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X.25 Network Control Program (NCP) Packet Switching Interface (NPSI) Presentation

by: D. L. Buckingham

September 1982

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INTRODUCTION

This material was prepared as an introduction presentation to the X.25 and the ACF/NCP X.25 NCP Packet Switching Interface (NPSI).

Note: The presenter should use X.25 NCP Packet Switching Interface Installation and Operation, SC30-3163, as a technical reference.

Foils 1 through 49 provide a presentation for technical personnel.

Foils 1 through 19 provide a background on X.25. Some of the material in this section references IBM support for X.25. This section can be used as an executive presentation.

Foils 20 through 27 give specific NCP Packet Switching Interface (NPSI) implementation concepts.

Foils 28 through 42 identify NPSI definition and generation requirements.

Foils 43 thought 46 identify the modulo 8 HDLC and Packet Identifier field values.

Foils 47 and 48 identify the NPSI support by hardware, access methods, NCP, and function.

Foil 49 identifies reference materials.

PRESENTATION SCRIPT

FOIL 1

Title cover.

FOIL 2

X.25 is a recommended interface defined by the CCITT (The International Telegraph and Telephone Consultative Committee).

There are three interfaces, (1) a physical interface, (2) a link level, and (3) a packet level. It provides a physical interface, a point-to-point link procedure, and packet headers for control and routing. It also defines a protocol which can be used for direct control on a point-to-point link without a packet network.

FOIL 3

X.25 does not define a packet network. It does not provide end-to-end communications, only end-to-end to the point where a packet is created or deleted. It does not allow for multi-point connection of data terminal equipment (DTEs) on one physical link. It does not provide data format compatibility; you can direct dial Japan, but there is no communication unless you both speak the same language. It does not ensure compatibility between subsets of X.25. There is no communication unless the packet network and the external DTE use a common X.25 set of facilities. There is no communication unless the external DTEs have a common understanding of the data within a packet.

FOIL 4

Why X.25? It provides connectivity between unlike devices by cable, direct communication link, or an X.25 network. Different equipment manufacturers had to provide special physical and/or logical support for communication. With a standard, such as X.25, if both pieces of equipment support X.25, there is a better chance of connection and communication. If both only support X.25 DTE, an X.25 network is required. If one can provide X.25 DCE support, the equipment can be cable or direct link connected.

Some X.25 networks provide packet assembly/disassembly support for an ASCII pad or non-standard pads to non X.25 interfaces. This provides support that may not otherwise be physically available or at a reasonable communication price.

In addition to connectivity, a reason for X.25 is the price of communication facilities. The X.25 service provides for switched and non-switched service. If the price for the packet service is competitive with dedicated non-switched or public switched, then a packet network is cost effective.

FOIL 5

The X.25 physical interface is defined by the standards of X.21, V.24 (RS-232-C) and V.35.

FOIL 6

The X.25 link procedure is HDLC asynchronous balanced mode. There are two versions, LAP and LAPB. LAP was an early standard which was found to have some interlock problems. LAPB is a later standard which in expected to totally replace LAP in the near future. Most packet carriers provide LAPB today.

SDLC is a subset of HDLC and is implemented as asynchronous unbalanced (primary and secondary) mode which supports both point-to-point and multi-point protocols. The X.25 HDLC asynchronous, balanced mode, full-duplex (concurrent send/receive) only supports point-to-point. The X.25 HDLC assumes both points are equals, not primary/secondary. Polling only occurs if the traffic is unbalanced and acknowledgement to transmitted frames has not been received. Either side can send to a maximum outstanding frame limit without polling or being polled.

FOIL 7

The HDLC frame has the same format as SDLC for modulo 8.

FOIL 8

X.25 packets have a three byte header. Packet commands have a fixed format. Data packets for non-SNA contain user data immediately following the packet header. SNA type 1 and type 2 physical units have a two byte control field following the header, and data (including TH/RH) in the remaining packet area. Packets are normally 128 or 256 bytes, but may be up to 4096 bytes.

The packet header contains a general format identifier of x001, where x indicates a qualified packet. Qualified packets indicate a special type of control packet. The logical channel group number plus the logical channel number provides the 12 bit destination address of the packet. The packet type identifier indicates data or command, and if a command the type of command.

FOIL 9

This foil indicates that X.25 is another communication facility which should be transparent to the host system. Direct X.25 packet service may be a direct cable, leased analog, leased digital, or private facilities.

FOIL 10

Connection using X.25 requires that the DTE or DCE equipment have an X.25 interface; physical, link protocol, and packet. This does not provide for end-to-end communication, as you can direct dial Japan but both parties must speak a common language for communication. In addition, end-to-end control is provided by SNA, but is not provided by X.25. X.25 does have a facility for end-to-end control between the two packet assembly/disassembly (PAD) support, but not beyond the pad.

FOIL 11

Foil 11 illustrates the symmetrical three layers of X.25 via a packet network between two DTEs. Physical and link level compatibility must exist between the DTE and the packet network. The packet level compatibility must exist between the DTE and network, and between DTE and DTE.

FOIL 12

Foil 12 illustrates the symmetrical three layers of X.25 via a direct connection between a DTE and DCE. Physical, link, and packet compatibility must exist between the direct connected DTE and DCE.

The NCP NPSI can be defined as the DTE or DCE. When the NPSI physical link is defined as a DCE it provides only support for a direct connection to a DTE, not DCE/DCE support. There are two major support areas for direct connection:

1. Direct X.25 native mode connections with multiple sessions between an SNA network and a non-IBM host.

2. A direct X.25 native mode connections between two independent SNA networks. When network addressing limitations become a problem, NPSI/NPSI can provide application to application sessions between networks, but not terminal sessions. The NPSI native mode provides a logical terminal appearance, and therefore can only connect to an application. Terminals support between separate SNA networks would only be supported by an application relay program.

FOIL 13

X.25 has new terminology. Some of the concepts of X.25 require a definition of the following.

Each physical X.25 link can logically have 4096 addresses associated with that link. These addresses are called logical channels. A logical channel represents a logical path into the X.25 DTE being addressed over this physical link. A logical channel consists of a logical channel group number (0 to 15) and a logical channel number (0 to 255). This combined 12 bit address is the total logical channel number. This is similar to an SNA network address of subarea and element.

A virtual circuit is a pair of logical channels, one at each end of the network. Each DTE knows the other DTE as a logical channel number. When a connection between the DTEs is defined, it is called a virtual circuit.

A permanent virtual circuit (PVC) is logically a non-switched connection. The two DTEs have a permanent relationship.

A switched virtual circuit (SVC) is logically a switched connection. A switched DTE can 'call' different DTEs. Switched virtual circuits are logically switched, as they still have a non-switched, full duplex, HDLC connection to the packet network.

A multi-channel link (MCH) is the IBM X.25 terminology for a physical link, full duplex, HDLC connection between a DTE and the DCE.

Logical Link Control (LLC) identifies the type of virtual circuit support required. An X.25 terminal requires different support than an SNA terminal connected over an X.25 network. Each type logical link control is covered later.

The NCP Packet Switching Interface (NPSI) is the X.25 support which co-resides with the NCP in a 3705.

The Network Interface Adapter (NIA) is a hardware unit which provides the packet assembly/disassembly between the HDLC and SDLC links for SNA terminals.

The IBM Series 1, X.25 PRPQ P10008, also provides X.25 support.

An integrated pad in an X.25 network provides support for ASCII start-stop terminals as defined by CCITT X.28. X.3 defines the pad, and X.29 defines the communication between the NPSI and the pad.

A transparent pad is a CCITT definition of a 'non-standard' pad which is provided by a network and controlled by a user-written application. All control and data is passed by the NPSI without validation.

General Access to X.25 Transport Extension (GATE) is the interface for a user-written application for control of a pad for both commands and data.

Dedicated Access to X.25 Transport Extension (DATE) allows a user-written application to control commands to control circuits.

Data Confirmation bit or D bit is a method of requesting confirmation of a packet reaching the destination pad. This is not end-to-end confirmation, but only between pads.

Qualified Logical Link Control (QLLC) (Q bit) indicates a special 'qualified' data, not a normal X.25 command. As an example, NPSI sends a 'qualified' packet to a network interface adapter (NIA) to request an SDLC command of SNRM, DISC, XID, and TEST, and to obtain responses.

FOIL 14

A packet assembly/disassembly (pad) is required between the X.25 network and SNA type 1 and type 2 physical units. The network interface adapter (NIA) provides a pad for SNA equipment. The front model, SC 7042, provides a pad for a 4331, System/38, System/34, and 8100. The remote model, SC 7043, provides a pad for SNA type 1 or type 2 physical units.

There is also RPQ X.25 support for the 4700, 5252-12, and 8100 DPPX which allow direct attachment to an X.25 HDLC link.

FOIL 15

Foil 15 illustrates the NPSI to an NIA, NPSI, or native X.25 node. The NPSI provides a native X.25 interface which can connect to another NPSI native definition (this is not NCP/NCP INN support) or other equipment which has an X.25 interface.

FOIL 16

Foil 16 illustrates the NIA as a front end and terminal end support. The NIA provides for conversion of SDLC/HDLC as well as packet assembly/disassembly support.

FOIL 17

Foil 17 illustrates the Start-Stop pad and non-standard (or transparent) pad support in an X.25 network.

FOIL 18

A multi-channel link is supported up to 19.2 kb on a type 2 scanner and 56kb on a type 3 scanner. Each network may provide only selected speeds.

The host connection multi-channel link speed should be selected in the same manner as a multi-point link. As more terminals are added to a link, the higher the speed must be to support the terminals with a reasonable response time and service. If 20 terminals are connected to an X.25 network at 1200 bps, it may not be reasonable to expect them all to be supported over a single host multi-channel link of 9600 bps. Plan for a peak of 50 to 60% utilization of the terminal link connections; not the sum of the speed of terminal connections, but based upon utilization of the terminal links.

The type of service may be limited by the X.25 carrier. Some carriers do not provide for permanent virtual circuits. If a permanent virtual circuit is available, it provides security of a direct connection and connection at power on. Switched virtual circuits allows call request connection to various multi-channel links and various logical channels on a multi-channel link.

FOIL 19

Network certification is provided by the carrier. A given carrier may only provide certification for a portion of support. As an example, a carrier may certify SNA terminal support, but not the start-stop pad. Each level of support should be checked. The user should test each level of support in a local environment.

FOIL 20

The types of virtual circuits are identified on foil 20.

X.25 NPSI code must process the flow in a different manner depending upon the type of destination and user selection. LLC0 defines native mode X.25 where all SNA headers must be removed. LLC2 defines SNA type 1 and type 2 physical units. LLC3 defines SNA type 4 physical unit as a destination (not supported on X.25 Release 2). LLC4 defines the general access to X.25 transport extension (GATE) where the user application provides all X.25 commands, responses, and data with an X.25 header; NPSI only provides packet assembly and disassembly. LLC5 defines the integrated pad (ASCII start/stop) and transparent pad.

FOIL 21

Foil 21 defines and identifies the DATE function. The DATE function, Dedicated Access to X.25 Transport Extension, allows the user to write a Communication and Transmission Program (CTCP) application to control connection and disconnection to a virtual circuit. The flow occurs to the LU of the multi-channel link (MCH). Data flows on the normal virtual circuit LU session.

The DATE function allows the user to provide extensions for X.25 network control beyond the normal support in command flow. It also would allow accounting for session initiation and termination.

FOIL 22

Foil 22 illustrates the command byte for CTCP and DATE control. This foil illustrates the types of commands supported by DATE.

FOIL 23

Foil 23 provides examples of CTCP and DATE communication for Call Out and Call In.

FOIL 24

Foil 24 defines and identifies the GATE function. The GATE function, General Access to X.25 Transport Extension, allows the user to write a Communication and Transmission Program (CTCP) application to control connection and disconnection to a virtual circuit and the data flow. The flow occurs to the LU of the normal virtual circuit LU session.

The GATE function allows the user to provide extensions for X.25 network control beyond the normal support in command and data flow. GATE allows support of a transparent PAD, such as BSC support. It also would allow accounting for session initiation and termination.

FOIL 25

Foil 25 illustrates the command byte for CTCP and GATE control. This foil illustrates the types of commands supported by GATE.

FOIL 26

Foil 26 provides examples of CTCP and GATE communication for Call Out and Call In.

FOIL 27

X.25 NPSI activation requires the activation of the multi-channel link and PU, and then activation of the virtual circuits.

FOIL 28

NCP defines all X.25 resources as SNA resources. The NCP source statements are created by the X.25 macro assembly. NCP views the code as NCP 'user line control'. The host view is SNA only. The application must recognize and provide for SNA, Start-Stop pad, and other such as transparent pad.

FOIL 29

X.25 generation process is identified in foil 29.

FOIL 30

Foil 30 illustrates the X.25 macros and macro sequence.

The X25BUILD identifies X.25/NCP common requirements.

Each X25NET defines each network type which is supported by this generated NPSI.

The X25VCCPT defines the virtual circuit parameters to be used for this defined X.25 network.

The X25OUFT is required for switched virtual circuit variable definition.

The X25MCH defines a single multi-channel link.

The X25LCG defines a single logical channel group for the following virtual circuit definitions.

The X25SVC or X25LINE, X25PU, and X25LU are used to define a virtual circuit. Depending upon the logical circuit type you must use X25 SVC or the LINE, PU, LU macro definitions.

The X25END macro is a delimiter and provides operands for the NCP GENEND macro.

FOIL 31 THROUGH 42

Foil 31 through 42 identify the X.25 macros and operands. See X.25 NCP Packet Switching Interface Installation and Operation, SC30-3163, for additional information.

Note on the X25MCH when STATION=DCE (for direct connection to DTE equipment), no sense information is provided on error conditions. Many networks also provide zero as sense information.

FOIL 43

Foil 43 illustrates the HDLC frame and the values for modulo 8 control byte.

FOIL 44 AND 45

Foil 44 and 45 identify the X.25 packet type dependent field, byte 3 of the packet header.

FOIL 46

SNA support requires special control for contact, discontact, XID, and Test. The logical link control for SNA, in bytes 3 and 4 following the packet three byte header, has the values illustrated. User data (TH, RH, and RU) begins in byte 5 of the packet.

FOIL 47

Foil 47 illustrates the X.25 NPSI support by hardware, access method, and NCP. The two columns identify Release 2 and Release 3 of X25NPSI indicating support or lack of support for hardware, access method, and NCP.

FOIL 48

Foil 48 illustrates the X.25 NPSI support of function by release 2 or 3. The two columns identify Release 2 and Release 3 of X25NPSI indicating support or lack of support of the functions listed in the first column.

FOIL 49

Foil 49 provides a list of X.25 publication reference materials.

X.25 (NPSI)

NCP PACKET SWITCHING INTERFACE

PRESENTATION

WHAT IS X.25?

CCITT (THE INTERNATIONAL TELEGRAPH AND TELEPHONE CONSULTATIVE COMMITTEE) RECOMMENDED INTERFACE

INTERFACE

- PHYSICAL INTERFACE
- LINK PROCEDURE (OR FRAME) LEVEL
- PACKET LEVEL

PROVIDES

- A PHYSICAL INTERFACE
- A POINT-TO-POINT LINK PROCEDURE
- PACKET HEADER CONTROL
  - CONTROL COMMANDS
  - ROUTING HEADERS
- NETWORK CONTROL TO PACKET NETWORK
- DIRECT CONTROL ON POINT-TO-POINT LINK

WHAT X.25 IS NOT

X.25 DOES NOT:

DEFINE A PACKET NETWORK, ONLY INTERFACE

PROVIDE END-TO-END COMMUNICATIONS

PROVIDE FOR MULTI-POINT CONNECTION OF DTES

PROVIDE DATA FORMAT COMPATIBILITY

ENSURE COMPATIBILITY BETWEEN SUBSETS OF X.25
AS IMPLEMENTED BY DCE OR DTE EQUIPMENT

WHY X.25?

CONNECTIVITY

- CABLE
- DIRECT COMMUNICATION LINK
- X.25 NETWORK

COMMUNICATION FACILITY PRICE

- NON-SWITCHED
- SWITCHED

X.25 PHYSICAL INTERFACE

ELECTRICAL AND PHYSICAL CHARACTERISTICS

X.21

V.24 (RS-232-C)

V.35

X.25 LINK PROCEDURE (OR FRAME) LEVEL

HDLC ASYNCHRONOUS BALANCED MODE

- LAP
- LAPB

POINT-TO-POINT (MULTI-POINT NOT POSSIBLE)

FULL DUPLEX

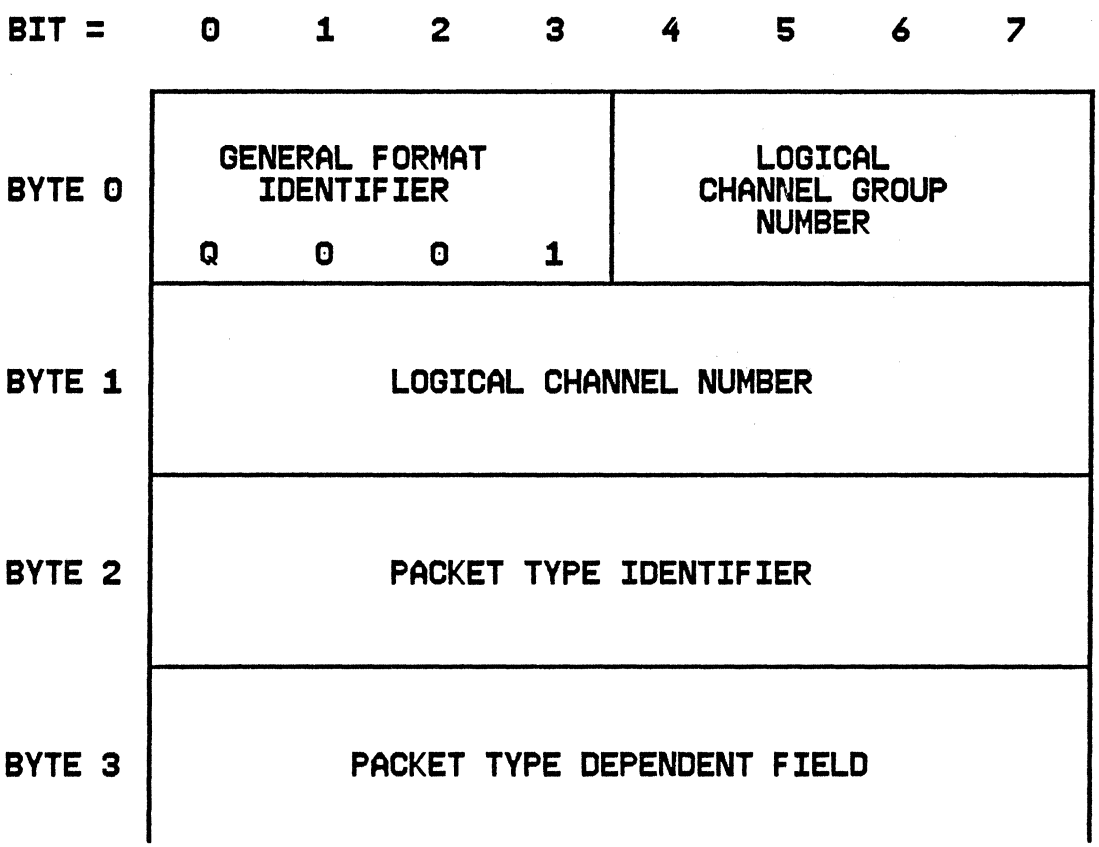
X.25 LINK PROCEDURE (OR FRAME) LEVEL EXAMPLE

FLAG 8 BIT	ADDRESS 8 BIT	CONTROL 8 BIT	INFORMATION N * 8 BIT	FCS 16 BIT	FLAG 8 BIT

- HDLC IS THE X.25 LINK PROTOCOL IN ASYNCHRONOUS BALANCED (EQUALS, NO PRIMARY/SECONDARY) MODE
- SDLC IS A SUBSET OF HDLC WHICH IS IMPLEMENTED IN ASYNCHRONOUS UNBALANCED (PRIMARY/SECONDARY) MODE

X.25 PACKET LEVEL

PACKET STRUCTURE



PACKET SIZE IS 32 TO 4096 BYTES.

SNA PACKET SIZE NIA SUPPORT IS 128 AND 256 BYTES.

COEXISTENCE OF TELECOMMUNICATION FACILITIES

LEASED ANALOG SERVICE

SWITCHED ANALOG SERVICE

LEASED DIGITAL SERVICE

SWITCHED DIGITAL SERVICE

PRIVATE FACILITIES

PACKET SERVICE

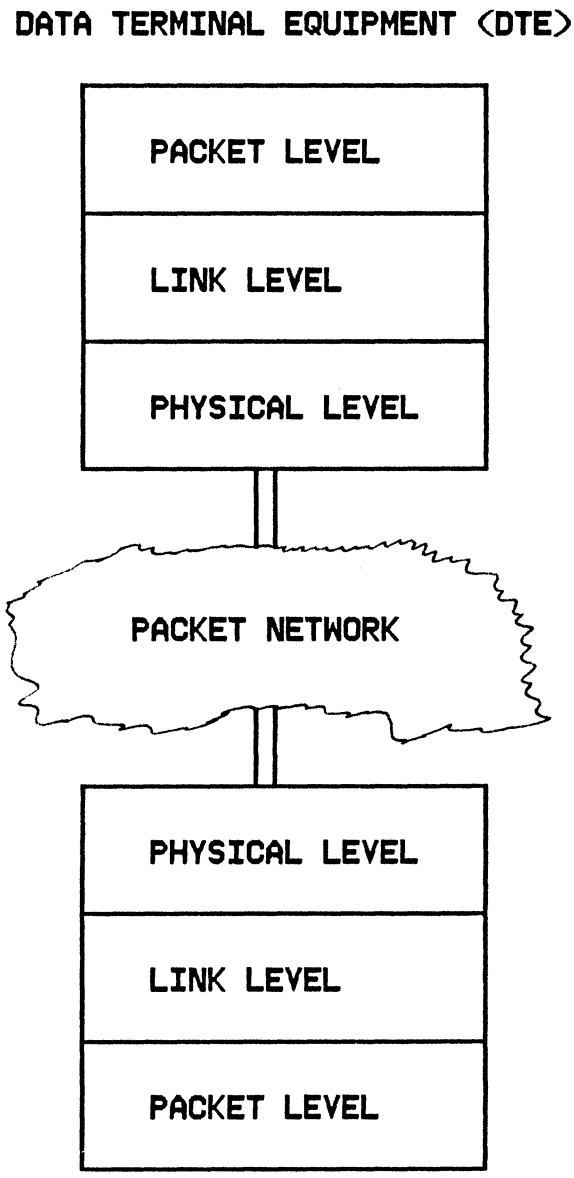
- DIRECT
- NETWORK

CONNECTION CONSIDERATIONS

EQUIPMENT MUST HAVE AN X.25 INTERFACE

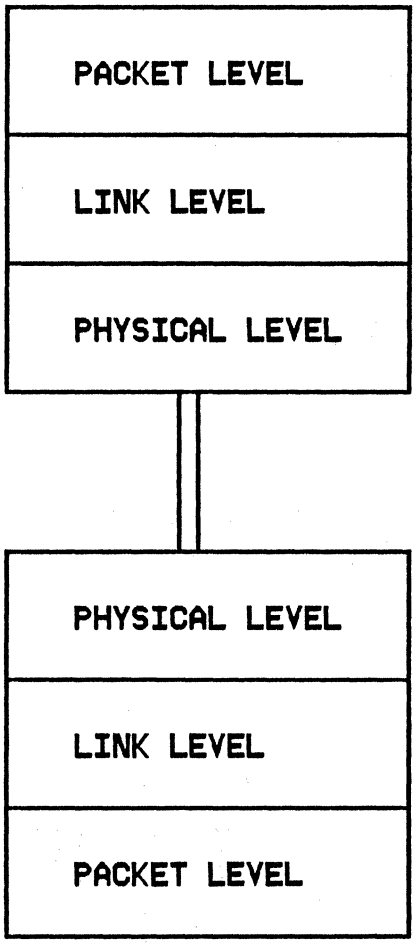
THERE MUST BE A HIGHER LEVEL PROTOCOL
FOR EFFECTIVE END-TO-END COMMUNICATION
I.E., YOU CAN CALL ANYWHERE, BUT BOTH
PARTIES MUST SPEAK THE SAME LANGUAGE

X.25 INTERFACE TO PACKET NETWORK



X.25 INTERFACE DIRECT CONNECT

DATA TERMINAL EQUIPMENT (DTE)



DATA COMMUNICATIONS EQUIPMENT (DCE)

X.25 TERMINOLOGY

LOGICAL CHANNELS - ONE DIRECTION

- LOGICAL CHANNEL GROUP - LESS THAN OR EQUAL TO 15
- LOGICAL CHANNEL NUMBER - LESS THAN OR EQUAL TO 255

VIRTUAL CIRCUIT - PAIR OF LOGICAL CHANNELS

- VCS APPEAR DIFFERENT TO PAIR OF DTES

PERMANENT VIRTUAL CIRCUIT (PVC)

SWITCHED VIRTUAL CIRCUIT (SVC)

MULTI-CHANNEL LINK (MCH)

LOGICAL LINK CONTROL (LLC)

NCP PACKET SWITCHING INTERFACE (NPSI)

NETWORK INTERFACE ADAPTER (NIA) (5793-L02)

IBM SERIES 1, X.25 PRPQ P10008

INTEGRATED PAD - X.3, X.28, X.29

TRANSPARENT PAD

GENERAL ACCESS TO X.25 TRANSPORT EXTENSION (GATE)
(APPLICATION PAD AND VIRTUAL CIRCUIT CONTROL

DEDICATED ACCESS TO X.25 TRANSPORT EXTENSION (DATE)
(VIRTUAL CIRCUIT CONTROL)

D BIT - DATA CONFIRMATION BIT

Q BIT - QUALIFIED LOGICAL LINK CONTROL (QLLC)

NETWORK INTERFACE ADAPTER (NIA)

NETWORK INTERFACE ADAPTER (NIA) (5793-L02)

FRONT MODEL SC 7042 FOR:

4331
SYSTEM/38
SYSTEM/34
8100

ONE SVC OR FOUR PVC

REMOTE MODEL SC 7043

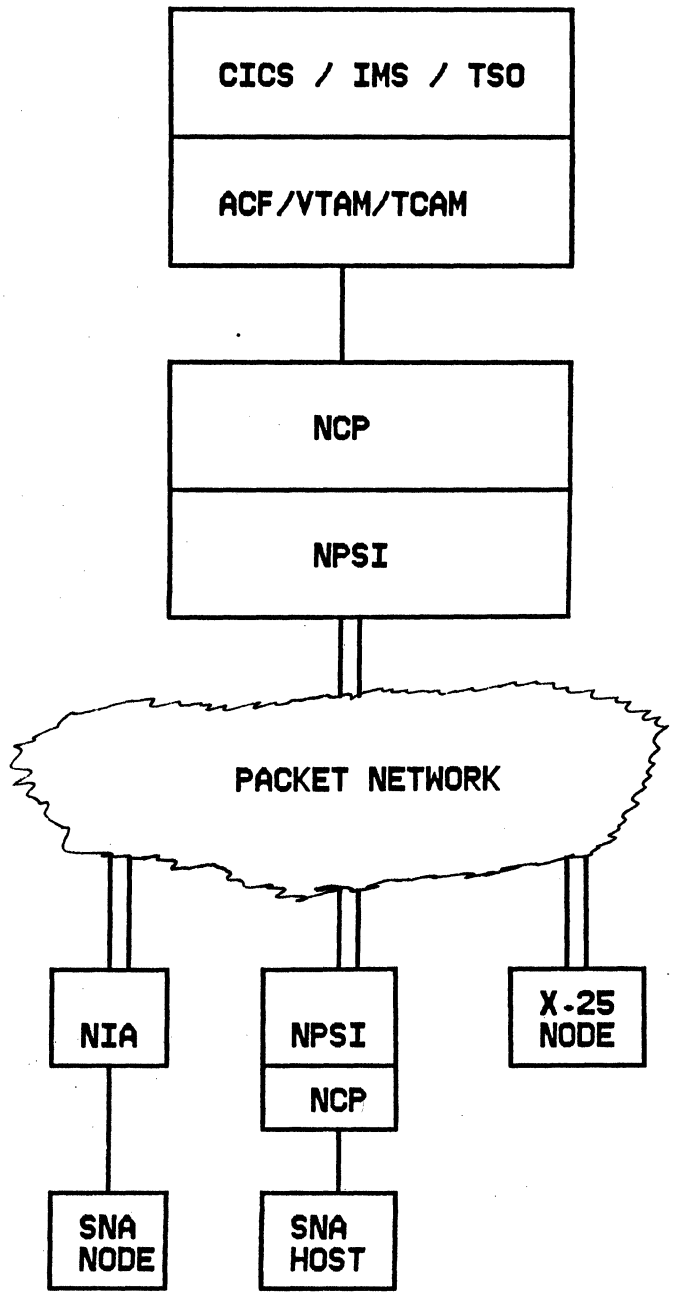
SNA CONTROLLERS

RPQ X.25 ADAPTER FOR IBM 4700

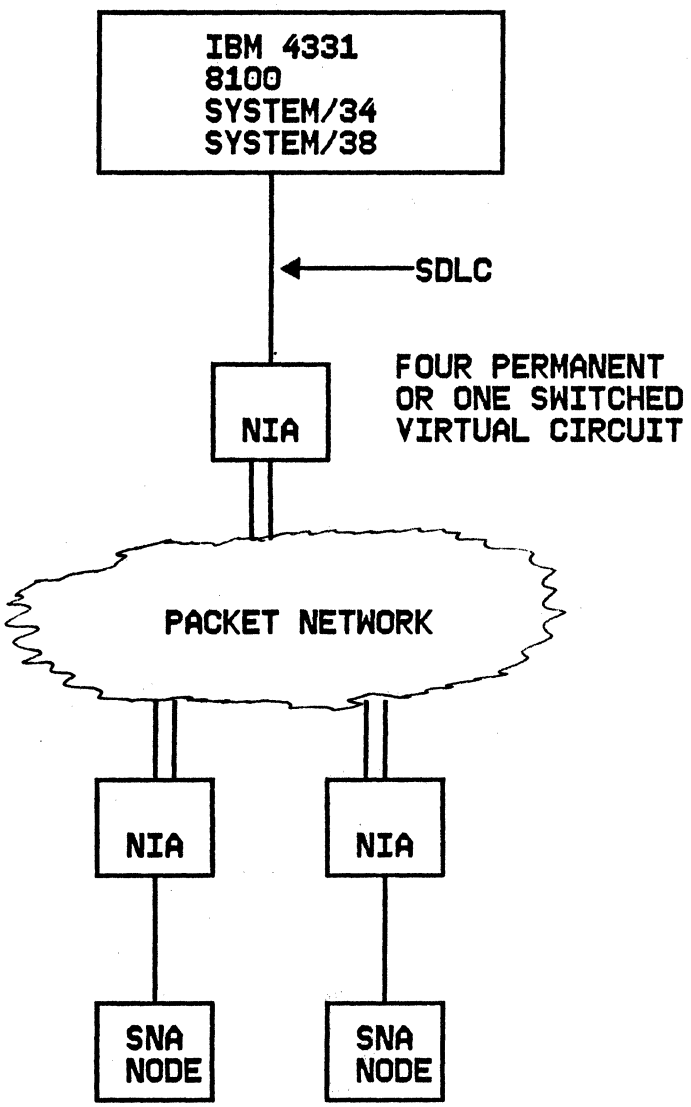
RPQ X.25 ADAPTER FOR IBM 5251-12

RPQ X.25 ADAPTER FOR 8100 DPPX

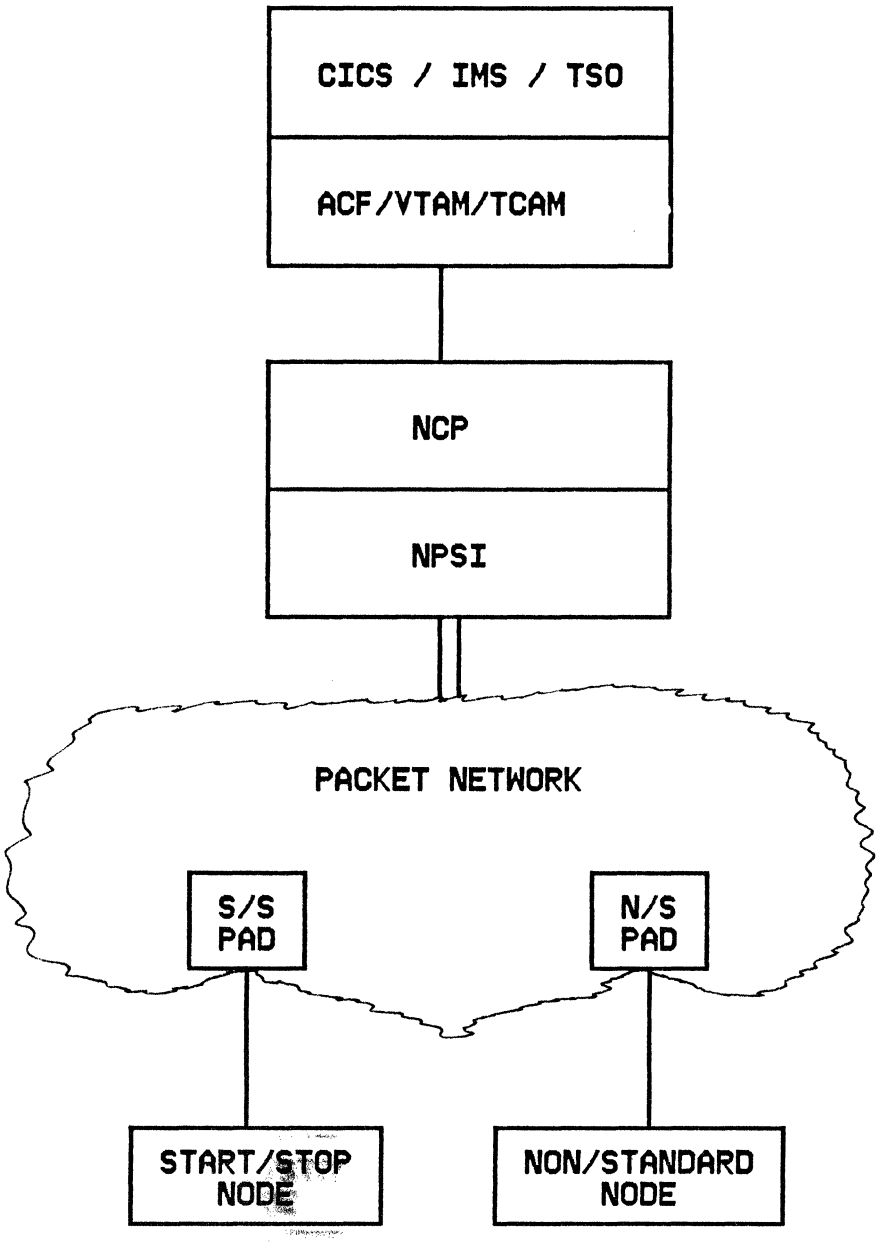
NETWORK INTERFACE ADAPTER WITH NPSI



FRONT-END
NETWORK INTERFACE ADAPTER



NPSI PAD SUPPORT



MULTI-CHANNEL LINK(S)
(PHYSICAL LINK(S))

WHAT ACCESS LINE SPEED?

- HOST CONNECTION
  - PEAK 50 - 60% UTILIZATION OF TERMINAL CONNECTIONS
- TERMINAL CONNECTION

WHAT TYPE OF SERVICE?

- PERMANENT VIRTUAL CIRCUIT
  - SECURITY
  - POWER ON CONNECTION
- SWITCHED VIRTUAL CIRCUIT
  - CALL REQUEST CONNECTION
  - FLEXIBLE CONNECTION TO MCH

NETWORK 'CERTIFICATION'

X-25 'STANDARD'

- MANY SUBSETS
- MANY 'ADDITIONS'
- TEST IN LIMITED 'LOCAL' ENVIRONMENT

VIRTUAL CIRCUIT TYPES

LLC0 - PCNE, PROTOCOL CONVERTER FOR NON-SNA EQUIPMENT, X.25 NATIVE MODE

LLC2 - PSH OR PSHC, PHYSICAL SERVICES HEADER CODE, SNA TYPE 1 AND TYPE 2 TERMINALS

LLC3 - QLLC, QUALIFIED LOGICAL LINK CONTROL, SNA SINGLE LINK TRANSMISSION GROUP (NCP R3)

LLC4 - GATE, GENERAL ACCESS TO X.25 TRANSPORT EXTENSION, A USER WRITTEN COMMUNICATION AND TRANSMISSION CONTROL PROGRAM (CTCP) SENDS/RECEIVES ALL COMMANDS AND DATA WITH A HEADER OF PACKET INFORMATION TO/FROM GATE.

LLC5 - PAD, PACKET ASSEMBLY/DISASSEMBLY INTERFACE FOR
INTEGRATED PAD - X.3, X.28, X.29
TRANSPARENT PAD - APPLICATION PAD CONTROL

DATE, DEDICATED ACCESS TO X.25 TRANSPORT EXTENSION, MAY CONTROL VIRTUAL CIRCUITS FOR LLC0, LLC2, LLC3, AND LLC5

X.25 DATE FUNCTION

DEDICATED ACCESS TO X-25 TRANSPORT EXTENSION

COMMUNICATES WITH USER WRITTEN COMMUNICATION

AND TRANSMISSION PROGRAM (CTCP)

CONTROLS CONNECTION AND DISCONNECTION TO A VIRTUAL

CIRCUIT AND THE EXCHANGE OF COMMANDS, NO DATA

CTCP COMMUNICATES WITH DATE VIA COMMANDS AND RESPONSES

IN BYTE 0 OF THE RU

X.25 DATE RU BYTE 0

ALL DATE FLOW IS ON THE CTCP LU PHYSICAL LU SESSION

RU BYTE 0	COMMAND
X'0B'	CALL
X'0F'	CALL CONFIRMATION
X'13'	CLEAR
X'17'	CLEAR CONFIRMATION
X'1B'	RESET
X'1F'	RESET CONFIRMATION
X'23'	INTERRUPT
X'27'	INTERRUPT CONFIRMATION
X'F1'	DIAGNOSTIC
X'00'	INFORMATION REPORT MESSAGE
X'FB'	RESTART
X'FF'	INFORMATION REPORT MSG

X.25 DATE RU FORMAT EXAMPLE

CALL OUT (CTCP TO DATE)

BYTE 0 AND 1: X'0XXX' WHERE XXX VC IDENTIFIER

BYTES 2: X'0B'

BYTE 3: PACKET WINDOW SIZE IN HEXADECIMAL

BYTES 4 AND 5: PACKET SIZE USED FOR THIS VC IN HEXADECIMAL

BYTE 6: THE TYPE OF VIRTUAL CIRCUIT TO BE SET UP:

X'C0' VC0

X'C2' VC2

X'01', X'41', X'81' VC5 TRANSPARENT PAD

BYTES 7: APPLICATION NAME LENGTH X'00' TO X'08'

BYTES 8 THROUGH N: APPLICATION NAME FOLLOWED BY CALL REQUEST PACKET WITHOUT PACKET HEADER

CALL IN (DATE TO CTCP)

BYTE 0 AND 1: X'0XXX' WHERE XXX VC IDENTIFIER

BYTES 2: X'0B'

BYTE 3 THROUGH N: CALL PACKET RECEIVED FROM THE NETWORK WITHOUT THE THREE-BYTE PACKET HEADER

X.25 GATE FUNCTION

GENERAL ACCESS TO X.25 TRANSPORT EXTENSION

COMMUNICATES WITH USER WRITTEN COMMUNICATION

AND TRANSMISSION PROGRAM (CTCP)

CONTROLS CONNECTION AND DISCONNECTION TO A VIRTUAL

CIRCUIT AND THE EXCHANGE OF COMMANDS AND DATA

CTCP COMMUNICATES WITH GATE VIA COMMANDS AND RESPONSES

IN BYTE 0 OF THE RU:

BIT 7 = 0 FOR DATA PACKETS

BIT 7 = 1 FOR COMMAND PACKETS

IF BIT 7 = 1:

BIT 6 = 1 IS Q BIT

BIT 6 = 0 IS NO Q BIT

X.25 GATE RU BYTE 0

RU BYTE 0	DATA	CIRCUIT
X'00'	DATA WITHOUT Q BIT	CTCP LU-VC LU SESSIONS
X'02'	DATA WITH Q BIT	CTCP LU-VC LU SESSIONS
	⋮	
RU BYTE 0	COMMAND	CIRCUIT
X'0B'	CALL	CTCP LU-PHYS LU SESSION
X'0F'	CALL CONFIRMATION	CTCP LU-PHYS LU SESSION
X'13'	CLEAR	CTCP LU-PHYS LU SESSION
X'17'	CLEAR CONFIRMATION	CTCP LU-PHYS LU SESSION
X'1B'	RESET	CTCP LU-VC LU SESSION
X'1F'	RESET CONFIRMATION	CTCP LU-VC LU SESSION
X'23'	INTERRUPT	CTCP LU-VC LU SESSION
X'27'	INTERRUPT CONFIRMATION	CTCP LU-VC LU SESSION
X'F1'	DIAGNOSTIC	CTCP LU-PHYS LU SESSION
X'FF'	INFORMATION REPORT MSG	CTCP LU-PHYS LU SESSION

X.25 GATE RU FORMAT EXAMPLE

CALL OUT (CTCP TO GATE ON SESSION BETWEEN CTCP LU
AND PHYSICAL CIRCUIT LU
BYTE 0: X'0B'
BYTES 1 AND 2: X'0XXX', WHERE XXX VC IDENTIFIER
BYTE 3: PACKET WINDOW SIZE IN HEXADECIMAL
BYTES 4 AND 5: PACKET SIZE USED FOR THIS
VC IN HEXADECIMAL
BYTES 6 THROUGH N: THE CALL REQUEST PACKET AS
IT WILL BE SENT THROUGH THE X.25 NETWORK
WITHOUT THE THREE-BYTE PACKET HEADER

CALL IN (GATE TO CTCP ON SESSION BETWEEN CTCP LU AND
PHYSICAL CIRCUIT LU
BYTE 0: X'0B'
BYTES 1 AND 2: X'FXXX', WHERE XXX VC IDENTIFIER
BYTE 3 THROUGH N: INCOMING CALL PACKET RECEIVED
FROM THE NETWORK WITHOUT THE THREE-BYTE
PACKET HEADER

X.25 NPSI ACTIVATION

ACTIVATE MULTI-CHANNEL LINK AND PU

ACTIVATE VIRTUAL CIRCUITS

NCP WITH X.25 DEFINITION

X.25 RESOURCES ARE DEFINED AS SNA RESOURCES

- REAL SNA RESOURCES ARE DEFINED AS STANDARD
  - TYPE 1, TYPE 2, OR TYPE 4 DEFINITIONS
- NON-SNA RESOURCES ARE DEFINED AS TYPE 1
  - SNA DEFINITIONS

NCP SOURCE FOR X.25 IS GENERATED BY X.25 MACROS

NCP VIEW IS SNA USER LINE CONTROL

HOST VIEW IS SNA

APPLICATION VIEW IS:

- TWX FOR X.3 PAD WITH SNA ENVELOPING
- USER DEFINED FOR GATE WITH SNA ENVELOPING
- FIXED FORMAT FOR DATE WITH SNA ENVELOPING
- SNA FOR ALL OTHER

X.25 GENERATION PROCESS

CODE X.25 MACROS

ASSEMBLE X.25 MACROS

OUTPUT:

- X.25 LOAD MODULES
- NCP SOURCE FOR X.25 CODE

MERGE USER NCP SOURCE WITH X.25 NCP SOURCE

ASSEMBLE AND LINKAGE EDIT NCP/X.25 NCP

OUTPUT:

- NCP/X.25 NCP LOAD MODULE
- NCP/X.25 RESOURCE RESOLUTION TABLE

X.25 GENERATION MACROS

X25BUILD	-	GENERAL PARAMETERS
X25NET	-	NETWORK PARAMETERS
X25VCCPT	-	VC CONNECTION PARMS
X25OUFT	-	SVC USER FACILITIES
X25MCH	-	MULTI-CHANNEL LINK
X25LCG	-	LOGICAL CHANNEL GROUP
X25VC	-	VIRTUAL CIRCUIT
OR		
X25LINE X25PU X25LU		
X25END	-	DELIMITER

X25BUILD MACRO

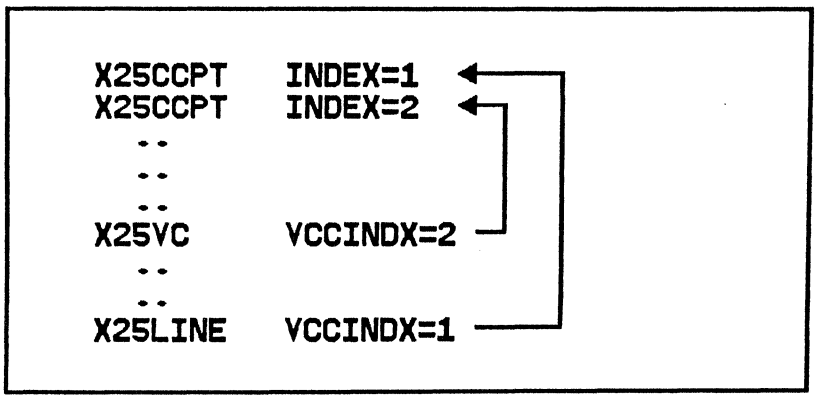
```
X25BUILD
     IDNUMH=00
     JOBCARD=YES
     MACLIB=                  (OS ONLY)
     MCHCNT=1
     OUTPUT=                  (OS ONLY)
     QUALIFY=SYS1             (OS ONLY)
     SNAP=NO
     SRCHI=X25BLK
     SRCLO=X25TBL
     SRCPRFX=X25
     TYPSYS=OS
```

X25NET MACRO

X25NET		ONE PER NETWORK
	DM=YES|NO	
	NETTYPE=1	TRANSPAC EURONET
	=2	DATAPAC DATEX-P NRW TELENET TYMNET
	CPHINDX=1	
	OUHINDX=1	

X25VCCPT MACRO

```
X25VCCPT            VC CONNECTION PARAMETERS

     INDEX=

     MAXPKTL=

     INSLOW=25,0

     VWINDOW=2
```



X25OUFT MACRO

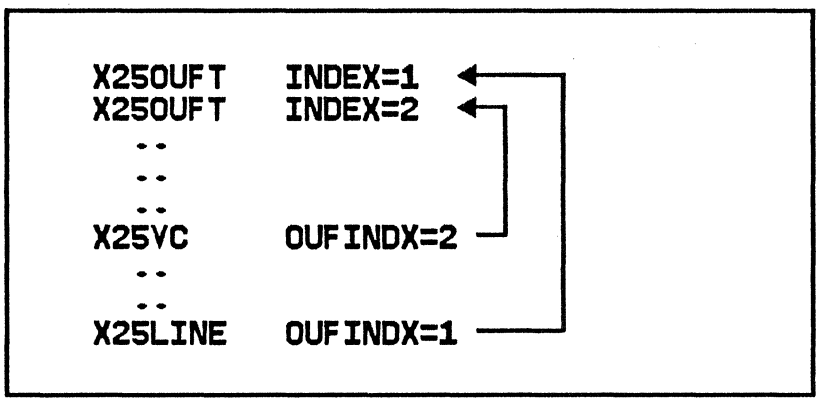
X25OUFT SVC PARAMETERS

INDEX=

OPTFACL=

USRFILD=

USRFIL2=



X25MCH MACRO (PART 1)

```
X25MCH   ADDRESS=(XMT,RCV)
         ANS=CONT|CONTINUE|STOP
         CSBTYPE=2|3
         DBIT=YES|NO
         FRMLGTH=
         LCGDEF=
         MWINDOW=
         DBIT=YES|NO
         GATE=NO
              DEDICAT
              GENERAL,SUBADDR=NO
                                YES,LLC0=
                                    LLC2=
                                    LLC4=
                                    LLC5=
         LCNO=USED|NOUSED
         LLCLIST=(LLC0,LLC2,LLC4,LLC5)
         LUNAME=
```

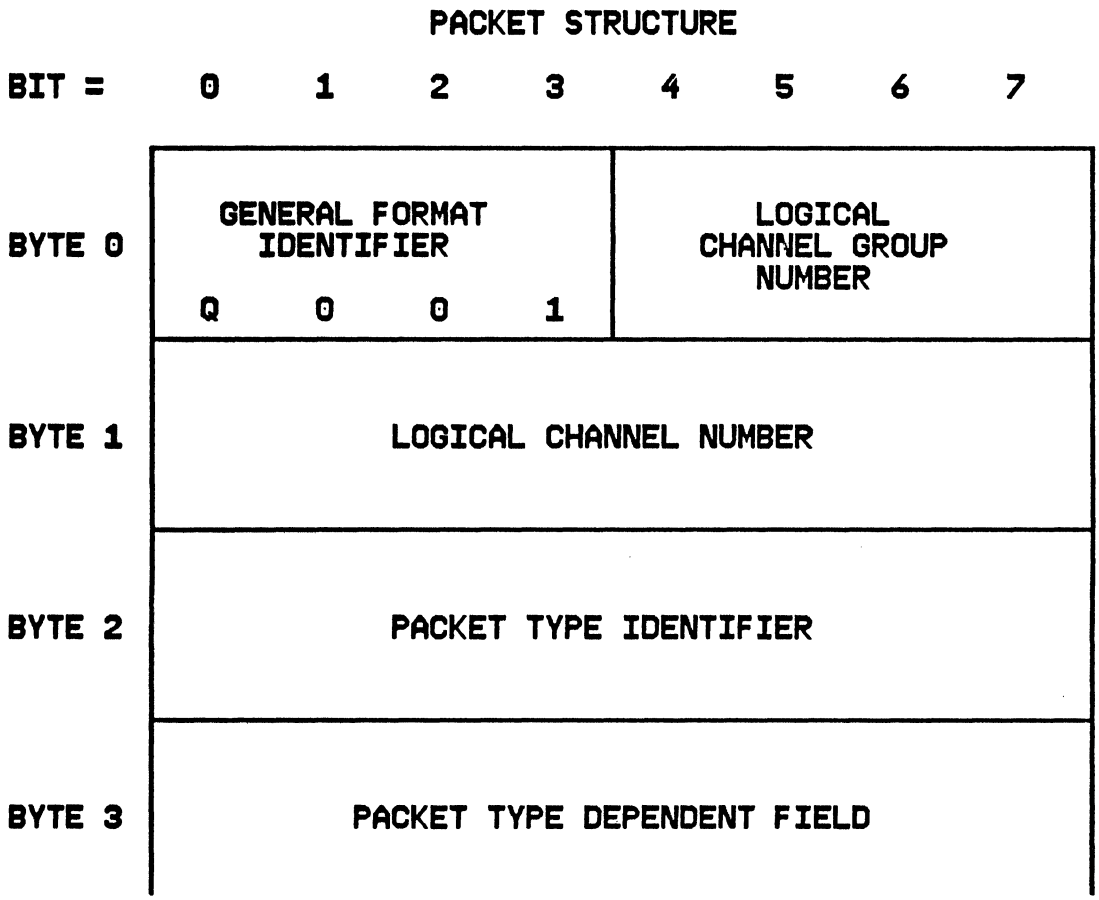
X25MCH MACRO (PART 2)

```
MACB=

NCPGRP=NEW

NDRETRY=

NPRETRY=

PAD=NO
    INTEG,TRAN=NO7ODD7EVEN
    TRANSP

PKTMODL=8|128

PROTCOL=LAPB|LAP

PUNAME=

SPEED=4800|N

STATION=DTE|DCE

TPTIMER=

TDTIMER=
```

X25LCG MACRO

X25LCG LCGN=

PACKET STRUCTURE



X25SVC MACRO

```
X25SVC

      LCN=(N,M)

      TYPE=SWITCHED,OUFINDX=
           PERMANENT,LLC=LLC0
                         LLC2
                         LLC4
                         LLC5

      VCCINDX=

      CALL=IN|OUT|INOUT

      MAXLU=

      NCPGRP=NEW

      RETVCCT=3

      RETVCTO=30

      VACB=
```

X25SVC IS VALID FOR VC0, VC2 (SWITCHED), VC4, AND VC5.

X25SVC IS NOT VALID FOR VC 3 OR NON-SWITCHED VC2.

X25LINE MACRO

```
X25LINE
     CALL=IN|OUT|INOUT
     LCN=
     MONLINK=YES|NO     (VC3 ONLY)
     NCPGRP=NEW|LABEL
     RETVCCT=3
     RETVCTO=30
     TYPE=SWITCHED,OUFINDX=
          PERMANENT,LLC=LLC0
                        LLC2
                        LLC3,DSTNODE=INN
                        LLC4
                        LLC5
     VACB=
     VCCINDX=
```

X25LINE IS VALID FOR VC2 (NON-SWITCHED) AND VC3.

X25LINE IS NOT VALID FOR VC 0, SWITCHED VC2, VC4, AND VC5.

X25PU MACRO

X25PU

(OPERANDS SAME AS NCP PU MACRO)

CODE PUDR=NO

CODE MAXDATA= GREATER THAN LARGEST
PIU FOR NON-SNA

X25PU IS VALID FOR VC2 (NON-SWITCHED) AND VC3.

X25PU IS NOT VALID FOR VC 0, SWITCHED VC2, VC4,
AND VC5.

X25LU MACRO

X25LU

(OPERANDS SAME AS NCP LU MACRO)

CODE LUDR=NO

X25LU IS VALID FOR VC2 (NON-SWITCHED).

X25LU IS NOT VALID FOR VC 0, SWITCHED VC2, VC3,
VC4, AND VC5.

X25END MACRO

```
X25END
      HSPDSEL=
      INCL2HI=X25HII
      INCINIT=X25INI
      INCL2LO=X25LOI
      INCPRFX=X25
      LSTUACB=YES
      NCPSTG1=X25NCP
      ORDINIT=X25INO        (OS/VS ONLY)
      ORDL2HI=X25HIO        (OS/VS ONLY)
      ORDL2LO=X25LOO        (OS/VS ONLY)
      SCANCTL=
      X25VTAM=YES
```

REFERENCE: G320-5850-1 ACF/NCP USER CODE

X25NPSI HDLC SUPPORT

FLAG 8 BIT	ADDRESS 8 BIT	CONTROL 8 BIT	INFORMATION N * 8 BIT	FCS 16 BIT	FLAG 8 BIT

1. FLAG IS X'7E'

2. ADDRESS:
   COMMANDS FROM THE DCE TO THE DTE CONTAIN X'03'
   RESPONSES FROM THE DTE TO THE DCE CONTAIN X'03'
   COMMANDS FROM THE DTE TO THE DCE CONTAIN X'01'
   RESPONSES FROM THE DCE TO THE DTE CONTAIN X'01'

   DCE SECONDARY ADDRESS IS X'01'
   DTE SECONDARY ADDRESS IS X'03'

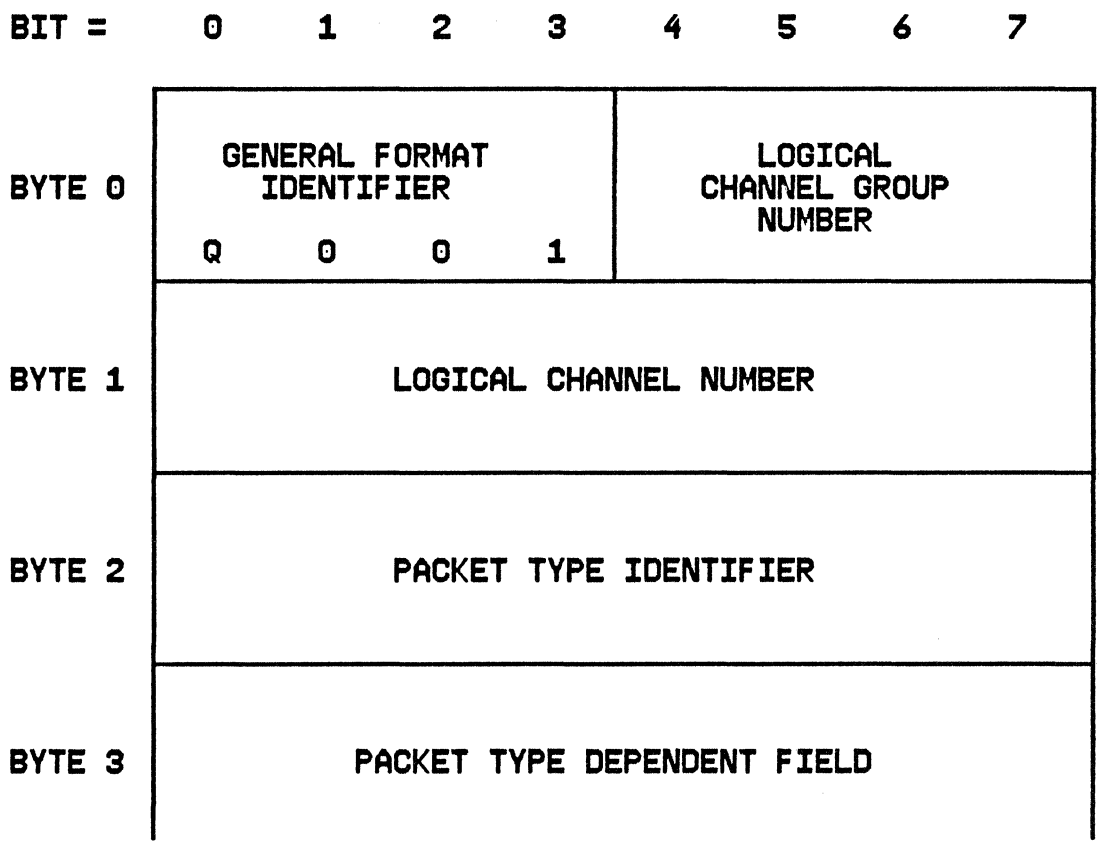
3. 8-BIT CONTROL FIELD:

COMMAND	8-BIT ENCODING 0	1	2	3	4	5	6	7
INFORMATION FRAME	N(R)			P	N(S)			0
RR RECEIVE READY	N(R)			P	0	0	0	1
RNR RECEIVE NOT READY	N(R)			P	0	1	0	1
REJ REJECT	N(R)			P	1	0	0	1
SARM SET ASYNCHRONOUS RESPONSE MODE	0	0	0	P	1	1	1	1
SABM SET ASYNCHRONOUS BALANCED MODE	0	0	1	P	1	1	1	1
DISC DISCONNECT	0	1	0	P	0	0	1	1
RESPONSE								
RR RECEIVE READY	N(R)			F	0	0	0	1
RNR RECEIVE NOT READY	N(R)			F	0	1	0	1
REJ REJECT	N(R)			F	1	0	0	1
DM DISCONNECT MODE	0	0	0	F	1	1	1	1
UA UNNUMBERED ACKNOWLEDGEMENT	0	1	1	F	0	0	1	1
FRMR FRAME REJECT	1	0	0	F	0	1	1	1

N(S) IS THE SEND SEQUENCE NUMBER
N(R) IS THE NEXT EXPECTED RECEIVE SEQUENCE NUMBER
P/F IS THE POLL/FINAL BIT.

X.25 PACKET LEVEL
(PART 1)

PACKET STRUCTURE



FROM DCE TO DTE	FROM DTE TO DCE	BYTE 2
CALL SET UP AND CLEARING		
INCOMING CALL	CALL REQUEST	B'00001011'
CALL CONNECTED	CALL ACCEPTED	B'00001111'
CLEAR INDICATION	CLEAR REQUEST	B'00010011'
DCE CLEAR CONFIRMATION	DTE CLEAR CONFIRMATION	B'00010111'
DATA		
DCE DATA (BYTE 0, BIT 0 OF 1 IS QUALIFIED DATA)	DTE DATA	B'RRRMSSS0'

X.25 PACKET LEVEL
(PART 2)

FROM DCE TO DTE	FROM DTE TO DCE	BYTE 2
FLOW CONTROL AND RESET		
DCE RR	DTE RR	B'RRR00001'
DCE RNR	DTE RNR	B'RRR00101'
RESET INDICATION	RESET REQUEST	B'00011011'
DCE INTERRUPT	DTE INTERRUPT	B'00100011'
DCE INTERRUPT CONFIRM	DTE INTERRUPT CONFIRM	B'00100111'
RESTART		
RESTART INDICATION	RESTART REQUEST	B'11111011'
DCE RESTART CONFIRM	DTE RESTART CONFIRM	B'11111111'

M = MORE DATA
RRR = PACKET RECEIVE SEQUENCE NUMBER
SSS = PACKET SEND SEQUENCE NUMBER

LOGICAL LINK CONTROL
(LL2 ONLY)

BYTE 3 AND 4 FOLLOWING THE PACKET HEADER

DATA LLU

	BYTE 0	BYTE 1
DATA LLU	B'11110N10'	B'SSSSSSSS'
CONTROL LLU		
PSCONT	B'11110001'	B'00001000'
PSDISC	B'11110001'	B'00000010'
PSXID	B'11110001'	B'00000100'
PSTEST	B'11110001'	B'00000110'

SSSSSSSS = LLC SEND SEQUENCE NUMBER
X = THE SEGMENT INDICATOR, 1 NOT LAST, 0 LAST

X25NPSI SUPPORT

	X-25NPSI	
	RELEASE 2	RELEASE 3
HARDWARE		
3705II OR 3705-80	YES	YES
ACCESS METHOD		
ACF/VTAM V1R2	YES	NO
ACF/VTAM V1R3	YES	YES
ACF/VTAM V2R1	YES	YES
ACF/TCAM V2R2	YES	NO
ACF/TCAM V2R3	YES	YES
ACF/TCAM V2R4	YES	YES
NCP		
ACF/NCP/VS R2.1	YES	NO
ACF/NCP/VS R3	NO	YES

X25NPSI SUPPORT

	X-25NPSI	
FUNCTION	RELEASE 2	RELEASE 3
SNA BOUNDARY NODE	YES	YES
PCNE	YES	YES
INTEGRATED PAD	YES	YES
TRANSPARENT PAD	YES	YES
GATE	YES	YES
DATE	YES	YES
SNA INN	NO	YES
X-21 N/S ADAPTER	NO	YES
HDLC MODULO 8	YES	YES
PACKET MODULO 128	YES	YES
LAP	YES	YES
LAPB	YES	YES
D BIT SUPPORT	YES	YES
Q BIT SUPPORT	YES	YES
FLOW CONTROL NEGOTIATION	YES	YES
DIAGNOSTIC PACKET SUPPORT	YES	YES

X.25 REFERENCE MATERIALS

GC30-3080	X.25 NPSI GENERAL INFORMATION
SC30-3163	X.25 NCP PACKET SWITCHING INTERFACE INSTALLATION AND OPERATION
SC30-3164	X.25 NCP PACKET SWITCHING INTERFACE DIAGNOSIS GUIDE
SC30-3079	X.25 NCP PACKET SWITCHING INTERFACE
G320-5850-1	ACF/NCP USER CODE
GG24-1567	X.25 NCP PACKET SWITCHING INTERFACE RELEASE 2 AND RELEASE 3 GUIDE
GG24-1568	X.25 SNA GUIDE
GG24-1569	X.25 NPSI PAD IMPLEMENATION GUIDE

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X.25 NCP Packet Switching Interface (NPSI) Presentation

D. L. Buckingham, Dept. 73G

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