



SHARE SESSION REPORT

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The following is a presentation made by Greg Ma from the IBM System Support Centre, Don Mills, Ontario, Canada.

The presentation reviewed the X.25 NPSI (Network Packet Switching Interface). Areas included were the NPSI gen process, gen macros, and supported functions.

Greg also provided a list of the various NPSI gen parameters which must be co-ordinated between an NPSI user and the packet switching network vendor.

The question and answer portion of the session was also very interesting as Greg pointed out the possibility of using an X.25/X.3 pad device to replace NTO in the Network, while retaining full SNA networking support. For additional information on this NTO bypass possibility contact Greg or the session chairman.

X.25 NPSI User Experience Update

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CHAPTER 1. INTRODUCTION

Connections through X.25-based Packet Switched Data Networks can be, in many cases, a cost effective way to satisfy a user's networking requirements. The IBM NCP Packet Switching Interface (NPSI) licensed program (5668-981) supports both SNA and non-SNA terminal attachments to an SNA host over an X.25 network.

Although part of the NPSI licensed program's objective is designed to insulate the user from the complexities of the X.25 network, certain considerations are required in order to define the configuration to the host system properly.

This paper gives a tutorial on such considerations. Topics covered include:

- X.25 network dependent parameters,
- Network service subscription dependent parameters,
- X.25 related parameters, and
- System definition considerations.

This paper is a follow-on to the NPSI user experience presentation given to the SHARE 60 meeting in San Francisco in February this year.

CHAPTER 2. X.25

OVERVIEW

X.25, which is an abbreviation for CCITT Recommendation X.25, is an interface standard endorsed by the International Telegraph and Telephones Consultative Committee to facilitate the attachment of Data Terminal Equipment (DTE) to a packet switched data network. A DTE can be a terminal, such as a 3270, a host system, or a communications front end processor, such as an IBM 3705.

The packet switched network itself usually consists of intelligent mini-computers, or nodes, interconnected by high speed trunk lines. The facilities are shared by all users of the network.

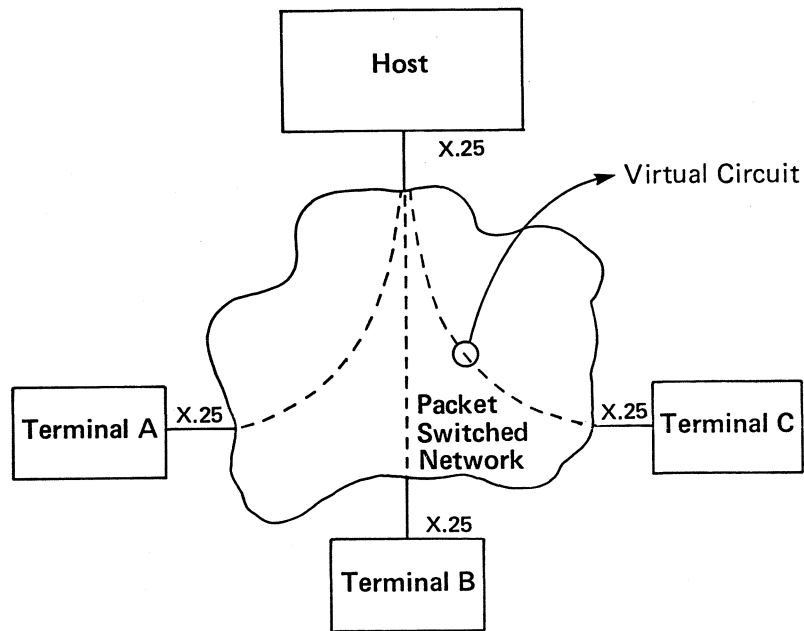
The user Data Terminal Equipment (or DTE) is connected to the network by means of a physical access line. The basic concept is such that each physical access line into the network can support multiple "logical channels". Each logical channel can pair with a logical channel at a remote DTE to form a "virtual circuit" connection. Figure 1 illustrates the connection of four DTE's to an X.25-based packet switched network. The physical access line from the host supports three simultaneous virtual circuit connections from the three terminals. When a user has data to transmit, the information is encoded into a small segment, call a packet, and passed to the network. It is the responsibility of the carrier to keep track of the end-points of a virtual circuit connection and to route the packet to its desired destination.

With such facility sharing, it is apparent that certain rules and protocols have to be followed if you want to have your data accepted and delivered to the correct destination. This is what X.25 provides.

The use of a packet switched network is almost analogous to the Mail Service. We all share the services of the postmen, mail trucks and post offices. When we have a letter to send, we enclose the information in an envelope. There are rules that restrict the size and weight of the envelope. We also have to address the envelope correctly; for example, name first, followed by street address, city etc. Otherwise, there is no guarantee that the letter will arrive at the desired destination. The timeliness of delivery is another issue.

LAYERS OF COMMUNICATIONS SYSTEMS ARCHITECTURE

As has been demonstrated with IBM's Systems Network Architecture (SNA), a layered structure with well-defined interface between the layers is an effective way of providing a solid framework for supporting the interconnection of systems. One of the main benefits of such a layered archi-



The Basic Concept in X.25: Virtual Circuit

- Switched
- Permanent

Figure 1. X.25: A Physical View

texture is the comparative ease with which new functions can be introduced into one layer without disrupting the others.

In a communications systems network architecture, such as SNA or the Open Systems Interconnection (OSI) provisional model of the International Standards Organization (ISO), which is illustrated in Figure 2, the bottom layers are devoted to information transfer.

X.25 defines the rules that a DTE must follow in order to exchange information with a packet switched network. It is comprised of three levels of specification. As such, it forms an implementation of the bottom layers of the OSI provisional model. X.25 support is also implemented in the SNA transmission subsystem to allow our users to take advantage of X.25-based packet switching services and provide another alternative to satisfy their communications networking requirements; that is, an alternative to leased or circuit-switched line managed by the SDLC protocol.

THE THREE LEVELS OF X.25

As you know, there are many packet switched networks in service around the world. Not all of them currently use the X.25 interface; and even those that do, they may have implemented different interpretations of the X.25 standard. This is sometimes due to their interfaces being based on different versions of X.25.

The possibility of different implementations of X.25 was addressed in November 1980 by the CCITT and resulted in a recommended universal subset of the standard to be provided by all carriers. This was a significant development for vendors of DTE's who serve the international market.

As illustrated in Figure 3, there are actually three distinct and independent levels defined in the X.25 interface; namely physical interface level, link access or frame level, and packet level. Each of these layers or levels is designed to handle different facets of the attachment.

1. Physical Level

This layer specifies the electrical and physical characteristics of the interface (i.e. the plug). There are two specifications recommended in this physical level: X.21 and X.21 bis.

In North America, this interface is usually the familiar EIA RS232-C, although X.21 is a more efficient specification and is favoured by the X.25 recommendation.

2. Link Procedure Level

The main objective of the Link Procedure level is to provide an error-free link for transferring data between the Data Terminal Equipment and the network. It corresponds to a point-to-point full duplex data link control procedure.

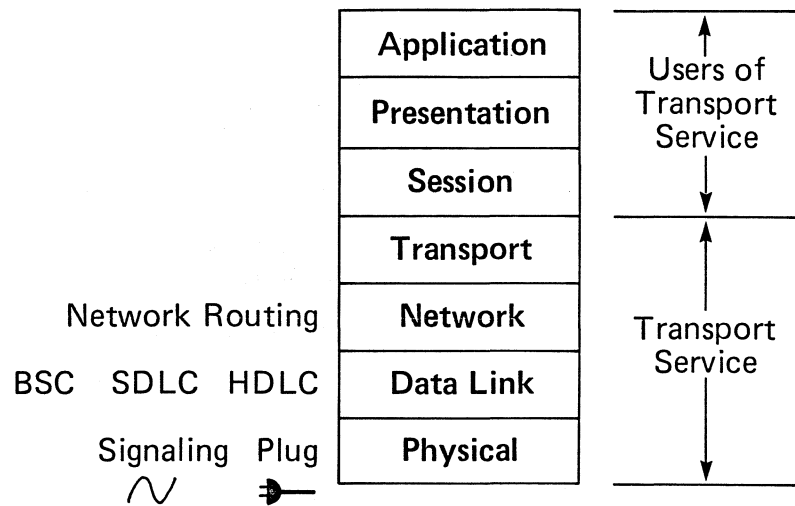


Figure 2. Layers of Communication System Architecture

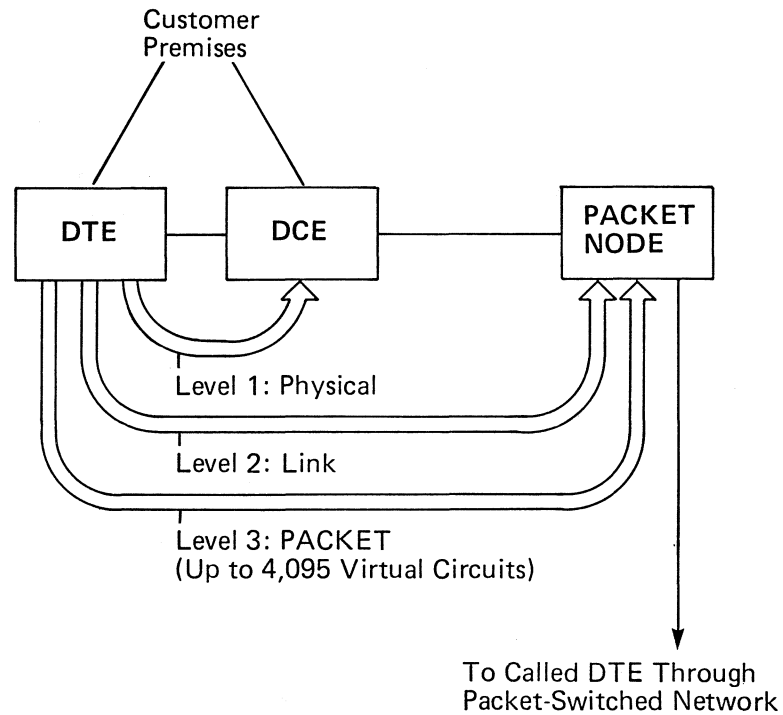


Figure 3. The Three Levels of X.25

It is sometimes known as the "frame level" as it defines how user information should be enclosed in frames for transmission to the network. Using the same technique as SDLC, it provides facilities for sequence checking, detection of the start and end of a frame, and transmission error checking.

This level also defines the procedure to be followed for link initialization and disconnection. This function is analogous to when you dial somebody on your telephone. You only attempt to communicate when synchronization is established. That is, you would not speak while the telephone is still ringing, but wait until the party on the other end has picked up the phone and said "Hello".

The connection between the DTE and the network operates in a full duplex asynchronous mode. So unlike SDLC, no polling is involved. There are two link access procedures specified in X.25: LAP (Link Access Procedure Symmetrical) and LAPB (Link Access Procedure Balanced). However, only LAPB conforms with the High Level Data Link Control (HDLC) of the International Standards Organization (ISO).

Under certain error reinitialization conditions, LAP is susceptible to producing dead-lock situations. Manual intervention may be required to reset the interface. LAPB was added into the Recommendation specifically to fix such problems, and is therefore the preferred procedure. That is why in some networks, e.g. DDX-P and Venus-P in Japan, only LAPB is supported. In North America, however, Datapac, Telenet and Tymnet support both LAP and LAPB.

3. Packet Level

This level specifies how a single physical link between the DTE and the network can be shared by multiple simultaneous virtual call and/or permanent virtual circuit connections. It defines the structure of data and control packets for information transfer between DTE's over a packet switched network, and how to establish and manage the virtual circuit connection.

These three levels in X.25 are distinct and independent of each other. The procedure at one level makes use of the functions offered immediately below but is independent of how it is implemented. For example, LAP or LAPB, X.21 or RS232-C.

CHAPTER 3. IBM X.25 NPSI LICENSED PROGRAM

OVERVIEW

The IBM X.25 NCP Packet Switching Interface (known as NPSI) is a licensed program designed to allow an IBM SNA host system equipped with an IBM 3705 communications controller to attach directly to an X.25-based packet switched data network. The main objective is to allow IBM customers to take advantage of cost savings that can be attained using packet switching. Packet switching facilities are typically an attractively priced alternative to leased lines when connecting to low volume and widely dispersed locations.

One or more X.25 physical access lines can be attached to the 3705. Each physical access line, called a Multichannel Link in NPSI terms, can support multiple virtual circuits simultaneously.

The other end of the virtual circuit connection can be either an SNA node or a non-SNA terminal.

SNA-SNA CONNECTION

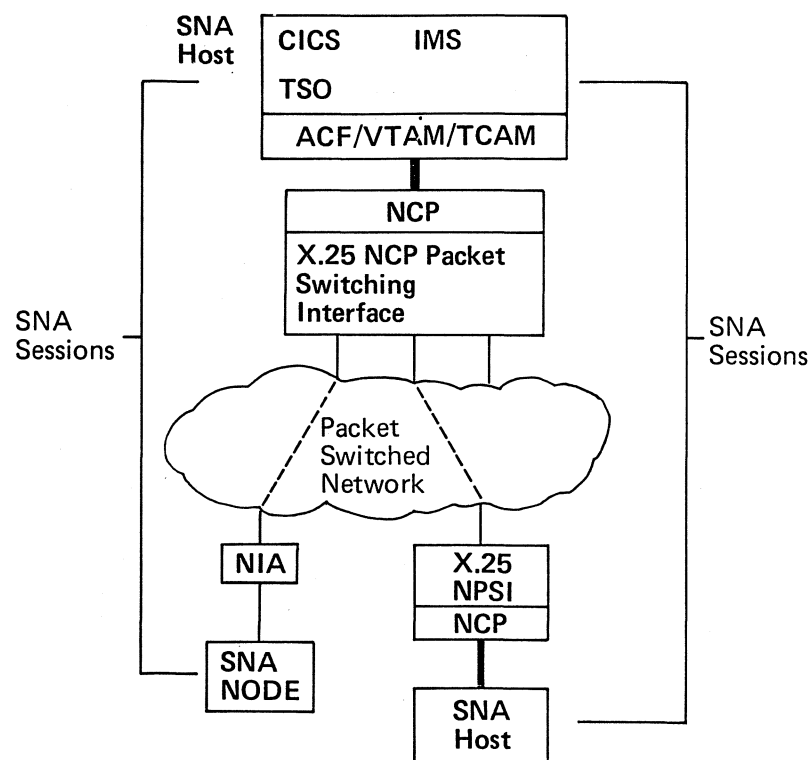
Just as the NPSI licensed program is required to allow an NCP system to attach to an X.25-based packet switched data network, some sort of adapting device is required so that a terminal can make use of the X.25 facilities for data transfer. For most SNA peripheral nodes or terminal/clusters, this adapter can be an external specially engineered (RPQ) protocol converter called the Network Interface Adapter (or NIA). The NIA operates such that on one end it can speak X.25 to communicate with the network and SDLC on the other end to communicate with the SNA node. SNA information or PIU's are enveloped in data packets for transportation through the network.

In some SNA cluster controllers, such as the 4700 Finance Control System, or the 5251 display controller, the X.25 adapter is intergrated into the controller itself.

A Multisystem Networking Facility (MSNF) link between two NCP systems is also possible with the NPSI through an X.25 network.

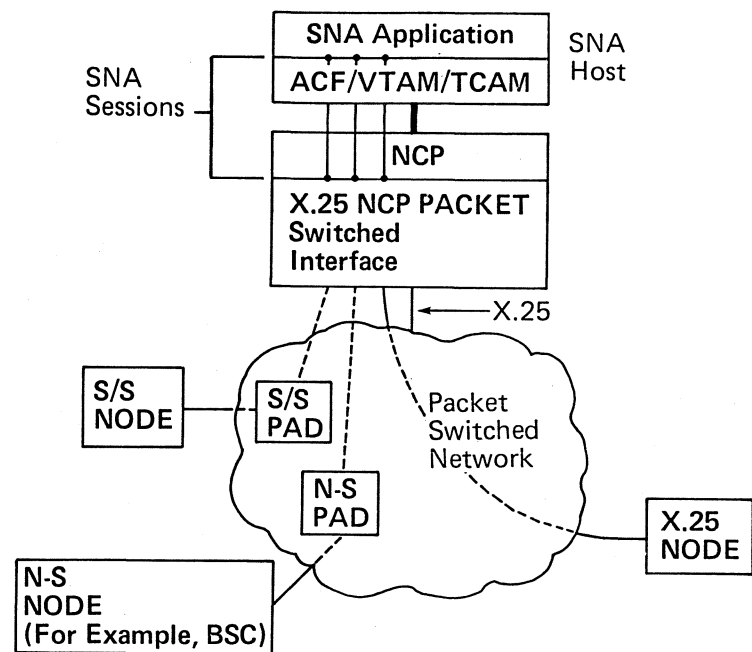
These types of SNA-to-SNA connection are illustrated in Figure 4.

SNA-NON-SNA CONNECTION



- X.25 within Data Link Control
- SNA Host to SNA Controller
- SNA Host to SNA Host

Figure 4. X.25 NPSI SNA Support



- Supports Attachment to Asynchronous PAD
- Support Connection to Non-Standardized PAD
- Supports Connection to Native X.25 Equipment
- Facility to Control Both X.25 Virtual and Physical Circuits (GATE & DATE)
- Use LU Simulation Fcn within NPSI

Figure 5. X.25 NPSI Non-SNA Support

The NPSI licensed program can also be used as a base for support of non-SNA terminals (see Figure 5).

Some DTE's have the three levels of X.25 incorporated into their communications control mechanism. Such DTE's are classified as "native X.25 terminals". The user can use the PCNE (Protocol Converter Function for Non-SNA Equipment) or the GATE (General Access to X.25 Transport Extension) functions within the licensed program for their support. As a matter of fact, the GATE function is designed to allow a user to have complete control of his own X.25 virtual circuits. Through GATE, it is possible to implement non-SNA communication protocols within an SNA host, for example, OSI end-to-end protocols above the three layers of X.25.

There are also protocol converters in the market place that allow non-SNA terminals, such as a BSC 3270 display or an ASCII terminal, to attach to an X.25-based packet switched network. Such protocol converters are commonly known as PAD's (Packet Assembler and Disassemblers). They can appear as a conversion service offered by the X.25 network carrier or can be implemented as an external protocol converter much like IBM's NIA.

The NPSI licensed program includes such PAD support.

Internationally, only the Start/Stop PAD for TTY 33/35-compatible devices has been endorsed by CCITT. This is known as the X.3 PAD. There is another standard, called CCITT Recommendation X.29, that specifies how an X.25-compatible business machine can interface with the X.3 PAD over an X.25 circuit to control the asynchronous terminal operation.

In NPSI, this X.29 support is known as the Integrated PAD support function. Through this support, TTY 33/35-compatible terminals can access the NCP. Coming out of the NPSI, the asynchronous device appears as an NTO or pseudo-SNA 3767 terminal, and can therefore be used to access, without modification, any standard IBM SNA subsystem, such as TSO or CICS, which normally supports such devices. We will be discussing the X.3 PAD support in more detail later on.

Other PAD services, such as those for BSC 3270 or RJE support, are not endorsed by CCITT. For this reason, they are termed Non-standard PAD's. For terminals accessing the SNA host via such non-standard PAD's, the user is provided with the capability of writing his own application program to interface with the PAD to control the terminal operations.

In addition to the above described functions, there is support within the NPSI licensed program called DATE (or Dedicated Access to X.25 Transport Extension) that allows a user program to exercise control over all the virtual circuits coming in over an X.25 physical access line. For example, the user can write an application program that examines the Calling Number within each Incoming Call packet to decide whether the virtual circuit connection should be established or not. Once a virtual circuit connection has been established, he can use other NPSI functions (e.g. PCNE) to control his terminal session.

VIRTUAL CIRCUIT TYPES

In the NPSI, a classification scheme is used to distinguish the types of support required:

- Native X.25 terminals which make use of the Protocol Converter for Non-SNA Equipment (PCNE) support function are said to be connected via Type 0 virtual circuits.
- SNA peripheral nodes which are attached via a remote NIA adapter make use of the Physical Services Header (PSH) code and are said to be connected via Type 2 virtual circuits.
- SNA peripheral or intermediate network nodes which make use of qualified data packets for logical link control or QLLC are known to be connected via Type 3 virtual circuits.
- Terminal accesses which use the General Access to X.25 Transport Extension (or GATE) function within the NPSI for user virtual circuit control are said to be connected via Type 4 virtual circuits.
- If the terminals are accessing the SNA host via a Packet Assembler/Disassembler facility, the virtual circuit is classified as Type 5. The Integrated PAD support function within NPSI is designed to interface with X.3 PAD's. The Transparent PAD support function is designed to allow a user to interface with other types of non-standard PAD's.

DATE is an extension to the support provided for virtual circuit types 0, 2, 3 and 5. With the DATE support, commands are exchanged between the NPSI and a user-written application to control the setup and take down of virtual circuits with a multichannel link. Once a virtual circuit is active, the data flow is directed by the NPSI to another user-specified application, and the virtual circuit type 0, 2, 3 or 5 protocol is used for the data flow control.

CHAPTER 4. X.25/NCP GENERATION PROCESS

NPSI X.25 GEN PROCESS

Figure 6 illustrates the process required to generate an NCP with the NPSI for X.25 circuit support.

In order to make use of the X.25 support facilities of the NPSI licensed program, an NCP pre-gen process is required. The main objective of this pre-gen or X.25 gen process is to provide a simple means for the user to describe his X.25 network configuration to the NCP.

The X.25 gen process consists of two stages. The user first makes use of a set of macro instructions provided by the NPSI to define his X.25 network configuration and then uses these as input to Stage 1 of the X.25 gen. The X.25 Stage 1 performs the following tasks:

- assemble the source macros and prepare a job stream for the X.25 Stage 2 step,
- convert the NPSI macros to normal NCP macros,
- build X.25 user control blocks and table, and
- prepare control statements to include appropriate pre-assembled NPSI modules in the NCP.

Stage 2 of the X.25 gen is simply a utility step to place the output of the X.25 Stage 1 Gen in a partitioned data set for later use by the NCP gen.

NPSI MACRO INSTRUCTIONS (OVERVIEW)

Figure 7 shows the set of macro instructions provided by the NPSI for the user to describe his X.25 attachment environment. The objective of some of these macro instructions are as follows:

- The X25BUILD macro is used to start the X.25 gen process. It also describes the physical environment and system related gen options.
- The X25NET macro is used to describe the packet switched data network characteristics.
- The X25MCH macro is used to define the X.25 physical access line, such as line speed, and what types of support facility are required. For example, whether the integrated PAD support function is to be used or

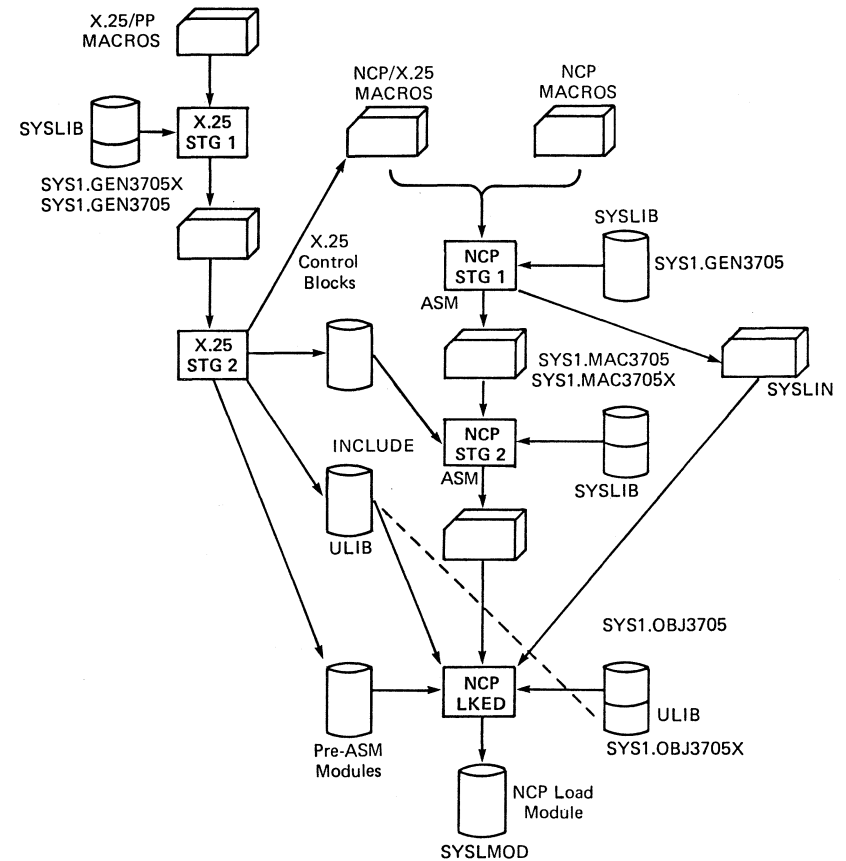


Figure 6. X.25/NCP Gen Process

X.25 BUILD**X.25 NET****X.25 VCCPT** Connection parameters**X.25 OUFT** User facility spec**X.25 MCH** Physical access line**X.25 LCG** Logical channel group**X.25 VC** Virtual circuit group

or

X.25 LINE**X.25 PU****X.25 LU****X.25 END**

Figure 7. X.25 NPSI Macros

the virtual circuits are to be controlled by a user-written application.

- The X25LINE, X25PU and X25LU macros are used to define the virtual circuit, physical and logical units respectively.

NCP GEN PROCESS

Once the X.25 gen is completed, the user is now ready to generate the NCP. The NCP generation procedure with the NPSI is similar to any other NCP gen. The only difference is that the converted X.25 macros from the X.25 gen and pre-assembled NPSI modules have to be included.

The procedure for the NCP gen is as follows:

1. code the NCP macros that define the NCP environment,
2. append the NCP macros generated from the X.25 gen to the NCP deck,
3. perform Stage 1 of the NCP gen,
4. using the output produced by the NCP Stage 1, perform the NCP Stage 2 gen, and
5. link edit the Stage 2 output to create the NCP load module.

Let us now take a look in more detail as to how the X.25 network configuration can be described to the NPSI and the SNA host.

CHAPTER 5. NETWORK DEFINITION CONSIDERATIONS

DEFINITION - OVERVIEW

Recommendation X.25 provides a set of rules and protocols that govern the interface between the DTE and a packet switched network. However, implementation of the recommendation is subject to interpretation. Consequently, not all X.25-based networks are alike.

In order for an X.25 DTE to interface properly with a network, it is important that the DTE understands any idiosyncrasies that might exist within the network. The user also has to be concerned with the operational characteristics of the physical access line, known in NPSI terms as the multichannel link, and the virtual circuits (or logical channels) that it supports. Some of these considerations are dependent on the parameters that he has subscribed for his multichannel link and virtual circuits. Some are dependent on the support features that the user may want to use for his virtual circuit connections. Instead of giving an NPSI macro instruction by macro instruction tutorial, my discussion here will focus on these perspectives instead.

Figure 8 outlines some of these network definition considerations.

NETWORK DEPENDENT PARAMETERS

Different X.25 networks may have different operational characteristics. These different characteristics can be described to the NPSI using various operands in the macro instructions as illustrated in Figure 9. Before the NPSI is implemented, the user will need to obtain from his carrier representative a description of the network characteristics. Some of the parameters that can affect the user's network definition are:

- The size of the Clear and Restart packets.

In the packet level definition of X.25, two types of packets are defined: control and data packets. Certain control packets, for example, the Clear and Restart packets can have an optional Diagnostic field as shown in Figure 10.

In some networks, such as Transpac in France and the EEC Euronet, this optional diagnostic field is supported. In some networks, such as Datapac in Canada and Datex-P in Germany, the diagnostic field is not supported.

Through the NETTYPE operand specification in the X25NET macro instruction, the NPSI is made aware of the size of the Clear and Restart packets. For example, if NETTYPE=1 is specified, and if a virtual call is disconnected by the host, the NPSI will insert the

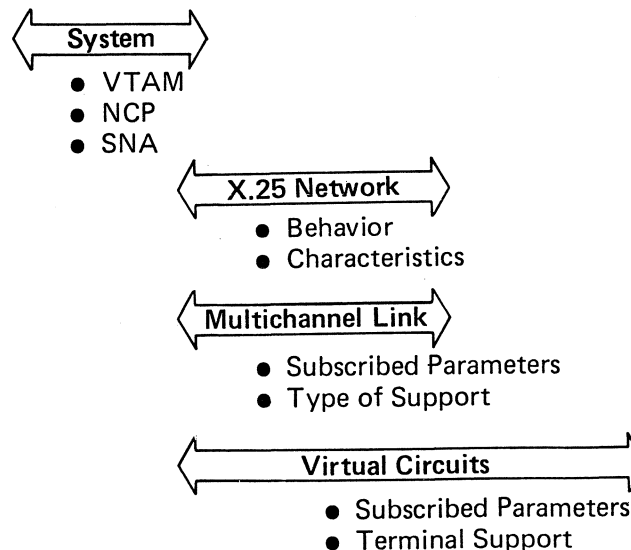
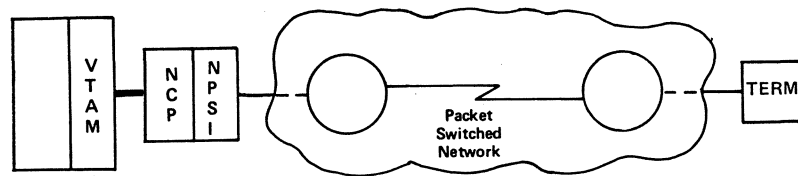


Figure 8. Network Definition Considerations

Network Dependent Parameters

•
•
•

X25NET NETTYPE = { 1 }, TRANSPAC, EURONET
 { 2 }, DATAPAC, TELENET, TYMNET

DM = { YES }, Disconnect Mode
 { NO }

•
•
•

X25MCH LCNO = { USED
 NOTUSED },

PKTMODL = { 8
 128 },

[GATE = GENERAL, SUBADDR = YES,]

•
•
•

X25LCG LCGN = Number

•
•
•

Figure 9. Network Dependent Parameters

Clear Request/Indication

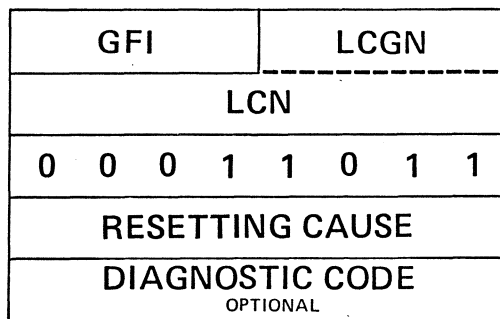
GFI				LCGN			
LCN							
0	0	0	1	0	0	1	1
CLEARING CAUSE							
DIAGNOSTIC CODE OPTIONAL							

Restart Request/Indication

GFI				0 0 0 0			
0	0	0	0	0	0	0	0
1	1	1	1	1	0	1	1
RESTARTING CAUSE							
DIAGNOSTIC CODE							

Figure 10. Clear/Restart Packets

Reset Request/Indication



Resetting Cause Codes

	<u>Type 1</u>	<u>Type 2</u>
DTE Originated	X '00'	X '00'

Out of Order	X '01'	X '01'
Remote Procedure Error	X '03'	X '03'
Local Procedure Error	X '05'	X '05'
Network Congestion	X '07'	X '07'
Remote DTE Operational	X '09'	X '00'
Network Operational	X '0F'	X '00'
Incompatible Destination	X '11'	X '11'

Figure 11. Resetting Cause Codes

diagnostic code as the fifth byte in the Clear Request packet. However, if NETTYPE=2, meaning that the diagnostic field is not supported, the NPSI will create a Clear Request packet that is only 4 bytes long.

There are also some minor differences in the meaning of the cause code in the Reset Indication packets between Type 1 and Type 2 networks as illustrated in Figure 11.

It should be noted that some networks have indicated that they will be supporting the diagnostic field in future implementations. For Datapac, for example, this supported is expected in their Datapac Release 10 software upgrade sometime between third quarter this year and first quarter next year. In other words, they will become type 1 networks.

- Modulo 8 or 128 packet sequence support.
- Use of logical channel number 0.

In the X.25 packet level specification, logical channel 0 is reserved for restart and diagnostic purposes. That is, for the exchange of control information that affects all the logical channels within the X.25 physical access line.

In some networks, such as Transpac, logical channel number zero is used for virtual circuit assignment. In most networks, such as Datapac and Telenet, virtual circuit assignment starts from logical channel number 1. In other networks, such as Tymnet, use of logical channel number zero for virtual circuit is a subscription option.

- Logical channel group number.

The logical channel group number is actually a subscription parameter. That is, it is assigned when the X.25 circuits are ordered or installed. In most networks, however, only logical channel group number zero is supported. In some networks, e.g. Telenet and DDX-P, other logical channel group numbers can be subscribed.

- Subaddressing support.

Subaddressing is an optional X.25 feature which allows a user to include a two-digit subaddress with the called DTE address in the Call Request packets for application identification. However, not all X.25 networks support this feature. If available, this can be used with the GATE function in the NPSI.

- Disconnect mode support.

Not all packet switched networks support a disconnect mode of operation.

SUBSCRIPTION DEPENDENT PARAMETERS

Usually a number of parameters have to be specified at X.25 circuit subscription time. Some of these parameters affect the multichannel link (i.e. the physical access line into the network). Some of these are related to the logical channels or virtual circuits. If the user does not specifically request certain parametric values, the defaults will be given. In any case, these parametric values must be defined to the NPSI at generation time. Furthermore, for the X.25 circuits to function properly, the defined values must coincide with what is installed in the user's X.25 circuits.

Figure 12 illustrates where such subscription parameters are coded in the macro instructions:

- The link access protocol to be used for the multichannel link initialization,
- The speed of the multichannel link,
- The frame window size; that is the number of consecutive frames that can be sent through the NCP/DCE interface without prior acknowledgment,
- The range of logical channel group numbers and logical channel numbers that will reside within the multichannel link and whether they will be used as permanent or switched virtual circuits,
- The maximum data packet size that can be sent through or received from the network,
- The packet window sizes; that is the maximum number of consecutive packets that the DTE can send to the DCE without receiving a prior acknowledgement, and
- The optional facilities, e.g. reverse charging, closed user group, or high priority service, that might be chosen for a virtual call.

Let us look at some of these parameters in more detail.

- In the second level, or frame level, of X.25, two link access procedures are specified: LAP and LAPB. We mentioned earlier in the X.25 overview section that LAPB is the preferred procedure. If the network vendor provides a choice between LAP or LAPB, LAPB should always be selected, and defined accordingly using the PROTOCOL operand to the NPSI. In some networks, such as Datapac, in addition to LAP and LAPB, the user can choose an UNSET link access procedure. What this means is that the X.25 physical access can either work in a LAP or LAPB mode depending on the initialization command that the network receives from the DTE. If PROTOCOL=LAPB is specified, the multichannel link will operate using the LAPB link access procedure, and under LAP if PROTOCOL=LAP is specified.

Subscription Dependent Parameters

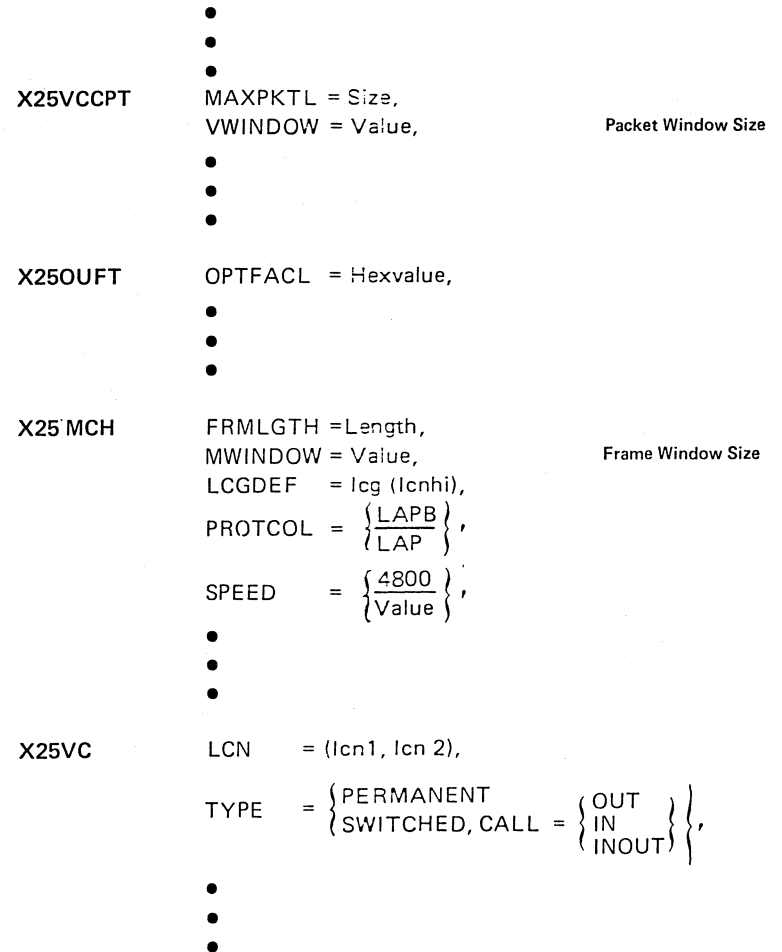


Figure 12. Subscription Dependent Parameters

If switched virtual circuits are used, at the time that the logical channels are ordered, the user can specify whether a channel is to be used for one way incoming, one way outgoing or two way calls.

In Annex 1 to Recommendation X.25, a logical channel assignment scheme is recommended. The illustration is reproduced in Figure 13.

The lowest logical channel numbers are usually reserved for use with permanent virtual circuits. The next range of numbers is for logical channels supporting one way incoming calls only, the next range, to those supporting two way calls, and the last range to those supporting one way outgoing calls. The idea is to minimize the chance of call collision, that is, both an incoming call and an outgoing call attempting to use the same logical channel for their switched virtual circuit connections.

When an incoming call packet is received, the network will select a free logical channel starting from the low end of the logical channel numbers in the one way incoming or two way call group. The virtual call will be refused if no free logical channels that is capable of receiving an incoming call can be found. Similarly, when the DTE wants to place a virtual call, it will select a free logical channel starting from the high end of the logical channel numbers in the one way outgoing or two way call group.

In the NPSI, the user will have to specify this calling capability via the CALL operand in the X25VC or X25LINE mcaro. That is, specify CALL=IN for logical channels in the one way incoming group, and CALL=OUT for the one way outgoing logical channel group. Actually, this is a redundant specification. The definition can be simplified if the user only subscribes to two way switched logical channels and use the CALL=IN, INOUT and OUT specifications to handle the one way incoming, two way and one way outgoing call requirements.

Some of these parameters, for example, the packet window size, can have performance implications. Performance tuning is a very important consideration in any X.25 installation and probably deserves a separate session to deal with adequately. It is not part of this presentation, but in a manual that I have developed with the IBM Raleigh International Support Centre called the X.25 SNA Guide (GG24-1568), I have devoted a chapter to Performance Tuning. I urge the interested user to refer to this manual for an in depth discussion.

It is important to remember that the specified NPSI operands must coincide with the subscribed parametric values. Otherwise dead lock situations could occur at network activation time.

X.25-RELATED PARAMETERS

In addition to the network and subscription dependent parameters, there are some X.25 related parameters that the user need to be concerned with.

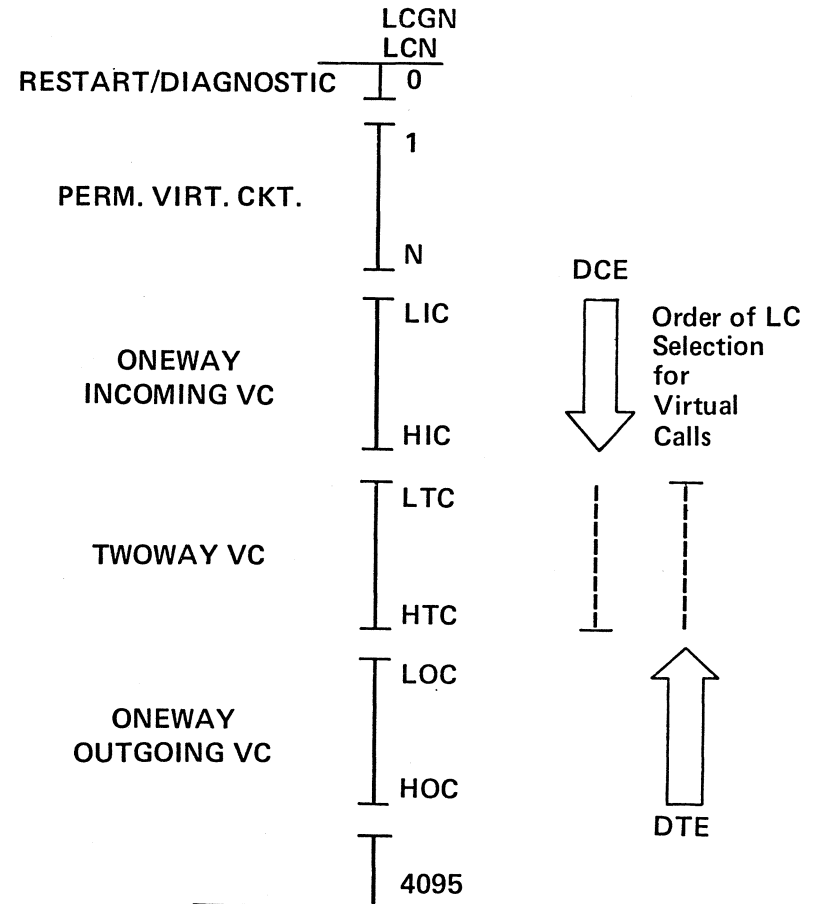


Figure 13. Logical Channel Assignment

X.25 Related Parameters

<p style="margin: 0;">• • •</p> <p>X25MCH</p>	<p>LLCIST = (LLC0, LLC2, LLC4, LLC5), SVC only</p> <p>DBIT = $\left\{ \begin{array}{l} \text{NO} \\ \text{YES} \end{array} \right\}$, Delivery Confirmation</p> <p>GATE = $\left\{ \begin{array}{l} \text{NO} \\ \text{GENERAL} \\ \text{DEDICAT} \end{array} \right\}$,</p> <p>PAD = $\left\{ \begin{array}{l} \text{NO} \\ \text{TRANSP} \\ \text{INTEG, TRAN} \end{array} \right\}$ = $\left\{ \begin{array}{l} \text{NO} \\ \text{ODD} \\ \text{EVEN} \end{array} \right\}$,</p> <p>STATION = $\left\{ \begin{array}{l} \text{DTE} \\ \text{DCE} \end{array} \right\}$,</p> <p>[TP TIMER = timer,]</p> <p>[TD TIMER = timer,]</p> <p>[ND RETRY = $\left\{ \begin{array}{l} 1 \\ \text{Count} \end{array} \right\}$,]</p> <p>[NP RETRY = $\left\{ \begin{array}{l} 7 \\ \text{Count} \end{array} \right\}$,]</p> <p style="margin: 0;">• • •</p>	<p>X25LINE</p> <p>TYPE = $\left\{ \begin{array}{l} \text{SWITCHED} \\ \text{PERMANENT, LLC} = \left\{ \begin{array}{l} \text{LLC0} \\ \text{LLC2} \\ \text{LLC3} \\ \text{LLC4} \\ \text{LLC5} \end{array} \right\} \end{array} \right\}$,</p>
---	--	---

Figure 14. X.25 Related Parameters

Figure 14 illustrates where some of these parameters are coded in the network definition:

Some of the parameters that should be considered are:

- The type of virtual circuit support required in the NPSI. Remember that within the NPSI, virtual circuit types are used to specify the terminal support functions.
- Whether the user wishes to have control of his own virtual circuits or the complete physical access link. That is, whether he wants to use the GATE or DATE facility.
- Whether a non-SNA terminal accessing the SNA host is via an X.3 PAD or some other means. In the X.3 (or Integrated) PAD support within NPSI, the user can specify whether he wants to send transparent data to the terminal, or whether he wants the NPSI to translate the output data stream to ASCII code with odd or even parity.
- Whether he wants to receive delivery confirmation (i.e. use the D-bit) for every output packet transmitted.

Note that D-bit support can only be used with non-SNA terminals. However its specification can have a serious impact on terminal performance since the next data packet will not be sent until an end-to-end confirmation has been received for the first packet.

D-bit is not used with SNA terminals because the SNA definite response mode can be used to achieve similar result. The definite response has the advantage in that it can only be used selectively for certain SNA commands.

- Whether the NPSI multichannel link should look like a DTE or DCE interface.

A limited capability is provide with the NPSI to make a multichannel link interface look like a DCE instead of a DTE. This function is useful for an X.25 terminal connection to the NPSI when there are no intervening X.25 network (e.g. via leased line, or local connection via modem eliminators). For example, the user may want to support start-stop terminals using an external X.3 PAD. By connecting the PAD directly to the DCE interface of the multichannel link, the user can use the integrated support function within the NPSI to provide SNA support for the start-stop terminals.

- The error and retry sequences.

By making use of the optional TPTIMER, TDTIMER, NPRETRY and NDRETRY operands, the user can also control the retransmission sequence under error situations.

X.25 DEFINITION EXAMPLE

A working example of how the NPSI macros are used to describe an X.25 connection configuration is given in Figures 15 and 16.

In this example, there is only one X.25 physical access line which supports three virtual circuits. The first logical channel is used for a permanent virtual circuit connection to an IBM 3276 display via an NIA. The second and third are switched logical channels that are capable of supporting both incoming and outgoing call connections. A native X.25 equipment, SNA node or asynchronous terminal connected via an X.3 PAD can be at the other end of the virtual calls.

Once the user has defined his X.25 network configuration, he can perform the X.25 gen. Output from stage 2 of the X.25 gen can then be included to his normal NCP definition for the NCP gen.

No special considerations are required in the NCP except for some buffer definitions, such as the BFRS operand specification in the NCP BUILD macro. These operands can be used to optimize packet utilization and improve terminal throughput. Again because performance tuning is outside of the scope of this discussion, I will not further elaborate on these parameters here.

VTAM DEFINITION CONSIDERATIONS

In addition to the NPSI parameters, some considerations have to be given to VTAM definitions to facilitate the X.25 connections.

SWITCHED MAJOR NODE PARAMETERS

Special considerations only need to be given to three operands in the VTAM switched major node definition when dealing with connections via a switched virtual circuit:

- the IDBLK and IDNUM operands in the PU macro, and
- the DIALNO operand in the PATH macro.

Figure 17 illustrates the coding rules required to define the IDBLK, IDNUM and DIALNO operands.

If the connection is to an SNA node via a Type 2 or 3 virtual circuit, since the SNA-to-SNA session is still end-to-end, no special considerations other than those usually given to the IDBLK and IDNUM need be

```

*****
*
*           GENERATION OF THE X25 BLOCKS WITHIN NCP
*
* N37X25V3: NOV 12, 1982 - USED WITH RELEASE 3 OF X25NPSI PP
*           GENERATED FOR ACF/VTAM V2R1 AND ACF/NCP/V5 R 3.0
*           USED IN X25NPSI STAGE 1 GENERATION!
*
* CONTENTS:
*   1) (04C,04D) FDX MULTICHANNEL LINK FOR DATAPAC 3000
*   2) 201      LINE ADDRESS FOR PERMANENT VIRTUAL CIRCUIT
*   3) 202      LINE ADDRESS FOR SWITCHED VIRTUAL CIRCUIT
*   4) 203      LINE ADDRESS FOR SWITCHED VIRTUAL CIRCUIT
*
*****
* COPY XGENEND          COPY NTO GENEND STATEMENT
*****
* X25BUILD -- PARSMS TO DEFINE ENVIRONMENT AND
*           SYSTEM RELATED NCP GENERATION OPTIONS
*****
N37X25 X25BUILD MCHCNT=1,          1 MCH LINK
*           MACLIB=MACX25,          DSNAME OF WORKING LIBRARY FOR STG 2
*           TYPYS=05                SYSTEM IS MVS 3.8 WITH ACF/VTAM V2R1
*****
* X25NET -- USED TO SPECIFY NETWORK
*****
DATAPAC X25NET NETTYPE=2,          NETWORK IS DATAPAC
*           DM=NO,                  REQ'D IF LAP USED IS UNSET
*           CPHINDX=1,              HIGHEST INDEX USED IN X25VCCPT MACRO
*           OUHINDX=1,              HIGHEST INDEX USED IN X25OUFT MACRO
*****
* X25VCCPT -- VIRTUAL CIRCUIT CONNECTION PARAMETERS
*****
*           X25VCCPT INDEX=1,        CONNECTION PARAMETER TABLE 1
*           MAXPKTL=256,             MAXIMUM PACKET SIZE IS 256 BYTES
*           VWINDOW=3,               SUBSCRIBED PACKET WINDOW SIZE IS 3
*****
* X25OUFT -- USED TO SPECIFY USER FACILITY IN CALL PACKET
*           ONLY REQUIRED FOR SVC'S
*****
*           X25OUFT INDEX=1          NO OPTIONAL FACILITIES REQUIRED
*****
* X25MCH -- DEFINITION OF MULTICHANNEL LINK
*****
L3704C X25MCH CSBTYPE=2,           ATTACHED TO TYPE 2 COMMUN SCANNER
*           ADDRESS=(04C,04D),        ADDRESS OF FDX LINE WITHIN 3705
*           LCNO=NOTUSED,             DATAPAC DOES NOT USE LCN #0
*           PKTMODL=8,                THIS NETWORK USES MODULO 8
*           LLCLIST=(LLC0,LLC2,LLC5), ALLOW PCNE, PSH & PAD ON SVC
*           GATE=NO,                  GATE/DATE NOT USED HERE
*           PAD=INTEG,                X3./X.28/X.29 PAD USED
*           TRAN=ODD,                 TRANSLATE TO EBCDIC FROM ODD PARITY
*           STATION=DTE,              NCP PORT WILL OPERATE AS DTE
*           FRMLGTH=259,              MAX FRAME SIZE IS PKT HDR(3) + 256
*           MWINDOW=7,                MAX 7 HDLC FRAMES
*           LCGDEF=0(3),              LOGICAL CHAN GRP 0, UP TO LOG CH #3
*           PROTOCOL=LAPB,            USE LAPB
*           SPEED=9600,               DATAPAC SERVICE IS 9600 BPS

```

Figure 15. X.25 Definition Example


```

*****
* X25LCG -- IDENTIFIES LOGICAL CHANNEL GROUP TO BE USED *
*****
X25LCG LCGN=0          LGL CHNL GRP #0 DEFINED BY X25MCH
*****
* X25LINE -- DEFINITION OF PERMANENT VIRTUAL CIRCUIT *
*****
L37201 X25LINE LCN=1,    LOGICAL CHANNEL #1 WITHIN GROUP 0 -
      TYPE=PERMANENT,    THIS IS A PERMANENT VIRTUAL CIRCUIT -
      LLC=LLC2,          NIA ON THE OTHER END -
      VCCINDX=1,        NORMALLY USE ENTRY 1 IN X25VCCPT -
      NCPGRP=G374CV1    1ST VC GROUP ON MCH 04C
*****
* X25PU -- DEFINITION OF PU ATTACHED TO ABOVE LINE *
*****
PU37201 X25PU  PUTYPE=2,  THIS IS TO ATTACH TO A 3276-12 -
      ADDR=C1,          STATION ADDRESS IS C1 -
      SPAN=(SPANLSSC),  NCCF CONTROL -
      ISTATUS=ACTIVE,   ACTIVATE AS NCP COMES UP -
      MODETAB=D3276S2,  3276-12 ONLY SCREEN IS 3276 -
      DLOGMOD=S3276,    USE THIS LOG MODE ENTRY -
      BATCH=NO,         MAKE LU'S INTERACTIVE BY DEFAULT -
      IRETRY=YES,       RETRY ON IDLE DETECT TIMEOUT -
      MAXDATA=265,      MAXIMUM PIU SEGMENT SIZE TO 3276 -
      MAXOUT=7,         MAX SDLC FRAMES BEFORE LINK RESPONSE-
      PASSLIM=7,        MAX PIU SEGMENTS IN ONE TX BURST
LU37201 X25LU  LOGADDR=2,  ADDRESS OF THIS LU ON THE PU -
      LOGAPPL=NETMON,   LOG TO NETMON -
      SPAN=(SPANLSSC),  NCCF CONTROL -
      ISTATUS=ACTIVE    ACTIVATE WITH PU
*****
* X25VC -- DEFINITION OF VIRTUAL CIRCUITS *
*****
L37202 X25VC  LCN=(2,3),  LOGICAL CHANNELS #2&3 WITHIN GROUP 0-
      TYPE=SWITCHED,     SWITCHED VIRTUAL CIRCUITS -
      VCCINDX=1,        NORMALLY USE ENTRY 1 IN X25VCCPT -
      OUFINDX=1,        DEFAULT IS NO USER FACILITY(X25OUFT)-
      CALL=INOUT,       TWO WAY CALLS ALLOWED -
      MAXLU=20,         MAX NUMBER OF LU'S (< LUDRPOOL) -
      NCPGRP=G374CV2    2ND VC GROUP ON MCH 04C
*****
* X25END -- END OF X25 DEFINITIONS *
*****
X25END NCPSTG1=N37X25R3,  MBR NAME IN MACLIB -
      X25VTAM=NO        VTAM HAS NOT BEEN MODIFIED
END

```

Figure 16. X.25 Definition Example

VTAM Definition Considerations

Switched Major Node Parameters

```

PU      IDBLK  = { Remote SNA / DTE IDBLK for Type 2 VC },
              { 003 for Types 0, 4 or 5 VCs }

IDNUM   = { Remote SNA / DTE IDNUM for Type 2VC },
              { (SVC position + 2) For Types 0, 4 or 5 VC's }

●
●
●

PATH    DIAL NO = NNN...N [*MMM...M] LXXYY*ZZZZ
●
●
●

NNN...N = Called DTE No.
MMM...M = Calling DTE No.
L        = VC Type
XX       = VCCPT INDEX
YY       = OUFT INDEX
ZZZZ    = PU ID NO. (For Type 0 VC)

```

Figure 17. Switched Major Node Definition Considerations

given. That is, the IDBLK is usually concerned with the SNA terminal type; and the IDNUM is the terminal serial number, or what the user has defined in his terminal customization process.

If the connection is to a non-SNA terminal over an X.25 network, special attention is required for the IDBLK and IDNUM definitions. In such connections, the NPSI simulates a type 1 PU/LU pair within the NCP for each non-SNA terminal access. Subsequently, the IDBLK and IDNUM used for the terminal identification exchange (XID) is from the NCP to VATAM only. The IDBLK is preset as 003 for the simulated PU/LU pair by the NPSI. The IDNUM assignment is more complicated. It could depend on a combination of the following:

- the type of non-SNA virtual circuit support required,
- the information stored in the Call User Data field in the Incoming Call packet received, and
- the IDNUMH operand specified in the X25MCH macro.

This definition can be a bit complicated for first time NPSI users, my suggestion is to simply use the default IDNUM generated by the NPSI instead. In this case, the IDNUM for connections on the first switched virtual circuit is 0002. The IDNUM for the second SVC is 0004, the third as 0006, and so on.

The same Switched Major Node definition can actually be used for both conventional circuit switched and X.25 switched virtual circuit connections. The only difference is in the DIALNO definition. The format of the dial number for outgoing virtual calls is as follows:

1. Called DTE number. This is the X.25 access line circuit number to which the user wants to have a connection.
2. An optional Calling DTE number. This is the X.25 access line number for the multichannel link that will be used for the connection. Usually this number is supplied by the network automatically as the Call Request packet is created and therefore need not be specified.
3. The type of virtual circuit support required.
4. The virtual circuit connection table entry as specified in the X25VCCPT macro in the X.25 gen. The entry specifies the maximum data packet size and the virtual circuit window size to be used for this call.
5. The optional facilities table entry as specified in the X25OUFT macro in the X.25 gen. This entry specifies the optional user facility, e.g. closed user group, requested for this virtual call.
6. The last field is the SSCP number, which is useful only if the connection uses the PCNE or virtual circuit type 0 functions. This is only useful for building the IDNUM in the XID command.

```

*****
M SWX25 -- DEFINITION OF SWITCHED X.25 CONNECTION. *
*****
SWX25 VBUILD MAXGRP=4, MAX NUMBER OF UNIQUE PATH GROUPS -
      MAXNO=9, MAX TOTAL NUMBER OF PHONES DEFINED -
      TYPE=SWNET THIS IS A SWITCHED MAJOR NODE
*****
M DEFINITION FOR 3276 - 12 *
*****
PU3276 PU ADDR=C1, HEX ADDRESS OF THIS PHYSICAL STATION -
      SPAN=(SPANLSSC), NCCF CONTROL -
      ISTATUS=ACTIVE, THIS RESOURCE MUST BE ACTIVATED LATER-
      MODETAB=D3276S2, 3276-12, ONLY SCREEN IS 3276 -
      DLOGMOD=S3276, DEFAULT MODETAB ENTRY -
      IDBLK=018, ACCORDING TO COMP. DESCRIPTION -
      IDNUM=0A116; SERIAL NUMBER 41328 -
      BATCH=NO, MAKE LU'S INTERACTIVE BY DEFAULT -
      DISCNT=(YES,F), BREAK CONNECTION WHEN SESSIONS DONE -
      IRETRY=YES, RETRY ON IDLE DETECT TIMEOUT -
      MAXDATA=265, UP TO 265 BYTES PER PIU SEGMENT -
      MAXOUT=7, MAX SDLC FRAMES BEFORE LINK RESPONSE -
      MAXPATH=2, NUMBER OF DIFFERENT PATHS -
      PASSLIM=7, MAX PIU SEGMENTS IN ONE TX BURST -
      PUTYPE=2, THIS IS A SMART CLUSTER -
PATH1 PATH USE=NO, OPERATOR MUST ACTIVATE THIS PATH -
      DIALNO=4990062, MANUAL DIAL - SDLC LINE -
      GRPNM=G37S3, GROUP NAME IN N37X30 FOR 3705#3 -
      GID=0, GROUP ID FOR THIS SET OF PATHS -
      PID=1, PATH ID FOR THIS CONNECTION ROUTE -
      REDIAL=1, REDIAL ONCE IF NOT SUCCESSFULL -
PATH2 PATH USE=NO, OPERATOR MUST ACTIVATE THIS PATH -
      DIALNO=401000622, X.25 USE DEFAULT VCCINDX/OUFINDX -
      GRPNM=G374CV2, GROUP NAME IN N37X30 FOR 3705#37 -
      GID=0, GROUP ID FOR THIS SET OF PATHS -
      PID=2, PATH ID FOR THIS CONNECTION ROUTE -
      REDIAL=1, REDIAL ONCE IF NOT SUCCESSFULL -
LU327601 LU ADDRESS OF THIS LU ON THE PU -
      LOGAPPL=NETMON, LOG TO NETMON -
      SPAN=(SPANLSSC), NCCF CONTROL -
      ISTATUS=ACTIVE ACTIVATE WITH PU

```

Figure 18. Switched Major Node Example

```

*****
* 3101 DEFINITION *
*****
PU3101 PU      ADDR=C1,          SDLC LINK STATION ADDRESS OF THIS PU -
              IDBLK=003,        HARD WIRED IN 3767 -
              IDNUM=00002,       FROM NPSI ID PARAMETER -
              DISCNT=(YES,F),    BREAK CONNECTION WHEN SESSIONS DONE -
              IRETRY=YES,        RETRY ON IDLE DETECT TIMEOUT -
              ISTATUS=ACTIVE,    ACTIVATE ALL RESOURCES AT STARTUP -
              MAXPATH=1,        UP TO 1 DIALOUT PATH -
              MAXDATA=268,       256 + 9 TH&RH + 7 HDLC FRAMING -
              MAXOUT=2,         MAX SDLC FRAMES BEFORE LINK RESPONSE -
              PASSLIM=1,        MAX PIU SEGMENTS IN ONE TX BURST -
              PUTYPE=1,         THIS IS A SIMPLE CLUSTER -
              SPAN=(SPANLSSC)    ALLOW APPROPRIATE NOSP CONTROL -
PATH3  PATH   USE=NO,           OPERATOR MUST ACTIVATE THIS PATH -
              DIALNO=409000185, X.25 USE DEFAULT VCCINDX/OUFINDX -
              GRPNM=G374CV2,    GROUP NAME IN N37X30 FOR 3705#37 -
              GID=0,           GROUP ID FOR THIS SET OF PATHS -
              PID=4,           PATH ID FOR THIS CONNECTION ROUTE -
PAD1   LU     REDIAL=1,        REDIAL ONCE IF NOT SUCCESSFULL -
              LOCADDR=0,       SLUTYPE-1 -
              BATCH=NO,       MAKE LU INTERACTIVE BY DEFAULT -
              TERM=TWX,       REQUIRED FOR PROPER LF/CR SUPPORT -
              SSCPFM=USSNTO,   USE UNFORMATTED SYSTEM SERVICES -
              ISTATUS=ACTIVE,   ACTIVATE WITH THE PU -
              MODETAB=T3767S,  MODE TABLE SET UP FOR NTO -
              DLOGMOD=S3767,   INTERACTIVE BIND PARAMETERS -
              PACING=1,       REGULATE FLOW TO DEVICE FROM NCP -
              VPACING=2,      KEEP NCP AHEAD, -
              SPAN=(SPANLSSC)  ALLOW APPROPRIATE NOSP CONTROL -
*****

```

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Figure 19. Switched Major Node Example

Figures 18 and 19 give a working example of a switched major node which is used to support switched connections from an IBM 3276 SNA display and an IBM 3101 start/stop terminal.

It is interesting to note that this same switched major node definition can be used to support dialup connection from both a conventions circuit-switched line or an X.25 switched virtual circuit. Dialout operation can be achieved by activating the appropriate path. For example, for the 3276, PATH1 refers to a line group definition in the NCP used with SDLC circuit-switched lines. PATH2 refers to an X.25 switched virtual circuit.

PU3101 is defined to allow connection from a TTY 33/35 compatible start-stop terminal to the SNA host via an X.3 PAD and the NPSI.

INTEGRATED PAD SUPPORT CONSIDERATIONS

In my presentation to SHARE 60 in San Francisco in February this year, I discussed the X.3 PAD access in some detail. Basically, an X.3 PAD is a protocol conversion type facility that allows an ASCII terminal to make use of the Packet Assembler and Disassembler functions of the facility to attach to an X.25 mode DTE. My discussion on the X.3 PAD and our users' experience can be found in the SHARE 60 proceedings.

It is interesting to note that under the Type 5 virtual circuit integrated PAD support in the NPSI, the simulated PU/LU pair coming out of the NPSI actually looks like an NTO device. In other words, any IBM subsystems and applications that can support NTO devices, e.g. TSO, VCNA, CICS/VS and IMS/VS VIR3, can be used with the NPSI integrated PAD support without modification. Subsequently, the PU/LU definition for such support should follow NTO rules. That is, the following specifications should be made:

- In the PU definition:
 - PUTYPE=1
- In the LU definition:
 - TERM=TWX,
 - SSCPFM=USSNTO.

Under the IBM SNA PU/LU Type 1 support, two modes of operations are supported:

- Contention mode, and
- Flipflop mode.

The mode of operation is dependent on the application or subsystem. For example, TSO supports the contention mode and VCNA, the flipflop mode. For subsystems such as CICS/VS, both contention and flipflop mode can be used. The mode of operation is determined by the SYSTYPE definition in the terminal gen (i.e. in the DFHTCT macro).

The mode of operation is actually specified by the COMPROT operand within the logmode entry that is used for the NPSI simulated LU session. For example, COMPROT='3040' specifies a contention mode of operation, and COMPROT='3080', a flipflop mode.

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CHAPTER 6. SUMMARY AND CONCLUSION

In this session, we discussed some of the considerations that a user might want to take into account when defining his X.25 circuit configuration to the SNA host. In addition to the normal system considerations, his definition should:

- provide a network description so as to define the network characteristics to the NPSI;
- match the X.25 circuit subscription parameters implemented by the common carrier for his physical access link and virtual circuits; and
- include the appropriate support functions that he wants the NPSI to provide.

Most of these specifications are through the X.25 macros provided by the NPSI. Some may reside in the VTAM switched major node definition.

X.25 does introduce an added level of complexity to the network definition and operation. However, it is our experience that once the basic concepts of X.25 are understood, the network definition is actually quite straight forward. A number of manuals are available from IBM to help users overcome this initial hurdle. Some of these are listed in the bibliography.

We now have quite a number of NPSI installations in IBM Canada. It can be demonstrated that X.25 and SNA is an effective combination. Some of the benefits that our customers enjoy include lower networking costs and enhanced terminal connectivity.



SHARE SESSION REPORT

SHARE NO.	SESSION NO.	SESSION TITLE	ATTENDANCE
61	C155	SNA Session Establishment White Paper	50
TPAM		Jim Cobban	DCL
PROJECT		SESSION CHAIRMAN	INST. CODE
Datacrown Inc. 650 McNicoll Ave. Willodale, ON, Canada (416) 499-1012			
SESSION CHAIRMAN'S COMPANY, ADDRESS, AND PHONE NUMBER			

The final report of the SNA Session Establishment White Paper Committee was presented. This paper addresses deficiencies in the currently available products for handling logons to applications in a VTAM, TCAM or other SNA Network. There was a brief foil presentation explaining the nature of the problems, reviewing existing solutions, and giving an overview of the White Paper. The remainder of the meeting was a question and answer session on the paper.

APPENDIX A. BIBLIOGRAPHY

An overview of the facilities available in the IBM X.25 NPSI PP is available in;

- X.25 NPSI General Information (GC30-3080)

A detailed technical discussion of the X.25 interface can be found in;

- The X.25 Interface for attaching IBM SNA Nodes to Packet-Switched Data Networks. General Information Manual. (GA27-3345)

The generation macro operands for the NPSI are documented in;

- X.25 NCP Packet Switching Interface - Installation and Operation. SC30-3163. (Releases 2 and 3.)

A detailed technical discussion on the installation experience of the NPSI in an OS/VS environment;

- X.25 NPSI Release 2 and 3 Guide. (GG24-1567)

A detailed technical discussion on SNA-to-SNA connection over an X.25 network including implementation, performance tuning and problem determination considerations;

- X.25 SNA Guide. (GG24-1568)

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