



System i
Networking
Frame relay

Version 5 Release 4





System i
Networking
Frame relay

Version 5 Release 4

Note

Before using this information and the product it supports, be sure to read the information in "Notices," on page 29.

Sixth Edition (February 2006)

This edition applies to version 5, release 4, modification 0 of IBM i5/OS (product number 5722-SS1) and to all subsequent releases and modifications until otherwise indicated in new editions. This version does not run on all reduced instruction set computer (RISC) models nor does it run on CISC models.

© Copyright International Business Machines Corporation 2000, 2006. All rights reserved.

US Government Users Restricted Rights – Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

Contents

Frame relay	1
Printable PDF	2
Network connections for frame relay	2
Physical environment for frame relay	3
Connections for frame relay	4
SNA direct connections	5
IP direct connections	6
Bridged connections for frame relay	6
System connection without a frame-relay network	6
Configuration objects for frame relay	7
Frame-relay addressing	8
Data link connection identifiers	8
Adapter addresses for frame relay	9
Routing characteristics for frame relay	9
Maximum frame-size parameter requirements for frame relay	14
Additional MAXFRAME parameter considerations	15
Tuning frame-relay performance	16
Local management interface	17
Parameters that control exchanges of information over local management interface	18
Local management interface exchanges	18
Scenarios: Frame-relay configuration	18
Scenarios: SNA direct connection for frame relay	18
Scenario: SNA direct connection of two System i models	19
Scenario details: Configuration for the System i model in Minneapolis	19
Scenario details: Configuration for the System i model in Madison	20

Scenario: SNA direct connection using a modem eliminator	20
Scenario details: Configuration for SYSTEM1	20
Scenario details: Configuration for SYSTEM2	21
Scenario: SNA direct connection to a host system	21
Scenarios: Bridged configuration for frame relay token-ring networks	22
Scenario details: Creating the frame-relay network interface description	23
Scenario details: Configuring the System i connection to a remote token-ring network through the 6611 Network Processor	23
Scenario details: Configuring the System i connection to a remote token-ring network through a RouteXpander/2	24
Scenario: Bridged connection to an Ethernet network	25
Related information for frame relay	26

Appendix. Notices	29
Programming Interface Information	30
Trademarks	31
Terms and conditions	31

Frame relay

Frame relay is a communications networking 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 the X.25 standard. The high speed that you can obtain through frame-relay networks makes them well suited for wide area network (WAN) connectivity. Administrators commonly use frame relay to connect two or more local area network (LAN) bridges over long distances.

The following figure shows the frame format that frame-relay networks use.

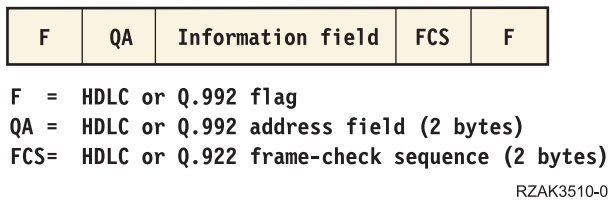


Figure 1. Frame format that frame-relay networks use

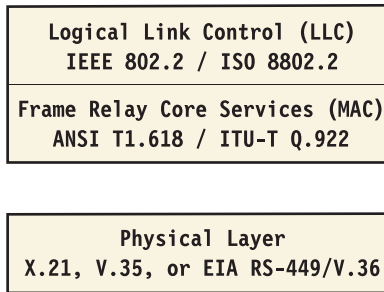
Frame-relay network architecture is based on the integrated systems digital network (ISDN) packet-mode bearer services. Table 1 shows the standards, either pending or approved, that define the services and the user-to-network interface of frame-relay networks.

Table 1. ANSI and equivalent ITU-T standards

ANSI standard	Equivalent ITU-T 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 System i[™] implementation of frame-relay network support uses protocol headers as defined in the TCP/IP Request for Comment (RFC) 1490.

Frame-relay networks achieve their greater efficiency by minimizing the error checking done by nodes within the network. For Systems Network Architecture (SNA), System i frame-relay support uses IEEE 802.2 logical link control to provide flow control and error recovery functions (see Figure 2 on page 2).



RZAK3511-0

Figure 2. System i implementation of frame-relay networking

As indicated previously, you can make the connection between the System i platform and the frame-relay network by using X.21, V.35, or RS-449 physical interfaces.

Printable PDF

Use this to view and print a PDF of this topic.


To view or download the PDF version of this document, select [Frame relay](#) (about 542 KB).

Saving PDF files

To save a PDF on your workstation for viewing or printing:

1. Right-click the PDF in your browser (right-click the link above).
2. Click the option that saves the PDF locally.
3. Navigate to the directory in which you want to save the PDF.
4. Click **Save**.

Downloading Adobe Reader

You need Adobe Reader installed on your system to view or print these PDFs. You can download a free copy from the Adobe Web site (www.adobe.com/products/acrobat/readstep.html) .

Network connections for frame relay

The direct frame-relay network and the bridged frame-relay network are the two types of network connections that you can configure.

Direct frame-relay network

The direct frame-relay network allows communications using Systems Network Architecture (SNA) or TCP/IP 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

The bridged frame-relay network allows the System i platform to communicate over a frame-relay network. This communication takes place through a remote bridge that is attached to a token-ring, Ethernet, or distributed data interface (DDI) network. Bridged frame-relay connections allow the System i platform to communicate with stations on the remote local area network (LAN) as if they were attached locally to the LAN. This function is also known as *boundary network node (BNN)* support. The following figure shows an example of a bridged frame-relay connection.

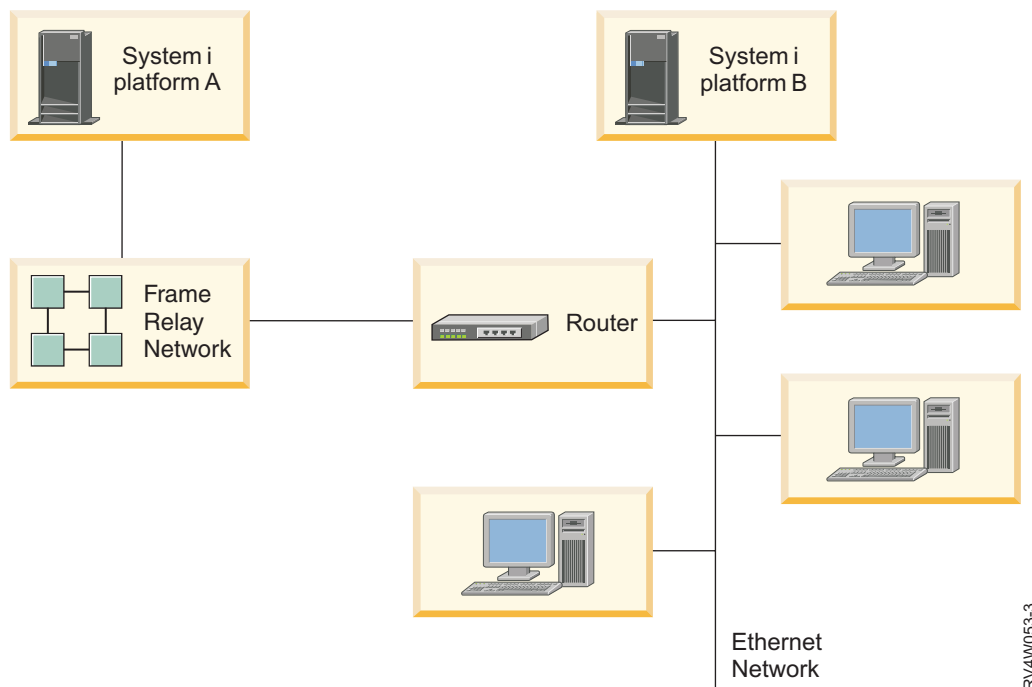


Figure 3. Example of a bridged frame-relay network connection

In this example, System i platform A communicates through the frame-relay network and the bridge to System i platform B. Bridged frame-relay connections support SNA and TCP/IP data communications.

Related concepts

“Bridged connections for frame relay” on page 6

The System i platform supports frame-relay connections to remote local area networks (LANs) that support the bridged frame-relay formats defined by the Frame-Relay Forum IA 3.1. Most bridges, routers, and communication controllers support these formats.

Physical environment for frame relay

The equipment that attaches to a frame-relay network, such as a System i model, is the terminal equipment (TE). A frame-relay network node is a frame handler (FH).

The connection from the TE to the FH normally exists through a data service unit (DSU) and channel service unit (CSU) pair. This DSU and CSU pair converts the TE physical interface to the FH interface that is used by the frame-relay network.

The System i platform supports these types of physical interfaces for attachment to the DSU and CSU pair:

- EIA RS-449, ITU-T V.36.
- ITU-T X.21.
- ITU-T V.35.

Create Network Interface (Frame Relay) command

Use the Create Network Interface (FR) (CRTNWIFR) command to specify both the physical interface (INTERFACE parameter) and data transmission rate (LINESPEED parameter). The type of physical interface that you specify depends on the cable that you use. The following table lists the supported physical interfaces, cable lengths, network interface (NWI) clock parameters, and the maximum data

transmission speed available for each interface:

Table 2. Device types 2699, 2721, 2742, 2745, 2771, and 2793 high-speed communications IOAs

Physical interface	Cable length	NWI clock parameter	Maximum data transmission rate
*RS-449	6.1 m (20 ft)	*MODEM, *LOOP, *INVERT	2 048 000 bps
	15.2 m (50 ft)	*MODEM	64 000 bps
	24.4 m (80 ft)		
	45.7 m (150 ft)		
	15.2 m (50 ft)	*LOOP	2 048 000 bps
	24.4 m (80 ft)		
45.7 m (150 ft)			
*V.35	20 ft (6.1 m)	*MODEM, *LOOP, *INVERT	2 048 000 bps
	50 ft (15.2 m)		
	24.4 m (80 ft)	*MODEM, *LOOP, *INVERT	64 000 bps
*X.21	6.1 m (20 ft)	*MODEM	2 048 000 bps
	15.2 m (50 ft)	*MODEM, *INVERT	64 000 bps

Notes:

1. *LOOP requires DCE support for looped clocking.
2. Data transmission rates greater than 512 000 bps might require *LOOP or *INVERT clocking.

On the frame-relay-supported hardware, the specified value for the INTERFACE parameter must match the physical interface and cable that you attached to the input-output adapter (IOA).

CLOCK parameter

The CLOCK parameter on the CRTNWIFR command specifies the method by which the clocking function is provided for the network interface. The parameter supports the following values:

***MODEM**

The default value. The modem provides the clocking.

***LOOP**

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 improves high-speed data transmission, but it is valid only if it is supported by the modem.

***INVERT**

All three interfaces support *INVERT.

Connections for frame relay

Various options are available for you to configure the frame-relay network connections.

SNA direct connections

The System i platform supports frame-relay connections to remote systems that support the Systems Network Architecture (SNA) direct format. In this format, the frame-relay packets encapsulate the SNA data.

The following figure shows an example of SNA direct connections to a remote System i platform, a 5494 Remote Control Unit, and a 3745 Communications Controller on data link connection identifiers (DLCIs) 22, 23, and 24.

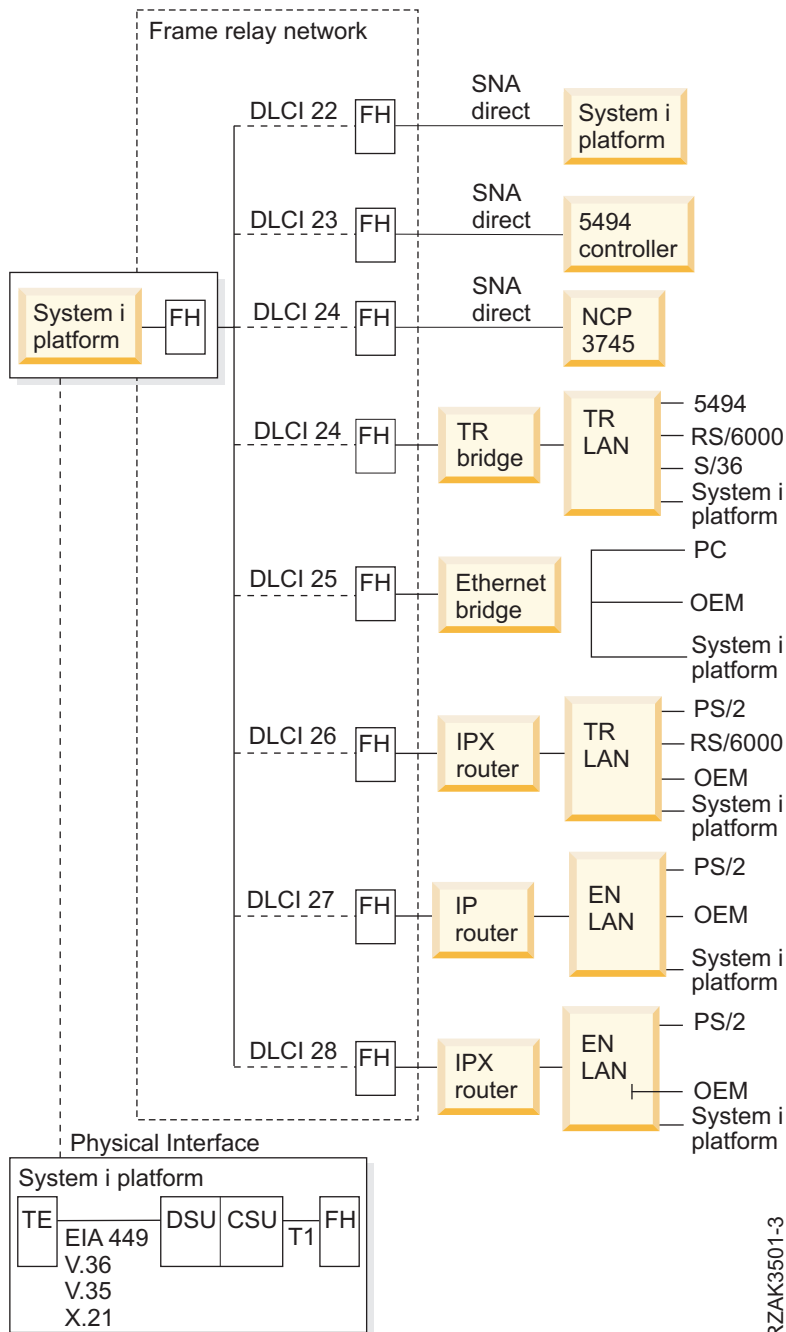


Figure 4. Example of a frame-relay network

IP direct connections

The System i platform supports frame-relay connections to remote systems that support the IP direct format. In this format, the frame-relay packets encapsulate the TCP/IP data.

Bridged connections for frame relay

The System i platform supports frame-relay connections to remote local area networks (LANs) that support the bridged frame-relay formats defined by the Frame-Relay Forum IA 3.1. Most bridges, routers, and communication controllers support these formats.

Note: You can use the System i platform to bridge Advanced Peer-to-Peer Networking® (APPN) networks. The integrated frame-relay support can eliminate the need for a bridge between the System i platform and the frame-relay network. However, the system does not provide a complete, integrated bridging function.

Bridged frame-relay connections support both Systems Network Architecture (SNA) and TCP/IP data traffic by encapsulating the token-ring, Ethernet, or distributed data interface (DDI) frames within the frame-relay packet.

Related concepts

“Network connections for frame relay” on page 2

The direct frame-relay network and the bridged frame-relay network are the two types of network connections that you can configure.

System connection without a frame-relay network

You can establish frame-relay connections without a frame-relay network, similar to the X.25 DTE-to-DTE mode. This type of configuration supports both Systems Network Architecture (SNA) direct and bridged frame-relay formats.

For example, by configuring one of a pair of System i models as a frame handler (LMIMODE(*FH)) on the network interface description and the other as terminal equipment (LMIMODE(*TE)), you can connect the two systems using a modem eliminator or a high-speed communications line. In this configuration, the system configured as the frame handler (FH) responds to local management interface (LMI) polls received from the terminal equipment (TE). It then reports the status of permanent virtual circuits (PVCs) configured on the FH system.

Related concepts

“Local management interface” on page 17

The System i platform uses the local management interface (LMI) to exchange status information between the frame-relay network (or the frame handler system) and systems attached to the network (terminal equipment).

“Data link connection identifiers” on page 8

The System i platform uses data link connection identifiers (DLCIs) to identify the logical connections between nodes.

“SNA direct connections” on page 5

The System i platform supports frame-relay connections to remote systems that support the Systems Network Architecture (SNA) direct format. In this format, the frame-relay packets encapsulate the SNA data.

“Bridged connections for frame relay”

The System i platform supports frame-relay connections to remote local area networks (LANs) that support the bridged frame-relay formats defined by the Frame-Relay Forum IA 3.1. Most bridges, routers, and communication controllers support these formats.

“Scenario: SNA direct connection using a modem eliminator” on page 20

The example shows a direct Systems Network Architecture (SNA) connection that uses a modem eliminator.

Configuration objects for frame relay

The System i platform uses several configuration objects, such as Network interface description, line description, and controller description, for frame-relay communications.

Network interface description

The network interface (NWI) description defines the characteristics of the physical connection, including:

- Physical interface used.
- Local management interface (LMI) mode.
- LMI timer and retry values.
- Data link connection identifier (DLCI) numbers assigned to the virtual connections.

Use the Create Network Interface (Frame Relay) (CRTNWIFR) command to create one NWI description for each input-output adapter (IOA).

Line description

The line description defines the logical connection to the network. You can attach up to 256 line descriptions to each frame-relay network interface. You must create one line description for each DLCI that is used. Use the following CL commands to create line descriptions attached to frame-relay NWI descriptions:

CRTLINFR

Systems Network Architecture (SNA) or IP direct connections to remote systems that support the frame-relay communications protocol, such as an SNA direct connection to another System i model or 3745 Communications Controller.

CRTLINTRN

Bridged token-ring network connections.

CRTLINDDI

Bridged distributed data interface (DDI) network connections.

CRTLINETH

Bridged Ethernet network connections.

Controller description

Use the controller description to define the remote system or controller. You can attach up to 256 controller descriptions to each line description. However, the NWI description supports no more than 256 active controllers. Controller descriptions occur across a number of line descriptions. Use the following CL commands to create controller descriptions for frame-relay communications:

CRCTLAPPC

Advanced Program-to-Program Communication (APPC) controllers represent systems that support APPC or Advanced Peer-to-Peer Networking (APPN) communications. APPC controllers typically represent System i products and personal computers.

CRCTLHOST

SNA host controllers represent controllers such as the 3745 controller running NCP.

CRCTLNET

Network controllers are used for direct IP connections. They are automatically created when you configure and start TCP/IP communications for frame relay.

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) attach only to frame-relay line descriptions.
- Controller descriptions that specify LINKTYPE(*LAN) attach to token-ring, DDI, or Ethernet lines.

You can configure both APPC and SNA host controllers as APPN(*YES). If you configure the controllers as APPN(*NO), then you must also create APPC or SNA host device descriptions for each session that the remote system supports.

Figure 5 shows an example of objects that are configured for frame-relay communications, including the NWI, line descriptions (LINDs), and controller descriptions (CTLDs).

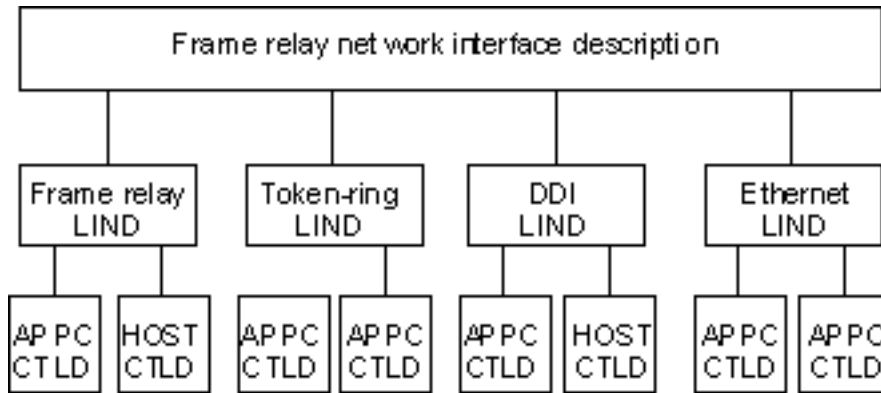


Figure 5. Example of objects configured for frame-relay communications

Frame-relay addressing

For direct connections, data link connection identifiers (DLCIs) provide frame-relay addressing. For bridged connections, local area network (LAN) adapter addresses provide frame-relay addressing.

Data link connection identifiers

The System i platform uses data link connection identifiers (DLCIs) 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. The frame-relay network assigns a DLCI number that identifies each virtual connection, called *permanent virtual circuit (PVC)*. The System i platform supports up to 256 virtual circuits for each physical connection.

The frame-relay network provider assigns the DLCI number, typically at subscription time, that is used to identify a virtual circuit. The DLCI number applies only to the connection between nodes (TE-to-FH or FH-to-FH).

The following figure shows an example of DLCI assignments for a frame-relay connection.

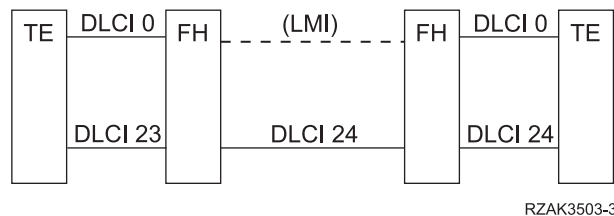


Figure 6. Example of DLCI assignments for PVC connections

To configure DLCI values for frame-relay and bridged local area network (LAN) line descriptions, specify the NWIDLCI parameter on the line description command. You can also configure DLCI values by specifying the DLCI number and line description name on the DLCI parameter of the Create Network Interface (Frame Relay) (CRTNWIFR) command.

The System i platform uses DLCI 0 for the local management interface (LMI). This corresponds to the ANSI Annex-D standard. The LMI manages the physical and virtual connections between the terminal equipment (TE) and the frame handler (FH). Use DLCIs 1 through 1018 to identify logical connections to remote TEs.

Related concepts

“Local management interface” on page 17

The System i platform uses the local management interface (LMI) to exchange status information between the frame-relay network (or the frame handler system) and systems attached to the network (terminal equipment).

Adapter addresses for frame relay

The frame-relay communications input/output processor (IOP) is not given a preset or burned-in adapter address. You must specify this address for the local adapter address (ADPTADR) parameter on token ring, distributed data interface (DDI), and Ethernet line descriptions used for bridged frame-relay connections.

Configure the frame-relay adapter address the same as for locally attached local area network (LAN) lines. Systems Network Architecture (SNA) or IP direct configurations do not require the local adapter address.

You must configure the remote adapter address (ADPTADR parameter on the controller description) to match the adapter address of the remote system.

SNA direct frames do not include adapter addresses. You do not need to configure the adapter address for frame-relay line descriptions or for controllers that specify LINKTYPE(*FR).

Related concepts

“Bridged connections for frame relay” on page 6

The System i platform supports frame-relay connections to remote local area networks (LANs) that support the bridged frame-relay formats defined by the Frame-Relay Forum IA 3.1. Most bridges, routers, and communication controllers support these formats.

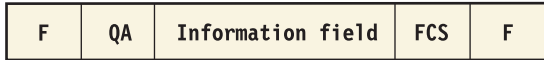
Routing characteristics for frame relay

The frame-relay network routes frames through the network by examining the data link connection identifier (DLCI) field and then routing the frame to an outgoing link. The network delivers frames to the remote terminal equipment (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 system verifies the frame check sequence (FCS) and checks the frame format and size. If the frame is valid, the system replaces the DLCI and FCS before routing the frame to the next node. If the frame is damaged or otherwise not valid, the system discards it. The network node provides no error recovery.

Frame-relay core services frame format

The following figure shows the basic frame format that is used for frame-relay communications.



F = HDLC or Q.992 flag
 QA = HDLC or Q.992 address field (2 bytes)
 FCS= HDLC or Q.922 frame-check sequence (2 bytes)

RZAK3510-0

Figure 7. Frame format that frame-relay networks use

The frame-relay core services (FRCS) portion of the frame routes the frame through the frame-relay network. The frame structure is based on the ITU-T Q.922 protocol.

Figure 8 shows the FRCS frame format on the fields within the 2-byte Q.922 address field (QA).

DLCI 0 = DLCI high order bits (6 bits)
 DLCI 1 = DLCI low order bits (4 bits)
 C/R = Command/response bit (not used)
 EA0/1 = Extended address indicators
 CC = Congestion control (3 bits)

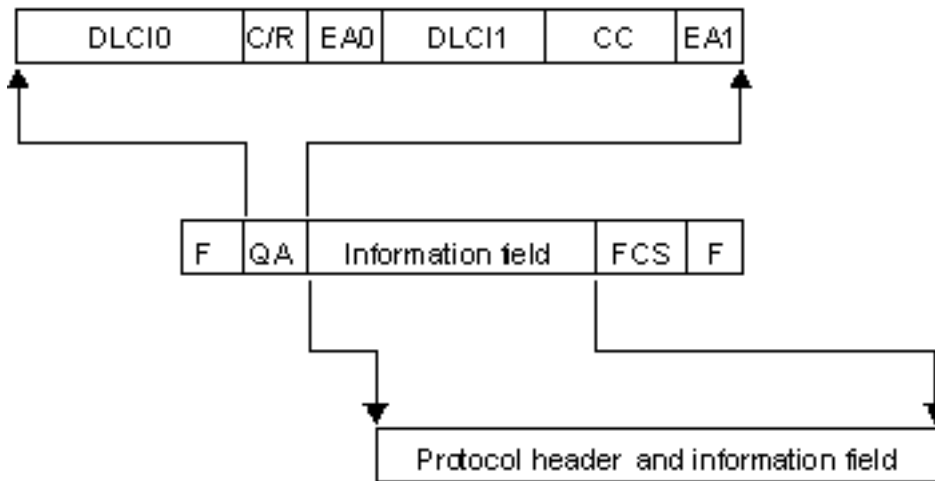


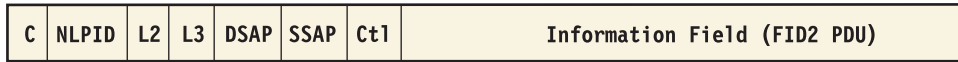
Figure 8. Frame format for frame-relay core services (FRCS)

Frame-relay protocol headers

Terminal equipment (TE) uses frame-relay protocol headers to provide routing for frames, to assure data integrity, and to perform recovery when frames are damaged or lost. System i frame-relay support uses protocol headers that are defined in Frame-Relay Forum IA 3.1.

The System i platform uses protocol header formats for Systems Network Architecture (SNA) direct, bridged local area network (LAN), and local management interface (LMI) connections. The information field of the FRCS frame contains these headers and information fields, such as, protocol data units or IP packets.

The following figures show the protocol header formats.



RZAK3518-0

Figure 9. SNA direct frame format



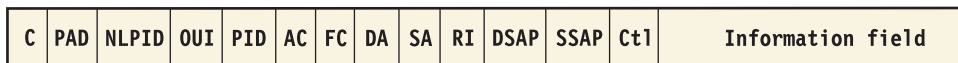
RZAK3517-0

Figure 10. IP direct frame format



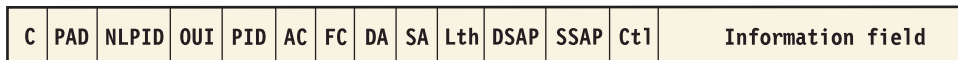
RZAK3516-0

Figure 11. High-Performance Routing (HPR) frame format



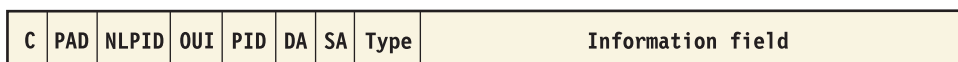
RZAK3513-0

Figure 12. Bridged token-ring and DDI LAN frame format (Frame-Relay Forum IA 3.1)



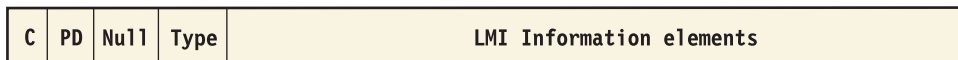
RZAK3512-0

Figure 13. Bridged IEEE Ethernet LAN frame format (Frame-Relay Forum IA 3.1)



RZAK3514-0

Figure 14. Bridged Ethernet version 2 LAN frame format (Frame-Relay Forum IA 3.1)



RZAK3515-0

Figure 15. LMI message frame format



RZAK3519-0

Figure 16. Address Resolution Protocol (ARP) format

The following table describes the protocol header fields.

Table 3. Format fields for the frame-relay protocol header

Field	Description	Values and 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	<p>08 ITU-T Q.931 (SNA direct and HPR).</p> <p>80 IEEE Subnetwork Access Protocol (SNAP) for bridged LAN connections.</p> <p>CC Internet Protocol (IP) direct.</p>
PD	Protocol discriminator	LMI frames use hex 08.
OUI	Organization-unique identifier	<p>0080C2 IEEE 802.1.</p> <p>000000 Address Resolution Protocol (ARP).</p>
PID	Protocol identifier	<p>The System i platform supports the following formats without using frame check sequence (FCS):</p> <p>0007 Ethernet.</p> <p>0009 Token-ring network.</p> <p>000A Distributed data interface (DDI) network.</p> <p>0806 ARP.</p> <p>The System i platform provides receive-only support for the following formats using FCS:</p> <p>0001 Ethernet.</p> <p>0003 Token-ring network.</p> <p>0004 DDI network.</p>

Table 3. Format fields for the frame-relay protocol header (continued)

Field	Description	Values and notes
L2	Layer 2 protocol	<p>For System i platform using SNA direct connections, 4C80 is placed in the L2 field.</p> <p>Byte 1</p> <p>4C IEEE 802.2 (ISO 8802/2).</p> <p>4E Q.922 (IDLC).</p> <p>46 LAP-B (X.25).</p> <p>4A HDLC NRM (SDLC).</p> <p>51 ISO 7776.</p> <p>70 Without IEEE 802.2 (ISO 8802/2) header.</p> <p>Byte 2</p> <p>80 Undefined.</p> <p>81 MAC address included (IEEE 802.2, ISO 8802/2) or HDLC address included (ISO 7776).</p>
L3	Layer 3 protocol	<p>For System i platform using SNA direct connections, 7082 is placed in the L3 field.</p> <p>Byte 1</p> <p>66 ITU-T X.25.</p> <p>67 ISO 8208 (X.25 PLC).</p> <p>70 User-specified.</p> <p>Byte 2</p> <p>81 SNA subarea (FID4).</p> <p>82 SNA peripheral (FID2).</p> <p>83 APPN (FID2).</p> <p>85 HPR Network Layer Protocol (FID5).</p>
Information field	Information field	<p>System i support for SNA direct frame-relay connections requires Protocol Data Unit (PDU) to contain the type of FID2 in the Format Identification Field.</p> <p>Information fields sent over bridged connections can contain FID2 PDUs or IP packets.</p>

Notes:

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.

Related concepts

“SNA direct connections” on page 5

The System i platform supports frame-relay connections to remote systems that support the Systems Network Architecture (SNA) direct format. In this format, the frame-relay packets encapsulate the SNA data.

“IP direct connections” on page 6

The System i platform supports frame-relay connections to remote systems that support the IP direct format. In this format, the frame-relay packets encapsulate the TCP/IP data.

“Bridged connections for frame relay” on page 6

The System i platform supports frame-relay connections to remote local area networks (LANs) that support the bridged frame-relay formats defined by the Frame-Relay Forum IA 3.1. Most bridges, routers, and communication controllers support these formats.

Maximum frame-size parameter requirements for frame relay

The frame-relay network provider defines and typically establishes a tariff for the frame information field size provided. This size is referred to as *N203*. Use the *N203* value to determine the value specified for the System i maximum frame size (MAXFRAME parameter).

The MAXFRAME parameter specifies the maximum protocol data unit (PDU) that the system transmits or receives. The System i platform supports MAXFRAME values from 262 to 8192 bytes. The common *N203* frame size that all networks and attached equipment support is 1600 bytes.

When configuring the MAXFRAME value, you 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 Systems Network Architecture (SNA) direct because these headers must include source and destination adapter addresses. Distributed data interface (DDI) and token-ring connections also include up to 18 bytes of routing information.

The following table shows the number of bytes required for the various frame-relay header types.

Table 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
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.

HPR

High-Performance Routing.

The MAXFRAME value configured for the line description must equal the N203 value subscribed to from the network minus the total length of the header for the connection type and protocol. 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

You need to base the maximum frame size on your System i platform on these values.

- N203.
- Maximum frame size supported by the protocol or connection type.
- Maximum frame size supported by the remote station.

Use the minimum of these values, minus the adjustment for the protocol header, to configure the MAXFRAME parameter for frame-relay connections. The following table shows the maximum frame size limits for supported connection types.

Table 5. Maximum frame size limits for connection types

Connection type	Maximum frame size (MAXFRAME parameter) limits
Systems Network Architecture (SNA) direct	8182

Table 5. Maximum frame size limits for connection types (continued)

Connection type	Maximum frame size (MAXFRAME parameter) limits
IP direct	8190
HPR	8186
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)
Note: At this time, the largest value allowed for the MAXFRAME parameter on the CRTLINFR command is 8182.	

You can configure the maximum frame size used for a connection at several levels of the System i configuration:

Line description MAXFRAME parameter

Specify the maximum frame size used for an individual permanent virtual circuit (PVC) on the MAXFRAME parameter of the frame-relay, token-ring, or distributed data interface (DDI) line description.

You cannot configure the MAXFRAME parameter on Ethernet line descriptions. Ethernet local area networks (LANs) normally use a frame size of 1500 bytes. A N203 value of 1600 for Ethernet connections to accommodate the standard 1500-byte frame size is recommended. For a N203 value less than 1600, you need to configure the maximum frame size on either the line description source service access point (SSAP) parameter or the controller description.

Line description SSAP parameter

You can specify the maximum frame size for an individual SSAP for the maximum frame size element of the line description SSAP parameter.

Controller description MAXFRAME parameter

You can specify the maximum frame size for connections to individual remote stations on the controller description MAXFRAME parameter.

The System i platform uses the smallest of the above values when it selects the maximum frame size used for connection to the remote station. For SNA connections, the system might also negotiate the frame size that is downward, based on the exchange identification (XID) that is exchanged with the remote station.

Tuning frame-relay performance

This topic provides information about adjusting parameters for greater network performance.

Advanced Program-to-Program Communication (APPC) and Systems Network Architecture (SNA) host controller descriptions support the specification of a group of LANxxxxxx parameters to provide performance-tuning capabilities for both local area network (LAN) and frame-relay connections. Because frame-relay networks operate at slower speeds than LANs, for greater network performance, it might be necessary to adjust some parameters when you use the controller description for frame-relay connections.

If you specify the default value, *CALC, for the LANxxxxxx parameters, then the System i platform automatically uses the values recommended for frame-relay connections. The system adjusts these values to allow for network delays. For example, the system might reduce them when using a high-speed network running at J1, T1, or E1 speeds. Reducing these values allows quicker error detection, but it also reduces the time allowed for error recovery.

You can display the values that the system chooses by using the Display Controller Description (DSPCTLD) command when the controller is active. Table 6 shows the values used for frame-relay connections when you specify *CALC for the LANxxxxxx parameters.

Table 6. *CALC values for controller description performance parameters

Parameter	Function	*CALC value
LANCNNTMR	Sets wait time for polling remote station.	20 seconds
LANCNRRTY	Sets number of poll retries sent to remote station.	10
LANRSP TMR	Sets wait time for frame retransmission.	20 seconds
LANFRMRTY	Sets number of frame retransmission attempts.	10
LANACKTMR	Sets wait time for acknowledgment to remote station.	1 second
LANACKFRQ	Sets number of frames received before sending acknowledgment.	1
LANINACTMR	Sets wait time for requesting response from remote station.	25 seconds
LANMAXOUT	Sets number of outstanding frames allowed before requesting acknowledgment 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

It should be noted that you might receive better performance with a larger frame size. In a mixed LAN and wide area network (WAN) environment, it might help to put CP Session support on the faster LAN controllers rather than the WAN controllers. The more data link connection identifiers (DLCIs) you have per network interface (NWI), the poorer the performance you have per DLCI.

Local management interface

The System i platform uses the local management interface (LMI) 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 data link connection identifier 0 (DLCI 0) to provide verification of the physical connection and status for logical connections.

LMIMODE parameter

Use the LMIMODE parameter on the network interface description to specify the type of LMI exchange done by the System i platform. You can configure the system as terminal equipment (*TE), or you can configure the System i platform as terminal equipment (*ANNEXA). When you specify *TE, you use ANNEX D, and when you specify *ANNEXA, you use ANNEX A.

You can also configure the system to exchange no LMI information (*NONE).

Your LMI type must match the values of the network provider. If ANNEX D or ANNEX A are unavailable, ask the network provider to turn LMI off and set the System i platform to *NONE.

When you make a connection without a network (using a modem eliminator or nonswitched line), you can configure the System i platform as a frame handler (LMIMODE(*FH)). In this configuration, the system responds to LMI messages as an FH.

Parameters that control exchanges of information over local management interface

The polling interval (POLLITV) and full inquiry interval (FULLINQITV) parameters are used to control the exchange of information over the local management interface (LMI).

- The POLLITV parameter represents the frame-relay T391 timer. It sets the interval at which the terminal equipment (TE) sends a status inquiry message to the frame handler (FH). You can set the POLLITV parameter 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. You can set the FULLINQITV parameter to any value between 1 and 255 cycles. The default value is 6 cycles.

Related reference

“Local management interface exchanges”

To maintain the exchanged status information between the frame-relay network and the systems attached to it, use the keep-alive exchange and permanent virtual circuit (PVC) status change.

Local management interface exchanges

To maintain the exchanged status information between the frame-relay network and the systems attached to it, use the keep-alive exchange and permanent virtual circuit (PVC) status change.

Keep-alive exchange

Use the keep-alive exchange to maintain contact between the terminal equipment (TE) and the frame handler (FH). It consists of an exchange of sequence messages.

At intervals specified by the POLLITV parameter, the TE sends status inquiry messages to the FH. The FH responds with a status message that includes the correct sequence number (both status inquiry and status messages include sequence numbers).

PVC status change

After the number of status inquiry messages specified by the FULLINQITV parameter have been completed, the TE requests a full status from the FH. The FH responds with a status message that includes a list of the PVCs 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.

Related reference

“Parameters that control exchanges of information over local management interface”

The polling interval (POLLITV) and full inquiry interval (FULLINQITV) parameters are used to control the exchange of information over the local management interface (LMI).

Scenarios: Frame-relay configuration

These examples show how to configure frame-relay connections.

Scenarios: SNA direct connection for frame relay

These scenarios show how to configure a direct Systems Network Architecture (SNA) connection.

Scenario: SNA direct connection of two System i models

This example shows a direct Systems Network Architecture (SNA) connection between two System i models.

The following figure shows a connection between a System i model in Minneapolis and a System i model in Madison over a frame-relay network.

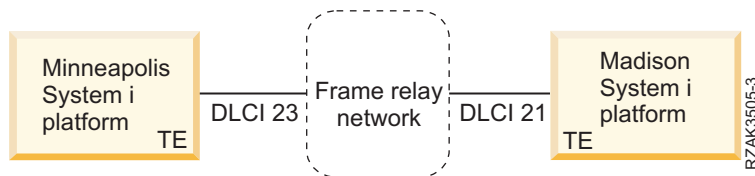


Figure 17. SNA direct connection between Minneapolis and Madison systems

The two systems have an Advanced Peer-to-Peer Networking (APPN) connection that is configured on the frame-relay data link connection identifier (DLCI). Note that the frame-relay link in Minneapolis has much more traffic and operates at 1 536 000 bps. The link in Madison operates at 64 000 bps. The frame-relay network allows for this difference in subscriptions at the two sites.

The Minneapolis connection to the network uses DLCI 23. In Madison, the DLCI number is 21. If the connection uses a frame-relay network, the DLCI numbers have only local (terminal end (TE) to frame handler (FH)) significance and might be different on the two interfaces. The network is responsible for setting up the connection between the DLCIs at administration time.

If you require more than one Advanced Program-to-Program Communication (APPC) connection between the two sites, you must define additional source service access point (SSAP) and destination service access point (DSAP) values on the lines, and the additional controllers need different SSAP and DSAP combinations.

Scenario details: Configuration for the System i model in Minneapolis:

To configure the System i model in Minneapolis, use these commands.

Use the prompt display for the Create Network Interface (Frame Relay) (CRTNWIFR) command to create the network interface (NWI) description on the Minneapolis system. The INTERFACE and LINESPEED parameter values must match the network subscription, and you must specify a LMIMODE value when communicating over a frame-relay network. The LMIMODE value must match the network subscription and can be *TE, *ANNEXA, or *NONE. The local management interface (LMI) uses data link connection identifier 0 (DLCI 0) for both *ANNEXA and *TE, but it does not use a DLCI for *NONE.

Use the prompt display for the Create Line Description (Frame Relay) (CRTLINFR) command to create the frame-relay line description on the Minneapolis system. The DLCI that you specify for the line must match the network subscription. Because frame-relay Systems Network Architecture (SNA) direct addressing requires 10 bytes of overhead, a frame size of 1590 is configured for the MAXFRAME parameter. In other words, you need to use a frame size that is at least 10 bytes less than the network subscription. You also need to know the frame size at the other side of the network. For example, if one side is 1600 and the other is 2100, then both sides need to be set to 1600.

Use the prompt display for the Create Controller Description (APPC) (CRTCTLAPPC) command to create the APPC controller description on the Minneapolis system. You must specify LINKTYPE(*FR) for SNA direct connections.

Note: The default values for SSAP and DSAP are both 04. These values must match the values specified for the remote system. If you create more controllers using the same line description (DLCI), you must specify a unique SSAP and DSAP pair. This might require you to configure more SAPs on the frame-relay line description.

Scenario details: Configuration for the System i model in Madison:

To configure the System i model in Madison, use these commands.

```
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) NWIDLICI(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 System i model in Minneapolis')
```

Scenario: SNA direct connection using a modem eliminator

The example shows a direct Systems Network Architecture (SNA) connection that uses a modem eliminator.

The following figure shows the configuration of two System i models (SYSTEM1 and SYSTEM2) for direct SNA frame-relay communications without a frame-relay network.

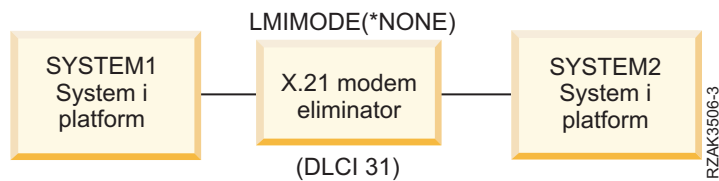


Figure 18. SNA direct connection using a modem eliminator

In this scenario, SYSTEM1 connects to 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 Advanced Peer-to-Peer Networking (APPN) end nodes. You must create the Advanced Program-to-Program Communication (APPC) controller descriptions, but the device descriptions are created automatically.

Scenario details: Configuration for SYSTEM1:

To configure SYSTEM1, use these commands.

```
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) NWIDLICI(31)3 MAXCTL(40) +
          MAXFRAME(8182)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')
```

Notes:

1. The INTERFACE and LINESPEED parameters must match the modem eliminator.
2. LMIMODE is *NONE, which means the systems do not exchange LMI data. You do not need the LMI for attachments without a network.
3. The data link connection identifier (DLCI) for the line must match the DLCI configured on the remote system for this connection. If you configure multiple lines, all DLCIs must match the remote system.
4. There is no maximum frame size in a system-to-system configuration, but both values must match. In this example, a value of 8182 gives the best performance.
5. Set the APPN link speed (LINKSPEED parameter) according to the speed specified on the NWI.
6. Specify LINKTYPE(*FR) for Systems Network Architecture (SNA) direct connections.
7. The default values for source service access point (SSAP) and destination service access point (DSAP) are both 04. These values must match the values specified for the remote system. If you create more controllers using the same line description, you must specify a unique SSAP and DSAP pair. This might require you to configure more service access points (SAPs) on the frame-relay line description.

Scenario details: Configuration for SYSTEM2:

To configure SYSTEM2, use these commands.

```
CRTNWIFR  NWID(SYSTEM2) RSRcname(LIN291) INTERFACE(*X21) +  
          LINESPEED(1536000) LMIMODE(*NONE) +  
          TEXT('Frame-relay Interconnect through modem eliminator')  
  
CRTLINFR  LIND(SYSTEM1FR) NWI(SYSTEM2) NWIDLCI(31) MAXCTL(40) +  
          MAXFRAME(8182) EXCHID(05600033) LINKSPEED(1536000) +  
          TEXT('Frame-relay direct line to SYSTEM1')  
  
CRTCTLAPPC  CTLD(SYSTEM1FR) LINKTYPE(*FR) APPN(*YES) +  
            SWTLINLST(SYSTEM1FR) RMTNETID(*NETATR)+  
            RMTCPNAME(SYSTEM2) EXCHID(05610441) DSAP(04) SSAP(04) +  
            TEXT('FR direct controller for SYSTEM2')
```

Scenario: SNA direct connection to a host system

This example shows a Systems Network Architecture (SNA) direct connection to a host system.

The following figure shows the configuration of a System i model for frame-relay communications with a 3745 host controller.



Figure 19. SNA direct connection to 3745 host controller

The 3745 host controller provides the frame-relay network function, and the System i model is configured as a terminal equipment (TE).

A 64000 bps V.35 line exists between the System i model and the 3745 host controller. The System i model might also have data link connection identifier (DLCI) connections to multiple 3745 host controllers, 6611 Network Processor, and RouteXpanders through the 3745 host controller. However, these configurations are not shown as part of this scenario.

There is a single permanent virtual circuit (PVC) connection between the System i model and the host system. This connection supports a 3270 emulation device that is used to access applications on the host. It also includes a distributed host command facility (DHCF) session.

Configuration for the System i model

Use the following commands to configure the System i model using an SNA direct connection with the 3745 host controller 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  LIND(FR3745) NWI(FR3745) NWIDLCI(26) +  
          EXCHID(05636759) TEXT('DLCI connection to the host')
```

```
CRCTCLHOST CTLD(FRHOST) LINKTYPE(*FR) APPN(*NO) +  
          SWTLINLST(FR3745) MAXFRAME(8182) +  
          SSCPID(050000000001) SWTDSC(*YES) +  
          TEXT('Remote host system')
```

```
CRTDEVSP  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')
```

Notes:

1. The INTERFACE and LINESPEEED parameters must match the characteristics of the line to the 3745 host controller.
2. The local management interface (LMI) mode is the default value of *TE, which means the System i model acts as the terminal equipment. You must configure the 3745 as the frame handler (FH) by using American National Standards Institute (ANSI) Annex D (DLCI 0).
3. By creating a frame-relay line description (CRTLINFR), you indicate that the DLCI is connected to another device. The device supports the frame-relay SNA direct frame format of RFC 1490, such as the 3745 host controller.
4. The DLCI for the line must match the DLCI that you assigned in the configuration of the 3745 host controller.

Scenarios: Bridged configuration for frame relay

These scenarios illustrate the bridged configuration for frame relay. Some general considerations for configuring the 6611 Network Processor and the RouteXpander/2 are also provided.

Scenario: Bridged connections to remote token-ring networks

This scenario shows how to connect a System i model on a frame-relay network to systems on two remote token-ring networks. The 6611 Network Processor and IBM® PS/2® computer-based RouteXpander/2 are used as bridges between the frame-relay network and the remote local area networks (LANs).

The following figure shows the configuration of a System i model for frame-relay communications with devices on two different token-ring networks.

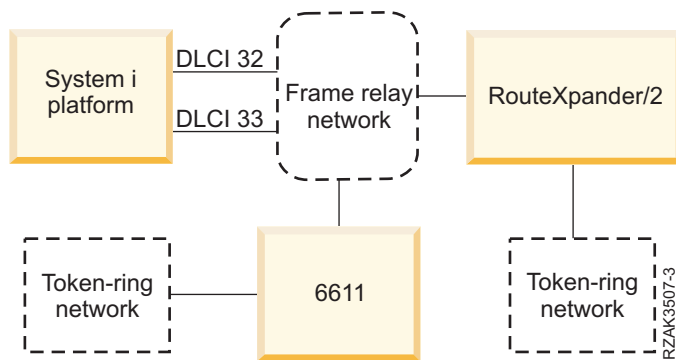


Figure 20. Bridged connections to remote token-ring networks

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 by using two data link connection identifiers (DLCIs), with each providing a link to one of the bridges. DLCI 32 defines a permanent virtual circuit (PVC) to the RouteXpander, and DLCI 33 defines a PVC to the 6611.

The source route bridging protocol is carried out on both bridges in this configuration. Both Systems Network Architecture (SNA) Advanced Program-to-Program Communication (APPC)/Advanced Peer-to-Peer Networking (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 System i platform.

Scenario details: Creating the frame-relay network interface description:

To create the frame-relay network interface description, use this command.

```
CRTNWIFRN NWID(FRMRLY) RSRNAME(LIN031) INTERFACE(*RS449V36)1 +
  LINESPEED(1536000)1 LMIMODE(*TE)2 +
  TEXT('T1 link to frame-relay network')
```

Notes:

1. Values that you specify for the INTERFACE and LINESPEED parameters must match the frame-relay services that the network provider supplies.
2. Local management interface (LMI) mode is *TE, which means the System i model exchanges information with the network on data link connection identifier 0 (DLCI 0). If the network does not support the LMI on DLCI 0, then you must configure the LMIMODE parameter to *NONE. The network provider must then configure the frame-relay switch not to perform LMI functions on the line.

Scenario details: Configuring the System i connection to a remote token-ring network through the 6611 Network Processor:

To configure the System i connection to a remote token-ring network through the 6611 Network Processor, use these commands.

```
CRTLINTRN1 LIND(ROUTE6611) RSRNAME(*NWID) NWI(FRMRLY) +
  NWIDL(33)2 LINESPEED(*NWI) MAXFRAME(8148)3 +
  ADPTADR(400000036760)4 EXCHID(05636760) +
  AUTOCRTCTL(*YES)5 TEXT('DLCI to the 6611')
```

```
ADDTCPFC6 INTNETADR('59.1.2.222') LIND(ROUTE6611)
```

```
CRTCTLAPPC CTLD(PC3) LINKTYPE(*LAN) SWTLINLST(ROUTE6611) +
  RMTNETID(APPN) RMTCPNAME(PC3) ADPTADR(400000051718) +
```

```

TEXT('PC3 on 6611 Token-ring Network')
CRTDEVAPPC DEVD(PC3) RMTLOCNAME(PC3) LCLLOCNAME(SYS320) CTL(PC3) +
TEXT('PC3 on 6611 Token-ring Network')

CRTCTLAPPC CTLD(PC4) LINKTYPE(*LAN) SWTLINLST(ROUTE6611) +
RMTNETID(APPN) RMTCPNAME(PC4) ADPTADR(400000564318) +
TEXT('PC4 on 6611 Token-ring Network')

CRTDEVAPPC DEVD(PC4) RMTLOCNAME(PC4) LCLLOCNAME(SYS320) CTL(PC4) +
TEXT('PC4 on 6611 Token-ring Network')

```

Notes:

1. By creating a token-ring line (CRTLINTRN), you indicate that the data link connection identifier (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 the DLCI that is supplied by the network provider. At administration time, the network provider must establish a permanent virtual circuit (PVC) connection to the location of the bridge. If you connect more than one bridge, you need to configure multiple DLCIs and token-ring line descriptions.
3. The MAXFRAME values for each line might be different. When selecting values, you must take into account the maximum sizes that the network and bridge support. For information about determining a frame size to configure in your line descriptions, see the Maximum frame-size parameter requirements for frame relay.
4. You must generate an adapter address (ADPTADR) for each line description that you configure for bridging over frame relay. The frame-relay adapter does not have a preset address.
5. Configure AUTOCRTCTL so that any devices that dial in to the System i model have controller and device descriptions automatically created.
6. Use the ADDTCPIFC command to define a new interface to the TCP/IP configuration.

This configuration allows you to communicate by using either Systems Network Architecture (SNA) or TCP/IP data.

Note: If the 6611 Network Processor passes TCP/IP data from a frame-relay network to a token-ring or Ethernet network, you must ensure that the 6611 Network Processor does not filter data for service access point (SAP) AA. You must turn off filtering for SAP AA on both the frame-relay port and the token-ring or Ethernet port.

Scenario details: Configuring the System i connection to a remote token-ring network through a RouteXpander/2:

To configure the System i connection to a remote token-ring network through a RouteXpander/2, use these commands.

```

CRTLINTRTN LIND(ROUTEEX) RSRNAME(*NWID) NWI(FRMRLY) NWIDL(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')
```

With this configuration, you can communicate by using either Systems Network Architecture (SNA) or TCP/IP data.

Scenario: Bridged connection to an Ethernet network

This scenario involves connecting a System i model to an Ethernet local area network (LAN) using a 6611 Network Processor. The 6611 Network Processor is used as both the frame-relay frame handler and a bridge.

The following figure shows the configuration of a System i platform for frame-relay communications with devices on an Ethernet network.

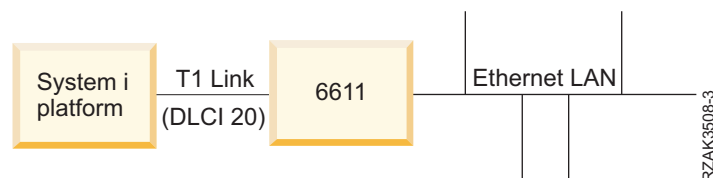


Figure 21. Bridged configuration to the Ethernet network

The Ethernet LAN is connected by using a 6611 Network Processor bridge and transparent bridging. The bridge is connected to the System i platform by using a T1 link.

As seen in the figure, there is no frame-relay network in the connection between the System i platform and the 6611 Network Processor. In this scenario, the System i platform provides the frame handler (FH) or DCE function, and the 6611 Network Processor 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 System i platform.

Use the following commands to configure the System i platform connection to the Ethernet network through a 6611 Network Processor.

```
CRTNWIFR NWID(FT1) RSRNAME(LIN231) NRZI(*YES)1
  INTERFACE(*RS449V36)2 LINESPEED(1536000)2 +
  LMIMODE(*FH)3 +
  TEXT('Network Interface for T1 link to Ethernet Bridge')
```

```
CRTLINETH4 LIND(ETHER6611) RSRNAME(*NWID) NWI(FRT1)
  NWIDLICI(20)5 ADPTADR(020000036759)6 +
  EXCHID(05636759) LINKSPEED(1536000) AUTOCRTCTL(*YES)7 +
  TEXT('DLCI to the 6611 Ethernet LAN')
```

```
ADDTCPIFC8 INTNETADR('59.1.2.222') 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(ETHERNET6611) +
  RMTNETID(RPC) RMTCPNAME(PC6) ADPTADR(400000455405) +
```

```
TEXT('PC6 on 6611 Ethernet Network')
```

```
CRTDEVAPP DEVD(PC6) RMTLOCNAME(PC6) LCLLOCNAME(SYS320) CTL(PC6) +  
TEXT('PC6 on 6611 Ethernet Network')
```

Notes:

1. You must configure NRZI(*YES) when communicating directly with a 6611 Network Processor without a frame-relay network, such as on a T1 link. You must also configure the 6611 Network Processor to use NRZI.
2. The INTERFACE and LINESPEED parameters must match the characteristics of the T1 line that you use.
3. The local management interface (LMI) mode is *FH, which means that the System i model acts as the frame handler and the 6611 Network Processor acts as the terminal equipment (TE). LMI is exchanged on data link connection identifier 0 (DLCI 0).
4. By creating an Ethernet line (CRTLINETH), you are indicating that the DLCI connects to an Ethernet bridge. The Ethernet bridge carries out RFC 1490 bridging and performs transparent bridging.
5. The System i model communicates with the 6611 bridge on DLCI 20.


Note: If the 6611 Network Processor passes TCP/IP data from a frame-relay network to a token-ring or Ethernet network, you must ensure that the 6611 Network Processor does not filter data for service access point (SAP) AA. You must turn off filtering for SAP AA on both the frame-relay port and the token-ring or Ethernet port.

6. You must generate an adapter address (ADPTADR) for each line description that you configure for bridging over frame relay. The frame-relay adapter does not have a preset address.
7. Configure the Automatically Create Controller Description (AUTOCRTCTL) command so that any devices that dial in to the System i model have controller and device descriptions automatically created.
8. Use the Add TCP/IP Interface (ADDTCPIFC) command to define a new interface to the TCP/IP configuration.

Use this configuration to communicate by using either SNA or TCP/IP data.

Related information for frame relay

Listed here is a manual that relates to the Frame relay topic collection. You can view or print the PDF.


The LAN, Frame-Relay and ATM Support (about 1.5 MB)  manual contains the latest information about distributed data interface (DDI) networks and wireless networks.

Saving PDF files

To save a PDF on your workstation for viewing or printing:

1. Right-click the PDF in your browser (right-click the link above).
2. Click the option that saves the PDF locally.
3. Navigate to the directory in which you want to save the PDF.
4. Click **Save**.

Downloading Adobe Reader

- | You need Adobe Reader installed on your system to view or print these PDFs. You can download a free
- | copy from the Adobe Web site (www.adobe.com/products/acrobat/readstep.html)  .

Appendix. Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not grant you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY 10504-1785
U.S.A.

For license inquiries regarding double-byte (DBCS) information, contact the IBM Intellectual Property Department in your country or send inquiries, in writing, to:

IBM World Trade Asia Corporation
Licensing
2-31 Roppongi 3-chome, Minato-ku
Tokyo 106-0032, Japan

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Licensees of this program who wish to have information about it for the purpose of enabling: (i) the exchange of information between independently created programs and other programs (including this one) and (ii) the mutual use of the information which has been exchanged, should contact:

IBM Corporation

Software Interoperability Coordinator, Department YBWA
3605 Highway 52 N
Rochester, MN 55901
U.S.A.

Such information may be available, subject to appropriate terms and conditions, including in some cases, payment of a fee.

- | The licensed program described in this information and all licensed material available for it are provided
- | by IBM under terms of the IBM Customer Agreement, IBM International Program License Agreement,
- | IBM License Agreement for Machine Code, or any equivalent agreement between us.

Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

All statements regarding IBM's future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs.

Each copy or any portion of these sample programs or any derivative work, must include a copyright notice as follows:

© (your company name) (year). Portions of this code are derived from IBM Corp. Sample Programs. © Copyright IBM Corp. _enter the year or years_. All rights reserved.

If you are viewing this information softcopy, the photographs and color illustrations may not appear.

Programming Interface Information

This Frame relay publication documents intended Programming Interfaces that allow the customer to write programs to obtain the services of IBM i5/OS.

Trademarks

The following terms are trademarks of International Business Machines Corporation in the United States, other countries, or both:

- | Advanced Peer-to-Peer Networking
- | i5/OS
- | IBM
- | IBM (logo)
- | PS/2
- | System i

Other company, product, and service names may be trademarks or service marks of others.

Terms and conditions

Permissions for the use of these publications is granted subject to the following terms and conditions.

Personal Use: You may reproduce these publications for your personal, noncommercial use provided that all proprietary notices are preserved. You may not distribute, display or make derivative works of these publications, or any portion thereof, without the express consent of IBM.

Commercial Use: You may reproduce, distribute and display these publications solely within your enterprise provided that all proprietary notices are preserved. You may not make derivative works of these publications, or reproduce, distribute or display these publications or any portion thereof outside your enterprise, without the express consent of IBM.

Except as expressly granted in this permission, no other permissions, licenses or rights are granted, either express or implied, to the publications or any information, data, software or other intellectual property contained therein.

IBM reserves the right to withdraw the permissions granted herein whenever, in its discretion, the use of the publications is detrimental to its interest or, as determined by IBM, the above instructions are not being properly followed.

You may not download, export or re-export this information except in full compliance with all applicable laws and regulations, including all United States export laws and regulations.

IBM MAKES NO GUARANTEE ABOUT THE CONTENT OF THESE PUBLICATIONS. THE PUBLICATIONS ARE PROVIDED "AS-IS" AND WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, AND FITNESS FOR A PARTICULAR PURPOSE.



Printed in USA