. These names must match the names specified on the ADDEWCPTCE command containing the name of this bar code group. Information contained in the specified source member is downloaded to the wireless adapter when the controller description is varied on.

Device descriptions used by PTC configurations

Device descriptions associated with the PTCs are automatically created when communications begins. Device descriptions created are for TYPE(3476) display devices. Up to 49 device descriptions (representing 5250 emulation sessions) can be attached to each local work station controller.

If device descriptions are not created when PTCs attempt to connect to the AS/400 system, use the Display System Value (DSPSYSVAL command) to verify that the QAUTOCFG system value is set to 1.

DDI networks

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Chapter 13. DDI networks

This chapter describes the DDI physical environment and general considerations for configuring a DDI network.

DDI physical environment

A DDI network consists of stations connected using optical fiber or shielded twisted pair (STP) media to form a physically closed loop. DDI allows many attachment units, including stations, concentrators, and bridges. These can be attached in various ways allowing a tree topology.

DDI uses two rings:

- The primary ring, similar to the main ring of a token-ring network.
- The secondary ring, similar to the backup ring path of a token-ring network.

A fiber DDI (FDDI) ring consists of two fibers, one for transmitting and one for receiving. Each fiber is equivalent to a pair of copper conductors used on a shielded twisted pair DDI (SDDI) ring.

Unlike token-ring networks, DDI networks allow devices to be attached to one or both of the rings and do not require attachment through a concentrator such as the token-ring multistation access unit (MAU). DDI networks identify two classes of devices, depending on how the device is attached to the rings.

Dual-Attached (Class A)

Stations or concentrators that are directly attached to both the primary and secondary ring.

Single-Attached (Class B)

Stations or concentrators that are directly attached to only one ring or that are attached through a concentrator.

The AS/400 DDI adapters allow the system to function as either a single- or dual-attached station.

Normally, only the primary ring in a DDI network is active. The secondary ring is used to maintain the network when a dual access station or concentrator becomes inactive.

Figure 13-1 on page 13-2 shows an example of a DDI network using both single- and dual-attached stations.

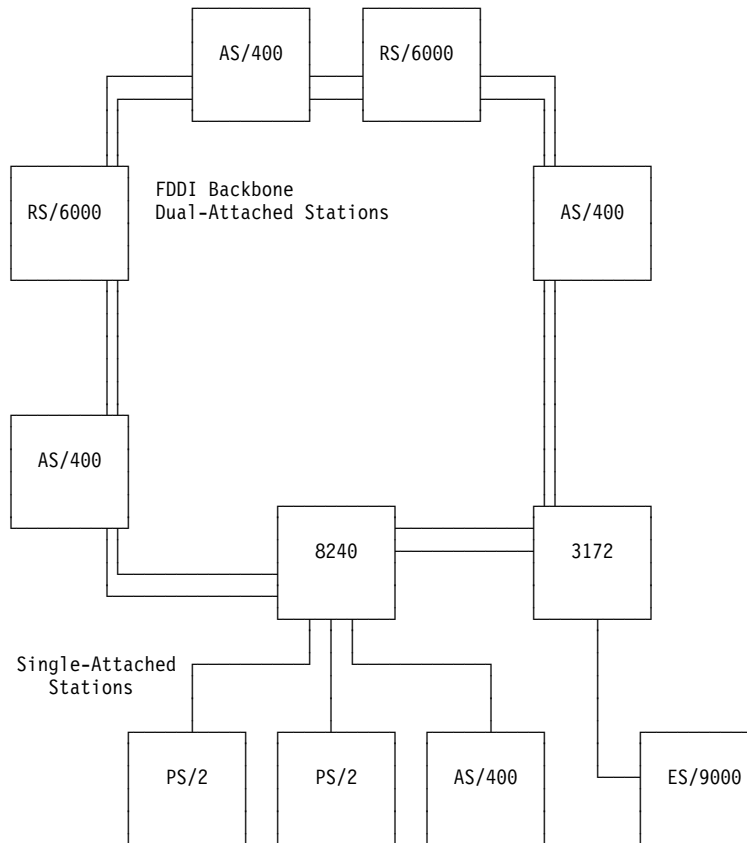


Figure 13-1. Example of DDI Network with Single- and Dual-Attached Stations

IBM 8240 FDDI concentrator

The IBM 8240 FDDI Concentrator is a single media access control (MAC) concentrator that allows attachment of up to 24 devices using either copper or multimode optical fiber. The 8240 FDDI Concentrator contains the following modules:

Concentrator Control (CC) Module

The CC Module contains the electronics that:

- Control access to the network for attaching devices.
- Perform error recovery.

Ring Attachment (RA) Module

The RA Module allows the 8240 Concentrator as a dual-attached station to an FDDI ring topology or as a dual-attached or single-attached station to other concentrators using multimode optical fiber.

Device Attachment (DA) Modules

Up to six DA Modules can be installed in the 8240 Concentrator. Two types of DA Module are supported:

- The Optical Fiber Cable Device Attachment Module is used for devices connected to the network using multimode optical fiber cabling.
- The Copper Device Attachment Module is used for devices attached using shielded twisted pair wiring.

Each DA Module allows attachment of up to four devices.

8240 Concentrators can be installed in either ring or tree topologies. When installed in a tree topology, 8240s can be configured as dual-attached concentrators.

See the *FDDI Network Introduction and Planning Guide* for detailed information about the 8240 FDDI Concentrator and how to use it in various network topologies.

Dual-homing stations

The AS/400 DDI adapter allows the system to be connected to an FDDI concentrator in a dual-homing configuration. In this configuration, both adapter ports (A and B) are connected to the master ports on the concentrator. The B port connection is identified as the primary connection; the A port is identified as the secondary connection.

The dual-homing station operates like a single-attached (Class B) station, except that the secondary connection is available as a backup to the primary connection. The connection automatically switches from primary to secondary if a problem is detected in the primary connection.

DDI physical address format

The AS/400 DDI adapters use the same 48-bit adapter address format that is used for token-ring adapters. See “Token-ring physical address format” on page 3-3 for more information.

Frame size considerations for DDI networks

Data is transmitted to remote stations in frames, the basic unit of transmission for all data. Frame size indicates how large each transmission is.

A DDI network provides an environment with few errors. Therefore, data transmission is more efficient if data is sent in as large a frame as possible. The largest frame size that can be sent by the AS/400 system is specified by the MAXFRAME parameter on the CRTLINDDI command. The MAXFRAME parameter can be set to any value in the range 265 through 4444. The default value is 4105.

Note: DDI frame sizes are sometimes described in terms of **symbols**. A symbol represents half of a byte (four bits); 4105 bytes is equivalent to 8210 symbols.

Except for the allowed range of frame sizes, frame size considerations for DDI networks are the same as those for token-ring networks. See “Frame size considerations for token-ring networks” on page 3-5 for more information.

Token rotation time (TKNRTTIME parameter)

The token rotation time (TKNRTTIME) parameter on the CRTLINDDI command represents the target token rotation timer (TTRT) in the FDDI architecture. The TTRT value is used to control ring scheduling: the longer the TTRT value, the more frames that can be transmitted by a station at one time. Possible values for the

TKNRTTIME parameter are *CALC (the default) or any value from 4 through 167 milliseconds.

A claim token process is used to negotiate the target token rotation time used by all stations on the ring. When the ring is initialized, the lowest TTRT value bid by stations on the ring is the value that is used.

The default value for the TKNRTTIME parameter, *CALC, normally sets the timer to 167 milliseconds. This value should provide good ring utilization but may not be appropriate for some applications that require frequent, short transmissions from a large number of stations.

Unless changing the TKNRTTIME value is specifically required, use *CALC. If an application requires a shorter target rotation time, the TKNRTTIME value should be lowered only on the machine running the application.

Chapter 14. DDI network configuration examples

This chapter provides an example of a DDI configuration for two AS/400 systems.

Configuration example for connecting two AS/400 systems

In the following example, two AS/400 systems, SYSTEM1 and SYSTEM2, are directly linked using either FDDI or SDDI cables. Both SYSTEM1 and SYSTEM2 are defined as APPN end nodes.

Because the line descriptions specify AUTOCRTCTL(*YES), only one APPC controller description needs to be created as APPN(*YES). The other system automatically creates the corresponding APPC controller description as APPN(*YES). Since the APPC controller descriptions are APPN(*YES), the device descriptions are created automatically.

Considerations for controller descriptions attached to DDI lines are essentially the same as those attached to token-ring network lines. See Chapter 3, "Token-ring networks" on page 3-1 and Chapter 4, "Token-Ring Network Configuration Examples" on page 4-1 for information about configuring controller descriptions.

Configuration on AS/400 system SYSTEM1

Figure 14-1 shows the prompt displays used to create the line description on system SYSTEM1.

```
                                Create Line Desc (DDI) (CRTLINDDI)

Type choices, press Enter.

Line description . . . . . > SYSTE1DDI      Name
Resource name . . . . . > CMN02 1           Name, *NWID
Online at IPL . . . . . *YES                 *YES, *NO
Vary on wait . . . . . *NOWAIT              *NOWAIT, 15-180 (1 second)
Maximum controllers . . . . . 40             1-256
Maximum frame size . . . . . 4105           265-4444
Logging level . . . . . *OFF                *OFF, *ERRORS, *ALL
Local manager mode . . . . . *OBSERVING     *OBSERVING, *NONE
Local adapter address . . . . . > 400070008001 400000000000-7FFFFFFF...
Exchange identifier . . . . . *SYSGEN        05600000-056FFFFF, *SYSGEN
SSAP list:
  Source service access point . . . . . *SYSGEN 02-FE, *SYSGEN
  SSAP maximum frame . . . . .                265-4444, *MAXFRAME
  SSAP type . . . . .                         *CALC, *NONSNA, *SNA
                                     + for more values

                                                                More...
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys
```

Figure 14-1 (Part 1 of 2). Prompt Displays for CRTLINDDI Command

```

                                Create Line Desc (DDI) (CRTLINDDI)

Type choices, press Enter.

Text 'description' . . . . . > 'DDI line on SYSTEM1'

                                Additional Parameters

Network controller . . . . .      Name
Group address . . . . . *NONE      800000000000-FFFFFFFFFE...
      + for more values
Token rotation time . . . . . *CALC  4-167, *CALC
Link speed . . . . . *MAX          *MIN, 1200, 2400, 4800...
Cost/connect time . . . . . 0      0-255
Cost/byte . . . . . 0             0-255
Security for line . . . . . *NONSECURE *NONSECURE, *PKTSWTNET...
Propagation delay . . . . . *LAN     *PKTSWTNET, *LAN, *MIN...
User-defined 1 . . . . . 128        0-255
User-defined 2 . . . . . 128        0-255

                                More...
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

Figure 14-1 (Part 2 of 2). Prompt Displays for CRTLINDDI Command

Considerations for specifying the CRTLINDDI command:

- 1** For an example of *NWI for resource name, see “Bridged connections to remote token-ring networks” on page 10-8.

Configuration on AS/400 system SYSTEM2

The following commands are used to create the DDI configuration on system SYSTEM2.

```

CRTLINDDI LIND(SYSTE2DDI) RSRNAME(LIN441) +
          ADPTADR(400070008002) AUTOCRTCTL(*YES) +
          TEXT('DDI Line On SYSTEM2')

CRTCTLAPPC CTLD(SYSTEM2) LINKTYPE(*LAN) +
          SWTLINLST(SYSTE2DDI) +
          RMTNETID(*NETATR) RMTCPNAME(SYSTEM1) +
          ADPTADR(400070008001) +
          TEXT('Controller description for DDI to SYSTEM1')

```

Appendixes

Appendix A. LAN link test

The link test option on the Verify Communications (VFYCMN) command allows you to test connectivity between the AS/400 system and remote stations on the local area network (See "Verify communications command" on page A-4 for an example of the Verify Communications procedure). The link test can be used to verify that the adapter address, SSAP, and DSAP values configured for local area network controller descriptions are accessible for a specified line description. The link test can also be used to ensure that the local AS/400 LAN adapter is connected to the network.

Before running the link test, the token-ring, DDI, Ethernet, or wireless line description must be created and varied on. The connection to a specific controller description can be tested, but a controller description is not required. No controller description needs to be varied on to perform the link test.

Running the LAN link test

To run the link test, determine the name of the line description and the controller description (if any) that will be used in the test. Use the Vary Configuration (VRYCFG) or Work with Configuration Status (WRKCFGSTS) command to vary on the line description. Then type VFYCMN to begin the verification procedure. Select the link test option and specify the name of the line description on the appropriate displays.

The values you specify on the Verify a Communications Line and Verify Controller Information displays depend on the type of link test you choose to run.

When the link test is complete you will be shown a display containing completion codes for each of the parameters tested (see "Link test completion codes" on page A-4).

Link tests for remote stations

Link tests for remote stations can be run with or without a controller description. The link test can be used to verify that a connection can be made between the AS/400 system and a remote station based on the following parameters:

ADPTADR LAN remote adapter address

DSAP LAN destination service access point

SSAP LAN source service access point

LANCNTMR LAN connection timer

LANCNRTY LAN connection retry

Each of these values can be entered directly on the Verify Controller Information display (see Figure A-2 on page A-2). Values used for the remote adapter address, SSAP, and DSAP can be taken from an existing controller description by specifying a controller name on the Verify a Local Area Network Line display (see Figure A-1 on page A-2). Any of the following methods can be used to test the connection to a remote station.

Existing controller description

To test the connection to a remote station for which the controller description has already been created, type the name of the controller description on the Verify a Communications Line display (see Figure A-1). Parameter values from the specified controller description will be shown on the next display, Verify Controller Information (see Figure A-2). Press Enter to run the link test.

Referenced controller description

To test the connection to a remote station for which the controller description has not yet been created, you can run the link test using some of the parameter values specified in an existing controller description. Type the name of the referenced controller description on the Verify a Communications Line display (see Figure A-1). Parameter values from the referenced controller description will be shown on the Verify Controller Information display (Figure A-2). Change the controller name to *NONE and the LAN remote adapter address to the adapter address of the station you want to test.

No controller description

The connection to a remote station can also be tested without referring to any controller description. Type *NONE in the controller description field on the Verify a Communications Line display (see Figure A-1). Specify the adapter address and other parameters shown on the Verify Controller Information display (Figure A-2).

```
Verify a Local Area Network (LAN) Line

To test a Local Area Network controller:

Type choice, press Enter.

Controller to be tested . . . . . _ *NONE

If a specific remote address is to be tested and no controller
is configured, select *NONE.
```

Figure A-1. Verify a Communications Line Display

```
Verify Controller Information

Please verify or update the following controller information.

Line name . . . . . _
Controller . . . . . _
LAN remote adapter address . . . _ *SELF, valid addr
DSAP (Destination SAP) . . . . . 04 00 to FE
SSAP (Source SAP) . . . . . 04 *A, 02 to FE
LANCNTMR . . . . . 03 1-25 seconds
LANCNRTY . . . . . 003 1-254
```

Figure A-2. Verify Controller Information Display

Link test for local adapters

The connection between the LAN adapter on the local AS/400 system and the network also also be tested.

- For DDI and token-ring adapters, the local adapter test verifies that the LAN adapter can be accessed from the network.
- For Ethernet adapters, the local adapter test sends a test frame internally. The Ethernet bus is not tested.
- For ATM adapters, the local adapter test verifies that the input/output adapter and network switch can be accessed from the network (through an Ethernet or a token-ring LEC line). See “Verify communications command” on page A-4 for an example.

Local adapter

To test the connection between the local system and the network, type *NONE in the controller description field on the Verify a Communications Line display (see Figure A-1 on page A-2). Then specify *SELF as the LAN remote adapter address on the Verify Controller Information display (see Figure A-3).

Verify Controller Information

Please verify or update the following controller information.

Line name	<u> </u>	<u> </u>
Controller	<u> </u>	<u> </u>
LAN remote adapter address . . . >	<u> </u>	*SELF, valid addr
DSAP (Destination SAP) >	<u> </u>	00 to FE
SSAP (Source SAP) >	<u> </u>	*A, 02 to FE
LANCNTMR >	<u> </u>	1-25 seconds
LANCNRTY >	<u> </u>	1-254

Figure A-3. Verify Controller Information Display for Local Adapter Test

Link test adapter address considerations

The following restrictions exist for the adapter address specified for LAN link tests:

- Broadcast addresses cannot be specified.
- Adapter addresses of remote stations accessed using bridges between Ethernet and token-ring or Ethernet and DDI networks must be converted using the procedure described under “Token-ring-to-Ethernet address conversion” on page D-3.

Link test completion codes

The LAN link test provides a set of hexadecimal completion codes to indicate whether or not the remote adapter and SAP values can be reached from the AS/400 system. Table A-1 lists the completion codes, their meanings, and possible recoveries.

Code	Meaning	Recovery
00000000	Parameter value found and valid	None
????????	Link test timed out. The parameter cannot be reached using the supplied values. Possible causes include the following: <ol style="list-style-type: none">1. Remote adapter address is incorrect.2. Remote SAP (DSAP) value is incorrect.3. LAN connection timer (LANCNNTMR parameter) or both LANCNNTMR and LAN connection retry (LANCNNRTY parameter) values are not large enough.4. Remote adapter is not attached to the network or is attached to a network other than that represented by the line description.5. Bridges between the AS/400 system and the remote adapter are unable to transmit the test frame.	Possible recoveries include the following. Verify the values specified for the link test and change the values as indicated. Then run the link test again. <ol style="list-style-type: none">1. Verify the remote adapter address (controller description ADPTADR parameter).2. Verify the remote SAP (controller description DSAP parameter).3. Increase the values specified for the LANCNNTMR or for both LANCNNTMR and LANCNNRTY parameters.4. Verify that the remote adapter is attached to the same network as the line description.5. Check the bridge and network configurations.
FFFFFFFF	Parameter value was not found. This completion code may indicate that the local SAP (SSAP parameter on the controller description) is not included in the SSAP list for the associated line description.	Change the value specified and run the link test again.
Any other values	Link test not run.	No recovery available. Record the completion code for the next level of support.

Verify communications command

The verify communications command allows you to verify that the IOP, IOA, licensed internal code, cabling and network switch are all operational and configured properly. In the following example, the verify communications command is performed for an ATM network.

1. Enter the Verify Communications (VFYCMN) command and press Enter.
2. Specify option 2 (*NWI - Network Interface Description) and press Enter.

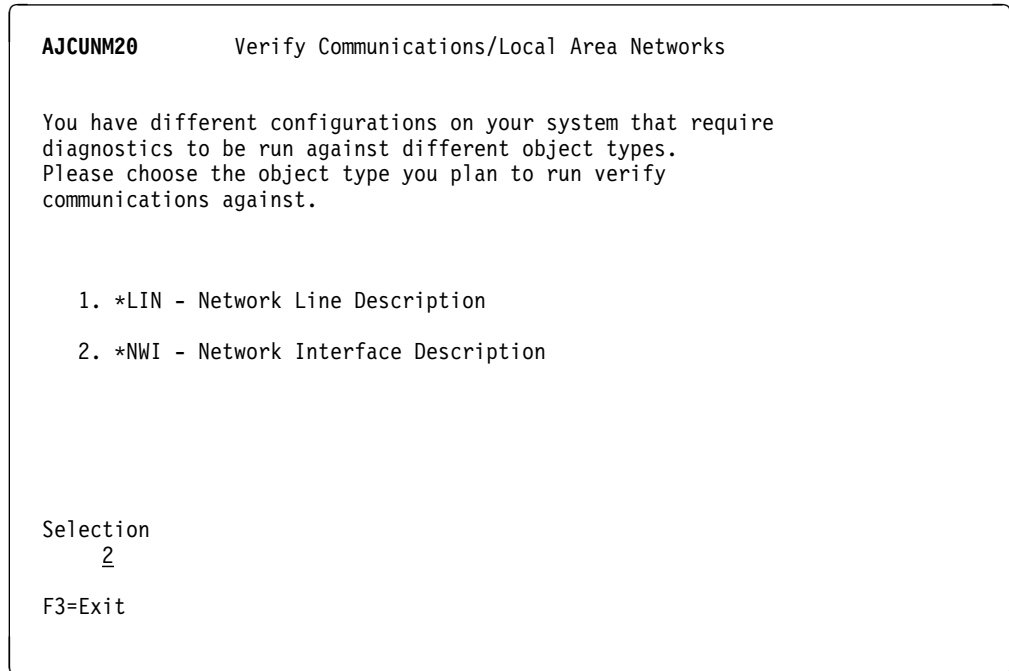


Figure A-4. Verify Communications, Display 1 of 8

3. Specify an ATM network interface description to test and press Enter.

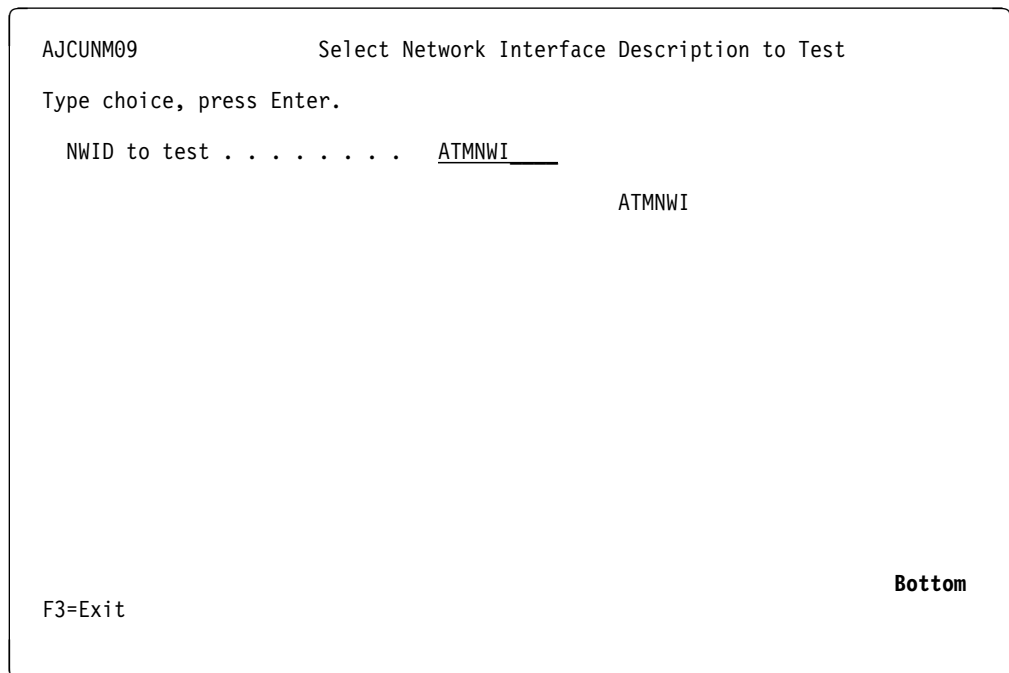


Figure A-5. Verify Communications Display, 2 of 8

4. Verify Communications for ATM objects does not support hardware tests. To perform hardware tests follow the instructions on this panel. Press Enter to continue with Verify Communications.

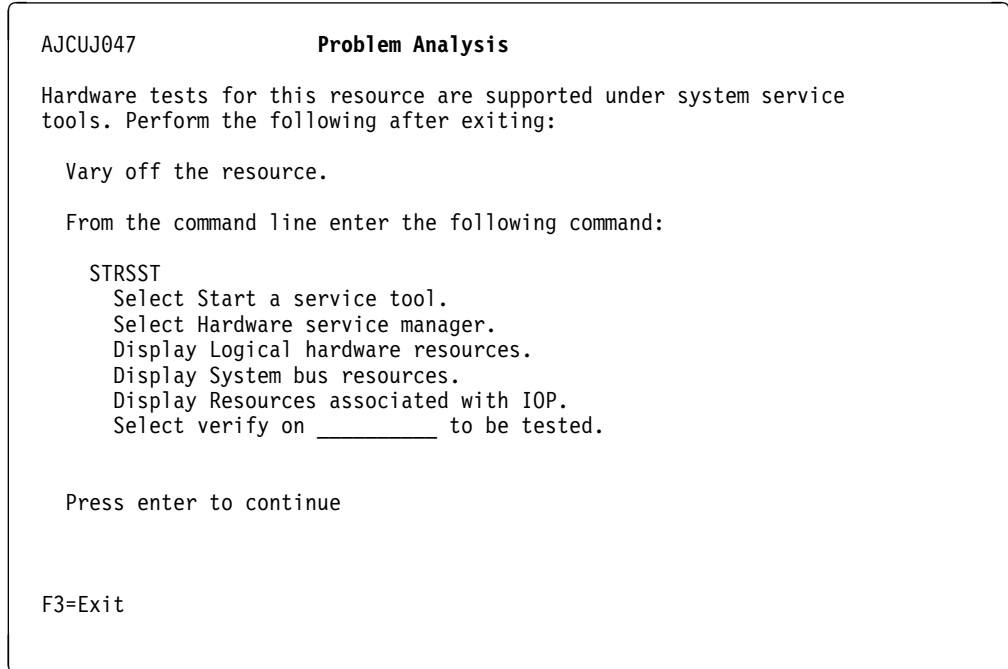


Figure A-6. Verify Communications, Display 3 of 8

5. Specify option 1 (Link test) and press Enter.

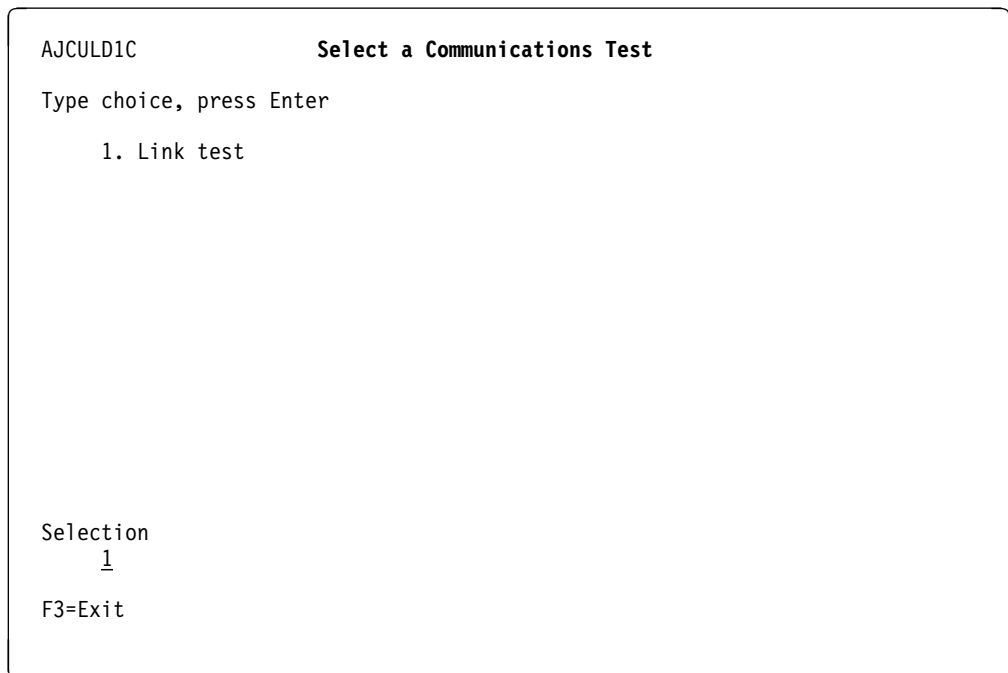


Figure A-7. Verify Communications, Display 4 of 8

6. Specify the ATM line description to be tested and press Enter.


```
AJCUAK23      Verify Communications/Local Area Network (LAN)

You have chosen to run link test on a network interface.
Please choose a specific line attached to the
network interface to test.

Type choice, press Enter.                                ATMLINE

  Line to test . . . . . ATMLINE__

F3=Exit
```

Figure A-8. Verify Communications, Display 5 of 8

7. Specify the ATM controller description to be tested and press Enter.

```
AJCULD1H      Verify a Local Area Network (LAN) line

To test a Local Area Network controller:

Type choice, press Enter,

Controller to be tested . . . . . ATMCTL__ *NONE

If a specific remote address is to be tested and no controller
is configured, select *NONE.

F3=Exit
```

Figure A-9. Verify Communications, Display 6 of 8

8. Verify that the information that is entered so far. If it is correct, press Enter.

```

AJCULD1J          Verify Controller information
Please verify or update the following controller information.
Line name . . . . . ATMLINE
Controller . . . . . ATMCTL
LAN remote adapter address . . . . . 400000083435 *SELF, valid addr
DSAP (Destination SAP) . . . . . 04      00 to FE
SSAP (Source SAP) . . . . . 04      *A, 02 to FE
LANCNTMR . . . . . 03      1-25 seconds
LANCNRTY . . . . . 003     1-254

F3=Exit

```

Figure A-10. Verify Communications, Display 7 of 8

9. This panel shows that the SSAP was found, so the link test has been successful.

```

AJCULD1K          Verify a Local Area Network (LAN) Line
Following are the results of the Link test you selected.
SSAP . . . . . : 00000000
Remote adapter address . . . . : ???????
DSAP . . . . . :

Legend:
x'00000000' = Found
x'???????' = Timed out
x'FFFFFFF' = Not found
any other   = Not tested

F3=Exit  F12=Cancel

```

Figure A-11. Verify Communications, Display 8 of 8

You have now verified that the ATM connection is properly configured and operational through the entire network.

Failures during the ATM verify communications test

Failures during the verify communications test may be caused by a number of problems. The LAN emulation configuration server (LECS), LAN emulation server (LES), or ATM network switch may be one of the following:

- Configured improperly
- Not operational
- Not reachable

A cable may be unplugged, reversed, or broken between the AS/400 adapter card and the ATM network switch. The AS/400 configuration may be incorrect or incomplete. The AS/400 input/output processor or adapter card may have failed. Finally, an internal code failure may have occurred.

For additional information on diagnosing such problems see “Finding ATM errors” on page 7-13 and “Analyzing data flows on the physical interface” on page B-6.

Appendix B. LAN communications trace

This appendix discusses communications trace functions available for local area network lines, as well as for frame-relay line and network interface descriptions. Communications traces can be used to collect and format data that is exchanged between the AS/400 system and remote systems, controllers, or personal computers. Trace data then can be displayed or printed for analysis and diagnosis of communications errors. Before running a communications trace, you can run the link test that is described in Appendix A, LAN link test to ensure that the remote station can be accessed by the AS/400 system.

Communications trace functions can be accessed using either CL commands or through the system service tools (SST) menu interface. This appendix uses the SST displays to describe communications trace functions. See *AS/400 Licensed Internal Code Diagnostic Aids - Volume 1* for more information about running communications traces using SST.

The following CL commands can be used to provide communications trace functions similar to those that are provided by SST. See the *CL Reference* book for complete descriptions of the following commands:

STRCMNTRC Start Communications Trace

ENDCMNTRC End Communications Trace

PRTCMNTRC Print Communications Trace

CHKCMNTRC Check Communications Trace

DLTCMNTRC Delete Communications Trace

Procedure for tracing data exchanged at vary on time

The purpose of running a communications trace most often is to collect data that is exchanged with a remote station when a configuration object is varied on.

For example, if a personal computer attached to the AS/400 system on a DDI line cannot communicate with the AS/400 system, you might use a communications trace to diagnose the problem. Using SST, the following procedure could be used to trace data exchanged with the personal computer when the controller description representing it is varied on. (This example assumes that the DDI line description is already varied on.)

1. Use the STRSST command to show the System Service Tools display. Choose the option to start a service tool.
2. Choose the option on the Start a Service Tool display to work with communications traces.
3. On the Work with Communications Traces display, press F6 to start a trace.
4. Specify the trace parameters shown on the Start Trace display shown in "Starting the trace" on page B-2. See "Starting the trace" on page B-2 for more information about these parameters. Press Enter to continue to the next display.
5. On the Select Trace Options display (shown in Figure B-2 on page B-4), choose the type of data you want to trace. In this example, you might choose

to trace only data sent to and received from the controller associated with the personal computer. After selecting the option to trace data for a remote controller, another display prompts for the name of the controller to trace. Enter the name of the controller and then press Enter to return to the Work with Communications Traces display.

See "Trace filters for high-speed communications" on page B-3 for more information about the Select Trace Options displays.

6. The trace status shown on the Work with Communications Traces display should now be waiting. The trace cannot begin until the controller being traced is varied on. Press F3 to return to the Start a Service Tool display, and then press F16 to return to the System Service Tools display. Press F10 to show the Command Entry display, and use the Vary Configuration (VRYCFG) or Work with Configuration Status (WRKCFGSTS) command to vary on the controller description for the personal computer.
7. Return to the Work with Communications Traces display. The trace status should be active or stopped, depending on the buffer size selected and whether the trace was specified to stop or wrap when the buffer is full. Use F5 to refresh the trace status.
8. When the trace is stopped, use option 6 to format and print the trace data.

Starting the trace

Starting the trace shows the Start Trace display used for SST communications traces. The Start Trace display allows you to control the size and use of the trace buffer and to select whether inbound or outbound data (or both) is traced.

Start Trace

Type choices, press Enter.

Configuration object	FDDILINE	
Type	<u>1</u>	1=Line, 2=Network interface 3=Network server
Trace description	FDDI line trace	
Buffer size (in kilobytes)	<u>7</u>	1=128, 2=256, 3=2048, 4=4096 5=6144, 6=8192, 7=16384
Stop on buffer full	<u>Y</u>	Y=Yes, N=No
Data direction	<u>3</u>	1=Sent, 2=Received, 3=Both
Number of bytes to trace:		
Beginning bytes	<u>*CALC</u>	Value, *CALC
Ending bytes	<u>*CALC</u>	Value, *CALC
F3=Exit F5=Refresh F12=Cancel		

Figure B-1. Start Trace Display

Configuration object

Specify the name of the line, network interface, or network server description to trace.

Type

Specify whether the traced object is a line or a network interface description.

Trace description

The trace description is optional but can be helpful in identifying trace data if many traces or many variations of a trace are run.

Buffer size

Specify the amount of storage the system should allocate for the trace buffer. For high-speed communications types such as DDI, fast Ethernet and frame relay, a large buffer size is recommended.

Stop on buffer full

This value determines whether collected trace data is overwritten with later data once the trace buffer is filled. To trace data exchanged when an attached controller is varied on, select Y to stop the trace when the buffer is full.

Data direction

Determines whether data sent, data received, or both, are traced. For example, select 3 to trace both the data sent from the AS/400 system to the remote station and the responses of the remote station to the AS/400 system.

Number of bytes to trace

This field allows you to specify the number of bytes traced from the beginning of each frame. For local area network lines, the beginning bytes value must be at least 72.

The default value, *CALC, determines the number of bytes to trace based on the protocol header length plus the frame size specified in the line or network interface description.

The ending bytes value is ignored for local area network lines, frame-relay lines, and network interface descriptions.

Trace filters for high-speed communications

The high data rates of DDI, frame-relay, token-ring and fast Ethernet communications can cause the trace buffer to fill very quickly. AS/400 communications trace support provides dynamic filtering options to save buffer space, and to exclude unwanted trace data. Formatting options also can be specified to limit the amount of data that is shown in the spooled file output of the trace.

Trace filter options for DDI, token-ring, and Ethernet lines

Trace data for DDI, token-ring and supported Ethernet line descriptions can be filtered to include only frames sent to or received from a specified:

- Controller
- Remote MAC (adapter) address
- Remote SAP

- Local SAP
- IP protocol number
- Remote IP address data

Note: Trace filtering options are not available for all Ethernet and token-ring adapters. If your Ethernet or token-ring adapter does not support trace filtering, all data is traced, and the following message appears in the prologue of the formatted trace: "Trace Options not supported. All data was traced (no filtering)".

Figure B-2 shows the Select Trace Options display that is used for DDI line descriptions. An identical screen is displayed when selecting trace options for Ethernet and token-ring line descriptions.

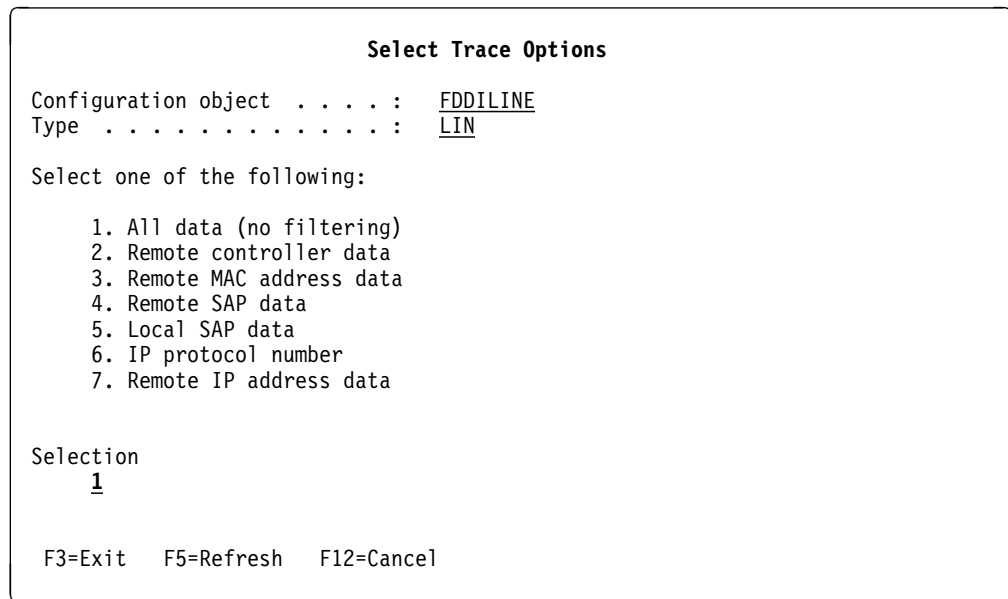


Figure B-2. Select Trace Options Display

The Format Trace Data display (Figure B-3) provides formatting options for collected trace data.


```

                                Format Trace Data
Configuration object . . . . . : FDDILINE
Type . . . . . : LINE
Type choices, press Enter.

Controller . . . . . : *ALL      *ALL, name
Data representation . . . . . : 3      1=ASCII, 2=EBCDIC, 3=*CALC

Format RR, RNR commands . . . : N      Y=Yes, N=No
Format Broadcast data . . . . : Y      Y=Yes, N=No
Format MAC or SMT data only . : N      Y=Yes, N=No
Format UI data only . . . . . : N      Y=Yes, N=No
Format SNA data only . . . . . : N      Y=Yes, N=No
Format TCP/IP data only . . . : N      Y=Yes, N=No
Format IPX data only . . . . . : N      Y=Yes, N=No

F3=Exit      F5=Refresh      F12=Cancel

```

Figure B-3. Format Trace Data Display

Trace options for frame-relay lines and network interfaces

Communications trace data for frame-relay-network interfaces can be filtered to exclude local management interface (LMI) data or to include only LMI data.

Figure B-4 shows the Select Trace Options display for a frame-relay network interface description.

A trace can be started either for the frame-relay network interface or for a single line attached to the network interface, but not both. Only one active communications trace is allowed on the frame-relay I/O adapter.

Running a communications trace on a frame-relay network interface without filtering collects trace data for all lines (DLCIs) attached to the network interface and can quickly fill the trace buffer. Use the option to trace only LMI data to trace data using DLCI 0 (the DLCI reserved for LMI data). Use the option to exclude LMI data to trace all other data on DLCIs attached to the network interface. To trace data using a particular DLCI, run the communications trace on the line description corresponding to that DLCI.

```

                                Select Trace Options
Configuration object . . . . . : FRNWI1
Type . . . . . : NWI

Select one of the following:

    1. All data
    2. Exclude LMI data
    3. Only LMI data

```

Figure B-4. Select Trace Options Display for Frame-Relay NWI

The Format Trace Data display (Figure B-5) provides options similar to those on the Select Trace Options display but is used to format data already collected.

```

                                Format Trace Data
Configuration object . . . . . : FRNWI1
Type . . . . . : NWI

Type choices, press Enter.

Line . . . . . : *ALL *ALL, name
Exclude LMI data . . . . . : N Y=Yes, N=No
Format LMI data only . . . . . : N Y=Yes, N=No

```

Figure B-5. Format Trace Data Display for Frame-Relay NWI

Analyzing data flows on the physical interface

For more in-depth analysis of the data transmitted and received by an ATM adapter, you may obtain more detailed information by tracing the data on the physical interface. The following example shows how to start, stop, format and view a communications trace.

1. Enter the Start System Service Tools (STRSST) command.
2. Select option 1 (Start a service tool).

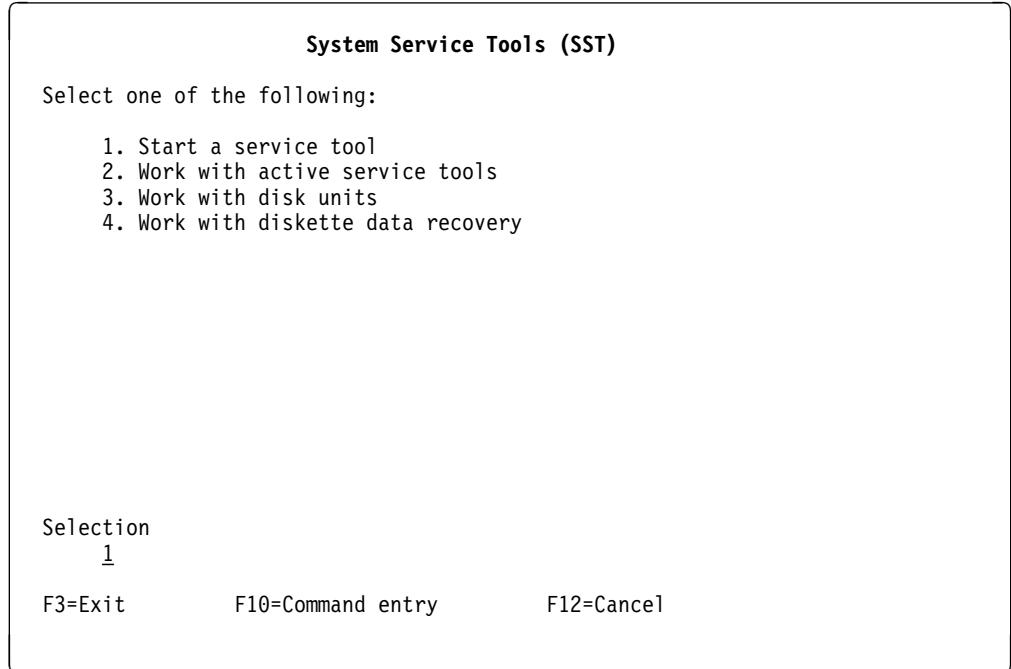


Figure B-6. System Service Tools (SST) Display

3. Select option 3 (Work with communications trace)

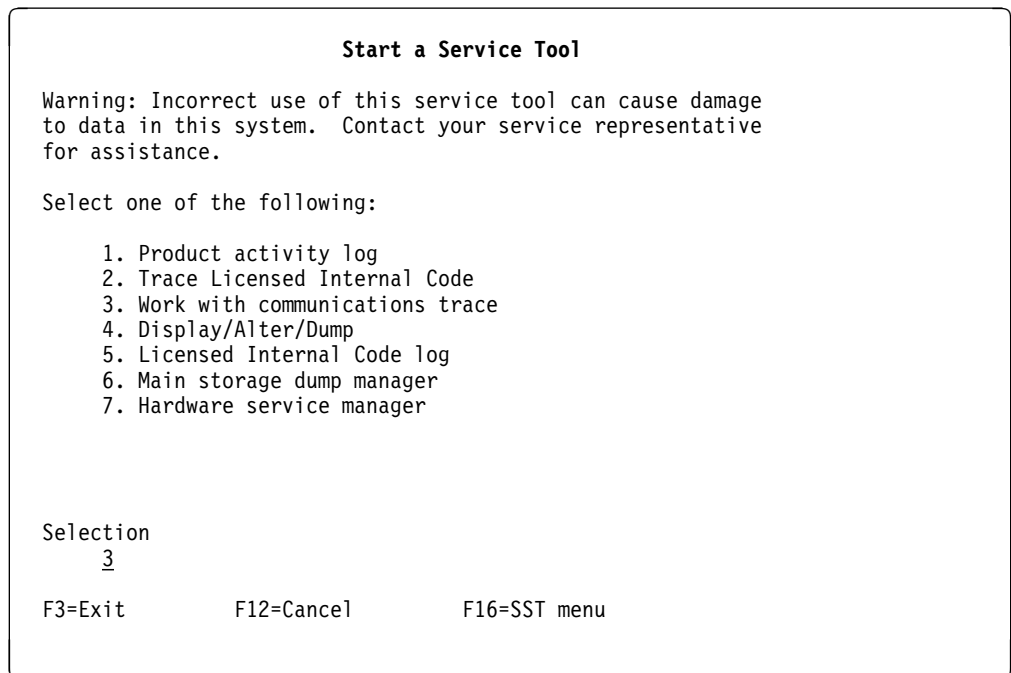


Figure B-7. Start a Service Tool Display

4. Press F6 (Start trace).


```

Work with Communications Traces

Type options, press Enter.
 2=Stop trace      4=Delete trace    6=Format and print trace
 7=Display message 8=Restart trace

Configuration
Opt  Object      Type  Trace Description  Protocol  Trace Status
 2   TSTETH1     LINE  TEST TRACE         ETHERNET  ACTIVE

F3=Exit   F5=Refresh   F6=Start trace  F10=Change size
F11=Display buffer size  F12=Cancel

```

Figure B-10. Active Communications Trace Display

8. Select option 6 (Format and print trace) to format the trace data.

```

Work with Communications Traces

Type options, press Enter.
 2=Stop trace      4=Delete trace    6=Format and print trace
 7=Display message 8=Restart trace

Configuration
Opt  Object      Type  Trace Description  Protocol  Trace Status
 6   TSTETH1     LINE  TEST TRACE         ETHERNET  STOPPED

F3=Exit   F5=Refresh   F6=Start trace  F10=Change size
F11=Display buffer size  F12=Cancel
Trace buffer wrapped

```

Figure B-11. Stopped Communications Trace Display

9. For this example, the defaults for formatting the trace are acceptable. Press Enter to format the trace.

```

                                Format Trace Data
Configuration object . . . . . : TSTETH1
Type . . . . . : LINE

Type choices, press Enter.

Controller . . . . . *ALL      *ALL, name

Data representation . . . . . 3      1=ASCII, 2=EBCDIC, 3=*CALC

Format RR, RNR commands . . . N      Y=Yes, N=No
Format Broadcast data . . . . Y      Y=Yes, N=No
Format UI data only . . . . . N      Y=Yes, N=No
Format SNA data only . . . . . N      Y=Yes, N=No
Format TCP/IP data only . . . . N      Y=Yes, N=No
Format IPX data only . . . . . N      Y=Yes, N=No
Select Ethernet data . . . . . 3      1=802.3, 2=ETHV2, 3=Both

F3=Exit      F5=Refresh      F12=Cancel

```

Figure B-12. Format Trace Data Display

10. When formatting of the trace data completes, you will be returned to the Format Trace Data panel with an appropriate message to confirm the formatting is complete. You may now press F3 repeatedly to exit System Service Tools.

```

                                Format Trace Data
Configuration object . . . . . : TSTETH1
Type . . . . . : LINE

Type choices, press Enter.

Controller . . . . . *ALL      *ALL, name

Data representation . . . . . 3      1=ASCII, 2=EBCDIC, 3=*CALC

Format RR, RNR commands . . . N      Y=Yes, N=No
Format Broadcast data . . . . Y      Y=Yes, N=No
Format UI data only . . . . . N      Y=Yes, N=No
Format SNA data only . . . . . N      Y=Yes, N=No
Format TCP/IP data only . . . . N      Y=Yes, N=No
Format IPX data only . . . . . N      Y=Yes, N=No
Select Ethernet data . . . . . 3      1=802.3, 2=ETHV2, 3=Both

F3=Exit      F5=Refresh      F12=Cancel
Format of trace data complete

```

Figure B-13. Format Trace Data Complete Display

11. The trace data may be viewed by entering the Work with Spooled Files (WRKSPLF) command, finding the entry just created and displaying that entry. An excerpt of the previous trace is included below.

The communications line trace is intended for use by individuals with extensive knowledge of communications protocols. The analysis of such information is beyond the scope of this book.

```

COMMUNICATIONS TRACE      Title: TEST TRACE      07/25/97 11:32:28      Page: 1
Trace Description . . . . . TEST TRACE
Configuration object . . . . . TSTETH1
Type . . . . . 1          1=Line, 2=Network Interface
                          3=Network server

Object protocol . . . . . ETHERNET
Start date/Time . . . . . 07/25/97 11:31:21.961
End date/Time . . . . . 07/25/97 11:31:40.051
Bytes collected . . . . . 4193526
Buffer size (in kilobytes) . . . . . 4          1=128, 2=256, 3=2048, 4=4096
                                          5=6144, 6=8192, 7=16384

Data direction . . . . . 3          1=Sent, 2=Received, 3=Both
Stop on buffer full . . . . . N          Y=Yes, N=No
Number of bytes to trace
Beginning bytes . . . . . *CALC      Value, *CALC
Ending bytes . . . . . *CALC      Value, *CALC

Select Trace Options:
-----
Remote Controller . . . . .          Name, *ALL
Remote MAC Address . . . . .          Value, *ALL
Remote SAP . . . . .          Value, *ALL
Local SAP . . . . .          Value, *ALL
IP Identifier . . . . .          Value, *ALL
Remote IP Address . . . . .          Value, *ALL

Format Options:
-----
Controller name . . . . . *ALL      *ALL, name
Data representation . . . . . 3      1=ASCII, 2=EBCDIC, 3=*CALC
Format SNA data only . . . . . N      Y=Yes, N=No
Format RR, RNR commands . . . . . N      Y=Yes, N=No
Format TCP/IP data only . . . . . N      Y=Yes, N=No
Format IPX data only . . . . . N      Y=Yes, N=No
Format UI data only . . . . . N      Y=Yes, N=No
Select Ethernet data . . . . . 3      1=802.3, 2=ETHV2, 3=Both
Format Broadcast data . . . . . Y      Y=Yes, N=No

COMMUNICATIONS TRACE      Title: TEST TRACE      07/25/97 11:32:28      Page: 2
Record Number . . . . . Number of record in trace buffer (decimal)
S/R . . . . . S=Sent R=Received M=Modem Change
Data Length . . . . . Amount of data in record (decimal)
Record Status . . . . . Status of record
Record Timer . . . . . Time stamp. Based on communications hardware, the time
                          stamp will be either:
                          1. 10 microsecond resolution time of day
                              (HH:MM:SS.NNNNN) based on the system time when the
                              trace was stopped
                          2. 100 millisecond resolution relative timer with
                              decimal times ranging from 0 to 6553.5 seconds
Data Type . . . . . EBCDIC data, ASCII data or Blank-Unknown
Controller name . . . . . Name of controller associated with record
Command . . . . . Command/Response information
Number sent . . . . . Count of records sent
Number received . . . . . Count of records received
Poll/Final . . . . . ON=Poll for Commands, Final for Responses
Destination MAC Address . . . . . Physical address of destination
Source MAC Address . . . . . Physical address of source
DSAP . . . . . Destination Service Access Point
SSAP . . . . . Source Service Access Point
Frame Format . . . . . 802.3 (IEEE Standard 802.3) or ETHV2
                          (Ethernet Version 2)

Commands/Responses:
-----
I . . . . . Information
RR . . . . . Receive Ready
RNR . . . . . Receive Not Ready
REJ . . . . . Reject
UI . . . . . Unnumbered Information
UA . . . . . Unnumbered Acknowledgment
DISC . . . . . Disconnect/Request Disconnect
TEST . . . . . Test
SIM . . . . . Set Initialization Mode
FRMR . . . . . Frame Reject
DM . . . . . Disconnected Mode
XID . . . . . Exchange ID
SABME . . . . . Set Asynchronous Balanced Mode Extended
***** . . . . . Command/Response Not Valid
VPI . . . . . Virtual Path Identifier (decimal)
VCI . . . . . Virtual Channel Identifier (decimal)
LEHDR . . . . . Lan Emulation Header

COMMUNICATIONS TRACE      Title: TEST TRACE      07/25/97 11:32:28      Page: 2
*** COMMUNICATIONS TRACE INFORMATION MESSAGES ***
Trace buffer wrapped
*** END TRACE INFORMATION MESSAGES ***

```

Figure B-14. Communications Trace Data Excerpt. Part 1 of 2.

Appendix C. AS/400 LAN manager support

The AS/400 LAN manager is part of the OS/400 licensed program that provides basic LAN management functions for token-ring and DDI networks. The LAN manager monitors the status of the network and attached stations and provides problem determination information. The AS/400 LAN manager provides this support for the locally attached ring only.

AS/400 LAN manager support includes the following:

- Analysis and reporting of error conditions, such as **beaconing**.¹
- Alerts the network central site of errors causing performance degradation and beaconing conditions.
- Operational functions, such as:
 - Displaying ring configuration
 - Displaying network status
 - Displaying adapter profiles
 - Adapter name support
 - Setting the level of error reporting and logging

For token-ring networks, the LAN manager uses the ring error monitor (REM) and configuration report server (CRS) functions. LAN manager support for DDI networks uses FDDI Station Management (SMT), versions 6.2 through 7.3. The AS/400 LAN manager does not support management of LAN Server-connected LANs or of remote LANs attached through frame-relay connections.

Token-ring network LAN manager support

You can turn on and turn off AS/400 LAN manager support on token-ring lines using the ACTLANMGR (Activate LAN Manager) parameter in the token-ring line description. Figure C-1 on page C-2 and Figure C-2 on page C-2 show examples of AS/400 line description screen displays. See “LAN manager support activation considerations” on page C-3 for further information.

ACTLANMGR Activate LAN Manager. This parameter provides the option of turning on or turning off LAN manager support for the line. Specifying *NO disables the REM and CRS functions, and no error information is sent to the history log queue (QHST) and the system operator queue (QSYSOPR). Setting ACTLANMGR to *NO may increase network processing performance.

Note: ACTLANMGR must be set to *YES when RSRNAME(*NWID) is specified.

Figure C-1 shows an example of the Create Line Description (CRTLINTRN) display for token ring. Set ACTLANMGR to *NO to turn off the LAN manager.

¹ Beaconing is a repeated message sent in a token-ring network to indicate an adapter is not receiving a normal signal because of a serious error, such as a line break or power failure.

```

Create Line Desc (Token-Ring) (CRTLINTRN)

Additional Parameters

Network controller . . . . . Name
Activate LAN manager . . . . . *NO *YES, *NO
TRLAN manager logging level . . *OFF *OFF, *MIN, *MED, *MAX
TRLAN manager mode . . . . . *OBSERVING *OBSERVING, *CONTROLLING
Log configuration changes . . . *LOG *LOG, *NOLOG
Token-ring inform of beacon . . *YES *YES, *NO
Functional address . . . . . *NONE *NONE, C00000000001...
      + for more values
Early token release . . . . . *LINESPEED *YES, *NO, *LINESPEED
Error threshold level . . . . . *OFF *OFF, *MIN, *MED, *MAX
Link speed . . . . . 4M *MIN, 1200, 2400, 4800...
More...

F3=Exit F4=Prompt F5=Refresh F12=Cancel F13=How to use this display
F24=More keys

```

Figure C-1. Turning Off LAN Manager in the CRTLINTRN Display for Token Ring

Figure C-2 shows an example of the Change Line Description (CHGLINTRN) display for a token-ring line. Set ACTLANMGR to *NO to turn off LAN Manager support for token-ring line TRN01.

```

Change Line Desc (Token-Ring) (CHGLINTRN)

Type choices, press Enter.

Line description . . . . . > TRN01 Name
Resource name . . . . . TRN01 Name, *SAME, *NWID, *NWSD
Online at IPL . . . . . *NO *SAME, *YES, *NO
Vary on wait . . . . . *NOWAIT *NOWAIT, 15-180 seconds
Maximum controllers . . . . . 40 1-256, *SAME
Line speed . . . . . 16M *SAME, 4M, 16M, *NWI
Duplex . . . . . *HALF Character value, *SAME...
Maximum frame size . . . . . 1994 265-16393, *SAME, 265, 521...
Activate LAN manager . . . . . *NO *SAME, *YES, *NO
TRLAN manager logging level . . *OFF *SAME, *OFF, *MIN, *MED, *MAX
TRLAN manager mode . . . . . *CONTROLLING *SAME, *OBSERVING...
Log configuration changes . . . *LOG *SAME, *LOG, *NOLOG
Token-ring inform of beacon . . *NO *SAME, *YES, *NO
Local adapter address . . . . . *ADPT 400000000000-7FFFFFFF...
Functional address . . . . . *SAME *SAME, *NONE, C00000000001...
      + for more values
More...

F3=Exit F4=Prompt F5=Refresh F12=Cancel F13=How to use this display
F24=More keys

```

Figure C-2. Turning Off LAN Manager in the CHGLINTRN Display for Token Ring

LAN manager support activation considerations

If the token-ring line supports LAN Manager, consider setting ACTLANMGR to *YES if:

- No other token-ring management is available in your installation
- No other token-ring line on an AS/400 system monitors the ring
- Problems are actively occurring on the ring
- Equipment that is attached on the token ring is being changed

Consider setting ACTLANMGR to *NO on a token-ring line if:

- Other lines on the current or another AS/400 system attach to the same token-ring line and have an active LAN Manager
- Hardware already on the ring provides LAN Manager support adequate to monitor the ring stations on the token ring
- The AS/400 system is a 9401 or 9402 model
- Your system has a multifunction input/output processor (IOP) supporting more than one token-ring attachment, and it has become a bottleneck

Note: When ACTLANMGR is set to *NO, the TRNLOGLVL, TRNMGRMODE, LOGCFGCHG and TRNINFBCN parameters are ignored (see “Specifying LAN manager operations”).

Specifying LAN manager operations

The level of support provided by the AS/400 LAN Manager is specified using several parameters on the token-ring and DDI line descriptions.

Token-ring network lines

The Create Line Description (Token-Ring) (CRTLINTRN) command allows you to specify a number of parameters used to control error reporting on the ring. After the line description has been created, these parameters can be changed using the Change Line Description (Token-Ring) (CHGLINTRN) command.

TRNLOGLVL

TRLAN Manager logging level. This parameter is used to change the level of error logging on the ring. The logging levels supported by the TRNLOGLVL parameter are *OFF, *MIN, *MED, and *MAX.

Table C-1 shows the messages logged by the AS/400 LAN Manager for various error conditions when TRNLOGLVL is set to *MIN, *MED, and *MAX. The TRNLOGLVL value listed is the minimum value required for the message to be logged. For example, messages listed as requiring a minimum TRNLOGLVL value of *MED will also be listed if the TRNLOGLVL value specified is *MAX.

<i>Table C-1. LAN Manager Message Logging for Token-Ring Network Lines</i>		
Event or Condition	Message	Minimum TRNLOGLVL Value
Recoverable errors increasing	CPF8B01	*MIN
Excessive recoverable errors	CPF8B03	*MIN
Frequency mismatch errors	CPF8B05	*MED
Frame copied errors	CPF8B06	*MED
Receive congestion errors	CPF8B07	*MED
Lost frame errors	CPF8B08	*MED
Token errors	CPF8B09	*MED
Ring monitor errors	CPF8B10	*MAX
Poll failure	CPF8B11	*MAX
Recoverable error report	CPF8B12	*MAX ¹
Excessive recoverable errors	CPF8B13	*MIN
Recoverable errors increasing	CPF8B14	*MIN
Received invalid ring error monitor (REM) data	CPF8B21	*MIN
Received invalid configuration report server (CRS) data	CPF8B22	*MIN
Receiver congestion table full	CPF8B25	*MIN
Receiver congestion	CPF8B26	*MIN
¹ CPF8B12 messages may also be logged when TRNLOGLVL(*MED) is specified. CPF8B12 is logged with one or more of messages CPF8B03 and CPF8B05—CPF8B09 when the number of errors reported by these messages exceeds the error threshold for the adapter.		

TRNMGRMODE

TRLAN Manager mode. The line description can be configured to serve as a controlling (*CONTROLLING) or observing (*OBSERVING) network manager. Only one adapter (line description) configured as a controlling network manager can be active on the ring at one time.

The controlling network manager tracks configuration changes on the ring and can remove other adapters from the ring. Changes are tracked through the nearest active upstream neighbor (NAUN) reports on the ring.

LOGCFGCHG

Log configuration changes. If LOGCFGCHG(*LOG) is specified on the line description, the network manager on the line logs all changes in QHST. These changes include one of the following:

- Whenever a station joins the ring, for example, when a workstation is powered on.
- Whenever a station leaves the ring, for example, when a workstation is powered off.

If LOGCFGCHG(*NOLOG) is specified, no changes are tracked.

TRNINFBCN

Token-ring inform of beacon. To send beaconing information to the history log (QHST), specify *YES for this parameter. If you specify *NO, the information is not logged.

Ring error problems reported to QHST are logged as messages. Many problems are also logged to the system operator message queue (QSYSOPR). Errors on the ring considered serious enough to affect performance and other errors that cause beaconing are logged to QHST as alertable messages. Alertable messages may cause an alert to be reported to a network operator at a problem management (alert) focal point.

IBM Personal Computer LAN manager

The IBM LAN Manager provides network management functions for the personal computer that are similar to those of the AS/400 LAN Manager. Table C-2 lists the terminology used by the PC LAN Manager to describe soft (recoverable) error levels and the equivalent logging level values specified for the AS/400 TRNLOGLVL parameter.

LAN Manager Error Logging Level	Equivalent AS/400 TRNLOGLVL Parameter Value
Full	*MAX (maximum)
Limited	*MIN or *MED (minimum or medium)
None	*OFF
Reset	No similar parameter

DDI lines

The Create Line Description (DDI) (CRTLINDDI) command allows you to specify a number of parameters used to control error reporting on the ring. After the line description has been created, these parameters can be changed using the Change Line Description (DDI) (CHGLINDDI) command.

LOGLVL

Log level. This parameter is used to change the level of error logging on the ring. The logging levels supported by the LOGLVL parameter are *OFF, *ERRORS, and *ALL. *ERRORS logs only ring error messages. *ALL logs both error and informational messages.

Table C-3 shows the messages logged by the AS/400 LAN manager for various error conditions when LOGLVL is set to *ERRORS or *ALL. The LOGLVL value listed is the minimum value required for the message to be logged. For example, messages listed as requiring a minimum LOGLVL value of *ERRORS will also be listed if the LOGLVL value specified is *ALL.

<i>Table C-3. LAN Manager Message Logging for DDI Lines</i>		
Event or Condition	Message	Minimum LOGLVL Value
Duplicate address	CPF8B95	*ERRORS
Elasticity buffer condition	CPF8B97	*ERRORS
Frame error condition	CPF8B90	*ERRORS
Frame not copied condition	CPF8B85	*ERRORS
Link error rate (LER) alarm	CPF8B92	*ALL
MAC path change event	CPF8BC0	*ALL
Neighbor change event	CPF8BB3	*ALL
Peer wrap condition	CPF8B9A	*ERRORS
Port path change event	CPF8BA4	*ERRORS
Undesirable connection	CPF8BA8	*ALL

LCLMGRMODE

Local manager mode. This parameter specifies whether the local station (line description) serves as an observing LAN Manager (*OBSERVING) or not (*NONE). If *OBSERVING is specified, this station can retrieve information about all other adapters on the network. If *NONE is specified, the local LAN Manager function can supply information about the local adapter only.

Using the LAN manager

You can use menus, prompt displays, or CL commands to perform AS/400 LAN Manager functions. The following commands provide the CL interface to the AS/400 LAN Manager.

ADDLANADPI Add LAN Adapter Information

CHGLANADPI Change LAN Adapter Information

DSPLANADPP Display LAN Adapter Profile

DSPLANSTS Display LAN Status

RMVLANADPT Remove LAN Adapter

RMVLANADPI Remove LAN Adapter Information

RNMLANADPI Rename LAN Adapter Information

WRKLANADPT Work with LAN Adapters

The Work with LAN Adapters display shown in Figure C-3 provides access to all of the functions of the commands listed above.

For token-ring lines, the Work with LAN Adapters display also includes Option 14 (Remove adapter) if the following are true:

- The line description specified is a token-ring line specified with TRNMGRMODE(*CONTROLLING)
- The user has authority to use the RMVLANADPT command

```

Work with LAN Adapters
                                                    System:  SYSNAMxx
Line description . . . . . :  DDILINE
Line type . . . . . :  *DDI

Type options, press Enter.
  1=Add entry  2=Change  4=Remove entry  5=Display profile  6=Print
  7=Rename

Opt  Address      Name                Status  Description
-  -
-  10005AEDC042  ENDAS401DD          Active  ENDAS401 DAS card
-  10005ADF035B  CONCENTRAT         Active  IBM Concentrator
-  10000418859A  STARWS              Active  Solar Workstation SAS
-  0000A65080B5  NETSYS              Active  NETSYS System
-  10005AEDC256  LABSYS01            Inactive DDI
-  10005AEDC25C  LABSYS02            Inactive DDI
-  10005AEDC226  ENDAS411DD         Inactive ENDAS411 FDDI Adapter
                                                    Bottom

Command
===>
F3=Exit  F4=Prompt  F5=Refresh  F6=Print  F9=Retrieve
F10=Display LAN status  F11=Display full text  F12=Cancel  F17=Position to

```

Figure C-3. Work with LAN Adapters Display

LAN manager functions can also be accessed through the following commands:

Work with Configuration Status

Select option 12 (Work with LAN adapters) on the Work with Configuration Status display for the token-ring or DDI line description. This option shows the Work with LAN Adapters display for the selected line description.

Work with Hardware Resources

Specify type *LAN on the Work with Hardware Resources command. The resulting display (Work with LAN Adapter Information) allows you to work with information in the network adapter file. See Working with LAN adapter information for more information about the network adapter file.

Working with LAN adapter information

The network adapter file contains information that allows you to easily identify each adapter on the network. The adapter file associates names and descriptions that you specify for each adapter on the token-ring or DDI network.

For example, if a user changes physical location or begins using a system with a different adapter address, you can use the network adapter file to update this information.

When the WRKLANADPT command is run, the system automatically assigns names to adapters that do not already exist in the network adapter file. Adapter names assigned by the system use the format Dxxxxxxxx, where xxxxxxxxx is the last 9 digits of the adapter address. Use the RNMLANADPI command or the rename option on the Work with LAN Adapters display to change the default name.

Use the WRKLANADPT, ADDLANADPI, CHGLANADPI, RNMLANADPI, and RMVLANADPI commands to update the network adapter file. Note that removing LAN adapter information does not remove (de-insert) that adapter from the network.

Display LAN adapter profile

You can display the adapter profile from the Work with LAN Adapters display by selecting option 5 (Display profile) or by using the Display LAN Adapter Profile (DSPLANADPP) command. If the specified adapter does not exist in the network adapter file when the DSPLANADPP command is run, the system automatically supplies a default name for the adapter. If the upstream or downstream adapters do not exist in the network adapter file, the system supplies default names for these adapters also.

Figure C-4 shows an example of the Display Adapter Profile displays for a token-ring network adapter.

```

Display Adapter Profile
                                     System:  SYSNAMxx
Product ID . . . . . : 0CAF000000100746600032A334701683347
Licensed internal code . . . . . : F0F0F0C1F6F4F1F1F740
Group address . . . . . : C00080000000
Adapter address . . . . . : 40007A01D03E
Adapter name . . . . . : D07A01D03E
Adapter description . . . . . :

NAUN address . . . . . : 400000001591
NAUN name . . . . . : D000001591
NAUN description . . . . . :

Function                                Functional
Ring Error Monitor                        Address
Configuration Report Server                C00000000008
                                           C00000000010

                                           Bottom

Press Enter to continue.

F3=Exit  F5=Refresh  F6=Print  F12=Cancel

```

Figure C-4. Display Adapter Profile Display for Token-Ring Network Adapter

Figure C-5 shows an example of the Display Adapter Profile displays for a DDI adapter. Blank entries indicate that the value either cannot be retrieved by the LAN manager or are not supported by the displayed adapter. The entry for *Last set station address* is always blank when the *Station set count* is zero.


```

Display LAN Adapter Profile
                                                    System:  SYSNAMxx

Line information:
  Line description . . . . . :  DDILINE
  Line type . . . . . :  *DDI

Adapter information:
  Address . . . . . :  10005AEDC042
  Name . . . . . :  ENDAS401DD
  Description . . . . . :  ENDAS401 DAS card

Neighbor information:
  Upstream address . . . . . :  10005ADF035B
  Upstream name . . . . . :  CONCENTRAT
  Description . . . . . :  IBM Concentrator

  Downstream address . . . . . :  0000A65080B5
  Downstream name . . . . . :  NETSYS
  Description . . . . . :  NETSYS System

                                                    More...

F3=Exit  F5=Refresh  F6=Print  F12=Cancel

```

Figure C-5 (Part 1 of 4). Display Adapter Profile Display for DDI Adapter

```

Display LAN Adapter Profile
                                                    System:  SYSNAMxx

Station states:
  Operating State . . . . . :  Thru
  Ring connection:
  Operational
  Port A connection . . . . . :  Active
  Port B connection . . . . . :  Active
  Station Connection . . . . . :  In
  Station Configuration . . . . . :  Thru

  Peer wrap . . . . . :  Off

```

Figure C-5 (Part 2 of 4). Display Adapter Profile Display for DDI Adapter

```

Display LAN Adapter Profile
                                                    System:  SYSNAMxx

Additional information:
  Non-master port count . . . . . :  2
  Master port count . . . . . :  0
  Port A physical media type . . . . . :  Unspecified
  Port B physical media type . . . . . :  Unspecified
  Supported SMT versions . . . . . :  00002
  Universal adapter address . . . . . :  10005AEDC042
  Manufacturer information . . . . . :

```

Figure C-5 (Part 3 of 4). Display Adapter Profile Display for DDI Adapter

```

Display LAN Adapter Profile
System:  SYSNAMxx

Station status:
Status reporting . . . . . : On
MAC total frames received . . . . . : 0000001318
MAC frames copied . . . . . : 0000001318
MAC frames transmitted . . . . . : 0000000239
MAC frames lost . . . . . : 0000000000
MAC frame errors . . . . . : 0000000000
MAC frame error threshold . . . . . : 00000
MAC frame error ratio . . . . . : 00000
Port A LEM count . . . . . : 0000000000
Port A LER alarm threshold . . . . . : 1.0E-08
Port A LER cutoff threshold . . . . . : 1.0E-07
Port A LER estimate . . . . . : 1.0E-15
Port B LEM count . . . . . : 0000000000
Port B LER alarm threshold . . . . . : 1.0E-08
Port B LER cutoff threshold . . . . . : 1.0E-07
Port B LER estimate . . . . . : 1.0E-15
Station set count . . . . . : 0000000000
Last set station address . . . . . :

F3=Exit  F5=Refresh  F6=Print  F12=Cancel
Bottom

```

Figure C-5 (Part 4 of 4). Display Adapter Profile Display for DDI Adapter

Display LAN status

You can display the status of the network from the Work with LAN Adapters display by pressing F10 (Display LAN status) or by using the Display LAN Status (DSPLANSTS) command.

Figure C-6 shows an example of the Display LAN Status display for a DDI network.

```

Display LAN Status
System:  SYSNAMxx

Line description . . . . . : DDILINE
Ring status . . . . . : Operational

```

Figure C-6. Display LAN Status Display

Appendix D. Address considerations for bridged environments

MAC addresses are always displayed in the physical address format for the DDI, token ring, or Ethernet environment even if they represent stations on other LAN media. Refer to "Token-ring physical address format" on page 3-3 for the format of token-ring and DDI MAC addresses or to "Ethernet physical address format" on page 5-4 for the format of Ethernet MAC addresses.

Because MAC address formats are in a different bit order, the configured physical addresses will appear in reversed bit order when viewed from different LAN types on opposite sides of the 8209 LAN Bridge. "Token-ring-to-Ethernet address conversion" on page D-3 provides a conversion table for determining the equivalent addresses.

Note: If you are using the same LAN types on both sides of a series of bridges, no address conversion is necessary. For example, an AS/400 system in an Ethernet network communicating with another AS/400 system in an Ethernet network across a token ring and two LAN Bridges does not need to convert addresses.

Examples of address views

Consider the following example of different address views.

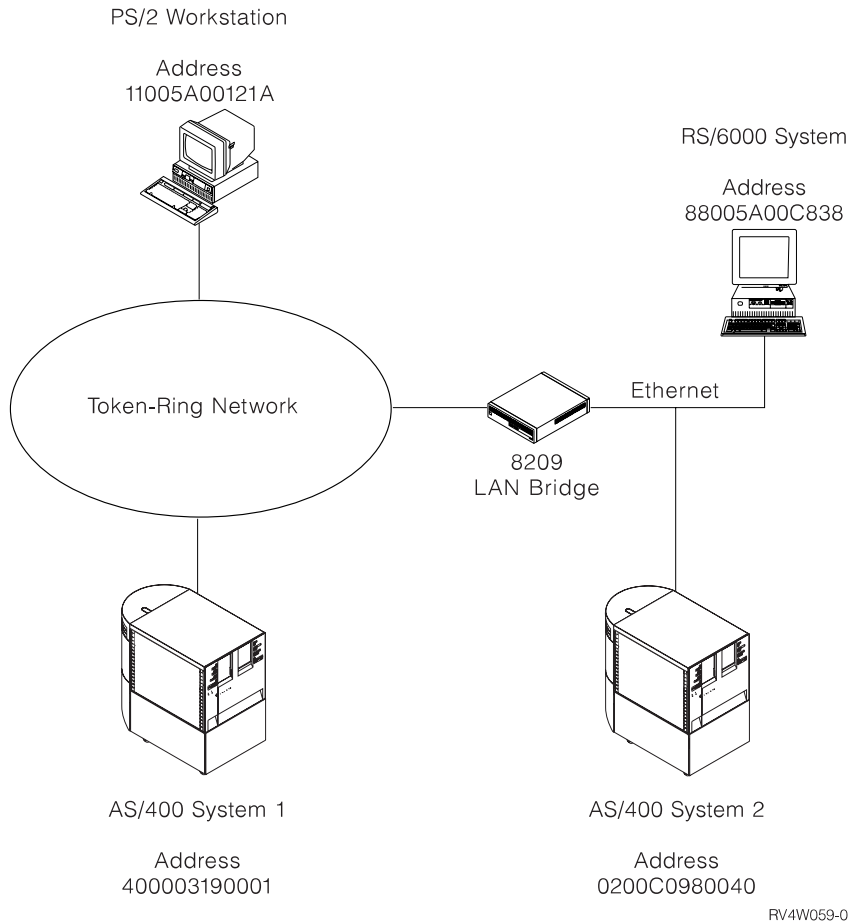


Figure D-1. Bridged LAN Addressing

Configuration records for AS/400 system on token-ring network

When System 1 in Figure D-1 is being configured, the addresses of the various systems in the network are viewed as being in token-ring addressing format of most significant bit. The following figure demonstrates System 1 viewpoint.

<i>Table D-1. Addresses from AS/400 1 View</i>	
AS/400 1 View	Address
Local Address (System 1)	400003190001
Remote AS/400 System (System 2)	400003190002
PS/2 Address	11005A00121A
RS/6000 Address	11005A00131C

Configuration records for AS/400 system on Ethernet network

When System 2 in Figure D-1 is being configured, the addresses of the various systems in the network are viewed as being in Ethernet addressing format of least significant bit. The following figure demonstrates System 2 viewpoint.

<i>Table D-2. Addresses from AS/400 2 View</i>	
AS/400 2 View	Address
Local Address (System 2)	0200C0980040
Remote AS/400 System (System 1)	0200C0980080
PS/2 Address	88005A004858
RS/6000 Address	88005A00C838

Token-ring-to-Ethernet address conversion

The bit order of the 48-bit (12-hexadecimal digits) IEEE MAC address is reversed between the token-ring and Ethernet LANs. Some protocols that use this MAC address may not adjust for the inverted bits when communicating between LANs. Therefore, you must manually convert the address bit order. Use the following procedure and Table D-3 on page D-4 to convert an address. For an example of how to convert an address, see “Example of converting an address” on page D-4.

1. Write the 12-hexadecimal-digit MAC address.

Note: Separate the 12-hexadecimal digits into pairs. Use the first character of each pair as the row coordinate and the second character as the column coordinate.

2. Locate a bit order inverted pair in Table D-3 on page D-4.
3. Combine the 6 pairs into a 12-hexadecimal-digit address.

Table D-3. Example Conversion Table

2nd Char → (Column) 1st Char ↓ (Row)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	00	80	40	C0	20	A0	60	E0	10	90	50	D0	30	B0	70	F0
1	08	88	48	C8	28	A8	68	E8	18	98	58	D8	38	B8	78	F8
2	04	84	44	C4	24	A4	64	E4	14	94	54	D4	34	B4	74	F4
3	0C	8C	4C	CC	2C	AC	6C	EC	1C	9C	5C	DC	3C	BC	7C	FC
4	02	82	42	C2	22	A2	62	E2	12	92	52	D2	32	B2	72	F2
5	0A	8A	4A	CA	2A	AA	6A	EA	1A	9A	5A	DA	3A	BA	7A	FA
6	06	86	46	C6	26	A6	66	E6	16	96	56	D6	36	B6	76	F6
7	0E	8E	4E	CE	2E	AE	6E	EE	1E	9E	5E	DE	3E	BE	7E	FE
8	01	81	41	C1	21	A1	61	E1	11	91	51	D1	31	B1	71	F1
9	09	89	49	C9	29	A9	69	E9	19	99	59	D9	39	B9	79	F9
A	05	85	45	C5	25	A5	65	E5	15	95	55	D5	35	B5	75	F5
B	0D	8D	4D	CD	2D	AD	6D	ED	1D	9D	5D	DD	3D	BD	7D	FD
C	03	83	43	C3	23	A3	63	E3	13	93	53	D3	33	B3	73	F3
D	0B	8B	4B	CB	2B	AB	6B	EB	1B	9B	5B	DB	3B	BB	7B	FB
E	07	87	47	C7	27	A7	67	E7	17	97	57	D7	37	B7	77	F7
F	0F	8F	4F	CF	2F	AF	6F	EF	1F	9F	5F	DF	3F	BF	7F	FF

Example of converting an address

Figure D-2 shows how token-ring address 10005A4DBC96 is converted into a bit-inverted Ethernet address of 08005AB23D69.

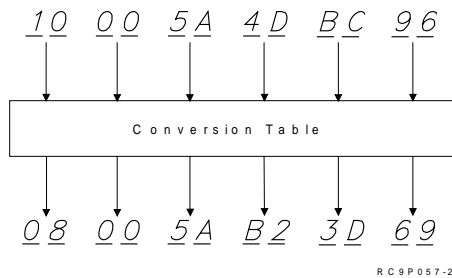


Figure D-2. An Example of Token-Ring Address Conversion

For more examples of converting adapter addresses for bridged configurations, see "Token-ring-to-Ethernet bridge configuration example" on page 6-8.

Appendix E. ATM network error codes and cause codes

This appendix describes AS/400 ATM network error codes and cause codes.

ATM network error codes

The LAN emulation software may report the following ATM network error codes:

Table E-1 (Page 1 of 6). ATM Network Error Codes

Error Code	Technical Description
1EC08001	A failure occurred during the JOIN request. The LAN emulation server reported the cause of the failure as "unknown".
1EC08002	The LEC attempted to create a connection to the LES and the call setup failed. The LEC received no response from the LES within the timeout period. The line description may contain an incorrect LES ATM address or the LES may be inoperative. Check the LES ATM address in the line description for accuracy and ensure the LES is powered on and operational.
1EC08003	The LEC attempted to create a connection to the LES and the call setup failed. The LEC received an error response from the switch. Use the network cause code to determine the source of the error and its remedy.
1EC08004	The LEC sent an ARP (address resolution protocol) to the LES to determine the address of the BUS. The LES responded to the request but did not return the address of the BUS to the LEC. The problem resides in either the LES or the BUS.
1EC0800A	The LEC sent an ARP (address resolution protocol) to the LES to determine the address of the BUS. The LES did not respond to the LEC within the timeout period. The problem resides in the LES.
1EC0800D	The AS/400 Licensed Internal Code failed during a vary-on of the line. You should contact your service provider.
1EC0800E	The LEC attempted to create a connection to the BUS and the call setup failed. The LEC received no response from the BUS within the timeout period. This may be due to an inoperative BUS, or due to an incorrect BUS address received from the LES. The problem resides either in the LES or the BUS.
1EC0800F	The LEC attempted to create a connection to the LECS and the call setup failed. Either the LEC received an error response from the switch, or it received no response from the LECS within the timeout period. The problem resides in either the switch or the LECS. Use the network cause code to determine the source of the error and its remedy.
1EC08011	The LEC attempted to register its ATM address with the switch. The switch returned an error and the address was not registered. This could be due to a number of reasons. There may be a problem with the switch. Another device may have already registered this address with the switch. A licensed internal code failure may have occurred. Check to ensure that no other device has registered the same ATM address as the AS/400 LEC. If this is not the case, contact your service provider for assistance.

Table E-1 (Page 2 of 6). ATM Network Error Codes

Error Code	Technical Description
1EC08020	The connection from the LAN Emulation Client (LEC) to the BUS was unexpectedly cleared. Use the network cause code to determine the reason for the failure and its remedy. If no network cause code was returned, the reasons may be either a timeout waiting for a response, the loss of the physical connection or the call was cleared due to other errors within the AS/400 ATM software.
1EC08021	The connection from the LAN Emulation Client (LEC) to the LES was unexpectedly cleared. Use the network cause code to determine the reason for the failure and its remedy. If no network cause code was returned, the reasons may be either a timeout waiting for a response, the loss of the physical connection or the call was cleared due to other errors within the AS/400 ATM software.
1EC08101	The version of LAN emulation in use by the LAN emulation server does not match that of the AS/400 LAN emulation client. The AS/400 supports only ATM Forum LAN Emulation standard 1.0. If possible, change the LES configuration to use this standard. Otherwise, the AS/400 can not connect with this LES.
1EC0810F	The version of LAN emulation in use by the LAN emulation configuration server does not match that of the AS/400 LAN emulation client. The AS/400 supports only ATM Forum LAN Emulation standard 1.0. If possible, change the LECS configuration to use this standard. Otherwise, the AS/400 can not connect with this LECS. Directly configuring the AS/400 LEC to use a specific LAN emulation server provides an alternative to using the LECS. Do this by changing the line description to *NO in the Use LECS address parameter field and entering a valid ATM address in the LES ATM address parameter fields.
1EC08201	This LEC sent a JOIN request to the LAN emulation server with parameters that are incompatible with the emulated LAN the LES controls. Consult the LES configuration to determine appropriate values and change the values on the AS/400 line description to acceptable alternatives. If no acceptable values can be found, the AS/400 LEC cannot connect with this LES.
1EC0820F	This LEC sent a JOIN request to the LAN emulation server with parameters that are either not valid or are incompatible with the emulated LAN the LES controls. Consult the LES configuration to determine appropriate values and change the values on the AS/400 line description to acceptable alternatives. If no acceptable values can be found, the AS/400 LEC cannot connect with this LES. If acceptable alternatives are used but the LEC still returns this error, a problem may exist in the AS/400 ATM software. In such a case, contact your service provider for further assistance.
1EC08401	The LEC attempted to JOIN an emulated LAN using a LAN MAC address already in use by another device. The LAN emulation server will not allow two devices to register with the same address. Either this LEC or the other device must change their MAC (local adapter) address in order for both to JOIN this emulated LAN.
1EC08501	The LEC attempted to JOIN an emulated LAN using an ATM address already in use by another device. The LAN emulation server will not allow two devices to register with the same address. Either this LEC or the other device must change their ATM address in order for both to JOIN this emulated LAN.
1EC08601	The LAN emulation server denied a JOIN request due to insufficient resources within the LES. Typically, this indicates the LES currently serves its maximum number of clients. Either increase the resources available to the LES (number of virtual connections, storage available, and so forth), or direct a portion of the clients from this LES to another.

Table E-1 (Page 3 of 6). ATM Network Error Codes

Error Code	Technical Description
1EC0860F	The LAN emulation configuration server denied a CONFIGURE request due to insufficient resources within the LECS. Typically, this indicates the LECS currently serves its maximum number of clients. Try waiting a short period of time and trying again.
1EC08701	The LES has denied access to the AS/400 LEC for security reasons. If the LES has a configuration table, add the LEC to the table. Also, some LES implementations require that the LEC contact the LECS first before contacting the LES. In this case, change the line description parameter Use LECS address from *NO to *YES to contact the LECS.
1EC0870F	The LECS has denied access to the AS/400 LEC for security reasons. If the LECS has a configuration table, add the LEC to the table. Directly configuring the AS/400 LEC to use a specific LAN emulation server provides an alternative to using the LECS. Do this by changing the line description to *NO in the Use LECS Address parameter field and entering a valid ATM address in the LES ATM Address parameter fields.
1EC08901	The LEC attempted to register a LAN address during a JOIN request that the LAN emulation server considers invalid. This includes broadcast, multicast group or functional addresses. For Ethernet/802.3, the valid range for LAN addresses is '020000000000' to '7EFFFFFFFF' in hexadecimal. The valid range for token-ring/802.5 is '400000000000' to '7FFFFFFFF' in hexadecimal.
1EC0890F	The LEC sent a CONFIGURE request with a LAN address the LAN emulation configuration server considers invalid. This includes broadcast, multicast group or functional addresses. For Ethernet/802.3, the valid range for LAN addresses is '020000000000' to '7EFFFFFFFF' in hexadecimal. The valid range for token-ring/802.5 is '400000000000' to '7FFFFFFFF' in hexadecimal. Directly configuring the AS/400 LEC to use a specific LAN emulation server provides an alternative to using the LECS. Do this by changing the line description to *NO in the Use LECS Address parameter field and entering a valid ATM address in the LES ATM Address parameter fields.
1EC08A01	This LEC sent a JOIN request to the LAN emulation server with an ATM address format that does not match the format in use by the LES. Since the AS/400 supports only one format it can not be changed. If possible, change the LES ATM address format to match that of the AS/400 client. Otherwise, the AS/400 LEC can not connect with this LES.
1EC08A0F	This LEC sent a CONFIGURE request to the LAN emulation configuration server with an ATM address format that does not match the format in use by the LECS. Since the AS/400 supports only one format it can not be changed. If possible, change the LECS ATM address format to match that of the AS/400 client. Otherwise, the AS/400 LEC can not connect with this LECS. Directly configuring the AS/400 LEC to use a specific LAN emulation server provides an alternative to using the LECS. Do this by changing the line description to *NO in the Use LECS Address parameter field and entering a valid ATM address in the LES ATM Address parameter fields.
1EC08B01	The LEC attempted to JOIN an emulated LAN using a maximum frame size larger than that supported by the LAN emulation server. The LLC maximum frame size must be less than or equal to the LAN emulation frame size of the LES. Use the CHGLINTRN command to change the maximum frame size on the token-ring line description for the LEC. The maximum frame size on Ethernet line descriptions are not configurable and, in this case, either the LES frame size must change or the AS/400 LEC cannot connect with this LES.

Table E-1 (Page 4 of 6). ATM Network Error Codes

Error Code	Technical Description
1EC08E01	The LEC attempted to JOIN an emulated LAN using either an unsupported LEC frame size or a LEC frame size that is smaller than that of the LES. The LEC frame size may be one of only four values: 1516, 4544, 9234 or 18190. Either change the LES LAN emulation frame size or verify which frame size that the LES is using and use the CHGLINTRN command to change the line speed on the token-ring line description to the same size as the LES. For a 16M line speed the LEC frame size used is 18190, and for a 4M line speed the LEC frame size used is 4544. The LEC frame size of Ethernet line descriptions is not configurable and, if the LES frame size cannot be changed to 1516, the AS/400 LEC cannot connect with this LES.
1EC08E0F	The LEC sent a CONFIGURE request to the LECS. The LEC received a valid response with a good status value. However, the maximum frame size returned by the LECS is greater than that of the client's configured LEC frame size. Either change the LECS configuration to point to a LES with a LAN emulation frame size that matches that of this client or verify which frame size that the LECS is returning and use the CHGLINTRN command to change the line speed on the token-ring line description to the same size as the LES. For a 16M line speed the LEC frame size used is 18190, and for a 4M line speed the LEC frame size used is 4544. The LEC frame size of Ethernet line descriptions is not configurable and, if the LECS cannot be altered to configure the client to an acceptable LES, the AS/400 LEC cannot connect using the LECS. Directly configuring the AS/400 LEC to use a specific LAN emulation server provides an alternative to using the LECS. Do this by changing the line description to *NO in the Use LECS Address parameter field and entering a valid ATM address in the LES ATM Address parameter fields.
1EC08F0F	The LEC sent a CONFIGURE request to the LECS. The LEC received a valid response with a status value of "unknown". This could be due to an LECS configuration problem, or due to an LECS failure. Directly configuring the AS/400 LEC to use a specific LAN emulation server provides an alternative to using the LECS. Do this by changing the line description to *NO in the Use LECS Address parameter field and entering a valid ATM address in the LES ATM Address parameter fields.
1EC0940F	The LEC sent a CONFIGURE request to the LAN emulation configuration server but the LECS did not recognize the client. Some possible reasons for this include: the client has not been entered into a configuration table in the LECS; the client does not match a configuration for any LES registered with the LECS; the client does not match configuration parameters required by the LECS. This may be resolved by either changing the line description parameters to values acceptable to the LECS or changing the LECS configuration to recognize the client. Directly configuring the AS/400 LEC to use a specific LAN emulation server provides an alternative to using the LECS. Do this by changing the line description to *NO in the Use LECS Address parameter field and entering a valid ATM address in the LES ATM Address parameter fields.
1EC0950F	The LEC sent a CONFIGURE request to the LAN emulation configuration server but the LECS returned an error status. Possible reasons for the error are a problem with the LECS configuration, conflicting information in the CONFIGURE request that prevented the LECS from identifying an appropriate LES for this client, or a LECS failure. Changing the LECS configuration may eliminate the problem. Directly configuring the AS/400 LEC to use a specific LAN emulation server provides an alternative to using the LECS. Do this by changing the line description to *NO in the Use LECS Address parameter field and entering a valid ATM address in the LES ATM Address parameter fields.

Table E-1 (Page 5 of 6). ATM Network Error Codes

Error Code	Technical Description
1EC0960F	The LEC sent a CONFIGURE request to the LAN emulation configuration server but the LECS can not configure the client based on the information in the request. This may be resolved by either changing the line description parameters to values acceptable to the LECS or changing the LECS configuration to recognize the client. Directly configuring the AS/400 LEC to use a specific LAN emulation server provides an alternative to using the LECS. Do this by changing the line description to *NO in the Use LECS Address parameter field and entering a valid ATM address in the LES ATM Address parameter fields.
33001D90	The interim local management interface (ILMI) attempted to contact the network switch but received no response within the timeout period. The problem most likely arises from an unconnected ATM cable, an inoperative network switch, a wrap connector on the ATM cable or a hardware problem with the input-output adapter (IOA).
33001DA0	
53001D90	The interim local management interface (ILMI) lost contact with the network switch. The problem most likely arises from a disconnected ATM cable, a network switch failure or a hardware problem with the input-output adapter (IOA).
A5550000 through A555FFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.
A5AA0000 through A5AAFFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.
A5DD0000 through A5DDFFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.
A5E10000 through A5E1FFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.
A5E20000 through A5E2FFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.
A5EE0000 through A5EEFFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.
A5F10000 through A5F1FFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.
A5F20000 through A5F2FFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.
A5F30000 through A5F3FFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.
A5F50000 through A5F5FFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.

Table E-1 (Page 6 of 6). ATM Network Error Codes

Error Code	Technical Description
A5F70000 through A5F7FFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.
A5F90000 through A5F9FFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.
A5FA0000 through A5FAFFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.
A5FC0000 through A5FCFFFF	The ATM card Licensed Internal Code failed. You should contact your service provider.

ATM network cause codes

The LAN emulation software may report a network cause code when an error occurs.

UNI 3.0

The following information is taken from the ATM Forum User Network Interface Standard, version 3.0:

Table E-2 (Page 1 of 4). UNI 3.0 Network Cause Codes

Cause Code (Decimal)	Cause Code (Hex)	Meaning	Technical Description
1	1	Unallocated (unassigned) number	This cause indicates that the called party cannot be reached because, although the number is in a valid format, it is not currently assigned (allocated).
2	2	No route to specified transit network	This cause indicates that the equipment sending this cause has received a request to route the call through a particular network which it does not recognize. The equipment sending the cause does not recognize the transit network either because the transit network does not exist or because that particular transit network, while it does exist, does not serve the equipment which is sending this cause. This cause is supported on a network-dependent basis.
3	3	No route to destination	This cause indicates that the called party cannot be reached because the network through which the call has been routed does not serve the destination desired.
10	0A	VPCI/VCI unacceptable	This cause indicates that the virtual channel most recently identified is not acceptable to the sending entity for use in this call.
17	11	User busy	This cause is used to indicate that the called party is unable to accept another call because the user busy condition has been encountered. This cause value may be generated by the called user or by the network.

Table E-2 (Page 2 of 4). UNI 3.0 Network Cause Codes

Cause Code (Decimal)	Cause Code (Hex)	Meaning	Technical Description
18	12	No user responding	This cause is used when a called party does not respond to a call establishment message with a connect indication within the prescribed period of time allocated.
21	15	Call rejected	This cause indicates that the equipment sending this cause does not wish to accept this call, although it could have accepted the call because the equipment sending this cause is neither busy nor incompatible.
22	16	Number changed	This cause is returned to a calling party when the called party number indicated by the calling user is no longer assigned. The new called party number may optionally be included in the diagnostic field. If a network does not support this capability, cause number 1 "unassigned (unallocated) number", should be used.
23	17	User rejects all calls with calling line identification restriction (CLIR)	This caused is returned by the called party when the call is offered without calling party number information and the called party requires this information.
27	1B	Destination out of order	This cause indicates that the destination indicated by the user cannot be reached because the interface to the destination is not functioning correctly. The term "not functioning correctly" indicates that a signalling message was unable to be delivered to the remote user; for example, a physical layer of SAAL failure at the remote user, user equipment off-line.
28	1C	Invalid number format (address incomplete)	This cause indicates that the called user cannot be reached because the called party number is not in a valid format or is not complete.
30	1E	Response to STATUS ENQUIRY	This cause is included in the STATUS message when the reason for generating the STATUS message was the prior receipt of a STATUS ENQUIRY message.
31	1F	Normal, unspecified	This cause is used to report a normal event only when no other cause in the normal class applies.
35	23	Requested VPCI/VCI not available	This cause indicates that the requested VPCI/VCI is not available.
38	26	Network out of order (not used in UNI 3.0)	This cause indicates that the network is not functioning correctly and that the condition is likely to last a relatively long period of time; for example, immediately re-attempting the call is not likely to be successful.
41	29	Temporary failure	This cause indicates that the network is not functioning correctly and that the condition is not likely to last a long period of time; for example, the user may wish to try another call attempt immediately.
43	2B	Access information discarded	This cause indicates that the network could not deliver access information to the remote user as requested: ATM adaptation layer parameters; broadband low layer information; broadband high layer information; or sub-address as indicated in the diagnostic.
45	2D	No VPCI/VCI available	This cause indicates that there is no appropriate VPCI/VCI presently available to handle the call.
47	2F	Resource unavailable, unspecified	This cause is used to report a resource unavailable event only when no other cause in the resource unavailable class applies.
49	31	Quality of Service unavailable	This cause is used to report that the requested Quality of Service cannot be provided.

Table E-2 (Page 3 of 4). UNI 3.0 Network Cause Codes

Cause Code (Decimal)	Cause Code (Hex)	Meaning	Technical Description
51	33	User cell rate not available	This cause is used to report that the requested ATM User Cell Rate is unobtainable.
57	39	Bearer capability not authorized.	This cause indicates that the user has requested a bearer capability which is implemented by the equipment which generated this cause but the user is not authorized to use.
58	3A	Bearer capability not presently available	This cause indicates that the user requested a bearer capability which is implemented by the equipment which generated the cause but which is not available at the time.
63	3F	Service of option not available, unspecified	This cause is used to report a service or option not available event only when no other cause in the service or option no available class applies.
65	41	Bearer capability not implemented	This cause indicates that the equipment sending this cause does not support the bearer capability requested.
73	49	Unsupported combination of traffic parameters	This cause indicates that the combination of traffic parameters contain in the ATM user cell rate information element is not supported.
81	51	Invalid call reference value	This cause indicates that the equipment sending this cause has received a message with a call reference which is not currently in use on the user-network interface.
82	52	Identified channel does not exist	This cause indicates that the equipment sending this cause has received a request to use a channel not activated on the interface for a call.
88	58	Incompatible destination	This cause indicates that the equipment sending this cause has received a request to establish a call which has Broadband low layer information, Broadband high layer information, or other compatibility attributes which cannot be accommodated.
89	59	Invalid endpoint reference	This cause indicates that the equipment sending this cause has received a message with an endpoint reference which is currently not in use on the user-network interface.
91	5B	Invalid transit network selection	This cause indicates that a transit network identification was received which is of an incorrect format as defined in Annex D.
92	5C	Too many pending add party requests	This cause indicates a temporary condition when the calling party sends an add party message but the network is unable to accept another add party message because its queues are full.
93	5D	AAL parameters cannot be supported	This cause indicates that the equipment sending this cause has received a request to establish a call which has ATM adaptation layer parameters which cannot be accommodated.
96	60	Mandatory information element is missing	This cause indicates that the equipment sending this cause has received a message which is missing an information element which must be present in the message before the message can be processed.
97	61	Message type non-existent or not implemented	This cause indicates that the equipment sending this cause has received a message with a message type it does not recognize either because this is a message not defined or defined but not implemented by the equipment sending this cause.

Table E-2 (Page 4 of 4). UNI 3.0 Network Cause Codes

Cause Code (Decimal)	Cause Code (Hex)	Meaning	Technical Description
99	63	Information element non-existent or not implemented	This cause indicates that the equipment sending this cause has received a message which includes information elements not recognized because the information element identifiers are not defined or are defined but not implemented by the equipment sending the cause. This cause indicates that the information elements were discarded. However, the information element is not required to be present in the message in order for the equipment sending this cause to process the message.
100	64	Invalid information element contents	This cause indicates that the equipment sending this cause has received an information element which it has implemented; however, one or more of the fields in the information element are coded in such a way which has not been implemented by the equipment ending this cause.
101	65	Message not compatible with call state	this cause indicates that a message has been received which is incompatible with the call state.
102	66	Recovery on timer expiry	This cause indicates that a procedure has been initiated by the expiry of a timer in association with error handling procedures.
104	68	incorrect message length	This cause is used to report in inconsistent message length.
111	6F	Protocol error, unspecified	This cause is used to report a protocol error event only when no other cause in the protocol error class applies.

UNI 3.1

The following information was taken from the ATM Forum User Network Interface Standard, version 3.1:

Table E-3 (Page 1 of 4). UNI 3.1 Network Cause Codes

Cause Code (Decimal)	Cause Code (Hex)	Meaning	Technical Description
1	1	Unallocated (unassigned) number	This cause indicates that the called party cannot be reached because, although the number is in a valid format, it is not currently assigned (allocated).
2	2	No route to specified transit network	This cause indicates that the equipment sending this cause has received a request to route the call through a particular network that it does not recognize. The equipment sending the cause does not recognize the transit network either because the transit network does not exist, or because that particular transit network, while it does exist, does not serve the equipment that is sending this cause. This cause is supported on a network-dependent basis.
3	3	No route to destination	This cause indicates that the called party cannot be reached because the network through which the call has been routed does not serve the destination desired.
10	0A	VPCI/VCI unacceptable	This cause indicates that the virtual channel most recently identified is not acceptable to the sending entity for use in this call.

Table E-3 (Page 2 of 4). UNI 3.1 Network Cause Codes

Cause Code (Decimal)	Cause Code (Hex)	Meaning	Technical Description
16	10	Normal call clearing	This cause indicates that the call is being cleared because one of the users involved in the call has requested that the call be cleared.
17	11	User busy	This cause is used to indicate that the called party is unable to accept another call because the user busy condition has been encountered. This cause value may be generated by the called user or by the network.
18	12	No user responding	This cause is used when a called party does not respond to a call establishment message with a connect indication within the prescribed period of time allocated.
21	15	Call rejected	This cause indicates that the equipment sending this cause does not wish to accept this call, although it could have accepted the call because the equipment sending this cause is neither busy nor incompatible.
22	16	Number changed	This cause is returned to a calling party when the called party number indicated by the calling user is no longer assigned. The new called party number may optionally be included in the diagnostic field. If a network does not support this capability, cause number 1, "unassigned (unallocated) number", should be used.
23	17	User rejects all calls with calling line identification restriction (CLIR)	This cause is returned by the called party when the call is offered without calling party number information, and the called party requires this information.
27	1B	Destination out of order	This cause indicates that the destination indicated by the user cannot be reached because the interface to the destination is not functioning correctly. The term "not functioning correctly" indicates that a signalling message was unable to be delivered to the remote user. An example is a physical layer of SAAL failure at the remote user, user equipment off-line.
28	1C	Invalid number format (address incomplete)	This cause indicates that the called user cannot be reached because the called party number is not in a valid format or is not complete.
30	1E	Response to STATUS ENQUIRY	This cause is included in the STATUS message when the reason for generating the STATUS message was the prior receipt of a STATUS ENQUIRY message.
31	1F	Normal, unspecified	This cause is used to report a normal event only when no other cause in the normal class applies.
35	23	Requested VPCI/VCI not available	This cause indicates that the requested VPCI/VCI is not available.
38	26	Network out of order (not used in UNI 3.0)	This cause indicates that the network is not functioning correctly, and that the condition is likely to last a relatively long period of time. For example, immediately re-attempting the call is not likely to be successful.
41	29	Temporary failure	This cause indicates that the network is not functioning correctly and that the condition is not likely to last a long period of time. For example, the user may wish to try another call attempt immediately.
43	2B	Access information discarded	This cause indicates that the network could not deliver access information to the remote user as requested. Examples are ATM adaptation layer parameters, broadband low layer information, broadband high layer information, or sub-address as indicated in the diagnostic.

Table E-3 (Page 3 of 4). UNI 3.1 Network Cause Codes

Cause Code (Decimal)	Cause Code (Hex)	Meaning	Technical Description
45	2D	No VPCI/VCI available	This cause indicates that there is no appropriate VPCI/VCI presently available to handle the call.
47	2F	Resource unavailable, unspecified	This cause is used to report a resource unavailable event only when no other cause in the resource unavailable class applies.
49	31	Quality of Service unavailable	This cause is used to report that the requested Quality of Service cannot be provided.
51	33	User cell rate not available	This cause is used to report that the requested ATM User Cell Rate is unobtainable.
57	39	Bearer capability not authorized.	This cause indicates that the user has requested a bearer capability that is implemented by the equipment that generated this cause, but which the user is not authorized to use.
58	3A	Bearer capability not presently available	This cause indicates that the user requested a bearer capability that is implemented by the equipment that generated the cause, but that is not available at the time.
63	3F	Service of option not available, unspecified	This cause is used to report a service or option not available event only when no other cause in the service or option not available class applies.
65	41	Bearer capability not implemented	This cause indicates that the equipment sending this cause does not support the bearer capability requested.
73	49	Unsupported combination of traffic parameters	This cause indicates that the combination of traffic parameters contained in the ATM user cell rate information element is not supported.
81	51	Invalid call reference value	This cause indicates that the equipment sending this cause has received a message with a call reference that is not currently in use on the user-network interface.
82	52	Identified channel does not exist	This cause indicates that the equipment sending this cause has received a request to use a channel not activated on the interface for a call.
88	58	Incompatible destination	This cause indicates that the equipment sending this cause has received a request to establish a call that has Broadband low layer information, Broadband high layer information, or other compatibility attributes that cannot be accommodated.
89	59	Invalid endpoint reference	This cause indicates that the equipment sending this cause has received a message with an endpoint reference that is currently not in use on the user-network interface.
91	5B	Invalid transit network selection	This cause indicates that a transit network identification was received that is of an incorrect format as defined in Annex D.
92	5C	Too many pending add party requests	This cause indicates a temporary condition when the calling party sends an add party message, but the network is unable to accept another add party message because its queues are full.
93	5D	AAL parameters cannot be supported	This cause indicates that the equipment sending this cause has received a request to establish a call that has ATM adaptation layer parameters that cannot be accommodated.
96	60	Mandatory information element is missing	This cause indicates that the equipment sending this cause has received a message that is missing an information element that must be present in the message before the message can be processed.

Table E-3 (Page 4 of 4). UNI 3.1 Network Cause Codes

Cause Code (Decimal)	Cause Code (Hex)	Meaning	Technical Description
97	61	Message type non-existent or not implemented	This cause indicates that the equipment sending this cause has received a message with a message type it does not recognize, either because this is a message not defined, or because it is defined but not implemented by the equipment sending this cause.
99	63	Information element non-existent or not implemented	This cause indicates that the equipment sending this cause has received a message that includes information elements that are not recognized because the information element identifiers are not defined or, because they are defined but not implemented by the equipment sending the cause. This cause indicates that the information elements were discarded. However, the information element is not required to be present in the message in order for the equipment sending this cause to process the message.
100	64	Invalid information element contents	This cause indicates that the equipment sending this cause has received an information element that it has implemented. However, one or more of the fields in the information element are coded in such a way that has not been implemented by the equipment sending this cause.
101	65	Message not compatible with call state	This cause indicates that a message has been received that is incompatible with the call state.
102	66	Recovery on timer expiry	This cause indicates that a procedure has been initiated by the expiry of a timer in association with error handling procedures.
104	68	Incorrect message length	This cause reports an inconsistent message length.
111	6F	Protocol error, unspecified	This cause reports a protocol error event only when no other cause in the protocol error class applies.

Bibliography

The publications provide additional information about topics described or referred to in this book.

AS/400 books

- *APPN Support*, SC41-5407, provides the information necessary to define and use advanced peer-to-peer networking (APPN).
- *APPC Programming*, SC41-5443, provides the information necessary to write application programs that use advanced program-to-program communications (APPC) support.
- *DSNX Support*, SC41-5409, provides information for configuring an AS/400 system to use the remote management support (distributed host command facility), the change management support (distributed systems node executive), and the problem management support (alerts).
- *SNA Distribution Services*, SC41-5410, provides the system operator or system administrator with information about configuring a network for SNA distribution services (SNADS) and VM/MVS bridge. Object distribution and the system distribution directory are also discussed.
- *Finance Communications Programming*, SC41-5449, provides the information necessary to define the OS/400 finance communications support and to write application programs that use the support.
- *ICF Programming*, SC41-5442, provides the information needed to write application programs that use AS/400 communications and the ICF file. It also contains examples of communications programs and describes return codes.
- *Communications Management*, SC41-5406, contains information on working with communications support, such as working with configuration status, error recovery, performance, aggregate line speed, and subsystem storage.
- *Communications Configuration*, SC41-5401, contains general configuration information, including detailed descriptions of network server, network interface, line, controller, device, mode, class-of-service, and NetBios descriptions, configuration lists, and connection lists.
- *SNA Upline Facility Programming*, SC41-5446, contains the programming information for using the Systems Network Architecture (SNA) upline facility with the AS/400 system. This guide describes how to set up the upline facility, how to write application programs for the SNA upline facility, and the return codes that the SNA upline facility can send to a program.
- *Remote Work Station Support*, SC41-5402, provides concepts, examples, and information on preparing for and configuring 5250 display station pass-through and SNA pass-through. It also contains information about using 3270-type remote attachment, 5250-type remote work station controllers, SNA Primary LU 2 Support (SPLS), network routing facility, and the distributed host command facility (DHCF).
- *CL Reference*, SC41-5722, provides a description of the AS/400 control language (CL) and its commands.
- *Publications Reference*, SC41-5003, lists books in the AS/400 library and lists tasks that are described in the books.
- *System Operation*, SC41-4203, explains how to use the system unit control panel, send and receive messages, respond to error messages, start and stop the system, use the display station keyboard function keys, control devices, and also process and manage jobs on the system.
- *System API Reference*, SC41-5801, provides the information necessary to define and use user-defined communications.
- *TCP/IP Configuration and Reference*, SC41-5420. Provides information for configuring and using the AS/400 TCP/IP support. The applications included are Network Status (NETSTAT), Packet InterNet Groper (PING), TELNET, File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP), line printer requester (LPR), and line printer daemon (LPD). The TCP and UDP Pascal application program interface (API) is also discussed.
- *Internetwork Packet Exchange (IPX) Support*, SC41-5400, provides information about configuring and using the AS/400 Internetwork Packet Exchange (IPX) Support.
- *OS/2 Warp Server for AS/400 Administration*, SC41-5423, provides information about the OS/2 Warp Server licensed program. OS/2 Warp Server provides fast file serving using the file server input/output processor (IOP). This information includes how to plan your network to use the AS/400 system as a file server, how to install and configure OS/2 Warp Server, and how to use the OS/2 Warp Server file system.

Other AS/400 printed information

The following books contain detailed information you may find helpful. The information contained in these books has not been submitted to any formal IBM test and is distributed on an 'as is' basis without any warranty either expressed or implied. These books are written for a specific release and modification level of the Operating System/400* licensed program and may not describe all the functions available on your AS/400 system.

- *AS/400 Communications Configurations, Tips, and Techniques Newsletter*, GC21-8180
- *AS/400 Communications Definitions Examples*, GG24-3449
- *AS/400 Communications Definitions Examples II*, GG24-3763
- *AS/400 Communications Definitions Examples III*, GG24-4386
- *AS/400 Communications Highlights Newsletter*, GC21-8179
- *AS/400 Office in a DIA/SNADS Network*, GG24-3268
- *AS/400—System/370 Connectivity*, GG24-3336
- *AS/400, System/38, and PS/2 as T2.1 Nodes in a Subarea Network*, GG24-3420
- *AS/400 TCP/IP Configuration and Operation*, GG24-3442
- *Examples of Advanced Program-to-Program Communications Between the Application System/400 and CICS*, GC21-8183
- *Management of AS/400 in SNA Subarea Network Using Netview Products*, GG24-3289
- *Managing Multiple AS/400s in a Peer Network*, GG24-3614
- *S3/X and AS/400 APPN Nodes Using the SNA/LEN Subarea Network*, GG24-3288

Communications controllers

The following books contain information about communications controllers.

- *Financial Branch System Services Application Programming*, SC19-5174
- *Financial Branch System Services Installation, Planning, and Administration Guide*, SC19-5173
- *Retail Communications Programming*
- *3174 Establishment Controller Planning Guide, Configuration Support A and S, Release 5*, GA27-3844

- *3174 Establishment Controller Planning Guide, Configuration Support B, Release 1*, GA27-3862
- *3174 Establishment Controller Utilities Guide, Configuration Support A and S, Release 5*, GA27-3853
- *4700 Finance Communications System Controller Programming Library: Communications Programming*, GC31-2068
- *4700 Finance Communications System Controller Programming Library: Control Program Generation*, GC31-2071
- *4700 Finance Communications System Controller Programming Library: General Controller Programming*, GC31-2066
- *4700 Finance Communications System Controller Programming Library (Volume 6)*, GC31-2071
- *4700 Finance Communications System Controller Programming Library: Work Station Programming*, GC31-2069
- *4700 Finance Communications System: Subsystem Operating Procedures*, GC31-2032
- *5294 Control Unit Setup Procedure*, GA21-9369
- *5394 Remote Control Unit Setup Guide*, GA27-3804
- *5394 Remote Control Unit User's Guide*, GA27-3852
- *5394 Remote Control Unit Type 2.1 Node Support RPQ 8Q0775*, SC30-3531
- *5494 Remote Control Unit Planning Guide*, GA27-3936
- *5494 Remote Control Unit User's Guide*, GA27-3960
- *5494 Remote Control Unit Attachment to Subarea Network RPQ 8Q0932*, SC30-3566

Communications protocols

The following books provide information about communications protocols and local area network architectures:

- *SNA Format and Protocol Reference Architecture Logic for LU Type 6.2*, SC30-3269
- *SNA Format and Protocol Reference Architecture Logic for Type 2.1 Nodes*, SC30-3422
- *SNA Format and Protocol Reference Manual: Architectural Logic*, SC30-3112
- *SNA Format and Protocol Reference: SNA Network Interconnection*, SC30-3339
- *SNA Formats*, GA27-3136
- *SNA: Sessions between Logical Units*, GC20-1868
- *SNA Transaction Programmer's Reference Manual for LU Type 6.2*, GC30-3084

- *Systems Network Architecture Concepts and Products*, GC30-3072
- *Systems Network Architecture Distribution Services (SNADS) Reference*, SC30-3098
- *Systems Network Architecture File Services Reference*, SC31-6807
- *Systems Network Architecture Management Services Reference*, SC30-3346
- *Systems Network Architecture Technical Overview*, GC30-3073
- *IBM Local Area Network Technical Reference*, SC30-3383
- *Supplement to the Local Area Network Technical Reference*, SD21-0049
- *Token-Ring Network Architecture Reference*, SC30-3374
- *Token-Ring Network Problem Determination Guide Kit*, SX27-3710
- *Local Area Networks Concepts and Products*, GG24-3178
- *FDDI Concepts and Products*, GG24-3865
- *FDDI Network Introduction and Planning Guide*, GA27-3892

RISC System/6000

The following books provide information on connecting your AS/400 system to a RISC System/6000* system.

- *AIX AS/400 Connection Program User's Guide*, SB35-4069
- *AIX Communications Programming Concepts for RISC System/6000*, SC23-2206
- *Communications Concepts and Procedures for RISC System/6000*, SC23-2203
- *RISC System/6000 Communications Connectivity Overview*, GC23-2190
- *AS/400 and RS/6000 Connectivity*, GG24-4039

Systems Network Architecture (SNA) hosts

The following books provide detailed information about the SNA communications controllers and the network programs. Refer to these books for network-dependent information.

- *ACF/NCP/VS NCP (System Support Program) General Information*, SC30-3058
- *ACF/NCP/VS SSP Installation*, SC30-3142
- *Network Control Program Resource Definition Reference*, SC30-3254

IBM 3172 Interconnect Controller

- *IBM 3172 Interconnect Controller Planning Guide*, GA27-3867
- *IBM 3172 Interconnect Controller Operator's Guide*, GA27-3860
- *IBM 3172 Interconnect Controller Installation and Service Guide*, GA27-3861
- *Interconnect Controller Program, Version 1.0., User's Guide*, GA27-3867

IBM 6611 Network Processor

- *The IBM 6611 Network Processor*, GG24-3870
- *IBM 6611 Network Processor: Introduction and Planning Guide*, GK2T-0334
- *IBM 6611 Network Processor: Installation and Service Guide*, GA27-3941
- *IBM 6611 Network Processor: Network Management Reference*, GC30-3567
- *IBM 6611 Network Processor: Operations Pocket Guide*, GX27-3909
- *IBM Multiprotocol Network Program: User's Guide*, SC30-3559

IBM 8229 LAN Bridge

- *8229 LAN Bridge Customer Information*, SA21-9994
- *8229 LAN Bridge: Service Information*, SY31-9077
- *8229 LAN Bridge Attachment Module Guide for the IBM Token-Ring Network*, GA27-3915
- *8229 LAN Bridge Attachment Module Guide for Ethernet and IEEE 802.3 LANs*, GA27-3891

IBM 8271 Nways Ethernet LAN Switch

- *IBM 8271 Nways Ethernet LAN Switch*, G224-4425-00
- *8271 Nways Ethernet LAN Switch Planning and Installation Guide*, GA27-4984-01

IBM 8272 Nways Token-Ring LAN Switch

- *8272 Nways Token-Ring LAN Switch*, GA27-4982-01
- *8272 Nways Token-Ring LAN Switch Model 108 Planning and Installation Guide*, GA27-4982-02

IBM 8240 FDDI Concentrator

- *FDDI Concepts and Products*, GG24-3865
- *FDDI Network Introduction and Planning Guide*, GA27-3892
- *IBM 8240 FDDI Concentrator Customer Setup Instruction*, GA17-0235
- *IBM 8240 FDDI Concentrator Service Guide*, SY17-0014
- *IBM 8240 FDDI Concentrator Maintenance Facility User's Guide*, GA17-0237

AS/400 wireless networks

- *AS/400 Wireless LAN Installation and Planning Guide*, G571-0303
- *AS/400 Wireless Ethernet LAN Access Point User's Manual*, G571-0323
- *AS/400 Wireless RS-485 LAN Access Point User's Manual*, G571-0324
- *AS/400 Wireless LAN Industry Standard Adapter User's Manual*, G571-0325
- *AS/400 Wireless LAN Micro Channel Architecture Adapter User's Manual*, G571-0326
- *2482 AS/400 Wireless Portable Transaction Computer User's Manual*, G571-0319
- *2483 AS/400 Wireless Portable Transaction Computer User's Manual*, G571-0320
- *2484 AS/400 Wireless Portable Transaction Computer User's Manual*, G571-0321
- *AS/400 5250 Emulation for Portable Transaction Computers User's Guide*, G571-0322

- *An Introduction to Wireless Technology*, GG24-4465
- *AS/400 Wireless LAN Products Family: Configuration Examples, Tips and Techniques*, GG24-4392

Other printed information

The following books provide detailed information about various communications standards.

- *American National Standards Institute/Institute of Electrical and Electronics Engineers 802.3a, b, d, c, 1988, Information Processing Systems — Local Area Networks: Supplements to Carrier Sense Multiple Access with Collision Detection.*
- *American National Standards Institute/Institute of Electrical and Electronics Engineers 802.3u, 1995, Standards for Local and Metropolitan Area Networks: Supplement to Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.*
- *The International Telegraph and Telephone Consultative Committee, Red Book, Volume VIII - Facsimile VIII.3, Data Communications Networks Interfaces, Recommendations X.20 - X.32, VIIIth Plenary Assembly, Malaga-Torremolinos, October 8-19, 1984.*
- *International Organization for Standardization 8802/2, 1989, Institute of Electrical and Electronics Engineers 802.2, 1989, Information Processing Systems — Local Area Networks: Logical Link Control.*
- *International Organization for Standardization 8802/3, 1990, American National Standards Institute/Institute of Electrical and Electronics Engineers 802.3, 1990, Information Processing Systems — Local Area Networks: Carrier Sense Multiple Access with Collision detection (CSMA/CD) access method and Physical Layer Specifications.*
- *International Standard 8802/5, 1990, Institute of Electrical and Electronics Engineers 802.5, 1989, Standards for Local Area Networks: Token Ring Access Method and Physical Layer Specifications.*
- *Request for Comments (RFC) 1294: Multiprotocol Interconnect over Frame Relay*

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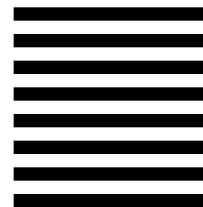
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