

IBM

World Trade Systems Centers

X.25 NCP PACKET

SWITCHING INTERFACE

RELEASE 2 AND 3 GUIDE

**IBM
World Trade
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**Technical
Bulletin**

**X.25 NCP Packet Switching Interface
Release 2 and 3 Guide**

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ABSTRACT

In August 1981, IBM Corp. announced the availability of an NCP X.25 packet switching interface licensed program (Program Number 5668-981) that extends the capability of a 3705 NCP to allow an SNA host to attach to a packet-switched data network (PSDN). The other end of the connection can be;

- Another SNA host equipped with the same X.25 NPSI licensed program
- An SNA peripheral node equipped with either an "integrated X.25 adapter" or connected through a "Network Interface Adapter" (IBM 5973-L02).
- A NON-SNA device that provides a native X.25 interface
- A NON-SNA device which is connected to the packet switched network via a Packet Assembler Disassembler (PAD) service.

It is also possible to use this licensed program to attach (SNA or NON-SNA) devices which are equipped with an X.25 adapter directly to the 3705 without the presence of an intervening network.

The IBM X.25 interface products are designed to strictly conform to a subset of the CCITT 1980 Recommendation X.25.

This document applies to Releases 2 and 3 of the X.25 NPSI licensed program. It is the first of a set of X.25-related manuals published by the IBM Raleigh Systems Centre to facilitate the installation of the IBM X.25 interface products. They are;

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

This is mainly concerned with the installation of the IBM X.25 NCP Packet Switching Interface (X.25 NPSI) licensed program (5668-981) in an OS/VS environment.

- X.25 SNA Guide. GG24-1568

This is a guide on SNA-to-SNA connections that provides implementation and performance considerations for connection through an X.25 network.

- X.25 NPSI PAD Implementation Guide. GG24-1569 (Under preparation)

This guide deals with the installation and application considerations when connection of a start/stop terminal to an SNA host over an X.28/X.3/X.29 PAD is desired.

This is the first of a series of X.25-related documents published by the IBM Raleigh Systems Centre. The intention of these manuals is to supplement existing IBM publications with working examples to facilitate the installation of IBM X.25 interface products. They are not meant to replace the product manuals. It is assumed that the user is already familiar with the functions and facilities available in the IBM X.25 interface products.

The initial publication consists of three documents;

1. X.25 NPSI Installation Guide. GG24-1567 (This document)

This is mainly concerned with the installation of the IBM X.25 NCP Packet Switching Interface (X.25 NPSI) licensed program (5668-981) in an OS/VS environment.

2. X.25 SNA Guide. GG24-1568

This is a guide on SNA-to-SNA connections that provides implementation and performance considerations for connection through an X.25 network. This document includes a detailed discussion of IBM 5973-L02 (NIA) installation and operation.

3. X.25 NPSI PAD Implementation Guide. GG24-1569 (Under preparation)

This guide deals with installation and application considerations when connection of a start/stop terminal to an SNA host over an X.28/X.3/X.29 PAD is desired.

The structure of the series is such that the reader should use this guide as a starting base and then select other appropriate parts which pertain to his installation environment.

For the sake of consistency and illustration, in the examples given in this document, the naming convention follows the standards used in the IBM Raleigh Systems Centre. This is described in "Appendix B. Naming Conventions" on page 73

The user is urged to read the following two manuals and understand his networking requirements before referring to this document:

- X.25 NPSI General Information GC30-3080
- X.25 NPSI Installation and Operation SC30-3163

The IBM X.25 interface products are designed to strictly conform to a subset of the CCITT 1980 Recommendation X.25. This subset is defined in the manual:

- The X.25 Interface for Attaching IBM SNA Nodes to Packet-Switched Data Networks. (GA24-3345).

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CHAPTER 1. INTRODUCTION

In the late 1970's, there were a lot of activities among the Postal Telegraph and Telephone carriers (PTT's), especially in Europe and Canada, to implement public data networks based upon packet switching technology and using the CCITT (the International Telegraph and Telephone Consultative Committee) Recommendation X.25 as the interface.

The objectives of these networks included optimizing the use of the PTT physical facilities and providing an international standard interface for the attachment of business machines to PTT facilities. The technology involves transporting user data in small segments or "packets". The network facilities are to be shared by all users.

Instead of having bandwidth dedicated to two communicating business machines as in circuit-switching services, in packet-switching, bandwidth is provided to a user only when there is data to be transmitted. This is done by multiplexing the users' data packets into shared network nodes and high speed trunk lines.

The resulting high degree of facility sharing provides justification for tariff structures that are relatively distance insensitive compared to traditional common carrier offerings. Of course tariff structures in many countries are a political rather than an economic issue. Thus tariffs for X.25 service vary widely from country to country. Also the relationship between X.25 tariffs and the tariff for leased line service (for example) is different in nearly every country. So an economic evaluation of a communication problem that suggests (say) a leased line solution in one country may well suggest the use of a PSDN in another. Depending on usage and applications, many customers are finding packet-switching an attractive alternative to the more traditional approaches.

However, using a packet switching network is not as simple as using conventional leased or circuit switched lines.

When using conventional services, the communications line becomes transparent once the connection between two business machines (or data terminal equipment (DTE)) is established. Since the communications medium is dedicated for the connection (at least for the duration of the call in the case of dial-up lines), the user can transmit and receive any protocol he likes.

In the case of packet switching, a user will usually be sharing the same communications facilities with many other users. This means that a set of rules and protocols must be understood and obeyed to enable the network to route data to its destination. Some kind of flow control must also be implemented so that the network can control how much data a user is allowed to send. This is to prevent flooding of the network and to ensure that each user will receive his fair share of the facilities. In case of errors, information must be provided to allow the user's equipment to detect and recover from the error condition. Also, when interfacing to a network, the range and type of error conditions that can be experienced is greatly increased. In addition to the kinds of errors experienced on a direct link (which still have to be provided for since the link to the network is direct), a packet switched network is potentially subject to logic errors (i.e. possible duplication of, resequencing and losing messages). Also it can deliver messages to the wrong user and it can corrupt data in transit without the user on either end being able to detect the condition.

The first requirement then for participation in the packet switched network is that the user's host/terminal equipment (DTE's) must be able to interface correctly with the Data Circuit-terminating Equipment (DCE) in the network.

In order to standardize such attachment, a study group was formed in the International Telegraph and Telephone Consultative Committee (CCITT), an organization chartered by the United Nations, to develop a recommendation for the DTE/DCE interface for public packet switched networks. This recommendation was first approved as a DRAFT specification by the CCITT Plenary Assembly in 1976, and became known as CCITT Recommendation X.25. It was not until 1980 that the specification (with modifications) finally became an official standard. Around the world, various packet switched

networks providing an interface based on CCITT Recommendation X.25 are now in service.

In 1977, IBM announced its intention to provide SNA/X.25 interface products enabling attachment to France's Transpac and Canada's Datapac networks. As X.25 interface specifications for other packet-switching services were published and determined to be compatible, IBM extended the availabilities of these products to include those public Packet-Switched Data Networks (PSDN's) as well. For example, in 1980, the interface products were announced for use with the X.25-based networks in the Federal Republic of Germany (Datex-P), the Netherlands (DN1) and the United Kingdom (PSS). In addition, functional enhancements were added to the interface products. New X.25 adapters were also introduced.

Because the 1976 version of X.25 was a draft and lacked firm detail, interpretations of the specification varied from country to country. Thus early IBM implementations of X.25 were released as "special products" (PRPQ/RPQ). After the final approval of the X.25 specification in 1980 the existing PRPQ NCP was replaced by a standard product with greatly expanded function.

Although the discussion here is mainly concerned with the X.25 NPSI licensed product and based on an OS/VS environment, most of the information is still applicable to a DOS/VSE installation and to customers who are planning to use other IBM X.25 interface products.

This Manual is not intended to replace any existing IBM product manuals. Instead, it is meant as a supplement to the X.25 NPSI Installation and Operations Manual (SC30-3163), the X.25 NPSI Diagnosis Reference (LY30-3054) and the X.25 NPSI Diagnosis Guide (SC30-3164).

CHAPTER 2. PUBLIC PACKET-SWITCHED DATA NETWORKS

A Packet-Switched Data Network (PSDN) is one in which user data is transmitted in small segments, or packets. Typically, a PSDN is a network of intelligent nodes connected by high-speed trunk lines. Each intelligent node is a computer whose functions include routing user data packets to their desired destinations, responding to command packets, and monitoring and managing the general welfare of the network. The intelligent nodes and high-speed transmission lines are shared by many users. Each user's Data Terminal Equipment (DTE) is attached to the network by a physical access line.

The basic concept used in a PSDN is a "virtual circuit". This "virtual circuit" is a logical connection between two users of the network. On that logical connection data flows in short packets of fixed maximum length. The network guarantees that packets will be delivered to the other end of the virtual circuit in the order in which they were received without duplication or corruption of the data. Because a "user" may be a cluster of devices or a computer etc., each user has the ability to set up many virtual circuits to many different users at the same time. To avoid the overheads of having one physical line to the network for each virtual circuit, many virtual circuits can be multiplexed onto a single network link. This physical access line, or physical circuit, can consist of multiple **logical channels**. Theoretically, up to 4095 logical channels can be assigned to a physical access line under CCITT Recommendation X.25.

A "Virtual Circuit" is a bi-directional association of two logical channels. Each virtual circuit can be considered as a point-to-point connection. The logical channel numbers need not be the same within the physical access lines between two communicating DTE's. The network's intelligent nodes are responsible for maintaining a routing table that identifies the physical circuit/logical channel/virtual circuit relationship of all connected DTE's.

For example, a host DTE may have 4 logical channels, numbered 1 to 4, assigned to its physical access line. Each logical channel is one end of a virtual circuit used to communicate with a terminal DTE which may have only one logical channel associated with its physical access line. Thus, logical channel number 1 in the host DTE and logical channel number 1 in terminal A forms one virtual circuit, logical channel number 2 in the host DTE and logical channel number 1 in terminal B forms another virtual circuit, and so on.

Packets for different virtual circuits can be interleaved (multiplexed one complete packet at a time) on the same physical access line. On this line packets are given an identifying header which includes a logical channel number so that the virtual circuit to which this packet belongs can be determined. Packets from different physical circuits are in turn multiplexed into the network's intelligent nodes and connecting trunk lines. Bandwidth is only assigned when packets are actually transferred. It is the carrier's responsibility to deliver a packet from the source DTE to the destination DTE.

The transportation mechanism used in a PSDN is essentially a "store and forward" operation. When a DTE has data to transmit, it will first of all compose the data into a "frame", and transmit this bit-by-bit serially to the connecting DCE at the speed of the physical access line. Buffer storage is usually provided in the network's intelligent nodes. Once the network node or DCE has received the contents of a complete frame it verifies that there are no errors. It then forwards the data portion (now called a packet) node-by-node, to its destination. The speed of transmission within the network is that of the interconnecting trunk line. The destination network node will forward the data to the destination DTE when it has received the last bit of the frame and verified that there have been no transmission errors. The speed of transmission is that of the physical access line connecting the destination DTE with its DCE. Because of the "store and forward" nature of such transmission, the speed of the physical access lines associated with two communicating DTE's can actually be different.

It should be noted that packet switching is not a new technology. One of the earliest packet-switched data network was ARPANET, which became operational in 1969 connecting universities and research laboratories in the

U.S. Though it is possible to trace many of the concepts used in modern packet switched networks back to those in ARPANET, the comparison is of historical interest only since in modern networks many things such as the concept of a virtual circuit are new and different.

It should also be noted that not all packet-switched networks use the same technology. CCITT Recommendation X.25 is an attempt to standardize the interface between the user's Data Terminal Equipment (DTE) and a packet-switched data network's Data Circuit-terminating Equipment (DCE). X.25 is a standard for the interface only and says nothing at all about how a public packet-switched network (PSDN) shall operate internally.

Many PSDN's in service today do not provide an X.25 interface. Packet switching is a much older concept than X.25 and many user interfaces have been implemented. However, it should be mentioned that since its introduction in 1976, X.25 has received world-wide acceptance. Today, many people consider X.25 to be a compatible subset of the lowest three layers of the ISO's (International Standard Organization) Open System Interconnect (OSI) reference model. It can be expected that eventually all public packet-switched data networks will provide an X.25 interface.

The discussion from this point on will be concerned with X.25-based packet-switched data networks only.

X.25 INTERFACE

As mentioned in the previous chapter, Recommendation X.25 was first approved by the Plenary Assembly of CCITT in 1976. It is important to understand that like all technical developments, packet-switching and X.25 continue to evolve. Improvements are being considered to enhance the standardization and operations of the networks.

Interface implementation based on the 1976 version of X.25 was open to interpretation. In fact, in the early implementations of X.25-based PSDN's, there were significant differences at the user interface level and in operational characteristics. These differences complicated the tasks of users and manufacturers when they tried to use the same equipment to interface to various networks.

Based on input from CCITT members and various user and vendor groups, revisions were made to Recommendation X.25, and the latest revision, as approved by the CCITT Plenary Assembly in Geneva in November 1980, is less permissive. It is believed that PSDN interface implementations based on this revision will have similar functional characteristics. The PTT's represented in the CCITT generally agreed that their PSDN's will have an interface conforming to the 1980 version of Recommendation X.25 by first quarter 1983.

It is important to understand that the CCITT Recommendation X.25 is merely a basic set of rules or protocols that applies to the interface between a DTE and a DCE for information exchange when operating in the packet mode. The DTE is the user's business machine (e.g. a 3274 cluster controller or a 3705 communications controller). The DCE is the carrier's equipment and usually includes the carrier-supplied dataset (modem) and the first node in the packet-switched network. Further, the standard can apply to a direct connection between two devices which obey the X.25 protocols without the presence of a public data network. In that case one device must have the characteristics of a DCE and the other a DTE. For example the IBM 3705 NCP NPSI Program Product can act in a limited way as a DCE thus enabling the direct attachment of many "native mode" X.25 DTE's (terminals or CPUs) without the intervention of a public data network.

There are three distinct and independent levels defined in the X.25 interface, namely: physical interface level, link access or frame level, and packet level.

1. Physical Interface level.

This layer specifies the electrical and physical characteristics of the interface, and how to establish and control connections: e.g. voltage levels, circuit signals, etc.

The recommended interface is defined by Recommendation X.21 (approved by the CCITT Plenary Assembly in October 1976). The X.21 physical interface makes use of a 15-pin connector and is designed to be considerably simpler than the present modem interfaces while providing for additional function. Although X.21-based circuit-switched services are available in the Nordic countries and Japan, there are not many packet-switched data networks that have implemented the X.21 physical interface.

For an interim period (the length is undefined), it is specified that the physical interface defined in Recommendation X.21 bis can be used. Recommendation X.21 bis, as approved by the CCITT Plenary Assembly in October 1976, is similar to the current V.24 (EIA RS-232-C in the US and Canada) and V.35 interfaces implemented on IBM's and other manufacturer's equipment today.

For most PSDN's, including Datapac in Canada and Telenet and Tymnet in the U.S., X.21 bis is the only interface supported. At the time of writing many networks do not have published commitments to support X.21.

2. Link Procedure (or Frame) level.

This level corresponds to a point-to-point data link control procedure. Its main objective is to convert the physical circuit into an error-free logical link for transferring data between the DTE and the network.

The connection between the DTE and DCE operates in a full duplex asynchronous response mode. The link access level provides facilities for sequence checking, detection of the start and end of a frame, and link initialization, disconnection or resetting procedures.

Like SDLC, this level adds address and control information to the front of a packet, and frame check sequence (FCS) at the end, to form a "frame" before passing the data to the physical level layer.

The address field defines the flow direction and content of an information frame. That is, whether the frame is a "command" or a "response", and whether the flow is from the DTE to DCE or vice versa. The control field allows the DTE or the DCE to detect out-of-sequence frames or duplicated or missing frames. The frame check sequence provides a facility to detect most transmission errors.

The full duplex connection between the DTE and DCE can be considered as two simplex channels. Both the DTE and DCE have responsibilities to provide a primary and secondary station function. Each channel connects a primary to a secondary with the primary controlling the channel and initiating commands to which the secondary responds.

Two specified classes of link access procedure are defined in X.25: LAP, the original symmetrical procedure, and LAPB, the more recently defined balanced procedure. Both are based on HDLC (a standard of ISO).

Both procedures operate in an asynchronous manner whereby, once a link is set up, the secondary can transfer information at its own initiative without receiving permission from the primary. This differs from the normal response mode used in SDLC whereby polling controls who transmits and when. Both LAP and LAPB have the inherent performance advantage of being full duplex in operation. However, because a polling scheme is not used, this confers the important disadvantage that multidropping is not possible. Thus a single X.25 terminal must have a dedicated 4 wire connection to the PSDN. If there are several terminals in the same location they must either share a common "controller" (as for example do IBM 3278 terminals sharing an IBM 3274 controller) or use some form of circuit splitting such as a multi-stream modem etc. In some circumstances this restriction can negate many of the inherent benefits of resource sharing in the network.

Under LAP, which was introduced as part of Recommendation X.25 in 1976, each end of the link is considered as having two separate stations - a primary and a secondary. The full duplex link can be considered as two independent channels, one for each of the primary-secondary pair. It has been found that, under certain error conditions, it is possible for the channels to be in a deadlock situation as a result of which the channel must be reinitialized.

The preferred procedure is LAPB. Under LAPB, which was adopted by CCITT in 1977, each side of a link is a combined primary-secondary station. The DTE, or DCE, can initialize the link for two way communication by a single command which resets all state information for transmission in both directions. There is no possibility of a deadlock situation in this procedure.

Although some PSDN's support both LAP and LAPB, or only LAP, LAPB is expected to be the dominant procedure. LAP will likely be phased out eventually.

3. Packet level.

This level specifies how a single physical link between a DTE and DCE can be treated as multiple logical channels to handle simultaneous virtual calls and/or permanent virtual circuit connections. It performs a concentrator function by interleaving packets into the physical link. It defines the structure of data packets and the various control packets used to establish and manage a virtual circuit connecting two DTE's through a PSDN.

The formal recommendation for this level is not as specific as in level 2. For example, it provides the PTT with the option to implement end-to-end (i.e. DTE-to-DTE) flow control or local flow control across the DTE/DCE interface. Another example is that for some PSDN's, e.g. Datapac in Canada, the network implementors have chosen to omit the diagnostic reason field in the Reset and Clear Indication packets.

These three levels in X.25 are distinct and independent of each other. The procedure at one level makes use of the functions offered by the level immediately below but is independent of how it is implemented.

CONNECTION CONSIDERATIONS

There are two major considerations that a user must take into account when looking at using an X.25 packet-switched service as a networking alternative:

- First, his host system and terminal equipment must be able to interface with the network, i.e. have an X.25 interface.
- Secondly, there must be some higher level protocol for effective end-to-end communications.

The fact that two DTE's are compatible with X.25 does not necessarily mean that they can communicate with each other.

An example is the telephone network. The operation and connection procedures are now so standardized that by dialing the correct country and routing codes plus some local telephone number, a user in North America can call almost anywhere in the world. A connection is established as soon as the called party picks up his telephone. However, there can be no conversation or end-to-end communications unless both parties speak a common language.

The same is true with packet switching services. X.25 compatibility only enables a DTE with a correct X.25 interface, to be connected to an X.25-based network and exchange information frames with the networks' DCE. It is possible to make use of the packet level of X.25 to establish a virtual circuit connection with a similarly arranged (X.25) remote DTE and exchange data packets. However, unless the receiving DTE can understand and respond to the data packets, communications is not achieved.

Since there are many DTE's that do not, and in fact, will not, have an X.25 interface, many PTT's are offering protocol conversion services in order

to facilitate connection to their PSDN's. These are commonly known as Packet Assembler and Disassembler (PAD) services. The protocol conversion is usually performed within the network's intelligent minicomputer node.

For example, two of the most widely provided PADs are for 8 level coded "ASCII" teletypewriters and for IBM BSC 3270s.

If a host DTE is attached to similar PAD services as the terminal DTE, "virtual circuit" connection can be made transparent to both the terminal and host. That is, the host and terminal DTE's can transmit data to each other as in non-packet mode operation. The PAD services provide protocol conversion and are also responsible for establishing the virtual circuit connection through the PSDN.

Alternatively, the PAD service can be employed at only one end of a virtual circuit. In this case, the PAD itself must be recognized by the other end (e.g. to establish a virtual call or set parameters to control the non-packet mode DTE through the PAD). A well known example of such interface is the CCITT Recommendation X.29, which defines how a packet mode DTE can interface, over an X.25 connection, with an X.3 PAD to control a start-stop mode DTE. If the packet mode DTE is a host system, this can be achieved by installing some program in the its front end communications controller (e.g. the X.25 NPSI).

In either case, the host system's architecture is still required for end-to-end communications. For example, IBM's CICS/BTAM/EP support for BSC 3270 terminals includes an end to end control function (albeit imbedded in the logic of the line control) and device control and formatting functions imbedded in the data stream. In SNA these functions are explicitly separated in a "layered" structure. In BSC they are mixed up with no clear separation of functions but the functions must exist nevertheless.

Currently most of the PTT PAD services are directed to a non-SNA environment. However, recently some networks have announced "HDLC" Pads. (HDLC is the name of the ISO standard for data link control. IBM's SDLC Normal Response Mode (NRM) is a subset of the HDLC standard.) These PADs will allow the multidrop attachment of IBM SDLC controllers and provide an appearance to the host similar to the appearance provided by the IBM 5973 "NIA" (Network Interface Adapter). Note that this type of PAD cannot be supported by the integrated or transparent PAD functions of the X.25 NPSI PP.

It should be noted that there is currently only one class of PAD service sponsored by CCITT. This is for the attachment of ASCII terminals that are compatible with TTY 33/35 to an X.25-based network. Internationally, this is known as CCITT Recommendations X.3/X.28/X.29. This topic is discussed in detail in the "X.25 NPSI PAD Implementation Guide" (GG24-1569).

IBM X.25 INTERFACE PRODUCTS

The objective of the IBM X.25 interface products is to allow selected IBM products to attach directly to an X.25-based PSDN so that the customer can have the flexibility of choosing the communications service that best suits his networking requirements. Part of the design philosophy is to insulate the user from the complexity of the X.25 interface. For example, with the IBM X.25 NCP Packet Switching Interface (X.25 NPSI) licensed program, as long as the user correctly specifies the parameters in his X.25 and NCP system generations, the PSDN is just another means of transporting data. He need not be overly concerned with a thorough understanding of the packet-switching technology. For SNA-to-SNA connection over an X.25 network, the end-to-end protocol will be provided by IBM's Systems Network Architecture (SNA).

The IBM X.25 interface products are designed to conform with a subset of the 1980 version of CCITT Recommendation X.25.

CHAPTER 3. IBM X.25 INTERFACE PRODUCT DESCRIPTIONS

STATEMENT OF DIRECTION

IBM has been supporting CCITT Recommendation X.25 ever since its approval in 1976. In 1977, IBM started introducing X.25 interface products in the form of specially engineered or RPQ devices or programs. In 1980 and 1981, IBM officially issued the following statement of direction in the U.S. and various other countries:

"We encourage the use of international standards as the basis for interfaces to public data networks providing circuit-switched, packet-switched and leased-circuit services. We continue to participate and contribute to international standard efforts to develop and enhance these interfaces. Services with interfaces based on CCITT Recommendation X.21 and X.25 provide users with new alternatives for transmission that supplement the functions provided by IBM's Systems Network Architecture (SNA), and should be made available to our customers."

The functional capability of the interface products, and the number of IBM terminals that can attach to an X.25-based network are increasing. For example, the X.25 NPSI licensed program (5668-981), was first introduced in the 1970's as an PRPQ product that operated in an NCP/VS environment. Later on, it was enhanced to operate with ACF/NCP/VS Release 2.0, then ACF/NCP/VS Release 2.1. In 1981, the program was changed to a program product status. The current version of X.25 NPSI (both Releases 2 and 3) allows both SNA and non-SNA devices to attach to an IBM SNA host system through the medium of an X.25 PSDN.

AVAILABLE INTERFACE PRODUCTS

The following is a brief description of the IBM X.25 interface products available today. It should be pointed out, however, that some or all of these products might not have been announced for use in your country. Their reference here does not imply that IBM intends to make them available. The potential user should consult his IBM marketing representative regarding any questions that he may have on their availability and use.

X.25 NPSI licensed program (5668-981)

The IBM X.25 NPSI licensed program (Program Number 5668-981) is described in detail in the IBM X.25 NCP Packet Switching Interface General Information manual (Form Number GC30-3080), and the X.25 NPSI Installation and Operation manual (Form Number SC30-3163).

The X.25 NPSI licensed program is intended to allow an IBM SNA host system equipped with an IBM 3705 communications controller to attach directly to an X.25-based PSDN.

Functioning as an integrated component of the user's Network Control Program (NCP), the X.25 NPSI licensed program is perhaps the most versatile of the IBM X.25 interface products. More discussion on the licensed program will be given later on in this document.

Network Interface Adapter (NIA 5793-L02)

The Network Interface Adapter (NIA) is an IBM specially engineered or RPQ device. It is essentially an external protocol converter. Placed between an SNA device and packet-switched DCE, it provides protocol conversion from SDLC to X.25 and vice versa.

Two models of the NIA are available: the frontal model (SC 7042) and the remote model (SC 7043).

The Frontal NIA is intended for IBM SNA host systems, such as the IBM 4331, System/38, System/34, and 8100, that do not normally have a 3705 communications controller attachment.

The Remote NIA is intended for use by IBM SNA peripheral nodes (cluster controllers of PU types 1 and 2). Via the Remote NIA and an X.25-based PSDN, an IBM SNA peripheral node can attach to an IBM SNA host equipped with a Frontal NIA or the X.25 NPSI licensed program.

More discussion on the NIA and its use in an SNA-to-SNA environment is provided in the "X.25 SNA Guide" (GG24-1568).

Integrated X.25 Adapters

Three RPQ integrated X.25 adapters have been announced. They perform essentially the same function as the Remote NIA.

- An integrated X.25 adapter for the IBM 4700 finance communication system. This is a microcode RPQ which allows the 4700 in SNA mode to attach directly to an X.25 PSDN. This replaces the SDLC link to the host. The X.25 feature applies only to the single link between the 4701/4702 and the host system. In principle, this adapter appears to the network as though the 4700 were attached to an NIA. However there is an additional mode of operation available as an option and the user is no longer restricted to segment sizes of 256 bytes or less as he is with the NIA. (Of course this depends upon the availability of main storage).
- An integrated X.25 attachment feature for the IBM 5251-12 Display Station. This adapter applies only in communication with a Frontal NIA attached to an IBM System/34 or an IBM System/38. This is because the 5251 is only supported on those systems. The 5251 appears to the host system as though it was connected through a remote NIA. This is also a special engineering feature (RPQ).
- 8100 DPPX Integrated Attachment. This operates in a similar way to the other integrated adapters described above. It is a hardware RPQ which consists of both a new circuit card and microcode. In addition to the "NIA" like function, this adapter is capable of providing up to 16 Virtual Circuits and can operate on a Virtual Circuit in "X.25 Native Mode" (NON-SNA). Thus the user is free to adopt his own higher level protocols if he so wishes. Note that this feature does not apply to DPCX operation on the 8100.

More details can be obtained from your IBM representative.

The Packet Network Support Program RPQ for IBM Series/1

This Packet Network Support PRPQ P10008 enables an IBM Series/1 to communicate via an X.25-based PSDN with another Series/1 with the P10008 PRPQ, or a processor, such as an IBM System/370 attached to an IBM 3705 using the X.25 NPSI licensed program.

The pre-requisite for the P10008 PRPQ is for the Series/1 to operate in a Realtime Programming System (RPS) and equipped with two RPQ 8T1067 DLC adapters.

More details on the PRPQ can be found in the Series/1 Packet Network Support Program Description and Operations Manual (Form Number SC09-1001).

Other X.25 Possibilities.

Every attempt has been made to ensure the accuracy and completeness of the above at the time of writing. However, IBM is often able to answer the needs of its customers through solutions that are specially engineered for the particular individual requirement. Also, as new developments may occur from time to time, the customer is advised to consult his IBM representative for information.

CHAPTER 4. PLANNING CONSIDERATIONS

It is important to remember that the economies of a packet switched service result from its ability to share resources among multiple subscribers. As opposed to conventional circuit-switched services where the cost of usage is based on connect time, packet-switched service usage costs are usually volume dependent, regardless whether switched (i.e. virtual call) or dedicated (permanent) virtual circuits are used. In general, packet-switched usage charges are not as distance sensitive as circuit-switched charges. Consequently, for terminal locations that are widely dispersed with low traffic volumes, packet-switched services may be a more economical alternative compared to leased or circuit-switched lines.

It is also important to understand that a packet-switched connection is not transparent as is the case with leased or circuit-switched line connections. Although the IBM X.25 interface products (and, for that matter, the PTT PAD services) are designed to insulate the user from the added complexity of the X.25 technology, some X.25 knowledge is required, especially when the user wants to design for good performance and efficient network usage.

A packet-switched data network is a "store-and-forward" network. Most public PSDN's use high speed trunk lines between network nodes, and publish network transit delay objectives. These objectives only define the time from correct receipt of the last bit of a packet at the network source node to the complete reception of the packet at the destination node. There is no guarantee for continuous throughput. In fact, there are flow control mechanisms (e.g. packet window sizes, maximum packet lengths) used to regulate input/output rate from all users. Any external protocol conversion or concentration devices used in a connection can add further delay to the terminal response time. In general, it can be expected that the response time or throughput for a given packet-switched access line speed may not be as good as that for a leased or circuit-switched line of the same speed. However, depending on the type of connection (e.g. SNA-X.25-SNA, SNA-X.25-PAD-TTY), certain tuning parameters are available that can be employed to design for close to equivalent leased or circuit-switched performance.

In planning for a network involving packet-switched services then, the user may want to consider the following implications:

- network costs,

He should be aware of the break even point where it becomes more economical to use conventional leased (including multi-point) or circuit-switched lines.

It would be advisable to review, from time to time, his packet usage charge. The user must also be able to relate this usage to more meaningful yardsticks (for example, transaction volume, connection time).

- performance,

He should have a realistic idea of the response time or throughput that he can expect from the virtual circuit connection. Because a packet-switched environment introduces added complexity, good performance requires more careful planning and tuning.

- other system-wide factors.

He should be aware of how such a service will fit into his installation objectives. For example, most PTT PAD services are designed for non-SNA operation environments. This may inhibit his ability to realize the benefits of SNA, such as one consolidated communications access method for all his applications, superior network management facilities and host system off-loading. Moreover, a packet-switching service is a facility sharing service and this concept of interleaving and sharing may not be compatible with the user's company security objectives.

Although the above are important planning issues, it is assumed in this document that the user has already taken most of these into consideration when deciding to use a packet-switched service.

A discussion of the parameters in both SNA and X.25 service subscription that the user can employ to tune for better performance will be given in the X.25 SNA Guide (GG24-1568).

PACKET SWITCHING SERVICE PLANNING AND ORDERING

Once it is decided to use the IBM X.25 NPSI licensed program, and a packet switching service, the user should meet with the PTT representative to discuss his installation plans. The customer should give careful consideration to the parameters for his service subscription as these parameters can have an impact on his system performance. Usually, it takes time to change subscription parameters. For example, some countries, after the network service is installed, any subsequent changes could mean that the service has to be cancelled and re-ordered. A normal service request lead time for some networks is approximately 21 to 25 working days. In some PSDN's, this may even take longer.

The following are some of the considerations that the customer must wish to take into account. Later when installing the IBM X.25 interface products many of these selected parameters will have to be known in order to generate the system.

• What access line speed?

Since a packet-switched data network is a "store and forward" type of network, it is not necessary to have the same speed for the host DTE-DCE and terminal DTE-DCE access lines. For performance reasons, it is advisable to order higher access line speeds for the host location since it will be handling multiple virtual circuits.

More discussion will be given on the physical access line speed later on.

It should be noted that X.25 NPSI can support link speeds of up to 56K bps (speeds above 19.2K bps are only available on a 3705 model 2 equipped with a type 3 communication scanner). For some PSDN's, e.g. Datapac, the maximum physical access line speed available is 9600 bps.

• Permanent Virtual Circuit (PVC) or Switched Virtual Circuit (SVC)?

In the IBM X.25 support a PVC is analogous to a leased point-to-point line, and an SVC (also referred to as Virtual Call) is similar to a dial-up line. The user should carefully consider this choice when planning his network.

For a PVC.

- In most networks logical channel charges are higher for a PVC than for an SVC.
- Operationally however, a PVC could create fewer problems for the remote user. A connection is established as the remote terminal is powered on. There is no need to put together a "Call Request" packet to establish connection.
- There can be better security as only known remote locations can be connected.
- With the X.25 NPSI if the controlling SSCP (host) is lost then the sessions in progress with other hosts can be continued (ANS=CONTINUE). This is not possible with SVCs so the sessions are lost when the controlling host fails.

On the other hand, an SVC;

- Provides better flexibility in that connection can be made to another host or physical access line for backup or alternate access. A pool of switched logical channels can be shared instead of dedicating one logical channel per PVC.

- Although sessions cannot be continued when the controlling host is lost, a new host taking over can re-dial the call almost immediately if the resource is defined correctly to VTAM.
 - With NCP when the user wants to add a new PVC he must do a new NCP tables generation. For SVC there is no definition - the connection is dynamic. All the user needs to do is define a new VTAM switched major node.
 - When a user orders a new PVC the networks' management has to plan and install the PVC. It therefore usually takes considerable time for a user to get changes made to his subscription. With SVC a user can plan ahead and order a larger number of logical channels than he immediately needs and thus no changes need to be made to the subscription. In some networks it is not possible to reserve a range of logical channel numbers for future PVC use. Thus when a new PVC is ordered the address range for SVCs can change and force additional changes in the X.25/NCP generation.
 - The access security problem can be addressed by using Closed User Groups.
 - Some networks only offer SVCs. In most networks PAD connections must be SVC only.
 - It should be noted that in some PSDN's, e.g. Datapac, a switched logical channel is provided free of charge with every physical access line. This can be used effectively as a backup SVC.
- **How many virtual circuits can be supported per physical access line?**

Remember that a virtual circuit is a logical association between two logical channels.

In X.25, up to 4095 user logical channels can be associated with each physical access line. In practice, however, a much lower number of active logical channels can be accommodated.

The number of virtual circuits that can be assigned to a physical access line is dependent on the speed of the access line, the peak traffic load of each virtual circuit and the X.25 adapter capacity. Some interface products only allow a small number of virtual circuits per physical access line. For example, the Frontal NIA can have either 1 SVC, or up to 4 PVC's attached. The Remote NIA can have 1 SVC and/or 1 PVC under LAPB, however, in this case only one virtual circuit can be active at a time.

The IBM term used for the physical access line in the X.25 NPSI environment is "physical circuit". In parts of this document and in the generation parameters of X.25 NPSI the term "multichannel link" (MCH) is also used. The virtual circuit capacity per MCH link is significantly larger with the X.25 NPSI. (The design is intended to allow any number up to the theoretical addressing capacity of the packet header. In practice this is limited by 3705 control block storage as discussed in the section entitled "X.25 NPSI Pre-Installation Planning".) However, in practice, when there are many virtual circuits associated with a physical access line, each with data ready to send, the packets will have to be queued for transmission. Since the packets will only be transmitted to the DCE at the speed of the MCH link, the queue will have to take up buffer storage in the 3705. From queueing theory, it can be demonstrated that the queue buffer storage requirement and queue waiting time increase approximately linearly with increased MCH load up to around 60%. However, as soon as the total MCH load approaches 60%, the buffer storage requirement (and wait time) starts to increase exponentially. Therefore, unless the user's 3705 has a lot of free storage, it is advisable to design for only 50 to 60% MCH utilization under peak load. That is, if the physical access line is 9600 bps, the aggregated data rate of all the associated virtual circuits should not exceed 4800 to 5700 bps at any time.

It should be pointed out that the physical access line is a full duplex link. Therefore, only the more heavily utilized transmit or receive leg need to be considered.

More than one MCH link can be defined per 3705. With proper distribution (e.g. taking advantage of time zones, or sharing a MCH with terminals having different peak load requirements), many virtual circuits can be supported per 3705.

The number of MCH links required for X.25 NPSI is also dependant on the support function that the user wants to use. For example, although the same MCH link can be shared by virtual circuits using the SNA (PSH) and Integrated PAD functions, a different MCH is required if the DATE (Dedicated Access to X.25 Transport Extension) function is required for some virtual circuits. An MCH function compatibility table is given in Chapter 2 of the X.25 NPSI General Information Manual (GC30-3080) that should help the user decide whether virtual circuits with various functional requirements can share the same MCH link.

- **What logical channel numbers should be assigned?**

In some PSDN's, the user can specify the logical channel numbers to be used in a physical access line. That is, he can reserve groups of logical channel numbers for future use. However, in some PSDN's, the logical channel numbers will be assigned sequentially by the network administration.

In the X.25 specification, up to 4096 logical channels can be associated with each physical access line. Each virtual circuit is assigned a Logical Channel Group Number (less than or equal to 15), and a Logical Channel Number (less than or equal to 255). For some PSDN's only Logical Channel Group Number 0 is allowed. In others it is possible to assign VC types to Logical Channel Groups. For example, assign one or more LCG's for PVC's, another group for SVC's used for incoming calls, followed by a group of SVC's that can be used for both incoming and outgoing calls, and a last group for SVC's that handle outgoing calls only. This latter scheme is by far the preferable option if available.

Assignment of the lowest Logical Channel Number (i.e. 0 or 1) can make a difference in the user's implementation of the IBM interface products. As specified in Recommendation X.25, Logical Channel Number 0 is reserved for the network's use (i.e. for Restart and Diagnostic packets). In some PSDN's (it is believed that Transpac and Euronet are the only two), however, Logical Channel Number 0 is also assignable for customer use. The user should verify this with his PTT representative.

In order to enable simultaneous PVC and SVC connections, and to minimize chances of call collision, X.25 recommends that different ranges of logical channel numbers should be used for various categories of virtual circuits. The usual scheme is that PVC's are given the lowest range of logical channels, the next range is given to one way incoming virtual calls, the next to two way virtual calls, and the highest range to one way outgoing virtual calls. In some PSDN's, gaps in logical channel numbers are allowed between different virtual circuit categories. In some PSDN's, however, virtual circuits must use consecutive logical channel numbers. This means that if the user has an PVC and an SVC, Logical Channel Number 1 will be assigned to the PVC, and Number 2 to the SVC. If the user later wants an additional PVC, this will be assigned Logical Channel Number 2, and the SVC re-assigned to Logical Channel Number 3. It can be seen that complex modifications may be required at the DTE end if the user's network configuration changes.

The user may want to first plan for his network requirements (e.g. how many PVC's and SVC's initially, how many a year from now), then discuss the logical channel assignment aspect with his PTT representative. If allowed, he should reserve ranges of logical channels for future expansion. For example, reserve logical channels 1 to 15 for PVC's, even though only 5 are required.

- **LAP or LAPB?**

As discussed in the previous chapter, LAPB is superior to LAP. Therefore, choose LAPB if it is available.

Note that the link access procedure controls the operation of the physical access line. Therefore it is not possible to have some virtual circuits in a physical line operating under LAP and some under LAPB

However, MCH's using different link access procedures can coexist on the same NCP.

Although LAP and LAPB has only local significance (i.e. between a DTE and its associated DCE), for consistency and easier installation, it may be advisable to subscribe to only one link access procedure for the whole network. For example, if the PTT is phasing in LAPB, the user may want to delay using LAPB in his environment until that link access procedure is implemented and stabilized in all the PSDN nodes.

Note that in some PSDN's, e.g. Datapac, in addition to LAP and LAPB, the user can subscribe for an UNSET link access procedure. With the UNSET option, the network waits for an asynchronous response command (i.e. SARM, SABM or DM) from the DTE at link set up time to decide whether LAP or LAPB should be used. From the previous discussions, it is obvious that such option would provide the user with the most flexibility.

- **What Link Level (HDLC) frame window size?**

CCITT Recommendation X.25 specifies Modulo 8 frame sequence numbering. The Frame Window size therefore can range from 1 to 7. This parameter controls the maximum number of information frames that can be outstanding at any given time between a DTE and DCE for each direction of transmission.

For an error free access line, better throughput will be obtained for larger frame window sizes. For most PSDN's, the Frame Window Size is fixed at 7. For other networks it is a subscription parameter. The customer should check with his PTT representative.

In the X.25 NPSI manuals, this frame window size is referred to as MWINDOW.

- **What Packet Window size?**

Most PSDN's adapt Modulo 8 packet sequence numbering. In some PSDN's, e.g. KDD in Japan, Modulo 128 is used.

This sequence number is applicable for each logical channel and to each direction of transmission. The Packet Window defines the maximum number of consecutive data packets that are authorized to cross the DTE/DCE interface before an acknowledgement is received for a given logical channel.

The packet window size is independent of the frame window size. The Frame Window is essentially an error checking mechanism to ensure that information frames exchanged between the DTE and DCE are free of errors. The Packet Window, on the other hand, has end-to-end flow control implications for a virtual circuit. The Packet Window size required is dependent on the application (e.g. inquiry or data entry), data volume (e.g. number of packets transmitted in one direction before a packet is expected in the other direction in response) and the physical access line speed. A rough rule of thumb is to choose a Packet Window size of 3, 4 or 5 for physical access line speed of 2400 bps, 4800 bps and 9600 bps respectively for good performance, although this value could change depending on the situation (e.g. packet sizes). In most PSDN's, the default Packet Window size is 2, and is not a subscription parameter in many cases. The reason is that large packet window sizes will use up more buffer storage space in the network's intelligent nodes. If every virtual circuit asks for a large packet window size, then overall network performance can be adversely affected.

Starting in Release 2 of the X.25 NPSI, Modulo 128 packet sequence numbering is also supported. The user should check with the PTT and IBM representatives to see if an appropriate Packet Window size can be agreed upon.

In the usual case applying to most networks, the packet window rotation mechanism applies only locally between the DTE (subscriber) and the DCE (nearest node of the public PSDN). This is modified in some networks where end to end significance is a part of the network design (e.g. the Japanese KDD Network) and in others when the user sets the "D" bit to request delivery confirmation. Without end to end signif-

icance the network can (perhaps dynamically) decide how many packets to accept from a DTE before even the first is delivered to the DTE at the other end of the virtual circuit. It is possible for a network to accept hundreds of packets in this way with a window size as low as one. So there is a very direct link between the need for modulo 128 (and a large packet window size) and the scope of significance (local versus end to end).

It is occasionally suggested that an X.25 connection with modulo 128 would improve communications on satellite links. This is not true since the LAPB standard at the link level allows only modulo 8, therefore on a directly connected link (without a PSDN) there is no improvement in the link control to be gained by using modulo 128 at the packet level.

In the X.25 NPSI manuals, two operands (PKTMODL in the X25MCH macro and VWINDOW in the VCCPT macro) are associated with Packet Window. PKTMODL refers to the modulo scheme used for all the virtual circuits supported by the MCH link. VWINDOW refers to the Packet Window used for a particular virtual circuit. Different virtual circuits within an MCH can have different Packet Window sizes.

- **Use of D-bit?**

As mentioned in the X.25 NPSI General Information manual (GC30-3080), the D-bit can be used to confirm delivery of a packet to a remote DTE.

This mechanism is useful and supported only in an SNA-to-Non-SNA connection. For SNA-to-SNA communications, the end-to-end delivery confirmation is provided by SNA (e.g. Definite Response, Exception Response etc.).

- **Flow Control Parameter Negotiation Option?**

This optional user facility, if subscribed to, permits negotiation on a call basis of the flow control parameters, and is applicable to SVC's only. The flow control parameters considered are the packet and window sizes at the DTE/DCE interface for each direction of data transmission.

The word "Negotiation" is a part of the official CCITT name of this facility but is a little misleading in its implications. "Adaptation" would be a better word. What happens is that when an SVC is established the DTE and DCE agree on mutually acceptable packet and packet window sizes. There are two packet window sizes - one for each direction of flow (DTE to DCE and DCE to DTE). Care is needed in the use of this facility with the X.25 NPSI because it allows only one packet window size - the same in each direction.

This option, although desirable in cases where the user's requirement may vary from call to call, may not be available in all PSDN's. The user should consult his PTT representative.

- **If an SVC, is this going to be for one way incoming virtual calls only, or one way outgoing calls, or two way virtual calls?**

Normally, if the IBM X.25 NPSI licensed program is used, this can be controlled by the NCP. That is, in the X25VC or X25LINE macro that are used to define SVC's, the user can specify whether the virtual circuit is to be for one way incoming calls only (CALL=IN), outgoing calls only (CALL=OUT), or two way calls (CALL=INOUT). Therefore, an ordinary two-way switched virtual circuit is usually sufficient. However, if a Frontal NIA is used, order the channel according to requirement. Note that only 1 SVC can be associated with the Frontal NIA.

- **If an SVC, is this circuit going to belong to a closed user group?**

A Closed User Group (CUG) is intended to bar unauthorized access and provide better security. Switched logical channels not subscribing to the same user group will not be able to communicate with each other. This could create a problem if occasional outside access is required. CCITT defines within X.25 three kinds of CUG. One that is fully closed, a second that provides outgoing access and a third that provides incoming access. Some networks allow these variations. It is possible for one user to be a member of multiple CUGs. Use of CUG facilities is determined totally between the user and the network

administration. There are no generation considerations for the X.25 NPSI.

- **Reversed charging option for the SVC?**

This is a consideration if the remote locations do not have budget allocated for data communications expenses. On the other hand, the DP department would have better control of its own communications expenses if reversed charging is not allowed.

For some PSDN's, if dialup is used to access the PTT PAD, e.g. Datapac 3101, the usage charges will automatically be passed to the host system accessed. That is, the reversed charging option is used anyway.

For some PSDN's, there is a volume related tariff which applies to the subscription number and NOT to the VC being used. So that total billing on the network is less if all packets are charged to one subscription.

The X.25 NPSI licensed program will unconditionally accept reversed charging of incoming calls. The user must arrange to either accept or reject reverse charge calls with his PSDN at subscription time. Many PSDNs only allow a yes/no option for all VCs on a single physical circuit. Some PSDNs insist on reverse charging for all calls of a certain type. (For example some PSDNs insist that calls made from PAD devices connected to the network via a switched lines be reverse charged.) There is no standard, easy way of selectively accepting or rejecting reverse charge calls. In order to implement selective acceptance of reverse charging the user must implement the "DATE" function and provide a host (user written) application to decide which calls are to be accepted or rejected.

- **Is priority service required?**

This virtual call option is not included in Recommendation X.25, but is available in some PSDN's (e.g. Datapac).

This option assures that a priority packet will be transmitted before a normal packet if both packets are queued in a network node. Generally, the priority packet is allowed a smaller maximum length (e.g. in Datapac, priority packets are 128 bytes maximum compared to 256 bytes allowed for normal packets), and there is a premium charge associated with the service (e.g. 25% in Datapac).

This facility is supported in the X.25 NPSI for both outgoing and incoming calls. For incoming calls NPSI checks for high priority service requests and internally updates the packet length to 128 for the duration of the call. For outgoing calls the user specifies this facility in the "OPTFACL=" operand of the X25OFT macro. This must be associated to a VCCPT entry containing a maximum packet length specification of 128.

This facility should not be confused with the "throughput class" selection option available at network subscription time for some networks.

Unless a user's data can fit in comfortably in the smaller packet size (e.g. 1 data packet each way per inquiry/response), when taking flow control (e.g. packet window) into account, the user may not obtain better response time with priority services.

- **Default Throughput Class Assignment**

This is an optional facility supported by some networks. It provides for the selection (at network subscription time) of a default throughput class from a list of classes supported by the network. It is important because it can affect both the performance and (in some networks) the tariff. Its use at subscription time is transparent to the X.25 NPSI.

For example in Transpac (France) the throughput class for VCs is by default determined by the speed of the physical link to the network. It can also be a different value assigned at subscription time for all

VCs assigned to a physical circuit, or individually for PVCs. It can also be selected at call set up time using optional facility 2.

There is another option present in some networks that provides for "throughput class negotiation" at call setup time for SVCs. This option is NOT supported by the X.25 NPSI. (Though the user could achieve support through processing the CALL packets himself with the DATE facility.)

- **Packet Assembler and Disassembler (PAD) services?**

A PAD service is essentially a protocol conversion service. Internationally, Recommendations X.3/X.28/X.29 are the only set of PAD recommendations sponsored by CCITT. A different notation (e.g. NIM - Network Interface Machine, in Datapac) may be used in certain PSDN's.

X.3 defines a set of parameters that a PSDN's PAD must have in order to allow attachment of certain start/stop ASCII devices that are TTY 33/35 compatible. X.28 provides a profile for the setting of the X.3 control parameters. X.29 specifies certain minimum functions that a packet mode DTE (e.g. 3705 with NCP and X.25 NPSI) must have to interface with the PAD over an X.25 connection.

Starting in Release 2 of the X.25 NPSI licensed program, a PAD support function is provided. X.25 NPSI differentiates this support into two sub-function: Integrated PAD and Transparent, or non-standard, PAD. The Integrated PAD function supports a subset of CCITT Recommendation X.29. This means that an ASCII terminal which conforms with Recommendation X.28 can access an SNA host via an X.3 PAD and X.25 NPSI. The remote PAD is generally transparent to the host application program, and the host application program is not generally involved in the sending or receiving of PAD messages. With Transparent PAD support, however, although virtual circuit setup and take down is handled by X.25 NPSI, the host application is responsible for communicating with and controlling the remote PAD. That is, some additional user coding is required that is unique to such PAD control. Transparent PAD support is required for any PAD that does not obey the X.3/X.28/X.29 standards EXACTLY. Transparent PAD support may also be required to use with a standard X.3 PAD if the user wants to transmit X.29 pad messages (e.g. READ parameter) that are outside of the subset supported by the X.25 NPSI.

The user should first examine his terminal and connection requirements and decide whether it is viable to use a PAD service. For example, if a standard IBM subsystem (e.g. TSO or CICS/VS) is to be used with Integrated PAD support, depending on the terminal support available in the IBM subsystem, no modifications may be required. On the other hand, if connection is via the Transparent PAD support, then some substantial modification may be required in the IBM subsystem.

More discussion on this topic can be found in the "X.25 NPSI PAD Implementation Guide" (GG24-1569).

- **Fast Select or Datagram?**

Fast select is an X.25 facility which allows the inclusion of up to 128 bytes of data in the CALL Request packet and in the Clear packet. Thus a short transaction consisting of one packet of data followed by a one packet response can be carried out in a short call. (Three packets are actually required because a Clear Confirmation packet is sent after the Clear Indication packet.)

Datagrams are a different facility where a call (however short) is not set up. Packets using this facility include the destination DTE address and (optionally) the originating DTE address and are routed through the network based on these addresses.

Neither of these features is directly supported by the IBM X.25 interface products. However it is possible to use the "fast select" facility via the "DATE" function of the X.25 NPSI Program Product. In this case the user must write a "Communication and Transmission Control Program" (CTCP) in the System/370 host in order to process and route these transactions. It is not possible to use the "datagram" network facilities with X.25 NPSI.

PLANNING THE OVERALL SYSTEM.

The characteristics of a PSDN service (in terms of response as well as economics) are very different from those of the more traditional services. For example in some networks charges are heavily based on the volume of data sent and not on the distance travelled. (Though some networks have recently introduced distance as a factor in tariffs). Also the response times experienced at the terminal will be longer in general than if the terminal was directly connected on a leased line. If the user is setting up a large network these kinds of effect must be given detailed consideration.

- **Connections to the network.**

In the case of leased line attachment, it is common for many terminals at the same location to be multidropped from the same physical line (or even from the back of a single modem). In this case, provided the terminals obey the same link control procedures then they may be of different types.

With X.25 "Native Mode" terminals, each terminal at a given location must have its own leased, 4-wire, link (and modem) to the nearest PSDN Node. Usually, the user pays for this in the form of needing to buy one network subscription per terminal. The obvious user consideration here is perhaps to buy a larger controller (or small computer) such as an IBM 8100 which can control a wide diversity of different terminal types outboard and yet require only one link to the network.

- **Transit delays and distributed processing.**

Since trivial transactions (e.g. simple data entry) may experience longer network transit delays, (thus longer response times), it may be desirable for the user to process simple transactions locally without communication with the host until a batch has been prepared. Again a distributed processor such as an IBM 8100 or 4700 could offer a potential solution in many circumstances.

- **Data Compaction.**

Charges for network use are usually dependant upon the volume of data transmitted. In some countries it has been suggested that international data traffic will in the future be taxed on a volume basis. There are many ways to reduce the amount of data transmitted.

- Data compaction algorithms of varying complexity from the simple removal of blanks to complex encoding of character data can be used.
- Sending data in "internal" or "binary" form. This requires an intelligent node or terminal which knows the format of data sent and is able to decode it before presentation to the user.
- The pre-sending of screen formats (maps) to a controller which can then present them to the screen based on a command from the host.
- True distributed processing where the "controller" is in fact a small computer which does much of its simple processing locally.

In summary, in a leased private line environment, where the major cost was for the line and the modems etc., the economics of system design weighed heavily in favor of using simple terminals and doing everything possible in the host. ("If you have the line anyway, you might as well use it"). With volume sensitive tariffs such as commonly used with PSDNs, it may well be economical to use less communications and more distributed processing since the user is now able to send the small amount of essential data to the host. Full period private lines might no longer be needed.

- **Encryption.**

Many users are concerned with delivering sensitive data to a public network where the potential for miss-routing exists. There is a potential for illegally tapping a leased line but virtually no potential

for miss-routing. Many users are concerned at the data security exposure inherent in the shared facilities of a public network.

A need for encryption of data exists in many situations. However, simple link level encryption is not possible in the X.25 environment because the network headers in the data have to be read and understood by the network. Many IBM products (3270, 4700, VTAM etc) have the ability to encrypt the data portion only of an SNA PIU. If the user feels that security is a requirement, the use of these features is consistent with operation of the X.25 network and is recommended. Encryption of this kind brings an added benefit in that should even one bit of the message be corrupted by the network (or a packet lost or duplicated for example), the decryption process will fail and the error will be detected instantly.

NETWORK "CERTIFICATION".

It is a common belief that "X.25 is a standard and provided that everyone works to that standard everyone can communicate with everyone else". Utopia. Unfortunately the real world isn't always as simple as we would like to believe.

Despite the best intentions of the equipment designers, two pieces of equipment built in isolation from one another using the same standard often may not work together. That is not a reflection of the network implementers but one inherent in the life of any new standard - that small differences arise in interpretation.

To avoid problems of this nature, many network providers require successful completion of an "approval" process but some do not. The need for such approval varies throughout the world. The general name for this process is "network certification". When using the IBM X.25 NPSI software for the direct attachment of NON-IBM DTEs (terminals or CPUs) to the 3705, this kind of testing process may not have been carried out. This could also be the case if the user is attaching to a private X.25 network.

Even in the case where packet switching is not involved it is good practice when installing a complex network, to set up a simple test facility with a few terminals, controllers, 3705s etc. to make sure that everything works in one room before introducing geographic separations. When installing equipment on a network that hasn't been previously tested with the exact equipment types and software releases to be used, thorough testing is essential.

For X.25 testing a simple configuration should be set up in a location where every aspect can be examined and tested. It is essential in this environment to have a hardware link testing tool such as an IBM PT-2 or similar device.

The X.25 NPSI PP Diagnosis Reference manual has a set of very detailed state transfer diagrams and logic descriptions of the link level set up and operation. These can aid the user in finding any problems that occur in the initial test.

In order to conduct such a test the user will need at least one person who is highly skilled in communications and who knows the detail of X.25 very well. Also systems programming personnel will be needed. Such tests seldom take less than two months and often take much longer.

X.25 NPSI PRE-INSTALLATION PLANNING

Both Releases 2 and 3 are current releases. X.25 NPSI Release 2 is designed to operate with ACF/NCP/VSE Release 2.1, and X.25 NPSI Release 3 is designed for ACF/NCP/VSE Release 3. X.25 NPSI Release 3 includes additional enhancements (INN connection over an X.25 network and X.21 adapter support) over X.25 NPSI Release 2. Both Releases 2 and 3 include enhanced non-SNA support that is not available in Release 1. Users currently using Release 1 of X.25 NPSI should migrate to either Release 2 or 3 as soon as possible.

It is assumed that the user has at least reviewed the X.25 NPSI General Information manual (GC30-3080) and understands the functional capabilities of the licensed program before he begins the X.25 NPSI planning exercise.

The following table summarizes the support and functional capabilities of the various releases of the X.25 NPSI licensed program:

	Release 1 -----	Release 2 -----	Release 3 -----
Access Method Support			
ACF/VTAM V1R2	yes	yes	no
ACF/VTAM V1R3	yes	yes	yes
ACF/VTAM V2R1	yes	yes	yes
ACF/TCAM V2R2	yes	yes	no
ACF/TCAM V2R3	yes	yes	yes
ACF/TCAM V2R4	yes	yes	yes
NCP Prerequisite			
ACF/NCP/VS R2.1	yes	yes	no
ACF/NCP/VS R3	no	no	yes
Support Functions			
SNA (BNN)	yes	yes	yes
PCNE	yes	yes	yes
Integrated PAD	no	yes	yes
Transparent PAD	no	yes	yes
GATE	no	yes	yes
DATE	no	yes	yes
SNA (INN)	no	no	yes
Other Functions			
X.21 N/S Adapter	no	no	yes
Modulo 8 Pkt Seq	yes	yes	yes
LAP Support	yes	yes	yes
LAPB Support	yes	yes	yes
Modulo 128 Pkt Seq	no	yes	yes
D bit Support	no	Note 1	Note 1
Q bit Support	no	yes	yes
Flow Ctl Negotiation	no	yes	yes
Diag Pkt Support	no	yes	yes

Note 1. Only supported with PCNE.

These functional capabilities are described in detail in the X.25 NPSI General Information (GC30-3080) and Installation and Operation (SC30-3163) manuals.

The following is a summary of the hardware, software and storage requirements of X.25 NPSI:

- A 3705-II or 3705-80 with at least one type 2 or type 3 communications scanner.
- A full duplex lineset is required for each MCH link. For services up to 9600 bps, a 1H or 1D (with cable group 473) lineset can be used. For the 3705-80, the "EIA RS-232C/CCITT V.24 Line Attachment" can be used for physical access line speed up to 19.2K bps.

At higher speeds, the 1T, 1U, or, for the 3705-80, LS2 and LS3 can be used.

Note that available access speeds are determined by the PSDN. Some networks offer a maximum line access speed for their packet-switched service of up to 9600 bps only.

- NRZI encoding cannot be used. For a discussion of the considerations surrounding the absence of the NRZI option the user is referred to "Appendix A. NRZI - A Potential Trap." on page 71.
- A System/370, models 115 to 168, or a 4341, or a 3031/3032/3033/3081. The operating system can be DOS/VSE, OS/V51 or OS/V52 (MVS, MVS/SP or XA).
- SMP or MSHP.

The X.25 NPSI program must be applied through the use of the System Modification Program (SMP) Release 4 for the OS/VS system, or the MSHP (Maintain System History Program) for DOS/VSE.

- **Disk Storage.**

Approximately 130 tracks of 3330 disk storage is required for the X.25 NPSI libraries. This figure does not include storage for the optional source material. Of course the X.25 NPSI libraries need only be on line during X.25 NPSI and NCP generation and need not be available at other times. The active part of the X.25 NPSI product is included in the NCP load module which must be available whenever the 3705 is to be loaded.

- **3705 Storage**

Depending on the functions required, the X.25 NPSI code can take from 36K to 59K bytes of 3705 storage. Each MCH link requires approximately 1100 bytes. Each "Non-SNA" virtual circuit requires approximately 674 bytes. Each SNA virtual circuit takes 530 bytes plus normal NCP control block requirements which are dependent on the number of LU's associated with the PU. There is also an important consideration in that the total number of virtual circuits that can be supported in a single 3705 is limited by the availability on 3705 main storage below the 64k boundary. This effectively limits the user to a maximum of around 300 virtual circuits. This of course is not a serious limitation when communicating with SNA cluster controller devices. However since each NON-SNA (e.g. pad connected) device uses one virtual circuit, it may be that this 64k boundary limitation is the constraining factor in configuring the 3705. Note that other line protocols such as SDLC, BSC or SS when used in the same NCP as X.25 NPSI will require storage below 64k and thus reduce the number of attachable Virtual Circuits.

The user should consult his IBM representative if he wants to obtain a better picture of the 3705 storage requirements for his network.

- **Additional 3705 processor cycles are required to interface with X.25. A detailed path length consideration for the various types of connections are given in Chapter 3 of the X.25 NPSI General Information manual.**

- **NCP Level**

For OS/VS users, the ACF/NCP/VS R2.1 system must be at a level corresponding at least to the PUT tape 8111. For the ACF/NCP/VS R3, it must be at least at the PUT tape 8203 level. When installing a new release of X.25 NPSI or any new or changed release of NCP the user should consult his IBM Systems Engineer or Software Customer Engineer for accurate PTF and change level information. They are able to find this information in the "PSP" record of the IBM "Retain" system.

X.25 NPSI ORDERING

The basic machine readable material for X.25 NPSI is distributed on magnetic tapes. To place the order, the user should supply the IBM representative with the following information:

- **The release level of the licensed program.**

Remember that Release 2 operates with ACF/NCP/VS R2.1, and Release 3 with ACF/NCP/VS R3. The release level, therefore, should be in accordance with the ACF/NCP/VS release level to be used in the 3705.

- **The operating system used to install the X.25 NPSI.**

A different distribution tape is provided for OS/VS and DOS/VSE customers, since either SMP or MSHP will be used, and different PTF's may be required.

- **Density of the tape.**

The distribution tape can be specified for either 9 track 1600 or 6250 bpi.

- Licensed optional machine readable material.

Let the IBM representative know if the X.25 NPSI source code is required.

- Licensed documentation.

One copy of the documentation for the product including licensed documentation is provided with the X.25 NPSI program. Additional copies will need to be ordered from your IBM representative.

OTHER INTERFACE PRODUCTS

The other end of the X.25 NPSI connection can be another 3705 equipped with the X.25 NPSI licensed program, an SNA cluster attached to a Remote NIA, a non-SNA terminal attached to a PTT PAD service, or a native X.25 equipment.

Whatever the terminal device, access line and logical channel planning and ordering has to be done.

If the device is an IBM X.25 interface special engineered or RPQ device, then delivery can take some time. The customer should advise his IBM representation to submit a Request for Price Quotation (RPQ) for the interface product as soon as possible. A transmittal and reference number will be returned with the approval for the RPQ which the IBM representative can use for ordering the interface product.

CHAPTER 5. INSTALLATION

The discussions here will be mainly concerned with an OS/VS environment. DOS/VSE users will be using MSHP to install the X.25 NPSI licensed program. The instructions in the Program Directory that is distributed with the X.25 NPSI program tape should be followed carefully.

PTF'S

The user should first review the Program Directory that comes with the X.25 NPSI program tape. The Program Directory provides detailed information on the installation procedures, the pre-requisite PTF's, dataset storage requirements and sample JCL.

One of the first tasks for the user is to ensure that all the mandatory PTF's are already installed. It may also be worthwhile to ask the IBM PSR (Program Service Representative) to browse the IBM RETAIN/370 system and see if additional PTF's (i.e. in addition to those mentioned in the Program Directory) are required. These can be found in the "PSP" entry.

The following is a recount of the pre-requisite PTF's as mentioned in the Program Directories for the two current releases:-

NPSI R2 PTF's

- **NCP Mandatory PTF's:**

APAR	PTF	PUT Tape
----	---	-----
	UR02311	8201

- **NCP Recommended PTF's:**

APAR	PTF	PUT Tape
----	---	-----
IR15915	UR90035	8201
IR16352	UR03062	*
IR17291	UR03100	*
IR16152	UR02627	*
IR16152	UR02628	*

* Note: The identified PTF's have not been included in a PUT tape at the time of writing this document, but can be obtained from your IBM Support Centre.

It is recommended that PTF UR90035 should be included. With this PTF, the NCP IFLDUMP utility program can be used to print a formatted NCP dump that includes all the X.25 control blocks. This will greatly facilitate error diagnosis in case of problems.

NPSI R3 PTF's

- **NCP Mandatory PTF's:**

APAR	PTF	PUT Tape
----	---	-----
IR15861	UR02454	8205
IR15707	UR02868	8207
IR17097	UR03026	8205
IR17340	UR03088	8205
IR17670		NOTE 1

• **NCP Recommended PTF's:**

APAR	PTF	PUT Tape
IR16152	UR02630	8205
IR16152	UR02631	8205
IR16352	UR03063	8205
IR17715	UR03101	8205
IR20155		NOTE 1

* Note: The identified PTF's have not been included in a PUT tape at the time of writing this document, but can be obtained from your IBM Support Centre.

NOTE 1: The PTF corresponding to this APAR is not known at the time of the edition of this manual, but the corresponding fix can be obtained from your IBM Support Centre.

The user must ensure that the mandatory NCP PTFs are included in his system, and optionally include the Recommended NCP PTF's if they apply to his environment. A description of each of the PTF's is provided in the X.25 NPSI Program Directory.

Retain PSP Entry.

The following is an example of the current PSP entry from the IBM RETAIN/370 system at the time of writing this document. It can be seen that the information provided above is here provided again in a different form.

```

*****
* REL 2 OS UPGRADE=X.25 NPSI120 SUBSET=JXX1200 *
*****
SYSTEM BASIS: ACF/NCP/V5 V1 R2.1 UP TO PUT TAPE 8111 INCLUDED
-----
- PTF # - APAR # - PE - PE APAR # - PUT TAPE # - RCOMP ID - NOTE-
-----
- UR90035 - IR15915 - n - na - 8201 - 5744AN100 - -
- UR02311 - IR15750 - n - na - 8201 - 5744AN100 - -
- UR03436 - IR19808 - n - na - dll - 5744AN100 - -
- UR03062 - IR16352 - n - na - dll - 5735SC300 - 1 -
- UR03100 - IR17291 - n - na - dll - 5744AN100 - 2 -
- UR02627 - IR16152 - n - na - dll - 5744AN100 - 3 -
- UR02628 - IR16152 - n - na - dll - 5744AN100 - 4 -
- UR03346 - IR17353 - n - na - - 5744AN100 - 5 -
-----

```

- NOTE 1: REFER TO THE CORRESPONDING COVER LETTER WHEN ACF/VTAM OR ACF/TCAM IS GENERATED WITH NCCF/NPDA FACILITY.
- NOTE 2: IN PEP ENVIRONMENT ONLY
- NOTE 3: IN PEP ENVIRONMENT ONLY AND PREREQUISITE TO PTF# UR03100
- NOTE 4: IN PEP ENVIRONMENT ONLY AND PREREQUISITE TO PTF# UR02627
- NOTE 5: REFER TO COREQUISITE APAR: IR17471

```

*****
* REL 3 OS UPGRADE=X.25 NPSI130 SUBSET=JXX1300 *
*****
SYSTEM BASIS: ACF/NCP/V5 V1 R3 UP TO PUT TAPE 8203 INCLUDED
-----
- PTF # - APAR # - PE - PE APAR # - PUT TAPE # - RCOMP ID - NOTE-
-----
- UR02454 - IR15861 - n - na - 8205 - 5735SC300 - -
- UR03026 - IR17097 - n - na - 8205 - 5735SC300 - -
- UR03088 - IR17340 - n - na - 8205 - 5735SC300 - -
- UR03063 - IR16352 - n - na - 8205 - 5735SC300 - 1 -
- UR03101 - IR17715 - n - na - 8205 - 5744AN100 - 2 -
- UR02630 - IR16152 - n - na - 8205 - 5744AN100 - 3 -
- UR02631 - IR16152 - n - na - 8205 - 5744AN100 - 3 -
- UR02868 - IR15707 - n - na - 8207 - 5735SC300 - -
- UR03437 - IR19808 - n - na - DLL - 5735SC300 - -
- - IR17670 - - - DLL - 5735SC300 - 4 -
-----

```

```

- - IR20155 - - - - - 5744AN100 - - -
- - IR21289 - - - - - 5744AN100 - - -
- UR03347 - IR17353 - n - na - - - 5744AN100 - 5 -
-----

```

NOTE 1: REFER TO THE CORRESPONDING COVER LETTER WHEN ACF/VTAM OR ACF/TCAM IS GENERATED WITH NCCF/NPDA FACILITY.
NOTE 2: IN PEP ENVIRONMENT ONLY
NOTE 3: IN PEP ENVIRONMENT ONLY AND PREREQUISITE TO PTF# UR03101
NOTE 4: THIS FIX CAN BE FROM DLL UNDER THE NAME CR17670
NOTE 5: REFER TO COREQUISITE APAR: IR17471

X.25 NPSI MODULES

There are three main datasets in the X.25 NPSI licensed program:

- GEN3705X which contains the X.25 macros to be used in the X.25 Stage 1 generation.
- MAC3705X which contains the macros to be used in Step 1 of the NCP Stage 2 generation, and
- OBJ3705X which contains the preassembled X.25 NPSI modules to be included in the NCP Stage 2 linkage editing step that produces the NCP load module.

The 3330 disk storage space required for the three libraries are as follows:

<u>Library Name</u>	<u>Space (Tracks)</u>	<u>Directory Blocks</u>
GEN3705X	38	3
MAC3705X	57	3
OBJ3705X	38	5

The first step, therefore, in the X.25 NPSI installation is to allocate sufficient PDS storage space. The user can either use the TSO dataset utility function for the allocation, or submit a utility job similar to the following.

Note in the following JCL that although UNIT=SYSDA is specified the real device used was a 3330.

```

COL-----1-----2-----3-----4-----5-----6-----
//WTCRES9D JOB , 'WTCRES9',MSGCLASS=A,MSGLEVEL=(1,1),TIME=1440,
//          CLASS=A,NOTIFY=WTCRES9
//*****
//* ALLOCATE X25 NPSI R2 DATA SETS *
//*****
//ROUTE PRINT RDPD3MVS.RMT99
//CREATE EXEC PGM=IEHPROGM
//SYSPRINT DD SYSOUT=*
//NCPLIB DD UNIT=SYSDA,VOL=SER=NCPLIB,DISP=OLD
//GEN3705X DD DSN=NCP715.GEN3705X,DISP=(NEW,CATLG),UNIT=SYSDA,
//          VOL=SER=NCPLIB,SPACE=(CYL,(2,1,10)),CONTIG),
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=3120)
//MAC3705X DD DSN=NCP715.MAC3705X,DISP=(NEW,CATLG),UNIT=SYSDA,
//          VOL=SER=NCPLIB,SPACE=(CYL,(3,1,10)),CONTIG),
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=3120)
//OBJ3705X DD DSN=NCP715.OBJ3705X,DISP=(NEW,CATLG),UNIT=SYSDA,
//          VOL=SER=NCPLIB,SPACE=(CYL,(2,1,10)),CONTIG),
//          DCB=(RECFM=U,LRECL=0,BLKSIZE=6400)
//

```

NOTE that the X.25 datasets GEN3705X and MAC3705X need to concatenated with the NCP datasets GEN3705 and MAC3705 during the generation process, and that their physical BLKSIZE's must follow the usual concatenation rules. (It is good practice to make them the same).

SMP INSTALL

The X.25 NPSI licensed program must be applied through the use of the System Modification Program (SMP) Release 4. Additional information regarding the use of SMP can be found in the OS/VS System Modification Program (SMP) System Programmer's Guide (Form Number GC28-0673).

There are 3 files in the basic X.25 NPSI tape distributed by the IBM Program Library. The volume serial for the tape is JXX120 for NPSI R2 and JXX130 for NPSI R3. File 1 contains the SMP modification control statements (SMPMCS) in a RELFILE format which will be used by the SMP Receive job. Files 2 and 3 contain the IEBCOPY unloaded partitioned data sets (JXX1200.F1 and JXX1200.F2 for R2) or (JXX1300.F1 and JXX1300.F2 for R3) which SMP will process.

The following are sample job streams for the SMP Receive, Apply and Accept steps that the user must execute to install the X.25 NPSI program:

1. SMP Receive

```
COL-----+-----1-----+-----2-----+-----3-----+-----4-----+-----5-----+-----6-----
//WTCRES9R JOB , 'WTCRES9',MSGCLASS=A,MSGLEVEL=(1,1),TIME=1440,
//          CLASS=D,NOTIFY=WTCRES9,REGION=2500K
//*****
// * RECEIVE X25 NPSI R2 TAPE *
//*****
//ROUTE PRINT RDPD3MVS.RMT99
//SMPREC EXEC PGM=HMASMP
//SMPOUT DD SYSOUT=*
//SMRPT DD SYSOUT=*
//SMPLIST DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SMPLOG DD DUMMY
//SMPPTS DD DSN=NCP715.SMPPTS,DISP=OLD
//SMPPTFIN DD DSN=SMPMCS,DISP=(OLD,PASS),UNIT=TAPE,
//          VOL=SER=JXX120,LABEL=(,SL),
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=8000)
//SMPTLIB DD DISP=OLD,UNIT=SYSDA,VOL=SER=NCPLIB
//SYSUT1 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
//        SPACE=(CYL,(10,1))
//SYSUT2 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
//        SPACE=(CYL,(10,1))
//SYSUT3 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
//        SPACE=(CYL,(10,1))
//SMPCNTL DD *
RECEIVE.
//
```

Note that the SMP control statements must terminate with a period (.). Spaces are allowed between the control keyword and period. Missing periods (.) will raise a completion code of 16 indicating incomplete control statements.

If the user's NCP SMP data sets and all pre-requisite PTF's are in place properly, this Receive step should finish with a completion code of 0.

2. SMP Apply

```

COL-----+-----1-----+-----2-----+-----3-----+-----4-----+-----5-----+-----6-----
//WTCRES9A JOB , 'WTCRES9',MSGCLASS=A,MSGLEVEL=(1,1),TIME=1440,
//          CLASS=D,NOTIFY=WTCRES9,REGION=2500K
//*****
//* APPLY X25 NPSI R2 PROCESS *
//*****
//ROUTE PRINT RDPD3MVS.RMT99
//SMPAPP EXEC PGM=HMASMP,PARM='DATE=U'
//SMPOUT DD SYSOUT=*
//SMPLIST DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SMPLOG DD DUMMY
//GEN3705X DD DSN=NCP715.GEN3705X,DISP=OLD
//MAC3705X DD DSN=NCP715.MAC3705X,DISP=OLD
//OBJ3705X DD DSN=NCP715.OBJ3705X,DISP=OLD
//SMPSTS DD DSN=NCP715.SMPSTS,DISP=OLD
//SMPPTS DD DSN=NCP715.SMPPTS,DISP=OLD
//SMPSCDS DD DSN=NCP715.SMPSCDS,DISP=OLD
//SMPCRQ DD DSN=NCP715.SMPCRQ,DISP=OLD
//SMPMTS DD DSN=NCP715.SMPMTS,DISP=OLD
//SMPSCDS DD DSN=NCP715.SMPSCDS,DISP=OLD
//SYSLIB DD DSN=NCP715.SMPMTS,DISP=OLD
// DD DSN=NCP715.GEN3705X,DISP=OLD
// DD DSN=NCP715.MAC3705X,DISP=OLD
//SMPTLIB DD DSN=NCP715.SMPTLIB,
// DISP=OLD,UNIT=SYSDA,VOL=SER=NCPLIB
//SYSUT1 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1))
//SYSUT2 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1))
//SYSUT3 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1))
//SMPWRK1 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1,5))
//SMPWRK2 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1,5))
//SMPWRK3 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1,5))
//SMPWRK4 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1,5))
//SMPWRK5 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(20,1,20))
//SMPCNTL DD *
// APPLY S(JXX1200).
//

```

A completion code 4 is acceptable.

If the user is migrating from X.25 NPSI Release 1 to Release 2, the Release 1 data sets (JXX1100) will be deleted as the Release 2 data sets are applied.

The SMP APPLY job step does not update any system libraries. The NPSI macros are copied into the SMP temporary data set NCP715.SMPMTS from the SMPTLIB data sets which were created during the SMP RECEIVE step. From this statement one can conclude that the NPSI generations are not possible until the SMP ACCEPT job has been successfully executed. Therefore it is feasible to only run the SMP RECEIVE and ACCEPT (no APPLY) jobs to install the NPSI program product.

3. SMP Accept

```
COL-----1-----2-----3-----4-----5-----6-----
//WTCRES9C JOB , 'WTCRES9',MSGCLASS=A,MSGLEVEL=(1,1),TIME=1440,
// CLASS=D,NOTIFY=WTCRES9,REGION=2500K
//*****
//* ACCEPT X25 NPSI R2 PROCESS *
//*****
//ROUTE PRINT RDPD3MVS.RMT99
//SMPACC EXEC PGM=HMASMP,PARM='DATE=U'
//SMPOUT DD SYSOUT=*
//SMRPT DD SYSOUT=*
//SMPLIST DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SMPLOG DD DUMMY
//GEN3705X DD DSN=NCP715.GEN3705X,DISP=OLD
//MAC3705X DD DSN=NCP715.MAC3705X,DISP=OLD
//OBJ3705X DD DSN=NCP715.OBJ3705X,DISP=OLD
//SMPSTS DD DSN=NCP715.SMPSTS,DISP=OLD
//SMPPTS DD DSN=NCP715.SMPPTS,DISP=OLD
//SMPACDS DD DSN=NCP715.SMPACDS,DISP=OLD
//SMPSCDS DD DSN=NCP715.SMPSCDS,DISP=OLD
//SMPACRQ DD DSN=NCP715.SMPACRQ,DISP=OLD
//SMPMTS DD DSN=NCP715.SMPMTS,DISP=OLD
//SMPSCDS DD DSN=NCP715.SMPSCDS,DISP=OLD
//SYSLIB DD DSN=NCP715.SMPMTS,DISP=OLD
// DD DSN=NCP715.MAC3705X,DISP=OLD
//SMPTLIB DD DSN=NCP715.SMPTLIB,
// DISP=OLD,UNIT=SYSDA,VOL=SER=NCPLIB
//SYSUT1 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1))
//SYSUT2 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1))
//SYSUT3 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1))
//SMPWRK1 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1,5))
//SMPWRK2 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1,5))
//SMPWRK3 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1,5))
//SMPWRK4 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1,5))
//SMPCNTL DD *
// ACCEPT S(JXX1200) APARS DIS(WRITE) NOAPPLY.
//
```

This step should end with a completion code of 0.

If the user is migrating from Release 1 to Release 2 messages will appear to indicate that the Release 1 (JXX1100) macros and object modules have been deleted.

A successful ACCEPT step indicates that the X.25 NPSI installation has been completed. The user can then proceed to perform his X.25 and NCP generations.

PTF APPLICATION

The following job stream can be used to apply a PTF to the NCP or X.25 NPSI licensed programs:

```
COL-----1-----2-----3-----4-----5-----6-----
//WTCRES9P JOB , 'WTCRES9',MSGCLASS=A,MSGLEVEL=(1,1),TIME=1440,
// CLASS=A,NOTIFY=WTCRES9,REGION=2500K
//*****
//* SMP JCL FOR PTF APPLICATION *
//*****
//ROUTE PRINT RDPD3MVS.RMT99
//SMPPTF EXEC PGM=HMASMP,PARM='DATE=U'
//STEPLIB DD DSN=SYS1.LINKLIB,DISP=SHR
```

```

//SMPOUT DD SYSOUT=*
//SMRPT DD SYSOUT=*
//SMPLIST DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SMPLOG DD DUMMY
//GEN3705X DD DSN=NCP715.GEN3705X,DISP=OLD
//MAC3705X DD DSN=NCP715.MAC3705X,DISP=OLD
//OBJ3705X DD DSN=NCP715.OBJ3705X,DISP=OLD
//GEN3705 DD DSN=NCP715.GEN3705,DISP=OLD
//MAC3705 DD DSN=NCP715.MAC3705,DISP=OLD
//OBJ3705 DD DSN=NCP715.OBJ3705,DISP=OLD
//LOAD DD DSN=NCP715.LOAD,DISP=OLD
//SSPLIB DD DSN=NCP715.SSPLIB,DISP=OLD
//SSPOBJ DD DSN=NCP715.SSPOBJ,DISP=OLD
//SMPSTS DD DSN=NCP715.SMPSTS,DISP=OLD
//SMPPTS DD DSN=NCP715.SMPPTS,DISP=OLD
//SMPACDS DD DSN=NCP715.SMPACDS,DISP=OLD
//SMPSCDS DD DSN=NCP715.SMPSCDS,DISP=OLD
//SMPACRQ DD DSN=NCP715.SMPACRQ,DISP=OLD
//SMPCRQ DD DSN=NCP715.SMPCRQ,DISP=OLD
//SMPMTS DD DSN=NCP715.SMPMTS,DISP=OLD
//SMPSCDS DD DSN=NCP715.SMPSCDS,DISP=OLD
//SYSLIB DD DSN=NCP715.SYSLIB,DISP=OLD
//SMPTLIB DD DSN=NCP715.SMPTLIB,
// DISP=OLD,UNIT=SYSDA,VOL=SER=NCPLIB
//SYSUT1 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=TPOSP1,
// SPACE=(CYL,(10,1))
//SYSUT2 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=TPOSP1,
// SPACE=(CYL,(10,1))
//SYSUT3 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=TPOSP1,
// SPACE=(CYL,(10,1))
//SMPWRK1 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=NCPLIB,
// SPACE=(CYL,(10,1,5))
//SMPWRK2 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=TPOSP1,
// SPACE=(CYL,(10,1,5))
//SMPWRK3 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=TPOSP1,
// SPACE=(CYL,(10,1,5))
//SMPWRK4 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=TPOSP1,
// SPACE=(CYL,(10,1,5))
//SMPWRK5 DD DISP=(,DELETE),UNIT=SYSDA,VOL=SER=TPOSP1,
// SPACE=(CYL,(10,1,5))
//SMPPTFIN DD DSN=NCP715.PTFS(UR90035),DISP=SHR
//SMPCNTL DD *
RECEIVE S(UR90035) .
APPLY S(UR90035) .
ACCEPT S(UR90035) DIS (WRITE) .
//

```

In this example, the NCP formatted dump PTF (UR90035) was first copied into a partitioned data set (SMPPTFIN DD statement).

CHAPTER 6. GENERATION PROCEDURE

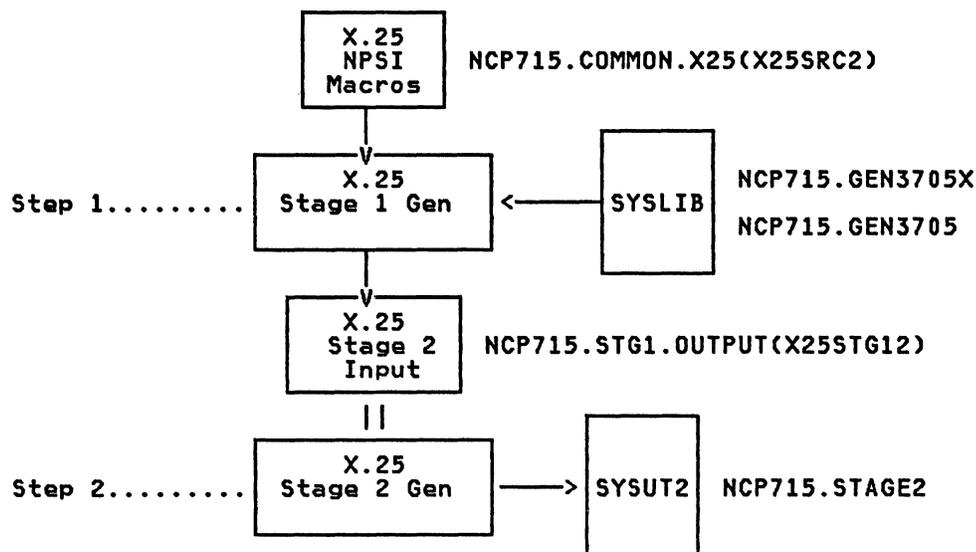
Assuming that the X.25 NPSI files have been loaded successfully into the system, the user is ready to generate the NCP for attachment to the PSDN.

There are two generation procedures involved:

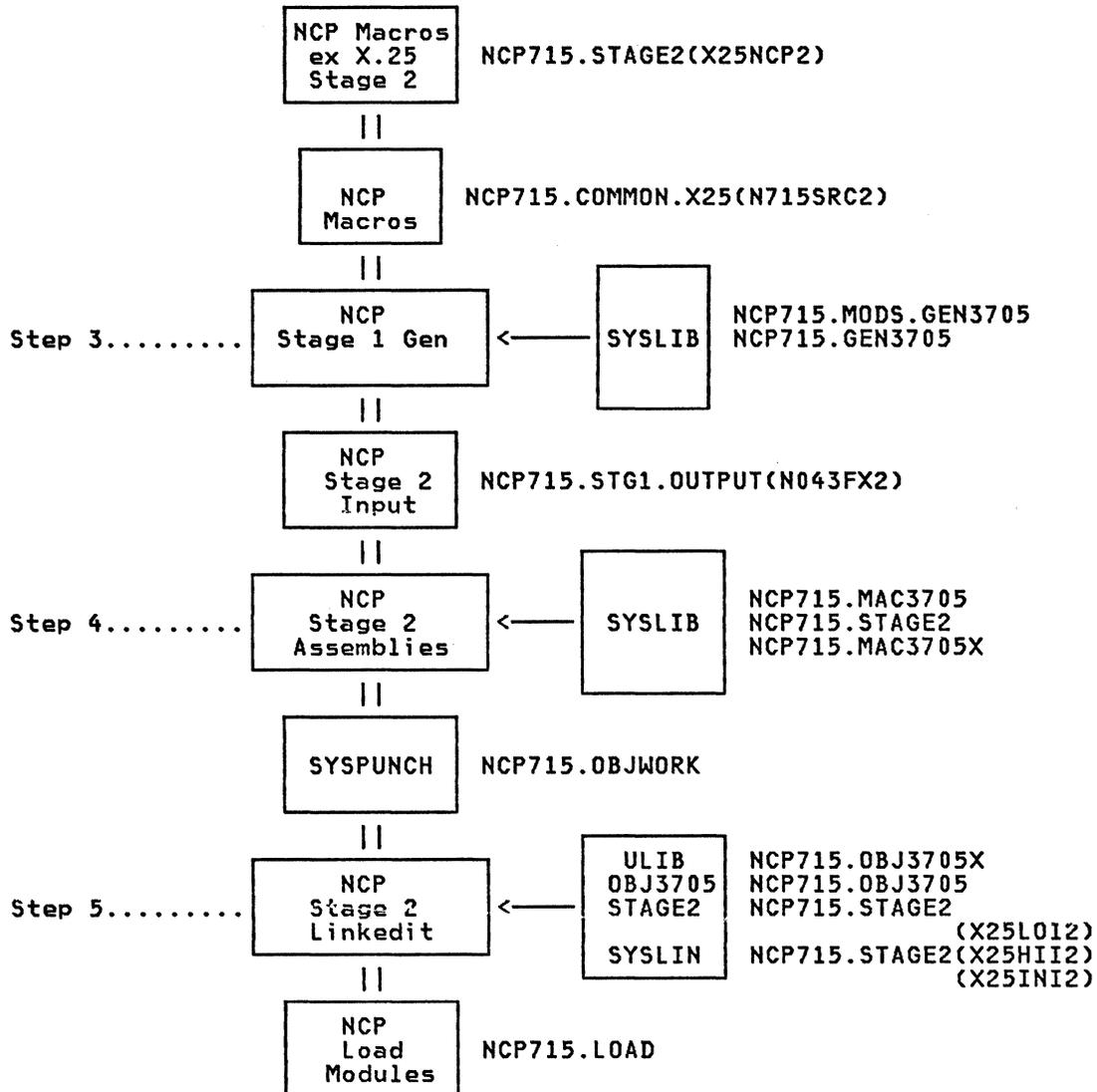
- a pre-NCP generation procedure or X.25 Gen, and
- the NCP generation.

The discussion here is concerned with how these procedures are generally applicable to a user's packet-switched environment. There will be more detailed discussions on the various X.25 and NCP macros and how their specifications can affect the user's network performance in other follow-on IBM Raleigh Systems Centre X.25 manuals (e.g. X.25 SNA Guide).

The following figure provides an overview of the process. The data set and PDS member names referenced are those used in the examples.



Summary of Generation Process (1 of 2)



Summary of Generation Process (2 of 2)

X.25 GEN

The X.25 Gen procedure is the first step used to define the user's environment for attachment to the packet-switched network. There are three steps involved in an X.25 generation:

1. use the X.25 NPSI macros to describe the user's X.25 network environment, i.e. the type of PSDN, the X.25 access lines, subscribed facilities, virtual circuits and terminal/cluster configuration;
2. perform an X.25 Stage 1 Generation to:
 - assemble the source macros and prepare a job stream for the X.25 Stage 2 step,
 - define the NPSI macros used in the NCP Stage 2 Gen to build the X.25 user control blocks and tables,
 - prepare control statements to include the appropriate pre-assembled X.25 NPSI modules in the NCP, and

- convert the X.25 macros describing the user's X.25 network to normal NCP macros;
3. do an X.25 Stage 2 Gen to place the output of the X.25 Stage 1 Gen into a PDS for later use by the NCP Generation process. This will become a number of distinct members in the PDS.

X.25 Macro Instructions

A new set of macro instructions is provided by the X.25 NPSI for the user to describe his X.25 attachment environment.

The following section "X.25 Network Definition Sample" on page 42 has an example of an X.25 network definition with three MCH's. The First MCH has 4 PVC's and 3 SVC's, the Second MCH has 1 PVC, and the Third MCH has 1 SVC.

The coding rules for the X.25 macros are the same as those for NCP macros: e.g. all continuations must be preceded by a non-blank character in column 72 and start on column 16.

The X.25 macros are described in the X.25 NPSI Installation and Operations Manual (SC30-3163). It is worthwhile to note the hierarchical sequence of the X.25 macros again:

X25BUILD

X25NET	One for each network
X25VCCPT	One for each filled VCCPT entry
X25OUFT	One for each filled OUFT entry
X25MCH	One per MCH link
X25LCG	One per logical channel group in MCH
X25VC	One per group of virtual circuits with similar characteristics
or	
X25LINE	One per virtual circuit
X25PU	One per virtual circuit
X25LU	As per virtual circuit reqm't. (At least one per PVC.)
GENEND	Not required if X.25 NPSI not coexisting in NCP with other software using the NCP Customization facility
X25END	

The following discussion is meant to provide supplemental background information to assist the user in coding the macros. The X.25 macros will be presented here in their hierarchical sequence as opposed to the description in the X.25 NPSI Installation and Operations manual where the macros are given in alphabetical sequence.

The X25BUILD macro starts the generation process of the X.25 control blocks. It is used to define the user environment and system related generation options.

The new operand for R2 and R3 is IDNUMH.

The X.25 NPSI manual suggests that the NCP macro statements and link edit control statements generated in the X.25 gen should be stored in a working library different from the NCP715.MAC3705X library. The reason probably is to avoid cluttering the macro library, or inadvertently replacing an X.25 macro. The QUALIFY and MACLIB operands are used to produce DD statements for the X.25 Stage 2 gen.

The SRCHI and SRCL0 operands when coded provide unique member names for the generated NCP macros for the csects \$SRCL0 and \$SRCHI in the X.25 Stage 2 gen output PDS. See the section "Unique Generation Naming" on page 67 for a method where these operands may be used to provide names for multiple generations of different configurations.

The MCHCNT operand specifies the number of MCH links to be used in the 3705. The user may wish to anticipate his network

requirements by specifying a large enough number of MCH's with ISTATUS=INACTIVE and gradually activating these links as physical circuits are installed.

The JOBCARD operand is used to specify whether the X.25 Stage 2 gen is to consist of a single job or a job stream with multiple jobs. Since the X.25 Stage 2 is simply a utility step to copy the output from the Stage 1 into the working library, JOBCARD=YES or NO will help to simplify the Stage 2 gen. Refer to "X.25 Stage 1 Gen" on page 48 for a method on how to tailor the X.25 Stage 2 Gen jobcard to an installation standard.

The X25NET macro is used to specify the PSDN (e.g. Transpac or Datapac) attachment, and what kind of provisions are to be allowed for virtual circuit connections.

The operand DM=YES/NO is new. As mentioned in the X.25 NPSI Installation and Operations manual, the Disconnected Mode (DM) response applies to MCH's operating under LAPB and may not be supported by all PSDN's. The user should consult his PTT representative regarding the coding of this operand.

In particular, the question to ask is whether the network sends a DISC (Disconnect) command as part on the link startup procedure and whether a DM response is acceptable. If the network is expecting an UA (Unnumbered Acknowledgement) response under any circumstance, then DM=NO must be coded. Otherwise this could create a timeout problem at the MCH. As a result, the user will find that he cannot activate the MCH PU.

Note that this is a mandatory operand. No default values will be supplied.

In R2 and R3, the user can only specify NETTYPE as either 1 or 2. However, this should not cause any migration problems as NETTYPE=3 to 6 are reserved in R1. The Installation and Operation manual provides guidelines as to the differences between Network Types 1 and 2 for the NETTYPE operand.

The NETTYPE and DM operands identify different networks to the X.25 NPSI. Special care must be taken in specifying the details for these operands.

The X25VCCPT macro describes the various connection parameters that can be used in the network.

It is possible to have different virtual circuits in the user's network to operate with different maximum packet and window sizes. For example, in a "call out" situation, it is possible for a virtual circuit to operate in the priority mode in Datapac and use the smaller 128 byte packet instead of the regular 256 byte packet size. Note that for some PSDN's, such as Datapac, the packet window (VWINDOW) size is subscription dependent and cannot be changed dynamically.

The X25OUFT macro is used to specify what user facilities are to be chosen at call setup time (e.g. collect call, closed user group). This facility applies to outgoing calls only. It is required only if SVC's are used in the customer's network. This macro also allows a user to insert information into the "Call User Data" field in the Call Request packet.

For some networks, e.g. Datapac, the user facility can only be asked for in a call setup if the option is included in the user's subscription. The more commonly used facility codes and parameters are as follows:

Optional Facility	Code	Parameter
Closed User Group	03	Provided by carrier
Reverse Charging	01	bit 0 = 0 not requested = 1 facility requested
High Priority Class	01	bit 1 = 0 not requested = 1 facility requested

The facility parameter field actually signifies what facilities are requested. For example, a facility code of 01 and a facili-

ty parameter field of 03 would indicate that the DTE is requesting a reversed charge call with a high priority class of traffic.

The USERFIL2 operand is new for R2 and R3. The USEFILD and USERFIL2 operands can be used to insert Call User Data in the Call Request packet for outgoing calls. Information supplied in USERFIL2 is appended to the those specified in USEFILD to make up the Call User Data field. The format and use of the Call User Data field is determined by bits 0 and 1 of the first byte (sometimes referred to as the Protocol Identifier) of this field. (These bits are called by the CCITT bits 8 and 7 of the first "octet") If bits 0 and 1 of the first byte are:

'00' a portion of the Call User Data field is used for protocol identification in accordance with CCITT Recommendation X.29.

'01' a portion of the Call User Data field may be used for protocol identification in accordance with PTT network specifications. (e.g. '0100 0111' identifies to the TCTS network intelligent node that the Datapac 3303 service is used and the User Data field contains information on physical properties of the attached device.)

'10' a portion of the Call User Data field may be used for protocol identification in accordance with specifications of international user bodies such as ISO.

'11' no constraints are placed on the use by the DTE/DCE. This is usually used to provide information to a DTE's higher level architecture.

In IBM's implementation of X.25 support, bit 6 is used together with bits 0 and 1 in the first byte of the Call User Data (CUD) field to identify different connection environments:

'0' is for SNA-to-NON SNA connection, and
'1' is for SNA-to-SNA connection.

Thus,

- X'C0' is for Type 0 virtual circuits (PCNE).
- X'C2' is for Type 2 virtual circuits (PSH).
- X'C3' is for Type 3 virtual circuits (QLLC).
- X'C4' is for Type 4 virtual circuits (GATE).
- B'pp00 0001' (where pp not=11) represents type 5 virtual circuits (PAD or Transparent Pad). Therefore byte 0 (i.e. first byte) of the CUD field for integrated pad must equal X'01', X'41' or X'81' for Type 5 virtual circuits.

Note that this first octet in the Call User Data field will be supplied automatically by the X.25 NPSI in the outgoing Call Request packet. (Except when using the "DATE" facility where the user must build his own Call Request packet.) The protocol identifier will be according to the LLC specification in the DIALNO operand of the PATH macro. This will be followed by the concatenated USRFILD and USRFIL2 values.

As specified in X.25, "users are cautioned that if bits 8 and 7 of the first octet of the Call User Data field have any value other than 11, a protocol may be identified that is implemented within some public data network."

It is possible to have more connection parameters (i.e. X25VCCPT) and user facilities (i.e. X25OUFT) defined than the number that will be actually used. Make sure that the maximum number of entries are defined by the CPHINDX and OUHINDX operands in the X25NET macro.

The X25MCH macro defines the characteristics of a multichannel link. Note that it requires a full duplex lineset address, and needs to be connected to a type 2 or 3 communications scanner.

New operands for releases 2 and 3 are, ANS, DBIT, GATE, LCN0, LLCLIST, NDRETRY, NPRETRY, PAD, PKTMODL, TPTIMER and TDTIMER. Operands from R1 not supported by R2 and R3 are, RETRYCT and RETRYT0. These will have to be removed from the X.25 macro definitions before generating with the new releases. The NRZI operand is no longer required. If specified, this will be ignored in the X.25 Gen.

The changes reflect some of the new functions announced with releases 2 and 3 of the X.25 NPSI program product. These new functions are summarized in a table in the section "X.25 NPSI Pre-installation Planning" on page 20.

LCN0 (note the zero) is a new operand and specifies to NPSI whether the PSDN uses logical channel number 0 (zero) of logical group 0 (zero) as a virtual circuit. This operand is tied to the NETTYPE operand of the X25NET macro and defaults to LCN0=USED when NETTYPE=1 is specified.

The LLCLIST operand which specifies what type of SVC will be used with this physical circuit (MCH), is now coded in the X25MCH macro for R2 and R3 instead of in the X25LINE or X25VC macros as in R1. Users migrating from Release 1 of the X.25 NPSI should note that in the LLCLIST specification, PCNE0 and PSH now have to be coded as LLC0 and LLC2 respectively.

The PKTMODL can be either 8 or 128. The default is 8. Note that the modulo 128 scheme is not supported by most PSDN's.

Four new operands: NDRETRY, NPRETRY, TDTIMER and TPTIMER are introduced in R2 and R3 of the X.25 NPSI. NDRETRY and NPRETRY replace RETRYCT, and TDTIMER and TPTIMER, RETRYCT which were available in R1. These four parameters together define the DTE time-out function.

TPTIMER is a function of the time allowed by the DTE between the transmission of frames (e.g. SABM, DM, DISC, I-frames) and receipt of the corresponding acknowledge frame (e.g. UA, DM or acknowledging frame). It is important to note that the value coded in the TPTIMER operand must match the actual speed of the access line that the physical circuit is based on. For example, TPTIMER must be specified as 1.0 seconds or greater for a 2400 bps MCH link with FRMLGTH=259, since it takes at least that long to transmit the I-frame (259 bytes I-frame + 6 HDLC framing characters * 8 / 2400 = 0.88 sec.) across the DTE/DCE interface and to receive an acknowledgement. NPSI will set TPTIMER AFTER the transmission of a block but the timeout will not be reset until a responding block is received and its FCS checked and found correct. Therefore the timeout must include the potential receive time for the longest block that can be received.

NPRETRY is the maximum number of transmissions and retransmissions of a frame following the expiration of TPTIMER.

TDTIMER should typically be many times greater than time TPTIMER. It is the time to be delayed between consecutive repetitions of the (NPRETRY*TPTIMER) sequence.

NDRETRY is the maximum number of repetitions of the (TPTIMER*NPRETRY + TDTIMER) sequence to be performed before the DTE/DCE interface is declared to be inoperative.

Default values are provided by the X.25 NPSI for these error/retry parameters. It is recommended that the customer stay with these defaults (except for TPTIMER, which is MCH link speed dependent) and override these values later-on if the DTE time-out function proves unsatisfactory.

The FRMLGTH operand specifies the largest frame size that can flow through the MCH. (This is the LAPB frame length). Most PSDN's support a 3-byte packet header. For instance, if the Datapac normal service is used, code FRMLGTH as 259 (256 byte packet size + a 3 byte packet header). There is one potential trap in this operand. For a normal packet length of 128 bytes a user may code FRMLGTH=131 and this will work for most users. However even with a packet size of 128 the user may decide to send a large amount of data in the user data field of the CALL

packet or the CLEAR packet. (This can be done by specifying a long CUD field in the X25OFT macro or by building a special call packet using the DATE facility). The CUD field may itself be 128 bytes in length. Together with the Optional Facilities and DTE address fields the CALL packet could grow a lot longer than 131. CALL packets are always sent as a single frame (and packet). If the user wants to include a large amount of data in the call packet then the FRMLGTH operand must be expanded accordingly.

The LCGDEF operand specifies the logical channel groupings within the MCH. Logically, the user should try to group his logical channels such that one group within a certain logical channel range is for permanent virtual circuits, another group for one way incoming virtual calls, another group for two way virtual calls and another group for outgoing calls. However, some PSDN's only provide one logical channel group number (zero) per physical access line. Therefore only 1 group need be defined. For some networks, the logical channel numbers are assigned sequentially according to subscription with PVC's occupying the lowest addresses. In some networks, however, it is possible to reserve ranges of logical channel numbers for future expansion. Please refer to "Chapter 4. Planning Considerations" on page 11 for more detailed discussions on logical channel assignments.

The MWINDOW operand specifies the frame window size. For most networks, this window size is fixed as 7 and is not even a subscription parameter. The user should consult his PTT representative as to the maximum number that can be specified.

The DBIT operand is only supported for non-SNA connections using the PCNE function.

The GATE operand is used to define whether the GATE or DATE facility is to be used in the MCH. In either case, there will be some restriction on the coexistence of certain types of virtual circuits. Some user application coding to interface with the GATE/DATE facility is also required. Please refer to the X.25 NPSI Installation and Operations manual for more details.

The SUBADDR operand (available when GATE=GENERAL is specified) applies only to SVC's and provides a means for identifying the type of virtual circuit connection. This facility is not available in some PSDN's (e.g. Datapac).

The PAD operand specifies whether a remote terminal will be connected via a PAD service. PAD=INTEG is for support of TTY 33/35 compatible terminals conforming to CCITT Recommendation X.28 attached via an X.3 PAD. PAD=TRANSP is for support of terminals connecting to a non-X.3 PAD. In this case, the user application is responsible for communicating with and controlling the operations of the PAD. More on the PAD support in X.25 NPSI will be given in the "X.25 NPSI PAD Implementation Guide."

The user should be aware of whether the LAP or LAPB link access procedure is used in his DTE/DCE X.25 interface. LAPB should be chosen if such an option exists. Note the spelling of the operand and PROTOCOL.

The SPEED operand specifies the speed of the access line subscribed. Each MCH macro defines one physical access line. Multiple virtual circuits (permanent and switched) can be defined within an MCH. Depending on the user's traffic volume, there can also be multiple physical access lines (MCH's) from the DCE to the 3705. Note that in the case of multiple physical access lines each line is a separate access to the network and a separate network subscription. NPSI does not support the "multilink" facility (offered by some networks) through which a group of links can be treated as a single logical link.

If the user wishes to use a 19.2 KBPS connection to the NCP with a V24 (RS-232, X.21bis) access he must raise a (no charge) RPQ. This RPQ specifies shorter cables to the modem interface. When generating this speed with NCP and a V24 lineset (1D or 1H) the

user MUST use the "upper scan limit" facility specified in the GENEND macro to provide sufficient scan cycles to the lineset. Other facilities provided for selectively scanning high speed lines (high speed select and address substitution) will NOT work with the V24 linesets. This is because they modify the scan to scan only even addresses and the 1D/1H lineset uses an EVEN/ODD address pair. When doing the X.25 generation for this line speed the SPEED= operand must be coded SPEED=9600 even though the actual line speed is 19.2.

The STATION=DCE parameter is used to specify whether the X.25 NPSI is to operate as a DCE for this MCH link. The only effect of this parameter is to change the frame level link address. All output commands will contain X'03' in the frame address field, and all output responses will have a frame address containing X'01'.

The specification of STATION=DCE in the MCH macro can be very useful in testing whether everything else is installed correctly before connecting to the network as shown in the "X.25 Network Definition Sample" on page 42. Some of the X.25 testing at the IBM Raleigh Systems Centre was accomplished without the use of a PSDN. As this example demonstrates it is possible to do a DCE to DTE link using PCNE LLC type 0 and PSH LLC type 2 facilities. The reader is cautioned that to do the PCNE test as described in the example a special VTAM application is required. The X.25 NPSI Installation and Operation manual (SC30-3163) has a section 'Using the PCNE Interface' on page 5-16 which discusses the implications of using this method. An easier way is to use the PSH LLC 2 method which allows the user to establish a session with TSO or NCCF once the link has been established. This test enables the checkout of both the X.25 NPSI parameters and also the remote NIA.

To enforce standard naming for the X.25 physical circuit resources in the generation process, the operands NCPGRP, PUNAME and LUNAME may be coded in conjunction with the X25MCH label.

The X25LCG signifies the beginning of the description of all the virtual circuits defined within a logical channel group within a multi-channel link. In some PSDN's, e.g. Datapac, only LCGN=0 can be defined.

There are two ways of describing the virtual circuits to the X.25 NPSI. If a range of logical channels (i.e. virtual circuits) have the same characteristics (e.g. all supporting one-way incoming calls only for PU types 1 and 2), then the X25VC macro can be used instead of the X25LINE macro.

The X25VC macro will cause a LINE, a PU, and applicable SERVICE and LU macros (used for NCP stage 1 gen) to be generated for each logical channel defined in the LCN operand.

New operands for R2 and R3 are MAXLU, RETVCCT and RETVCT0. The LLCLIST macro is not supported by the X25VC macro for the new releases, and is now coded in the X25MCH macro.

For a PVC, only 1 PU (ADDR=01) with 1 LU (LOCADDR=0) will be generated if the MAXLU operand is omitted or coded with a value of 1. For a SVC, only 1 PU macro with MAXLU=3 will be generated if the MAXLU operand is omitted in the X25VC macro.

The OUFINDX operand is only applicable to SVC's and points to entry in the Optional User Facilities Table (X25OUFT) that contains user facilities and Call User Data field to be copied in the Call Request packet in case of an Outgoing Call. This operand applies to normal operation and can be overridden by the DIALNO specification in the PATH macro in VTAM.

Alternatively, the X25LINE macro can be used to specify each virtual circuit within a logical channel group within a MCH. Each X25LINE macro allows the user to describe his own PU and LU characteristics using the X25PU and X25LU macros.

New operands for R2 and R3 are MONLINK (R3 only), RETVCCT and RETVCT0. The LLCLIST operand for SVC's is now moved to the X25MCH macro. This will cause an error if coded here.

It is recommended by the X.25 NPSI program description and operation manual to use the generated line, PU and LU names. This method has been used in the published examples. In our testing, however, we found it more convenient to include our own symbol in the X25LINE macro. This helped make the line name more readily recognizable for problem determination and network management. Also, we found that although the X25LINE macro may require more coding, it allows us to define the network more precisely.

Note that there is an error here in the "X.25 NPSI Installation and Operation Manual". (SC30-3163-0). The MAXLU operand, if required, should be coded in the X25PU macro instead of the X25LINE macro. It may NOT be coded on the X25LINE macro.

The X25PU macro is used to define the PU that will be attached to the virtual circuit defined in the X25LINE macro. The operands are identical to those for the NCP PU macro.

The GENEND macro should be included if there are other software (such as the Network Terminal Option (NTO)) using the NCP Customization Facility (NEO) that will be sharing the same 3705.

Note that if this facility is used, the first statement of the X.25 NPSI stage 1 input deck must be

COPY XGENEND

This is necessary no matter which operating system is in use. (In the PRPQ NCP support this operand was required for DOS/VSE only.)

This macro instruction belongs to the NCP715.GEN3705X library. Its purpose is to punch a GENEND statement for NCP Stage 1, during X.25 stage 1 gen. The resulting GENEND statement will contain (in a concatenated format) the parameters to be specified for the software using the NEO facility (e.g. NTO or the Airline Control Program) together with those required by X.25 NPSI. The following is an example:

```

-----
X25VC   -----
GENEND  INIT=USRINIT, INCINIT=USRINI,----
X25END  -----

```

The resulting GENEND macro as produced by the X.25 stage 1 gen will be as follows:

```

GENEND
INIT=(USRINIT,BALINIMD),INCINIT=(USRINI,X25INI2),---

```

Note that the GENEND operands HSPDSEL and SCANCTL can be coded on the X25END macro. These will be copied through (unchecked) into the GENEND macro produced as output by X25END. If X.25 support is being added to an old NCP, be careful that these operands do not inadvertently remove the old (now redundant) GENEND statement.

The X25END macro signifies the end of the user packet-switching network definition.

It is recommended that the NCPSTG1 operand be used. Part of the X.25 gen function is to convert the X.25 macros to equivalent NCP macros. The output from the X.25 Stage 1 gen will include IEBUPDT utility control statements to store the converted NCP macros in the working library with the member name specified in NCPSTG1. This would help locating the macros later on when preparing for the NCP gen.

The ORDL2LO operand will only allow 5 digits to be specified as the symbol name. See "X.25 Network Definition Sample" on page 42.

The NCPSTG1, INCL2HI, INCINIT, INCL2LO, ORDINIT, ORDL2HI and the ORDL2LO operands when coded provide unique member names in

the X.25 Stage 2 gen output PDS. See the section "Unique Generation Naming" on page 67 for a method where these operands be may used to provide naming for multiple generations of different configurations.

X.25 Network Definition Sample

```

*****
* X25 NPSI R 2 STAGE 1 INPUT *- UNIQUE GENERATION NUMBER = 2 -----*
*****
* THE UNIQUE GENERATION NUMBER (ALSO REFERRED TO AS 'GENNO') IS      *
* USED IN THE FOLLOWING PLACES IN THIS X25 STAGE 1 INPUT SOURCE:-    *
* 1 - IN 'SRCHI' AND 'SRCLO' IN THE 'X25BUILD' MACRO.                *
* 2 - IN THE PARAMETERS 'NCPSTG1', 'INCL2HI', 'INCINIT', 'INCL2LO', *
*   'ORDINIT', 'ORDL2HI' AND 'ORDL2LO' DEFINED IN THE 'X25END'     *
*   MACRO.                                                            *
* THIS GENNO ALLOWS A UNIQUE NAMING SYSTEM THROUGHOUT THE X25 STAGE 1,*
* X25 STAGE 2, NCP STAGE 1 AND NCP STAGE 2 GENERATION PROCESS WHICH *
* ENABLES MORE THAN 1 SIMULTANEOUS GENERATION (FULL OR PARTIAL) TO  *
* BE EXECUTED USING THE SAME DATA SETS.                             *
*****
*-----GENERATION SPECIFICATIONS-----*
* THIS GENERATION IS FOR 3 MCH LINKS WITHOUT THE USE OF A PSDN.     *
* 3 TESTS CAN BE DONE, IE CPU TO CPU PCNE LLC TYPE 0 (1 MCH),      *
* CPU TO 327X LLC TYPE 2 PVC (1 MCH) AND SVC (1 MCH) WITH REMOTE NIA.*
*****
*           * ----- TEST 1 ----- *
*----- CPU TO CPU PCNE TYPE 0 VIRTUAL CIRCUIT -----*
*-----*
*-----MCH CHARACTERISTICS-----*
*-----*
*           DCE END                               DTE END
* MCH ADDRESS = 0A0/0A1                          MCH ADDRESS = 0A2/0A3
* MCH NAME    = XM040A0                          MCH NAME    = XM040A2
* PU NAME     = XP040A0                          PU NAME     = XP040A2
* LU NAME     = XU040A0                          LU NAME     = XU040A2
* M/WINDOW    = 7                                M/WINDOW    = 7
****VIRTUAL CIRCUIT DATA***                      ****VIRTUAL CIRCUIT DATA***
* VC/NO TYPE PKT/SZ V/WNDW                        VC/NO TYPE PKT/SZ V/WNDW *
* --1--PVC---128-----3--|                       |--1--PVC---128-----3-- *
* --2--PVC---256-----3--|                       |--2--PVC---256-----3-- *
* --3--PVC---128-----7--|                       |--3--PVC---128-----7-- *
* --4--PVC---256-----7--|=====|--4--PVC---256-----7-- *
* --5--SVC---064-----2--|                       |--5--SVC---064-----2-- *
* --6--SVC---128-----2--|                       |--6--SVC---128-----2-- *
* --7--SVC---256-----2--|                       |--7--SVC---256-----2-- *
*
*****
*           * ----- TEST 2 ----- *
*----- CPU TO 327X PSH TYPE 2 VIRTUAL CIRCUIT -----*
*-----*
*-----MCH CHARACTERISTICS-----*
*-----*
*           DCE END                               DTE END
* MCH ADDRESS = 0A4/0A5                          REMOTE NIA
* MCH NAME    = XM040A4
* PU NAME     = XP040A4
* LU NAME     = XU040A4
* M/WINDOW    = 7                                M/WINDOW    = 7
****VIRTUAL CIRCUIT DATA***                      ****VIRTUAL CIRCUIT DATA***
* VC/NO TYPE PKT/SZ V/WNDW                        VC/NO TYPE PKT/SZ V/WNDW *
* --1--PVC---256-----3--|=====|--1--PVC---256-----3-- *
*
*****
*           * ----- TEST 3 ----- *
*----- CPU TO 327X PSH TYPE 2 VIRTUAL CIRCUIT -----*
*-----*
*-----MCH CHARACTERISTICS-----*
*-----*
*           DCE END                               DTE END
* MCH ADDRESS = 0A6/0A7                          REMOTE NIA
* MCH NAME    = XM040A6
* PU NAME     = XP040A6
* LU NAME     = XU040A6

```

```

* M/WINDOW      = 3                               M/WINDOW      = 3                               *
****VIRTUAL CIRCUIT DATA****                   ****VIRTUAL CIRCUIT DATA****
* VC/NO TYPE PKT/SZ V/WNDW                       VC/NO TYPE PKT/SZ V/WNDW                       *
* --1---SVC---128-----3---|=====|---1---SVC---128-----3--- *
*                                                                 *
*****                                                                 *
*                                                                 *
*           X25BUILD - THIS MACRO DESCRIBES THE GENERATION PROCESS. *
*                                                                 *
*****                                                                 *
WTCX252 X25BUILD IDNUMH=01,                       ID FOR NON-SNA SWITCHED SUPPORT                   C
                JOBCARD=YES,                       USE OS JOBCARD FROM 'MODS.GEN3705'                 C
                MACLIB=STAGE2,                     WORK DATA SET FOR NPSI STAGE 2 OUTPUT             C
                MCHCNT=4,                           4 MCH LINKS DEFINED                               C
                QUALIFY=NCP715,                     USE NPSI R2 AND NCP R2.1 DATA SETS                 C
                SNAP=NO,                             SNAP FACILITY NOT ALLOWED.                         C
                SRCHI=X25BLK2,                       STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
                SRCLO=X25TBL2,                       STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
                SRCPRFX=X25,                         STAGE 2 OUTPUT TABLES & BLOCKS PREFIX           C
                TYPYSYS=OS                           MVS 3.8 WITH ACF/VTAM V2R1
**
*****                                                                 *
*                                                                 *
*           X25 NET - DESCRIBES THE PPSN. *
*                                                                 *
*****                                                                 *
WTCNET X25NET  DM=NO,                               LAPB DM COMMAND NOT USED                           C
                NETTYPE=2,                           TYPE 2 NETWORK                                     C
                CPHINDX=7,                             7 ENTRIES IN VIRTUAL CIRCUIT TABLE             C
                OUHINDX=1                             1 ENTRY IN THE OPTIONAL FACILITY TABLE
**
*****                                                                 *
*                                                                 *
*           X25VCCPT - VIRTUAL CIRCUIT CONNECTION PARAMETERS TABLE. *
*                                                                 *
*****                                                                 *
                X25VCCPT INDEX=1,                   TABLE ENTRY NUMBER                               C
                MAXPKTL=128,                         MAXIMUM PACKET LENGTH EXCL PACKET HDR           C
                INSLOW=(25,0),                       FREE BUFFER PERCENTAGE                           C
                VWINDOW=3                             PACKET TRANSMIT/RECEIVE WINDOW SIZE
**
                X25VCCPT INDEX=2,                   TABLE ENTRY NUMBER                               C
                MAXPKTL=128,                         MAXIMUM PACKET LENGTH EXCL PACKET HDR           C
                INSLOW=(25,0),                       FREE BUFFER PERCENTAGE                           C
                VWINDOW=7                             PACKET TRANSMIT/RECEIVE WINDOW SIZE
**
                X25VCCPT INDEX=3,                   TABLE ENTRY NUMBER                               C
                MAXPKTL=256,                         MAXIMUM PACKET LENGTH EXCL PACKET HDR           C
                INSLOW=(25,0),                       FREE BUFFER PERCENTAGE                           C
                VWINDOW=3                             PACKET TRANSMIT/RECEIVE WINDOW SIZE
**
                X25VCCPT INDEX=4,                   TABLE ENTRY NUMBER                               C
                MAXPKTL=256,                         MAXIMUM PACKET LENGTH EXCL PACKET HDR           C
                INSLOW=(25,0),                       FREE BUFFER PERCENTAGE                           C
                VWINDOW=7                             PACKET TRANSMIT/RECEIVE WINDOW SIZE
**
                X25VCCPT INDEX=5,                   TABLE ENTRY NUMBER                               C
                MAXPKTL=64,                           MAXIMUM PACKET LENGTH EXCL PACKET HDR           C
                INSLOW=(25,0),                       FREE BUFFER PERCENTAGE                           C
                VWINDOW=2                             PACKET TRANSMIT/RECEIVE WINDOW SIZE
**
                X25VCCPT INDEX=6,                   TABLE ENTRY NUMBER                               C
                MAXPKTL=128,                         MAXIMUM PACKET LENGTH EXCL PACKET HDR           C
                INSLOW=(25,0),                       FREE BUFFER PERCENTAGE                           C
                VWINDOW=2                             PACKET TRANSMIT/RECEIVE WINDOW SIZE
**
                X25VCCPT INDEX=7,                   TABLE ENTRY NUMBER                               C
                MAXPKTL=256,                         MAXIMUM PACKET LENGTH EXCL PACKET HDR           C
                INSLOW=(25,0),                       FREE BUFFER PERCENTAGE                           C
                VWINDOW=2                             PACKET TRANSMIT/RECEIVE WINDOW SIZE
**
*****                                                                 *
*                                                                 *
*           X25OUFTT - SVC USER FACILITIES AND CALL USER DATA TABLE. *
*                                                                 *

```

```

*
*****
X25OUFT INDEX=1          TABLE ENTRY NUMBER
**
*****
*
*   X25MCH - DESCRIBE THE PHYSICAL MULTICHANNEL LINK.
*   - DCE END 0A0/0A1
*
*****
XM040A0 X25MCH ADDRESS=(0A0,0A1), 3705 FDX LINE ADDRESS      C
        CSBTYPE=2,          COMMUNICATION SCANNER TYPE        C
        FRMLGTH=259,        MAXIMUM FRAME LENGTH (+3 BYTE PKT HDR)C
        LCGDEF=0(7),        LOGICAL CHAN GRP 0, UP TO CHAN #7    C
        MWINDOW=7,          LINK ACCESS FRAME WINDOW SIZE (HDLC) C
        ANS=STOP,           AUTO NETWORK SHUTDOWN DECISION     C
        DBIT=NO,            DELIVERY CONFIRMATION BIT SUPPORTED  C
        GATE=NO,            GATE OR DATE FUNCTION SUPPORTED     C
        LCNO=NOTUSED,       LOGICAL CHANNEL 0 NOT USED  C
        LLCLIST=(LLC0),     ALLOW PCNE ON THIS CIRCUIT  C
        LUNAME=XU040A0,     MCH LU NAME (SEE NAMING STANDARDS) C
        NDRETRY=2,          NP/TP SEQUENCE EXECUTED    C
        NPRETRY=4,          I OR U FRAME TIMEOUT RECOVERY C
        PAD=NO,             PAD FUNCTION NOT SUPPORTED  C
        TRAN=NO,            NO TRANSLATION IF NO PAD FUNCTION C
        PKTMDL=8,          MODULO 8 PACKET NUMBERING   C
        PROTCOL=LAPB,       LINK ACCESS BALANCED PROTOCOL. C
        PUNAME=XP040A0,     MCH PU NAME (SEE NAMING STANDARDS) C
        SPEED=9600,         SPEED OF PHYSICAL CIRCUIT.    C
        STATION=DCE,        NO CONNECTION TO A NETWORK NODE  C
        TDTIMER=1,          TIME (SECS) BETWEEN ND RETRANSMISSIONS C
        TPTIMER=0.5         X25 T1 TIMER IN SECS
**
*****
*
*   X25LCG - DESCRIBE THE LOGICAL CHANNEL GROUP.
*
*****
X25LCG LCGN=0          LOGICAL CHANNEL GROUP NUMBER
**
*****
*
*   X25VC - DESCRIBE THE VIRTUAL CIRCUIT.
*
*****
X25VC LCN=1,          LOGICAL CHANNELS WITHIN A GROUP      C
        TYPE=P,          V C TYPE - P=PERMANENT, S=SWITCHED    C
        LLC=LLC0,        PCNE - NON=SNA DTE                          C
        VCCINDX=1,       INDEX IN CONNECTION PARAMETER TABLE    C
        MAXLU=1          NO OF LU'S PER PU
**
X25VC LCN=2,          LOGICAL CHANNELS WITHIN A GROUP      C
        TYPE=P,          V C TYPE - P=PERMANENT, S=SWITCHED    C
        LLC=LLC0,        PCNE - NON=SNA DTE                          C
        VCCINDX=3,       INDEX IN CONNECTION PARAMETER TABLE    C
        MAXLU=1          NO OF LU'S PER PU
**
X25VC LCN=3,          LOGICAL CHANNELS WITHIN A GROUP      C
        TYPE=P,          V C TYPE - P=PERMANENT, S=SWITCHED    C
        LLC=LLC0,        PCNE - NON=SNA DTE                          C
        VCCINDX=2,       INDEX IN CONNECTION PARAMETER TABLE    C
        MAXLU=1          NO OF LU'S PER PU
**
X25VC LCN=4,          LOGICAL CHANNELS WITHIN A GROUP      C
        TYPE=P,          V C TYPE - P=PERMANENT, S=SWITCHED    C
        LLC=LLC0,        PCNE - NON=SNA DTE                          C
        VCCINDX=4,       INDEX IN CONNECTION PARAMETER TABLE    C
        MAXLU=1          NO OF LU'S PER PU
**
X25VC LCN=5,          LOGICAL CHANNELS WITHIN A GROUP      C
        TYPE=S,          V C TYPE - P=PERMANENT, S=SWITCHED    C
        OUFINDX=1,       INDEX IN USER TABLE                          C
        LLC=LLC0,        PCNE - NON=SNA DTE                          C
        VCCINDX=5,       INDEX IN CONNECTION PARAMETER TABLE    C
        CALL=INOUT,      BOTH ENDS MAY ESTABLISH CALLS      C
        MAXLU=1          NO OF LU'S PER PU
**
X25VC LCN=6,          LOGICAL CHANNELS WITHIN A GROUP      C
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```

```

TYPE=S,          V C TYPE - P=PERMANENT, S=SWITCHED  C
OUFINDX=1,      INDEX IN USER TABLE                C
LLC=LLC0,       PCNE - NON=SNA DTE                C
VCCINDX=6,      INDEX IN CONNECTION PARAMETER TABLE C
CALL=INOUT,     BOTH ENDS MAY ESTABLISH CALLS      C
MAXLU=1         NO OF LU'S PER PU                C

**
X25VC LCN=7,     LOGICAL CHANNELS WITHIN A GROUP      C
TYPE=S,         V C TYPE - P=PERMANENT, S=SWITCHED  C
OUFINDX=1,      INDEX IN USER TABLE                C
LLC=LLC0,       PCNE - NON=SNA DTE                C
VCCINDX=7,      INDEX IN CONNECTION PARAMETER TABLE C
CALL=INOUT,     BOTH ENDS MAY ESTABLISH CALLS      C
MAXLU=1         NO OF LU'S PER PU                C

**
*****
*
* X25MCH - DESCRIBE THE PHYSICAL MULTICHANNEL LINK. *
* - DTE END 0A2/0A3 *
*****
XM040A2 X25MCH ADDRESS=(0A2,0A3), 3705 FDX LINE ADDRESS C
CSBTYP=2,       COMMUNICATION SCANNER TYPE          C
FRMLGTH=259,    MAXIMUM FRAME LENGTH (+3 BYTE PKT HDR)C
LCGDEF=0(7),    LOGICAL CHAN GRP 0, UP TO CHAN #7   C
MWINDOW=7,     LINK ACCESS FRAME WINDOW SIZE (HDLC) C
ANS=STOP,      AUTO NETWORK SHUTDOWN DECISION      C
DBIT=NO,       DELIVERY CONFIRMATION BIT SUPPORTED  C
GATE=NO,       GATE OR DATE FUNCTION SUPPORTED      C
LCN0=NOTUSED,  LOGICAL CHANNEL 0 NOT USED           C
LLCLIST=(LLC0), ALLOW PCNE ON THIS CIRCUIT          C
LUNAME=XU040A2, MCH LU NAME (SEE NAMING STANDARDS)  C
NDRETRY=2,     NP/TP SEQUENCE EXECUTED              C
NPRETRY=4,     I OR U FRAME TIMEOUT RECOVERY        C
PAD=NO,        PAD FUNCTION NOT SUPPORTED           C
TRAN=NO,       NO TRANSLATION IF NO PAD FUNCTION    C
PKTMDL=8,     MODULO 8 PACKET NUMBERING             C
PROTCL=LAPB,   LINK ACCESS BALANCED PROTOCOL        C
PUNAME=XP040A2, MCH PU NAME (SEE NAMING STANDARDS)  C
SPEED=9600,    SPEED OF PHYSICAL CIRCUIT           C
STATION=DTE,   NO CONNECTION TO A NETWORK NODE     C
TDTIMER=1,     TIME (SECS) BETWEEN ND RETRANSMISSIONS C
TPTIMER=0.5    X25 T1 TIMER IN SECS

**
*****
*
* X25LCG - DESCRIBE THE LOGICAL CHANNEL GROUP. *
* *
*****
X25LCG LCGN=0    LOGICAL CHANNEL GROUP NUMBER

**
*****
*
* X25VC - DESCRIBE THE VIRTUAL CIRCUIT. *
* *
*****
X25VC LCN=1,     LOGICAL CHANNELS WITHIN A GROUP      C
TYPE=P,         V C TYPE - P=PERMANENT, S=SWITCHED  C
LLC=LLC0,       PCNE - NON=SNA DTE                C
VCCINDX=1,      INDEX IN CONNECTION PARAMETER TABLE C
MAXLU=1         NO OF LU'S PER PU                C

**
X25VC LCN=2,     LOGICAL CHANNELS WITHIN A GROUP      C
TYPE=P,         V C TYPE - P=PERMANENT, S=SWITCHED  C
LLC=LLC0,       PCNE - NON=SNA DTE                C
VCCINDX=3,      INDEX IN CONNECTION PARAMETER TABLE C
MAXLU=1         NO OF LU'S PER PU                C

**
X25VC LCN=3,     LOGICAL CHANNELS WITHIN A GROUP      C
TYPE=P,         V C TYPE - P=PERMANENT, S=SWITCHED  C
LLC=LLC0,       PCNE - NON=SNA DTE                C
VCCINDX=2,      INDEX IN CONNECTION PARAMETER TABLE C
MAXLU=1         NO OF LU'S PER PU                C

**
X25VC LCN=4,     LOGICAL CHANNELS WITHIN A GROUP      C
TYPE=P,         V C TYPE - P=PERMANENT, S=SWITCHED  C

```

```

**          LLC=LLC0,          PCNE - NON=SNA DTE          C
          VCCINDX=4,          INDEX IN CONNECTION PARAMETER TABLE  C
          MAXLU=1            NO OF LU'S PER PU

**          X25VC LCN=5,          LOGICAL CHANNELS WITHIN A GROUP          C
          TYPE=S,            V C TYPE - P=PERMANENT, S=SWITCHED      C
          OUFINDX=1,        INDEX IN USER TABLE                    C
          LLC=LLC0,        PCNE - NON=SNA DTE                      C
          VCCINDX=5,        INDEX IN CONNECTION PARAMETER TABLE  C
          CALL=INOUT,      BOTH ENDS MAY ESTABLISH CALLS          C
          MAXLU=1            NO OF LU'S PER PU

**          X25VC LCN=6,          LOGICAL CHANNELS WITHIN A GROUP          C
          TYPE=S,            V C TYPE - P=PERMANENT, S=SWITCHED      C
          OUFINDX=1,        INDEX IN USER TABLE                    C
          LLC=LLC0,        PCNE - NON=SNA DTE                      C
          VCCINDX=6,        INDEX IN CONNECTION PARAMETER TABLE  C
          CALL=INOUT,      BOTH ENDS MAY ESTABLISH CALLS          C
          MAXLU=1            NO OF LU'S PER PU

**          X25VC LCN=7,          LOGICAL CHANNELS WITHIN A GROUP          C
          TYPE=S,            V C TYPE - P=PERMANENT, S=SWITCHED      C
          OUFINDX=1,        INDEX IN USER TABLE                    C
          LLC=LLC0,        PCNE - NON=SNA DTE                      C
          VCCINDX=7,        INDEX IN CONNECTION PARAMETER TABLE  C
          CALL=INOUT,      BOTH ENDS MAY ESTABLISH CALLS          C
          MAXLU=1            NO OF LU'S PER PU

**
*****
*          X25MCH - DESCRIBE THE PHYSICAL MULTICHANNEL LINK.          *
*          - DCE END 0A4/0A5                                          *
*****
XM040A4 X25MCH ADDRESS=(0A4,0A5), 3705 FDX LINE ADDRESS          C
          CSBTYPE=2,        COMMUNICATION SCANNER TYPE              C
          FRMLGTH=259,      MAXIMUM FRAME LENGTH (+3 BYTE PKT HDR) C
          LCGDEF=0(1),     LOGICAL CHAN GRP 0, UP TO CHAN #7    C
          MWINDOW=7,       LINK ACCESS FRAME WINDOW SIZE (HDLC) C
          ANS=STOP,        AUTO NETWORK SHUTDOWN DECISION          C
          DBIT=NO,         DELIVERY CONFIRMATION BIT SUPPORTED     C
          GATE=NO,         GATE OR DATE FUNCTION SUPPORTED         C
          LCN0=NOTUSED,    LOGICAL CHANNEL 0 NOT USED              C
          LLCLIST=(LLC2),  ALLOW PSH ON THIS CIRCUIT                C
          LUNAME=XU040A4,  MCH LU NAME (SEE NAMING STANDARDS)        C
          NDRETRY=2,       NP/TP SEQUENCE EXECUTED                C
          NPRETRY=4,       I OR U FRAME TIMEOUT RECOVERY          C
          PAD=NO,          PAD FUNCTION NOT SUPPORTED              C
          TRAN=NO,        NO TRANSLATION IF NO PAD FUNCTION        C
          PKTMODL=8,      MODULO 8 PACKET NUMBERING              C
          PROTCOL=LAPB,   LINK ACCESS BALANCED PROTOCOL          C
          PUNAME=XP040A4, MCH PU NAME (SEE NAMING STANDARDS)        C
          SPEED=9600,     SPEED OF PHYSICAL CIRCUIT              C
          STATION=DCE,    NO CONNECTION TO A NETWORK NODE        C
          TDTIMER=1,     TIME (SECS) BETWEEN ND RETRANSMISSIONS C
          TPTIMER=0.5    X25 T1 TIMER IN SECS

**
*****
*          X25LCG - DESCRIBE THE LOGICAL CHANNEL GROUP.              *
*****
          X25LCG LCGN=0          LOGICAL CHANNEL GROUP NUMBER

**
*****
*          X25LINE - DESCRIBE THE VIRTUAL CIRCUIT.                  *
*****
L040A4 X25LINE LCN=1,          LOGICAL CHANNELS WITHIN A GROUP          C
          TYPE=P,            V C TYPE - P=PERMANENT, S=SWITCHED      C
          LLC=LLC2,        PSH - SNA PERIPHERAL                    C
          VCCINDX=3        INDEX IN CONNECTION PARAMETER TABLE  C

**
P040A4A X25PU PUTYPE=2,        ATTACH TO AN SNA 3276 VIA REMOTE NIA  C
          ADDR=C1,        STATION ADDRESS IS ALWAYS 'C1' FOR NIAC  C
          MAXDATA=265,    DEPENDANT ON PPSN PACKET SIZE          C
          PASSLIM=7,      MAXIMUM PIU SEGMENTS IN TRANSMISSION  C

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```

```

MAXOUT=7,          MAXIMUM SDLC FRAMES BEFORE LINK RESP  C
ISTATUS=INACTIVE, DO NOT ACTIVATE AT INITIALISATION  C
SSCPFM=USSSCS,    LOGON FORMAT                          C
MODETAB=MT32763,  MODE TABLE REFERENCE FOR VTAM             C
USSTAB=US3276     USS TABLE REFERENCE FOR VTAM
**
T040A4A1 X25LU LOCADDR=2,      ADDRESS OF LU                C
ISTATUS=ACTIVE     ACTIVATE WITH PU
**
*****
*
*       X25MCH - DESCRIBE THE PHYSICAL MULTICHANNEL LINK.      *
*       - DCE END 0A6/0A7                                       *
*
*****
XM040A6 X25MCH ADDRESS=(0A6,0A7), 3705 FDX LINE ADDRESS      C
CSBTYPE=2,          COMMUNICATION SCANNER TYPE              C
FRMLGTH=131,       MAXIMUM FRAME LENGTH (+3 BYTE PKT HDR) C
LCGDEF=0(1),       LOGICAL CHAN GRP 0, UP TO CHAN #7       C
MWINDOW=3,        LINK ACCESS FRAME WINDOW SIZE (HDLC)    C
ANS=STOP,         AUTO NETWORK SHUTDOWN DECISION          C
DBIT=NO,          DELIVERY CONFIRMATION BIT SUPPORTED      C
GATE=NO,          GATE OR DATE FUNCTION SUPPORTED         C
LCNO=NOTUSED,     LOGICAL CHANNEL 0 NOT USED              C
LLCLIST=(LLC2),   ALLOW PSH ON THIS CIRCUIT              C
LUNAME=XU040A6,   MCH LU NAME (SEE NAMING STANDARDS)     C
NDRETRY=2,        NP/TP SEQUENCE EXECUTED                 C
NPRETRY=4,        I OR U FRAME TIMEOUT RECOVERY           C
PAD=NO,           PAD FUNCTION NOT SUPPORTED              C
TRAN=NO,          NO TRANSLATION IF NO PAD FUNCTION       C
PKTMDL=8,        MODULO 8 PACKET NUMBERING                C
PROTCOL=LAPB,    LINK ACCESS BALANCED PROTOCOL           C
PUNAME=XP040A6,  MCH PU NAME (SEE NAMING STANDARDS)     C
SPEED=9600,      SPEED OF PHYSICAL CIRCUIT                C
STATION=DCE,     NO CONNECTION TO A NETWORK NODE         C
TDTIMER=1,       TIME (SECS) BETWEEN ND RETRANSMISSIONS C
TPTIMER=0.5      X25 T1 TIMER IN SECS
**
*****
*
*       X25LCG - DESCRIBE THE LOGICAL CHANNEL GROUP.          *
*
*****
X25LCG LCGN=0      LOGICAL CHANNEL GROUP NUMBER
**
*****
*
*       X25VC - DESCRIBE THE VIRTUAL CIRCUIT.                *
*
*****
X25VC LCN=1,       LOGICAL CHANNELS WITHIN A GROUP        C
TYPE=S,           V C TYPE - P=PERMANENT, S=SWITCHED     C
OUFINDX=1,       INDEX IN USER TABLE                    C
LLC=LLC2,        PSH - SNA PERIPHERAL                    C
VCCINDX=1,       INDEX IN CONNECTION PARAMETER TABLE    C
CALL=INOUT,      BOTH ENDS MAY ESTABLISH CALLS           C
MAXLU=3          NO OF LU'S PER PU
**
*****
*
*       X25END - NPSI GENERATION END, NAME MEMBERS FOR STAGE 2 OUTPUT.*
*
*****
X25END INCPRFX=X25,  STAGE 2 OUTPUT MEMBERS PREFIX        C
LSTUACB=YES,       NPSI SUPPLY LASTUACB MACRO            C
NCPSTG1=X25NCP2,  STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
X25VTAM=NO,       VTAM ACCEPT ADDRESS=NONE & AUTO=YES   C
HSPDSEL=(00111111), SCANNER3 HIGH SPEED SELECT MASKS  C
INCL2HI=X25HII2,  STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
INCINIT=X25INI2,  STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
INCL2LO=X25LOI2,  STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
ORDINIT=X25INO2,  STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
ORDL2HI=X25HIO2,  STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
ORDL2LO=X25LO2,  STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
SCANCTL=(2,2)     SCANNER 2 & 3 SCAN LIMITS & ADDR SUBS
**

```

END

X.25 Stage 1 Gen

After the X.25 macros have been coded, the user can use either assembler F (IFOX00) or assembler H (IEV90) or the 3705 assembler to assemble the macros. A minimum region size of 1536K is required for the F compiler and 1024K is required for the H compiler.

(For the DOS/VSE user, the DOS Assembler is used. The user should first ensure that his Assembler is at Version 3 level or later. It has been known that version 2 of the DOS Assembler can cause incorrect output from the X.25 Stage 1 gen. It should be noted that the X.25 Stage 1 gen for a DOS/VSE system can be done on an OS/VSE system. All the user needs to do is code TYPESYS=DOS in his X25BUILD macro.)

The following section "JCL for X.25 Stage 1 Gen" shows an example of the JCL used in an X.25 Stage 1 gen. Do not forget to put the DECK parameter in the EXEC statement, and to specify the X.25 NPSI (GEN3705X) and NCP (GEN3705) gen libraries as part of the SYSLIB.

In any stage 1 gen jobs (X.25 or NCP stage 1 gens), it is a good practice to specify the SYSPUNCH output data set to be on a different data set from the PDS that contains the JCL for the stage 1 jobstream. It has been known that the OS/VSE assembler can occasionally punch a duplicate output to overlay on top of the submitting member if the input JCL and designated output data sets happened to belong to the same PDS.

In the X.25 Stage 1 Gen JCL example below, use is made of an additional dataset MODS.GEN3705 which is concatenated in front of the other libraries. This dataset contains two members JOBXCARD and X25JCL which have been modified as follows:-

- JOBXCARD as shown below is the OS JCL jobcard for the X.25 Stage 2 Gen that is automatically produced by the X.25 Stage 1 Generation process when JOBCARD=YES or MULTI is specified in the X25BUILD macro. This example is a complete replacement of the same member in library GEN3705X.

```
COL-----1-----2-----3-----4-----5-----6-----+
PUNCH '//NCPGENX&SNOA JOB , 'NCPGEN',MSGCLASS=A,MSGLEVEL=(1,1),
PUNCH '//          CLASS=A,NOTIFY=NCPGEN,TIME=1440'
PUNCH '/*ROUTE PRINT RDPD3MVS.RMT99'
```

- X25JCL is a copy of the same macro from the NPSI library GEN3705X with the SYSOUT class on the SYSPRINT Assembler PUNCH statement changed to an *.

This method can be used to tailor the X.25 Stage 2 Generation JCL to conform to installation standards.

JCL for X.25 Stage 1 Gen

```
COL-----1-----2-----3-----4-----5-----6-----
//WTCRES9X JOB , 'WTCRES9',MSGCLASS=A,MSGLEVEL=(1,1),TIME=1440,
//          CLASS=A,NOTIFY=WTCRES9
//*****
//* X25 STAGE 1 JCL *
//*****
/*ROUTE PRINT RDPD3MVS.RMT99
//X25GEN PROC GEN=
//* GEN = 1 DIGIT UNIQUE GENERATION NUMBER (GENNO)
//ASM EXEC PGM=IEV90,PARM='DECK,NOOBJECT',REGION=1024K
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR,UNIT=SYSDA,VOL=SER=M11LB1
//SYSPRINT DD SYSOUT=*
//SYSPUNCH DD DSN=NCP715.STG1.OUTPUT(X25STG1&GEN),DISP=OLD
//SYSLIB DD DSN=NCP715.MODS.GEN3705,DISP=SHR
// DD DSN=NCP715.GEN3705X,DISP=SHR
// DD DSN=NCP715.GEN3705,DISP=SHR
//SYSUT1 DD DSN=&&SYSUT1,UNIT=SYSSQ,SEP=SYSLIB,
//          SPACE=(1700,(600,100))
```

```

//SYSIN      DD DSN=NCP715.COMMON.X25(X25SRC&GEN),DISP=SHR
//          PEND
//          EXEC X25GEN,GEN=2
//

```

X.25 Stage 2 Gen

The output from the X.25 Stage 1 gen provides a job stream for the X.25 Stage 2 gen. The following section "X.25 Stage 2 Gen Sample" contains the sample output from an X.25 Stage 1.

Depending on the JOBCARD operand definition in the X25BUILD macro, the output can be a single job, or a job stream consisting of several jobs. In our case, we specified JOBCARD=YES which automatically produced an OS Jobcard as per our specifications. See "X.25 Stage 1 Gen" on page 48. Now we are ready to submit the X.25 Stage 2 gen jobstream from the dataset NCP715.STG1.OUTPUT and member X25STG12 using TSO.

Basically, the X.25 Stage 2 consists of 9 IEBUPDT utility steps to copy the data created in the X.25 Stage 1 into a partitioned dataset (i.e. the working library).

- Steps 1 and 2 copy the X.25 control blocks into 2 PDS members X25TBL2 and X25BLK2 for NCP CSECT's: \$SRCL0 and \$SRCHI.
- Steps 3 to 8 create PDS members that contain INCLUDE and ORDER link edit control statements to include the required pre-assembled X.25 NPSI modules (stored in OBJ3705X) in the NCP during the NCP Stage 2 gen.
- Step 9 copies the NCP macros (converted from the X.25 macros in the X.25 Stage 1 gen) into the working library so that this can be extracted later on to be included with other required NCP macros for the NCP gen.

These macros will be stored into the working library under the name specified in the NCPSTG1 operand in the X25END macro discussed earlier.

In our case, we have specified NCP715.STAGE2 as our working library. The X.25 Stage 1 gen makes use of the QUALIFY and MACLIB operands of the X25BUILD macro to produce the DD statement for the output of X.25 Stage 2. Note that this working library has to be pre-allocated before the Stage 2 job is run. In our case, we pre-allocated the NCP715.STAGE2 as a PDS with 27 directory blocks, with a logical record length of 80 bytes and a block-size of 3120 bytes, and initial space allocation of 5 cylinders.

X.25 Stage 2 Gen Sample

```

//NCPGENX1 JOB , 'NCPGEN',MSGCLASS=A,MSGLEVEL=(1,1),
//          CLASS=A,NOTIFY=NCPGEN,TIME=1440
//*ROUTE PRINT RDPD3MVS.RMT99
//S1 EXEC PGM=IEBUPDTE,PARM=NEW
//SYSPRINT DD SYSOUT=*
//SYSUT2 DD DSN=NCP715.STAGE2,DISP=OLD
//SYSIN DD DATA
./ ADD NAME=X25TBL2
./   NUMBER          NEW1=10000,INCR=1000
X25$MKB  BAK2INIT AVTN=BAL$AVT,LLCTN=BAL$LLC,SARL=0,MCHCNT=4
WTCNET  BAK2NET NETTYPE=2,CPTITN=X25N1C,CPTITL=8,OUFTITN=X25N10,OUFTIT*
          L=2
X25N1C1 BAK2VCPT DATAPTY=LOW,INDEX=1,MAXPKTL=128,PKTSEQ=0,VWINDOW=3,OU*
          TSLOW=0,INSLOWY=2,INSLOWX=16
X25N1C2 BAK2VCPT DATAPTY=LOW,INDEX=2,MAXPKTL=128,PKTSEQ=0,VWINDOW=7,OU*
          TSLOW=0,INSLOWY=2,INSLOWX=16
X25N1C3 BAK2VCPT DATAPTY=LOW,INDEX=3,MAXPKTL=256,PKTSEQ=0,VWINDOW=3,OU*

```

TSLW=0, INSLWY=2, INSLWX=16
X25N1C4 BAK2VCPT DATAPTY=LOW, INDEX=4, MAXPKTL=256, PKTSEQ=0, VWINDOW=7, OU*
 TSLW=0, INSLWY=2, INSLWX=16
X25N1C5 BAK2VCPT DATAPTY=LOW, INDEX=5, MAXPKTL=64, PKTSEQ=0, VWINDOW=2, OUT*
 SLOW=0, INSLWY=2, INSLWX=16
X25N1C6 BAK2VCPT DATAPTY=LOW, INDEX=6, MAXPKTL=128, PKTSEQ=0, VWINDOW=2, OU*
 TSLW=0, INSLWY=2, INSLWX=16
X25N1C7 BAK2VCPT DATAPTY=LOW, INDEX=7, MAXPKTL=256, PKTSEQ=0, VWINDOW=2, OU*
 TSLW=0, INSLWY=2, INSLWX=16
X25N101 BAK2OUFT INDEX=1, FACL=0, DATL=0, VALUE=, VALUE1=, VALUE2=
X25KM0A0 BAK2MCH NRZI=, STATION=DCE, PROTCOL=LAPB, SOTN=XC0A0, MWINDOW=7, FR*
 MLGTH=259, RETRYCT=0, RETRYTO=0, ACBXN=X25A0A0X, ACBRN=X25A0*
 A0R, LIQN=X25Q0A0, MCHNO=1, CSBTYPE=2, VCGATL=1, VCGATN=X25KG*
 0A0, VCBATN=X25KV0A0, VCBATL=8, PLPOUEP=BALPLPO, VCMINEP=BAL*
 VCIE1, GCBN=XNET11, RLINADD=0A1, PKTMODL=8, XLINADD=0A0, VCSC*
 NB=30, DM=0, LL2IDL=BALL2IDL, LL3IDL=BALL3IDL, TPTIMER=5, NPR*
 ETRY=4, NDRETRY=2, TDTIMER=1, REL2MSK=0000000, LCN0=0, XPARE*
 NT=0, XUACBRN=X25U0A0R, XUACBXN=X25U0A0X, XSLUBN=, STATSEP=B*
 ALNASTA
X25K0A00 BAK2LCG LCGN=0, LCCNT=8
XB0A0001 BAK2VC TYPE=P, DSTNODE=, XID=1000, VCCINAM=X25N1C1, RETVCTO=30, RET*
 VCCT=3, LLC=0, LCN=1, VCCINDX=1, OUFINDX=0, VCMOUEP=BALVCOF1, *
 LLCOUTK=BALT5OUT, SOTN=XC0A0001, PLPINAC=BALPLPI1, SLUBN=XS*
 0A0001, PLPINEP=BALPLPI, VACBN=XA0A0001, GCBN=X25P0A0A, PKTM*
 ODL=8
XB0A0002 BAK2VC TYPE=P, DSTNODE=, XID=1000, VCCINAM=X25N1C3, RETVCTO=30, RET*
 VCCT=3, LLC=0, LCN=2, VCCINDX=3, OUFINDX=0, VCMOUEP=BALVCOF1, *
 LLCOUTK=BALT5OUT, SOTN=XC0A0002, PLPINAC=BALPLPI1, SLUBN=XS*
 0A0002, PLPINEP=BALPLPI, VACBN=XA0A0002, GCBN=X25P0A0A, PKTM*
 ODL=8
XB0A0003 BAK2VC TYPE=P, DSTNODE=, XID=1000, VCCINAM=X25N1C2, RETVCTO=30, RET*
 VCCT=3, LLC=0, LCN=3, VCCINDX=2, OUFINDX=0, VCMOUEP=BALVCOF1, *
 LLCOUTK=BALT5OUT, SOTN=XC0A0003, PLPINAC=BALPLPI1, SLUBN=XS*
 0A0003, PLPINEP=BALPLPI, VACBN=XA0A0003, GCBN=X25P0A0A, PKTM*
 ODL=8
XB0A0004 BAK2VC TYPE=P, DSTNODE=, XID=1000, VCCINAM=X25N1C4, RETVCTO=30, RET*
 VCCT=3, LLC=0, LCN=4, VCCINDX=4, OUFINDX=0, VCMOUEP=BALVCOF1, *
 LLCOUTK=BALT5OUT, SOTN=XC0A0004, PLPINAC=BALPLPI1, SLUBN=XS*
 0A0004, PLPINEP=BALPLPI, VACBN=XA0A0004, GCBN=X25P0A0A, PKTM*
 ODL=8
XB0A0005 BAK2VC TYPE=S, DSTNODE=, XID=1000, VCCINAM=X25N1C5, OUFINAM=X25N10*
 1, CALL=INOUT, RETVCTO=30, RETVCCT=3, LLC=0, LLCLIST=(0), LCN=*
 5, VCCINDX=5, OUFINDX=1, VCMOUEP=BALVCOF1, LLCOUTK=BALT5OUT, *
 SOTN=XC0A0005, PLPINAC=BALPLPI1, SLUBN=XS0A0005, PLPINEP=BA*
 LPLPI, VACBN=XA0A0005, GCBN=X25S0A0B, PKTMODL=8
XB0A0006 BAK2VC TYPE=S, DSTNODE=, XID=1000, VCCINAM=X25N1C6, OUFINAM=X25N10*
 1, CALL=INOUT, RETVCTO=30, RETVCCT=3, LLC=0, LLCLIST=(0), LCN=*
 6, VCCINDX=6, OUFINDX=1, VCMOUEP=BALVCOF1, LLCOUTK=BALT5OUT, *
 SOTN=XC0A0006, PLPINAC=BALPLPI1, SLUBN=XS0A0006, PLPINEP=BA*
 LPLPI, VACBN=XA0A0006, GCBN=X25S0A0B, PKTMODL=8
XB0A0007 BAK2VC TYPE=S, DSTNODE=, XID=1000, VCCINAM=X25N1C7, OUFINAM=X25N10*
 1, CALL=INOUT, RETVCTO=30, RETVCCT=3, LLC=0, LLCLIST=(0), LCN=*
 7, VCCINDX=7, OUFINDX=1, VCMOUEP=BALVCOF1, LLCOUTK=BALT5OUT, *
 SOTN=XC0A0007, PLPINAC=BALPLPI1, SLUBN=XS0A0007, PLPINEP=BA*
 LPLPI, VACBN=XA0A0007, GCBN=X25S0A0B, PKTMODL=8
X25KM0A2 BAK2MCH NRZI=, STATION=DTE, PROTCOL=LAPB, SOTN=XC0A2, MWINDOW=7, FR*
 MLGTH=259, RETRYCT=0, RETRYTO=0, ACBXN=X25A0A2X, ACBRN=X25A0*
 A2R, LIQN=X25Q0A2, MCHNO=2, CSBTYPE=2, VCGATL=1, VCGATN=X25KG*
 0A2, VCBATN=X25KV0A2, VCBATL=8, PLPOUEP=BALPLPO, VCMINEP=BAL*
 VCIE1, GCBN=XNET11, RLINADD=0A3, PKTMODL=8, XLINADD=0A2, VCSC*
 NB=30, DM=0, LL2IDL=BALL2IDL, LL3IDL=BALL3IDL, TPTIMER=5, NPR*
 ETRY=4, NDRETRY=2, TDTIMER=1, REL2MSK=0000000, LCN0=0, XPARE*
 NT=0, XUACBRN=X25U0A2R, XUACBXN=X25U0A2X, XSLUBN=, STATSEP=B*
 ALNASTA
X25K0A20 BAK2LCG LCGN=0, LCCNT=8
XB0A2001 BAK2VC TYPE=P, DSTNODE=, XID=1000, VCCINAM=X25N1C1, RETVCTO=30, RET*
 VCCT=3, LLC=0, LCN=1, VCCINDX=1, OUFINDX=0, VCMOUEP=BALVCOF1, *
 LLCOUTK=BALT5OUT, SOTN=XC0A2001, PLPINAC=BALPLPI1, SLUBN=XS*
 0A2001, PLPINEP=BALPLPI, VACBN=XA0A2001, GCBN=X25P0A2A, PKTM*
 ODL=8
XB0A2002 BAK2VC TYPE=P, DSTNODE=, XID=1000, VCCINAM=X25N1C3, RETVCTO=30, RET*
 VCCT=3, LLC=0, LCN=2, VCCINDX=3, OUFINDX=0, VCMOUEP=BALVCOF1, *
 LLCOUTK=BALT5OUT, SOTN=XC0A2002, PLPINAC=BALPLPI1, SLUBN=XS*
 0A2002, PLPINEP=BALPLPI, VACBN=XA0A2002, GCBN=X25P0A2A, PKTM*
 ODL=8
XB0A2003 BAK2VC TYPE=P, DSTNODE=, XID=1000, VCCINAM=X25N1C2, RETVCTO=30, RET*
 VCCT=3, LLC=0, LCN=3, VCCINDX=2, OUFINDX=0, VCMOUEP=BALVCOF1, *

```

LLCOUTK=BALT5OUT,SOTN=XC0A2003,PLPINAC=BALPLPI1,SLUBN=XS*
0A2003,PLPINEP=BALPLPI,VACBN=XAOA2003,GCBN=X25P0A2A,PKTM*
ODL=8
XB0A2004 BAK2VC TYPE=P,DSTNODE=,XID=1000,VCCINAM=X25N1C4,RETVCTO=30,RET*
VCCT=3,LLC=0,LCN=4,VCCINDX=4,OUFINDX=0,VCMOUEP=BALVCOF1,*
LLCOUTK=BALT5OUT,SOTN=XC0A2004,PLPINAC=BALPLPI1,SLUBN=XS*
0A2004,PLPINEP=BALPLPI,VACBN=XAOA2004,GCBN=X25P0A2A,PKTM*
ODL=8
XB0A2005 BAK2VC TYPE=S,DSTNODE=,XID=1000,VCCINAM=X25N1C5,OUFINAM=X25N10*
1,CALL=INOUT,RETVCTO=30,RETVCCCT=3,LLC=0,LLCLIST=(0),LCN=*
5,VCCINDX=5,OUFINDX=1,VCMOUEP=BALVCOF1,LLCOUTK=BALT5OUT,*
SOTN=XC0A2005,PLPINAC=BALPLPI1,SLUBN=XS0A2005,PLPINEP=BA*
LPLPI,VACBN=XAOA2005,GCBN=X25S0A2B,PKTMODL=8
XB0A2006 BAK2VC TYPE=S,DSTNODE=,XID=1000,VCCINAM=X25N1C6,OUFINAM=X25N10*
1,CALL=INOUT,RETVCTO=30,RETVCCCT=3,LLC=0,LLCLIST=(0),LCN=*
6,VCCINDX=6,OUFINDX=1,VCMOUEP=BALVCOF1,LLCOUTK=BALT5OUT,*
SOTN=XC0A2006,PLPINAC=BALPLPI1,SLUBN=XS0A2006,PLPINEP=BA*
LPLPI,VACBN=XAOA2006,GCBN=X25S0A2B,PKTMODL=8
XB0A2007 BAK2VC TYPE=S,DSTNODE=,XID=1000,VCCINAM=X25N1C7,OUFINAM=X25N10*
1,CALL=INOUT,RETVCTO=30,RETVCCCT=3,LLC=0,LLCLIST=(0),LCN=*
7,VCCINDX=7,OUFINDX=1,VCMOUEP=BALVCOF1,LLCOUTK=BALT5OUT,*
SOTN=XC0A2007,PLPINAC=BALPLPI1,SLUBN=XS0A2007,PLPINEP=BA*
LPLPI,VACBN=XAOA2007,GCBN=X25S0A2B,PKTMODL=8
X25KM0A4 BAK2MCH NRZI=,STATION=DCE,PROTCOL=LAPB,SOTN=XC0A4,MWINDOW=7,FR*
MLGTH=259,RETRYCT=0,RETRYTO=0,ACBXN=X25A0A4X,ACBRN=X25A0*
A4R,LIQN=X25Q0A4,MCHNO=3,CSBTYPE=2,VCGATL=1,VCGATN=X25KG*
0A4,VCBATN=X25KV0A4,VCBATL=2,PLPOUEP=BALPLPO,VCMINEP=BAL*
VCIE1,GCBN=XNET11,RLINADD=0A5,PKTMODL=8,XLINADD=0A4,VCSC*
NB=30,DM=0,LL2IDL=BALL2IDL,LL3IDL=BALL3IDL,TPTIMER=5,NPR*
ETRY=4,NDRETRY=2,TDTIMER=1,REL2MSK=00000000,LCNO=0,XPARE*
NT=0,XUACBRN=X25U0A4R,XUACBXN=X25U0A4X,XSLUBN=,STATSEP=B*
ALNASTA
X25K0A40 BAK2LCG LCGN=0,LCCNT=2
XB0A4001 BAK2VC TYPE=P,DSTNODE=,XID=1000,VCCINAM=X25N1C3,RETVCTO=30,RET*
VCCT=3,LLC=2,LCN=1,VCCINDX=3,OUFINDX=0,VCMOUEP=BALVCOF1,*
LLCOUTK=BALT5OUT,SOTN=XC0A4001,PLPINAC=BALPLPI1,PLPINEP=*
BALPLPI,VACBN=XAOA4001,GCBN=X25P0A4A,PKTMODL=8
X25KM0A6 BAK2MCH NRZI=,STATION=DCE,PROTCOL=LAPB,SOTN=XC0A6,MWINDOW=3,FR*
MLGTH=131,RETRYCT=0,RETRYTO=0,ACBXN=X25A0A6X,ACBRN=X25A0*
A6R,LIQN=X25Q0A6,MCHNO=4,CSBTYPE=2,VCGATL=1,VCGATN=X25KG*
0A6,VCBATN=X25KV0A6,VCBATL=2,PLPOUEP=BALPLPO,VCMINEP=BAL*
VCIE1,GCBN=XNET11,RLINADD=0A7,PKTMODL=8,XLINADD=0A6,XPSC*
NB=30,DM=0,LL2IDL=BALL2IDL,LL3IDL=BALL3IDL,TPTIMER=5,NPR*
ETRY=4,NDRETRY=2,TDTIMER=1,REL2MSK=00000000,LCNO=0,XPARE*
NT=0,XUACBRN=X25U0A6R,XUACBXN=X25U0A6X,XSLUBN=,STATSEP=B*
ALNASTA
X25K0A60 BAK2LCG LCGN=0,LCCNT=2
XB0A6001 BAK2VC TYPE=S,DSTNODE=,XID=1000,VCCINAM=X25N1C1,OUFINAM=X25N10*
1,CALL=INOUT,RETVCTO=30,RETVCCCT=3,LLC=2,LLCLIST=(2),LCN=*
1,VCCINDX=1,OUFINDX=1,VCMOUEP=BALVCOF1,LLCOUTK=BALT5OUT,*
SOTN=XC0A6001,PLPINAC=BALPLPI1,SLUBN=XS0A6001,PLPINEP=BA*
LPLPI,VACBN=XAOA6001,GCBN=X25S0A6A,PKTMODL=8
$SRCL0 CSECT
./ ADD NAME=X25BLK2
./ NUMBER NEW1=10000,INCR=1000
BAK2END LSTUACB=YES,LLC0EP=(BALPCA0,BALPCA1),LLC2EP=(BALPSHO,B*
ALPSHI)
$SRCHI CSECT
./ ADD NAME=X25LOI2
./ NUMBER NEW1=10000,INCR=1000
INCLUDE ULIB(BALNASME)
./ ADD NAME=X25HII2
./ NUMBER NEW1=10000,INCR=1000
INCLUDE ULIB(BALNASM4)
INCLUDE ULIB(BALL2TMB)
INCLUDE ULIB(BALSTAM8)
INCLUDE ULIB(BALVCIM6)
INCLUDE ULIB(BALVCIMC)
INCLUDE ULIB(BALVCOMA)
INCLUDE ULIB(BALPLPL3)
INCLUDE ULIB(BALPLPOU)
INCLUDE ULIB(BALPLPI)
INCLUDE ULIB(BALCTLPR)
INCLUDE ULIB(BALLCIND)
INCLUDE ULIB(BALT5OUT)

```

```

INCLUDE ULIB(BAL2BM)
INCLUDE ULIB(BAL3LAP1)
INCLUDE ULIB(BAL3LAP2)
INCLUDE ULIB(BAL3LAPS)
INCLUDE ULIB(BAL2B2)
INCLUDE ULIB(BALUSIMF)
INCLUDE ULIB(BALPCNM9)
INCLUDE ULIB(BALPSHM7)
./ ADD NAME=X25INI2
./ NUMBER NEW1=10000,INCR=1000
INCLUDE ULIB(BALINIMD)
./ ADD NAME=X25L2
./ NUMBER NEW1=10000,INCR=1000
ORDER BALNASME
./ ADD NAME=X25HI02
./ NUMBER NEW1=10000,INCR=1000
ORDER BALTICK
ORDER BALNASM4
ORDER BALL2TMB
ORDER BALSTAM8
ORDER BALVCIM6
ORDER BALVCIMC
ORDER BALVCOMA
ORDER BALPLPL3
ORDER BALPLPOU
ORDER BALPLPI
ORDER BALCTLPR
ORDER BALLCIND
ORDER BALT5OUT
ORDER BAL2BM
ORDER BAL3LAP1
ORDER BAL3LAP2
ORDER BAL3LAPS
ORDER BAL2B2
ORDER BALUS9
ORDER BALUSA
ORDER BALUSB
ORDER BALPCNM9
ORDER BALPSHM7
./ ADD NAME=X25IN02
./ NUMBER NEW1=10000,INCR=1000
ORDER BALINIMD
./ ADD NAME=X25NCP2
./ NUMBER NEW1=10000,INCR=1000
XNET11 GROUP LNCTL=SDLC,LEVEL2=BALNAML2,LEVEL3=BALNAML3,USERID=(56689*
81,BALMBDT),LEVEL5=NCP,TYPE=NCP,TIMER=(BALLAP4,BALLAP4,B*
ALLAP4,BALLAP4),XIO=(BALNAMXL,BALNAMXS,BALNAMXI,BALNAMX*
),DIAL=NO
XM040A0 LINE UACB=(X25A0A0X,X25A0A0R),ADDRESS=(0A0,0A1),SPEED=9600
XC0A0 SERVICE ORDER=XP040A0
XP040A0 PU ADDR=01,MAXDATA=261,ANS=STOP,PUTYPE=1
XU040A0 LU LOCADDR=0,ISTATUS=INACTIVE
XM040A2 LINE UACB=(X25A0A2X,X25A0A2R),ADDRESS=(0A2,0A3),SPEED=9600
XC0A2 SERVICE ORDER=XP040A2
XP040A2 PU ADDR=01,MAXDATA=261,ANS=STOP,PUTYPE=1
XU040A2 LU LOCADDR=0,ISTATUS=INACTIVE
XM040A4 LINE UACB=(X25A0A4X,X25A0A4R),ADDRESS=(0A4,0A5),SPEED=9600
XC0A4 SERVICE ORDER=XP040A4
XP040A4 PU ADDR=01,MAXDATA=261,ANS=STOP,PUTYPE=1
XU040A4 LU LOCADDR=0,ISTATUS=INACTIVE
XM040A6 LINE UACB=(X25A0A6X,X25A0A6R),ADDRESS=(0A6,0A7),SPEED=9600
XC0A6 SERVICE ORDER=XP040A6
XP040A6 PU ADDR=01,MAXDATA=261,ANS=STOP,PUTYPE=1
XU040A6 LU LOCADDR=0,ISTATUS=INACTIVE
X25P0A0A GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*
PE=NCP,USERID=(5668981,BALPBDT),TIMER=(BALNATER,BALNATRA*
,BALNATST,BALNATLS),XIO=(BALNAVXL,BALNAVXS,BALNAVXI,BALN*
AVXK),DIAL=NO
XLOA0001 LINE ADDRESS=NONE,UACB=XA0A0001
XC0A0001 SERVICE ORDER=XP0A0001
XP0A0001 PU PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A0001 LU LOCADDR=0
XLOA0002 LINE ADDRESS=NONE,UACB=XA0A0002
XC0A0002 SERVICE ORDER=XP0A0002
XP0A0002 PU PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A0002 LU LOCADDR=0
XLOA0003 LINE ADDRESS=NONE,UACB=XA0A0003
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```

```

XC0A0003 SERVICE ORDER=XP0A0003
XP0A0003 PU PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A0003 LU LOCADDR=0
XL0A0004 LINE ADDRESS=NONE,UACB=XA0A0004
XC0A0004 SERVICE ORDER=XP0A0004
XP0A0004 PU PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A0004 LU LOCADDR=0
X25P0A2A GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*
PE=NCP,USERID=(5668981,BALPBDT),TIMER=(BALNATER,BALNATRA*
,BALNATST,BALNATLS),XIO=(BALNAVXL,BALNAVXS,BALNAVXI,BALN*
AVXK),DIAL=NO

XL0A2001 LINE ADDRESS=NONE,UACB=XA0A2001
XC0A2001 SERVICE ORDER=XP0A2001
XP0A2001 PU PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A2001 LU LOCADDR=0
XL0A2002 LINE ADDRESS=NONE,UACB=XA0A2002
XC0A2002 SERVICE ORDER=XP0A2002
XP0A2002 PU PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A2002 LU LOCADDR=0
XL0A2003 LINE ADDRESS=NONE,UACB=XA0A2003
XC0A2003 SERVICE ORDER=XP0A2003
XP0A2003 PU PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A2003 LU LOCADDR=0
XL0A2004 LINE ADDRESS=NONE,UACB=XA0A2004
XC0A2004 SERVICE ORDER=XP0A2004
XP0A2004 PU PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A2004 LU LOCADDR=0
X25P0A4A GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*
PE=NCP,USERID=(5668981,BALPBDT),TIMER=(BALNATER,BALNATRA*
,BALNATST,BALNATLS),XIO=(BALNAVXL,BALNAVXS,BALNAVXI,BALN*
AVXK),DIAL=NO

L040A4 LINE ADDRESS=NONE,UACB=XA0A4001
XC0A4001 SERVICE ORDER=P040A4A
P040A4A PU ADDR=C1,MAXDATA=265,MAXOUT=7,PASSLIM=7,MODETAB=MT32763,S*
SCPFM=USSCS,USSTAB=US3276,ISTATUS=INACTIVE,PUTYPE=2
T040A4A1 LU LOCADDR=2,ISTATUS=ACTIVE
X25S0A6A GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*
PE=NCP,USERID=(5668981,BALSBDT),TIMER=(BALNATER,BALNATRA*
,BALNATST,BALNATLS),XIO=(BALNAVXL,BALNAVXS,BALNAVXI,BALN*
AVXK),DIAL=YES

XL0A6001 LINE CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A6001
XP0A6001 PU PUTYPE=(1,2),MAXLU=3
X25S0A2B GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*
PE=NCP,USERID=(5668981,BALSBDT),TIMER=(BALNATER,BALNATRA*
,BALNATST,BALNATLS),XIO=(BALNAVXL,BALNAVXS,BALNAVXI,BALN*
AVXK),DIAL=YES

XL0A2007 LINE CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A2007
XP0A2007 PU PUTYPE=(1,2),MAXLU=1
XL0A2006 LINE CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A2006
XP0A2006 PU PUTYPE=(1,2),MAXLU=1
XL0A2005 LINE CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A2005
XP0A2005 PU PUTYPE=(1,2),MAXLU=1
X25S0A0B GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*
PE=NCP,USERID=(5668981,BALSBDT),TIMER=(BALNATER,BALNATRA*
,BALNATST,BALNATLS),XIO=(BALNAVXL,BALNAVXS,BALNAVXI,BALN*
AVXK),DIAL=YES

XL0A0007 LINE CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A0007
XP0A0007 PU PUTYPE=(1,2),MAXLU=1
XL0A0006 LINE CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A0006
XP0A0006 PU PUTYPE=(1,2),MAXLU=1
XL0A0005 LINE CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A0005
XP0A0005 PU PUTYPE=(1,2),MAXLU=1
GENEND SCANCTL=(2,2),HSPDSEL=(00111111),INIT=BALINMD,SRCHI=X2*
5BLK2,SRCL0=X25TBL2,INCL2L0=X25L0I2,ORDL2L0=X25L2,INCL2H*
I=X25HI2,ORDL2HI=X25HIO2,INCINIT=X25INI2,ORDINIT=X25INO*
2,TMRTICK=BALTICK

./' ENDUP
/*

```

NCP GEN

The NCP generation procedure with the X.25 NPSI is similar to any other NCP gen without the X.25 NPSI. The only difference is that the converted X.25 macros from the X.25 gen and pre-assembled X.25 NPSI modules have to be included in the NCP.

The procedure for the NCP gen is as follows:

1. code the macros that define the NCP environment. This includes inserting the macros generated from the X.25 gen at the back of the NCP deck.
2. perform Stage 1 of the NCP gen, and
3. using the output produced by the NCP Stage 1, perform the NCP Stage 2 gen.

NCP Definition

The X.25 NPSI does not affect the definition of the NCP environment. The macros (e.g. PCCU, BUILD, GROUP, LINE, PU etc.) are coded the same way as when a PSDN is not used. The NCP in fact can be used in a mixed environment of virtual circuits and conventional leased and switched lines.

Contained in the following section "NCP Definition Example" is a sample NCP definition.

The NCP macros generated by the X.25 gen were inserted at the end of the normal NCP definition deck before the NCP END macro.

Careful consideration should be given to the BFRS operand in the BUILD macro. This operand specifies the size of the buffers in the NCP buffer pool, and can have some impact on the user's packet network cost. The X.25 SNA Guide contains a detailed discussion on the effect that the NCP buffer size has on the data flow through a PSDN.

In the BUILD macro, the OBJLIB=OBJWORK operand specified that the output from the assembly steps in the NCP Stage 2 is to be placed in the NCP715.OBJWORK working library.

The MACLIB=(STAGE2,MAC3705X) operand specified that the macro libraries of NCP715.STAGE2 (i.e. the working PDS library from X.25 Stage 2 Gen) and NCP715.MAC3705X (from the X.25 NPSI tape) are to be included in the NCP Stage 2 gen in addition to the standard ACF/NCP/VS NCP715.MAC3705 library. This operand also specified that the NCP715.STAGE2 dataset contained INCLUDE and ORDER link edit control statements to be used in the NCP Stage 2 link edit step. Please note the order of entry in the MACLIB operand of the BUILD macro. Only the first member specified in this operand will have a DD statement produced by the NCP Stage 1 for the NCP Stage 2 link edit step.

The USERLIB=OBJ3705X operand instructed the NCP Stage 1 to include the NCP715.OBJ3705X user library (object modules supplied in the X.25 NPSI) - i.e. the ULIB DD statement - in the NCP Stage 2 link edit step.

In our network, since we have an SVC, we had to include a LUDRPOOL macro to define a pool of logical unit control blocks that the NCP can use to communicate with the LU's over the SVC.

In the NCP definition example below the OBJQUAL operand of the BUILD macro is used to give a unique name to the assembled object modules produced by the NCP Stage 2 Gen. This topic is further discussed in the section titled "Unique Generation Naming" on page 67.

Don't forget to include an END statement at the end of the NCP definition or the NCP Stage 1 gen will end with a 04 completion code.

NCP Definition Example

```

*****
*   NCP STAGE 1 INPUT      *-- UNIQUE GENERATION NUMBER = 2 -----*
*****
*   THE UNIQUE GENERATION NUMBER (ALSO REFERRED TO AS 'GENNO') IS *
*   USED IN THE FOLLOWING PLACES IN THIS INPUT SOURCE CODE:- *
*   1 - AS THE LAST DIGIT IN 'NEWNAME' BELOW. *
*   2 - 'NEWNAME' AND 'OBJQUAL' IN THE 'NCPBUILD' MACRO. *
*   3 - IN THE COMMENTS PRECEDING THE INCLUDED X25 GENERATED NCP *
*   SOURCE CODE. *
* THIS GENNO ALLOWS A UNIQUE NAMING SYSTEM THROUGHOUT THE X25 STAGE 1,*
* X25 STAGE 2, NCP STAGE 1 AND NCP STAGE 2 GENERATION PROCESS WHICH *
* ENABLES MORE THAN 1 SIMULTANEOUS GENERATION (FULL OR PARTIAL) TO *
* BE EXECUTED USING THE SAME DATA SETS. *
*****
*   NEWNAME = N043FX2      *           UNITSZ = 152 *
*****                       MAXBFRU = 25 *
*           *           MAXSUBA = 127 *
*   ACF/NCP REL 2.1      *           SUBAREA = 04 *
*           *           3705 = 03F (REAL) *
*   PUT LEVEL 8204      *           = 0FB (MVS) *
*****
*   HARDWARE SPECIFICATIONS:- *
*           R P L IS INSTALLED *
*           512 K STORAGE *
*****
*   CHANNEL ATTACHED TO SUBAREA 01, 03, 09 *
*****
*-- 3705 BASE FRAME -----*
*           CHANNEL ADAPTER TYPE 1 (2 CHANNEL SWITCH) *
*           SCANNER TYPE 3 *
*   LINE ADDR      NEWSYNCH NRZI POLLED USE           ADAPTER*
*   *
*   24              NOT USED              1S *
*   *
*   26              NOT USED              1W *
*   *
*   28/2A          NOT USED              1Z *
*   *
*   2C/2E          NOT USED              1U *
*   *
*-- 3706 1ST EXTENSION -----*
*           SCANNER TYPE 2 *
*   LINE ADDR      NEWSYNCH NRZI POLLED USE           ADAPTER*
*   *
*   A0/A1 X25 , FDX, NO      NO      NO      STATION DCE           1D *
*   *
*   A2/A3 X25 , FDX, NO      NO      NO      STATION DTE           1D *
*   *
*   A4/A5 X25 , FDX NO      NO      NO      STATION DCE           1D *
*   *
*   A6/A7 X25 , FDX NO      NO      NO      STATION DCE           1D *
*   *
*   A8              NOT USED              1A *
*   *
*   A9              NOT USED              1A *
*   *
*   AA              NOT USED              1A *
*   *
*   AB              NOT USED              1A *
*   *
*   AC              NOT USED              1C *
*   *
*   AD              NOT USED              1C *
*   *
*****
*           PCCU SPECIFICATIONS - VTAM ONLY *
*           *
*           MEMORY SIZE IS 512K *
*****
VTAMV2R1 PCCU CUADDR=0FB,      3705 CONTROL UNIT ADDRESS *
AUTODMP=NO,      AUTODMP IF NCP FAILS *
AUTOIPL=NO,      AUTOIPL AND RESTART *
X
X
X

```

```

AUTOSYN=YES,           USE THE ALREADY LOADED NCP IF OK   X
DUMPDS=NCPDUMP,       AUTODUMP REQUESTED                 X
INITEST=NO,           NCP TEST NOT REQUIRED BEFORE USE   X
MAXDATA=3758,         THIS IS THE MAX PIU INTO THE HOST X
SUBAREA=11,           SUBAREA 1 USES CHANNEL 03F        X
OWNER=HOST01,         (V) VTAM VER 2                     X
VFYLM=YES             VERIFY LOADED NCP BY OPERATOR      X

```

```

*
*****
* BUILD MACRO SPECIFICATIONS *
*****

```

```

NCPBUILD BUILD ABEND=YES, X
ASMREF=NO, NO ASSEMBLER CROSS-REFERENCE X
BFRS=128, NCP BUFFER SIZE X
CA=(TYPE1), CHANNEL ADAPTER TYPES X
CHANTYP=TYPE1, X
CSMHDR=27F5C711C3F0405C40C8C4D9405C, 3270 CRITSIT HEADERX
CSMHDR=40E3C5E7E3405C5C, 3270 CRITST HEADER EXTRA TEXT X
CSMSG=C3D9C9E3E2C9E35A40E385819440F040, CRITSIT MESSG X
CSMSGC=6040C1D5E240828587A4954B, CRITST MESSG EXTRA TEXT X
CUID=, NO SWITCHED BSC ID SEQUENCE DEVICES X
ENBLTO=6.5, IBM 386X REQUIRE 6.5 AS MINIMUM X
JOB CARD=MULTI, JOBCARDS PROVIDED BY NCP GEN X
LESIZE=320, LINK EDIT SIZE X
LOADLIB=LOAD, LIBRARY FOR NCP LOAD MODULE X
LTRACE=4, CAN TRACE 2 LINES CONCURRENTLY X
MAXSSCP=8, CONCURRENT, 2 HOSTS & 6MLocal-LOCAL X
MAXSUBA=127, ALLOW FOR UP TO 512 DEVICES/3705 X
MEMSIZE=512, 3705 STORAGE SIZE IS 512K BYTES X
MODEL=3705-2, MOD 2 3705 X
NEWNAME=N043FX2, NAME OF THIS LOAD MODULE (2 = GENNO)X
OBJLIB=OBJWORK, LIBRARY FOR ASSEMBLER OUTPUTS X
OBJQUAL=X2, X = X25, 2 = GENNO X
QUALIFY=NCP715, 1ST LEVEL QUALIFIER X
USERLIB=OBJ3705X, X25 OBJECT CODE LIBRARY X
MACLIB=(STAGE2,MAC3705X), X25 SOURCE CODE FOR NCP GEN X
PRTGEN=(NOGEN,NOGEN), GENERATED STATEMENTS NOT PRINTED X
REMLoad=YES, RPL INSTALLED X
RESOEXT=40, ALLOW 40 NAUS TO BE RE-USED X
SLOWDOWN=12, SLOWDOWN WHEN 12% OF BUFFERS AVAIL X
SUBAREA=04, SUBAREA OF THIS NCP X
TRACE=(YES,64), USE 64 16-BYTE ENTRIES X
TYPGEN=NCP, NCP ONLY X
PARTIAL=NO, PARTIAL GENERATION REQUIRED X
TYP SYS=OS, OS USED FOR STAGE 2 X
UNIT=SYSDA, DATA SET FOR ASSEMBLY AND LINK EDIT X

```

```

*****
* SYSCNTRL MACRO SPECIFICATIONS *
*****
NCP SYSC SYSCNTRL OPTIONS=(MODE,NAKLIM,SESSION,XMTLMT, X
BHSASSC,STORDSP, X
RCNTRL,RCOND,RECMD,RIMM,ENDCALL,SSPAUSE)

```

```

*****
* HOST MACRO SPECIFICATIONS ACF/VTAM *
*****
HOST01 HOST BFRPAD=0, 0 REQUIRED BY ACF/VTAM X
INBFRS=10, INITIAL 3705 ALLOCATION X
MAXBFRU=25, VTAM BUFFER UNIT ALLOCATION X
SUBAREA=(11), HOSTSA VTAM VER 2 X
STATMOD=YES, MINIMIZE ASYNCH CHANNEL INTERRUPTS X
TIMEOUT=120, AUTO SHUT DOWN IF NO RESP IN 2 MIN X
UNITSZ=152, VTAM IO BUFFER SIZE (IOBUF) X

```

```

*
*****
* CSB MACRO SPECIFICATIONS *
*****
NCP CSB0 CSB SPEED=(150,600,1200), BUS MACH CLOCKS X
MOD=0, SCANNER ADDRESS 020 TO 03F X
TYPE=TYPE3, TYPE 3 COMM SCANNER
NCP CSB1 CSB SPEED=(134,300,600,1200), BUS MACH CLOCKS X
MOD=1, SCANNER ADDRESS 0A0 TO 0CF X
TYPE=TYPE2, TYPE 2 COMM SCANNER

```

```

*****
* SWITCHED LINE LU POOL *
*****
SWPOOLU LUDRPOOL NUMTYP1=10,NUMTYP2=10

```

```

*           X25 DEFINITION - FROM X25 STAGE2 OUTPUT           *
*****
* PLACE GENERATED X25NCP2 (2 = GENNO) NCP DEFINITION STATEMENTS HERE *
* FROM LIBRARY 'NCP715.STAGE2' BEFORE END STATEMENT.         *
*****
XNET11  GROUP LNCTL=SDLC,LEVEL2=BALNAML2,LEVEL3=BALNAML3,USERID=(56689*
          81,BALMBDT),LEVEL5=NCP,TYPE=NCP,TIMER=(BALLAP4,BALLAP4,B*
          ALLAP4,BALLAP4),XIO=(BALNAMXL,BALNAMXS,BALNAMXI,BALNAMXK*
          ),DIAL=NO
XM040A0  LINE  UACB=(X25A0A0X,X25A0A0R),ADDRESS=(0A0,0A1),SPEED=9600
XC0A0    SERVICE ORDER=XP040A0
XP040A0  PU    ADDR=01,MAXDATA=261,ANS=STOP,PUTYPE=1
XU040A0  LU    LOCADDR=0,ISTATUS=INACTIVE
XM040A2  LINE  UACB=(X25A0A2X,X25A0A2R),ADDRESS=(0A2,0A3),SPEED=9600
XC0A2    SERVICE ORDER=XP040A2
XP040A2  PU    ADDR=01,MAXDATA=261,ANS=STOP,PUTYPE=1
XU040A2  LU    LOCADDR=0,ISTATUS=INACTIVE
XM040A4  LINE  UACB=(X25A0A4X,X25A0A4R),ADDRESS=(0A4,0A5),SPEED=9600
XC0A4    SERVICE ORDER=XP040A4
XP040A4  PU    ADDR=01,MAXDATA=261,ANS=STOP,PUTYPE=1
XU040A4  LU    LOCADDR=0,ISTATUS=INACTIVE
XM040A6  LINE  UACB=(X25A0A6X,X25A0A6R),ADDRESS=(0A6,0A7),SPEED=9600
XC0A6    SERVICE ORDER=XP040A6
XP040A6  PU    ADDR=01,MAXDATA=261,ANS=STOP,PUTYPE=1
XU040A6  LU    LOCADDR=0,ISTATUS=INACTIVE
X25P0A0A GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*
          PE=NCP,USERID=(5668981,BALPBDT),TIMER=(BALNATER,BALNATRA*
          ,BALNATST,BALNATLS),XIO=(BALNAVXL,BALNAVXS,BALNAVXI,BALN*
          AVXK),DIAL=NO
XL0A0001 LINE  ADDRESS=NONE,UACB=XA0A0001
XC0A0001 SERVICE ORDER=XP0A0001
XP0A0001 PU    PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A0001 LU    LOCADDR=0
XL0A0002 LINE  ADDRESS=NONE,UACB=XA0A0002
XC0A0002 SERVICE ORDER=XP0A0002
XP0A0002 PU    PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A0002 LU    LOCADDR=0
XL0A0003 LINE  ADDRESS=NONE,UACB=XA0A0003
XC0A0003 SERVICE ORDER=XP0A0003
XP0A0003 PU    PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A0003 LU    LOCADDR=0
XL0A0004 LINE  ADDRESS=NONE,UACB=XA0A0004
XC0A0004 SERVICE ORDER=XP0A0004
XP0A0004 PU    PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A0004 LU    LOCADDR=0
X25P0A2A GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*
          PE=NCP,USERID=(5668981,BALPBDT),TIMER=(BALNATER,BALNATRA*
          ,BALNATST,BALNATLS),XIO=(BALNAVXL,BALNAVXS,BALNAVXI,BALN*
          AVXK),DIAL=NO
XL0A2001 LINE  ADDRESS=NONE,UACB=XA0A2001
XC0A2001 SERVICE ORDER=XP0A2001
XP0A2001 PU    PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A2001 LU    LOCADDR=0
XL0A2002 LINE  ADDRESS=NONE,UACB=XA0A2002
XC0A2002 SERVICE ORDER=XP0A2002
XP0A2002 PU    PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A2002 LU    LOCADDR=0
XL0A2003 LINE  ADDRESS=NONE,UACB=XA0A2003
XC0A2003 SERVICE ORDER=XP0A2003
XP0A2003 PU    PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A2003 LU    LOCADDR=0
XL0A2004 LINE  ADDRESS=NONE,UACB=XA0A2004
XC0A2004 SERVICE ORDER=XP0A2004
XP0A2004 PU    PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A2004 LU    LOCADDR=0
X25P0A4A GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*
          PE=NCP,USERID=(5668981,BALPBDT),TIMER=(BALNATER,BALNATRA*
          ,BALNATST,BALNATLS),XIO=(BALNAVXL,BALNAVXS,BALNAVXI,BALN*
          AVXK),DIAL=NO
L040A4  LINE  ADDRESS=NONE,UACB=XA0A4001
XC0A4001 SERVICE ORDER=P040A4A
P040A4A  PU    ADDR=C1,MAXDATA=265,MAXOUT=7,PASSLIM=7,MODETAB=MT32763,S*
          SCPFM=USSSCS,USSTAB=US3276,ISTATUS=INACTIVE,PUTYPE=2
T040A4A1 LU    LOCADDR=2,ISTATUS=ACTIVE
X25S0A6A GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*

```

```

                PE=NCP,USERID=(5668981,BALSBDT),TIMER=(BALNATER,BALNATRA*
                ,BALNATST,BALNATLS),XIO=(BALNAVXL,BALNAVXS,BALNAVXI,BALN*
                AVXK),DIAL=YES
XLOA6001 LINE  CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A6001
XPOA6001 PU     PUTYPE=(1,2),MAXLU=3
X25S0A2B GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*
                PE=NCP,USERID=(5668981,BALSBDT),TIMER=(BALNATER,BALNATRA*
                ,BALNATST,BALNATLS),XIO=(BALNAVXL,BALNAVXS,BALNAVXI,BALN*
                AVXK),DIAL=YES
XLOA2007 LINE  CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A2007
XPOA2007 PU     PUTYPE=(1,2),MAXLU=1
XLOA2006 LINE  CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A2006
XPOA2006 PU     PUTYPE=(1,2),MAXLU=1
XLOA2005 LINE  CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A2005
XPOA2005 PU     PUTYPE=(1,2),MAXLU=1
X25S0A0B GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*
                PE=NCP,USERID=(5668981,BALSBDT),TIMER=(BALNATER,BALNATRA*
                ,BALNATST,BALNATLS),XIO=(BALNAVXL,BALNAVXS,BALNAVXI,BALN*
                AVXK),DIAL=YES
XLOA0007 LINE  CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A0007
XPOA0007 PU     PUTYPE=(1,2),MAXLU=1
XLOA0006 LINE  CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A0006
XPOA0006 PU     PUTYPE=(1,2),MAXLU=1
XLOA0005 LINE  CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A0005
XPOA0005 PU     PUTYPE=(1,2),MAXLU=1
                GENEND SCANCTL=(2,2),HSPDSEL=(00111111),INIT=BALINIMD,SRCHI=X2*
                5BLK2,SRCL0=X25TBL2,INCL2L0=X25LOI2,ORDL2L0=X25L2,INCL2H*
                I=X25HII2,ORDL2HI=X25HIO2,INCINIT=X25INI2,ORDINIT=X25INO*
                2,TMRTICK=BALTICK
**
                END

```

NCP Stage 1 Gen

Once the NCP definition is put together, the NCP Stage 1 assembly can be run.

The section below "JCL for NCP Stage 1 Gen" on page 59 has the sample JCL used in our Stage 1 gen. The output was punched into a PDS NCP715.STG1.OUTPUT(N043FX2). Note that NCP stage 1 generations run much faster when the Assembler H is used as in our example. There is no need to use the 3705 assembler for the stage 1 generation in OS.

Note that the library NCP715.MODS.GEN3705 is again concatenated in front of the normal generation libraries (ddname = SYSLIB). This serves the same purpose as described for the X.25 Stage 1 Gen. See "X.25 Stage 1 Gen" on page 48. The members that have been modified and placed in the MODS.GEN3705 dataset and their relevant changes are described below:-

- The first required member is JOBCARD which is the NCP Stage 2 OS JCL jobcard that is automatically produced by the NCP Stage 1 Gen if JOBCARD=MULTI or JOBCARD=YES is coded as an operand of the BUILD macro. Listed below is an illustration of the JOBCARD member as used in the IBM Raleigh Systems Centre. Note the characters &SNOA coded in the jobname, this is to provide an automatic sequential number as a suffix to the jobname eg. NCPGEN1 to NCPGEN15.

```

COL-----+-----1-----+-----2-----+-----3-----+-----4-----+-----5-----+-----6-----
PUNCH '//NCPGEN&SNOA JOB ','NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),'
PUNCH '// CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440'

```

- The next member ASMJCL is a modified copy of the same member in the library NCP715.GEN3705. This macro produces the NCP Stage 2 assembler JCL. The first change was to add in a STEPLIB DD statement. The SYSOUT operand in the SYSPRINT DD statement was modified to =*. A VOL=SER=TPOSP1 operand was added to the SYSUT1, SYSUT2 and SYSUT3 DD statements to provide sufficient direct access work space for the Stage 2 assembly jobs. The last modification to this member was to the SYSLIB DD statement to point to our NCP macro library NCP715.MAC3705 in the DSN= operand.

- The last modified member added to NCP715.MODS.GEN3705 was NGEN4. This macro produces the NCP Stage 2 linkage edit JCL and Link Edit statements. The SYSOUT operand on the SYSPRINT DD statement was changed to a print class=*, and the OBJ3705 DD statement had the DSN qualifier changed to NCP715 from SYS1.

Your NCP Stage 1 gen should have a completion code of 00.

JCL for NCP Stage 1 Gen

```

COL-----+-----1-----+-----2-----+-----3-----+-----4-----+-----5-----+-----6-----
//WTCRES9B JOB  , 'WTCRES9',MSGCLASS=0,MSGLEVEL=(1,1),TIME=1440,
//          CLASS=D,NOTIFY=WTCRES9
//*****
//* NCP STAGE 1 JCL                                     *
//*****
//*ROUTE PRINT RDPD3MVS.RMT99
//NCPGEN PROC GEN=
//* GEN = 1 DIGIT UNIQUE GENERATION NUMBER (GENNO)
//S1      EXEC PGM=IEV90,PARM='DECK,NOOBJECT',REGION=1024K
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR,UNIT=SYSDA,VOL=SER=M11LB1
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
//          SPACE=(3025,(120,120))
//SYSUT1  DD UNIT=SYSDA,SPACE=(CYL,(100)),DSN=##SYSUT1
//SYSLIB  DD DSN=NCP715.MODS.GEN3705,DISP=SHR
//          DD DSN=NCP715.GEN3705,DISP=SHR
//          DD DSN=NCP715.GEN3705X,DISP=SHR(not necessary)
//SYSPUNCH DD DSN=NCP715.STG1.OUTPUT(N043FX&GEN),DISP=OLD
//SYSIN   DD DSN=NCP715.COMMON.X25(N715SRC&GEN),DISP=SHR
//          PEND
//          EXEC NCPGEN,GEN=2
//

```

NCP Stage 2 Gen

The output from the NCP Stage 1 gen is used as the basis for input to the NCP Stage 2 gen. For better control, it is advisable to break the Stage 2 jobs into two parts: part 1 for the Stage 2 assembly jobs and part 2 for the link edit job. This way the link edit step only needs to be run after the user is satisfied that the assemblies have been completed successfully.

"JCL for NCP Stage 2 assembly steps" on page 61 and "JCL for NCP Stage 2 link edit step" on page 65 give the JCL used in the Stage 2 assembly and link edit jobs. The assembly job consists of 14 steps. Note that the X.25 NPSI macro library NCP715.MAC3705X and the X.25 user control blocks macros in the dataset NCP715.STAGE2 that were generated in the X.25 gen are required only in job 1 (NCPGEN1). A completion code of 4 is acceptable for the various assembly job steps.

Note that the output from the assembly jobs are stored in the SYSPUNCH data set named NCP715.OBJWORK. This PDS must first be pre-allocated with a DCB of FB.

After the assembly jobs have been completed successfully, the link edit job is run to create the load module for the NCP.

Note the various datasets used in the link edit step.

- SYSLMOD specifies where the NCP load module is to be stored (NCP715.LOAD). Make sure that this PDS has been authorized to the system (e.g. via SYS1.PARMLIB(IEAAPF00) under MVS) if the NCP is to be loaded from this dataset by VTAM.
- LOAD3705 (NCP715.LOAD) is used as a temporary store for the included X.25 object modules which are linked as load module N043FX2U in the link edit job.

- The SYSPUNCH dataset (NCP715.OBJWORK) refers to the output from the Stage 2 assembly jobs.
- OBJ3705 and ULIB point to the NCP and X.25 NPSI object module libraries NCP715.MAC3705 and NCP715.MAC3705X.
- STAGE2 (NCP715.STAGE2) refers to the linkage editor ORDER statements built in the X.25 Stage 1 gen.
- SYSLIN (NCP715.STAGE2) contains the link edit include statements for the X.25 object modules from ULIB (NCP715.OBJ3705X). These link edit statements are produced by the X.25 Stage 1 gen.

A completion code of 4 is acceptable for this link edit step.

Both LOAD3705 and SYSLMOD point to the same PDS - NCP715.LOAD. The first steps in the link edit job are to create NCP load modules (e.g. SYSX2000, SYSX2001, SYSX2002, SYSX2006, SYSX2007, SYSX2008, SYSX200B, SYSX200C, SYSX200D, etc.). These are later combined with previous NCP stage 2 output (object modules and control blocks) and the X.25 user load module to create the NCP load module. Although these temporary NCP load modules are not necessary for loading the NCP, the user may still want to keep them for future partial NCP generations. If the user is short of real DASD storage space, or he does not want to clutter the NCP load library, he could specify an MSS or an alternate DASD volume for the LOAD3705 and SYSLMOD datasets for this link edit step. After the successful completion of the job, he can then move the NCP load module (e.g. N043FX2) and resource resolution table (e.g. N043FX2R) into his NCP load library.

After the NCP gen, the user may want to perform an SMP JCLIN run to include the NCP into the CDS.

JCL for NCP Stage 2 assembly steps

This section is included only for completeness, to show all the output produced by the Stage 1. It is just a normal NCP stage 2 generation process with no special features.

```
//NCPGEN1 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
//          CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S1 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
//          SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSLIB DD DSN=NCP715.MAC3705,DISP=SHR
//          DD DSN=NCP715.STAGE2,DISP=SHR
//          DD DSN=NCP715.MAC3705X,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK(N043FX2),DISP=OLD
//SYSIN DD *
//          ***** NCP GENERATION MACROS *****
//          ***** X25 GENERATION MACROS *****
/*
//NCPGEN2 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
//          CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S2 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
//          SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSLIB DD DSN=NCP715.MAC3705,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK(N043FX2T),DISP=OLD
//SYSIN DD *
//          ***** NCP GENERATION MACROS *****
/*
//NCPGEN3 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
//          CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S3 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
//          SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSLIB DD DSN=NCP715.COMMON.X25,DISP=SHR
//          DD DSN=NCP715.MAC3705,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK(SYSX2000),DISP=OLD
//SYSIN DD *
//          ***** NCP GENERATION MACROS *****
/*
//NCPGEN4 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
//          CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S4 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
//          SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSLIB DD DSN=NCP715.MAC3705,DISP=SHR
```

```

//SYSPUNCH DD DSN=NCP715.OBJWORK(SYSX2010),DISP=OLD
//SYSIN DD *
***** NCP GENERATION MACROS *****
/*
//NCPGEN5 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
// CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S5 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
// SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
// DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
// DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
// DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSLIB DD DSN=NCP715.MAC3705,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK(SYSX2001),DISP=OLD
//SYSIN DD *
***** NCP GENERATION MACROS *****
/*
//NCPGEN6 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
// CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S6 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
// SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
// DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
// DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
// DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSLIB DD DSN=NCP715.MAC3705,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK(SYSX2002),DISP=OLD
//SYSIN DD *
***** NCP GENERATION MACROS *****
/*
//NCPGEN7 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
// CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S7 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
// SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
// DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
// DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
// DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSLIB DD DSN=NCP715.MAC3705,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK(SYSX2006),DISP=OLD
//SYSIN DD *
***** NCP GENERATION MACROS *****
/*
//NCPGEN8 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
// CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S8 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
// SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
// DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
// DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
// DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSLIB DD DSN=NCP715.MAC3705,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK(SYSX2007),DISP=OLD
//SYSIN DD *
***** NCP GENERATION MACROS *****
/*
//NCPGEN9 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
// CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S9 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),

```

```

//          SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSLIB DD DSN=NCP715.MAC3705,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK(SYSX2008),DISP=OLD
//SYSIN DD *
          ***** NCP GENERATION MACROS *****
/*
//NCPGEN10 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
//          CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S10 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
//          SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSLIB DD DSN=NCP715.MAC3705,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK(SYSX200B),DISP=OLD
//SYSIN DD *
          ***** NCP GENERATION MACROS *****
/*
//NCPGEN11 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
//          CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S11 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
//          SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSLIB DD DSN=NCP715.MAC3705,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK(SYSX200C),DISP=OLD
//SYSIN DD *
          ***** NCP GENERATION MACROS *****
/*
//NCPGEN12 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
//          CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S12 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
//          SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSLIB DD DSN=NCP715.MAC3705,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK(SYSX200D),DISP=OLD
//SYSIN DD *
          ***** NCP GENERATION MACROS *****
/*
//NCPGEN13 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
//          CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S13 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
//          SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1

```

```

//SYSLIB DD DSN=NCP715.MAC3705,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK(SYSX200E),DISP=OLD
//SYSIN DD *
        ***** NCP GENERATION MACROS *****
/*
//NCPGEN14 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
//          CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S14 EXEC PGM=CWAX00,PARM='DECK,NOXREF'
//STEPLIB DD DSN=TPO.PPLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=121,BLKSIZE=3025,RECFM=FB),
//          SPACE=(3025,(120,120))
//SYSUT1 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT2 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSUT3 DD UNIT=SYSDA,SPACE=(1700,(800,800)),
//          DCB=(OPTCD=C),VOL=SER=TPOSP1
//SYSLIB DD DSN=NCP715.MAC3705,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK(SYSX2011),DISP=OLD
//SYSIN DD *
        ***** NCP GENERATION MACROS *****
/*

```

JCL for NCP stage 2 link edit step

```
//NCPGEN15 JOB , 'NCPGEN',MSGCLASS=0,MSGLEVEL=(1,1),
//          CLASS=D,NOTIFY=NCPGEN,REGION=500K,TIME=1440
//S15 EXEC PGM=IEWL,REGION=320K,
//          PARM='LIST,LET,DC,NCAL,XREF,SIZE=(310K,48K),ALIGN2'
//SYSPRINT DD SYSOUT=*
//SYSUT1 DD UNIT=SYSDA,SPACE=(1024,(50,20))
//LOAD3705 DD DSN=NCP715.LOAD,DISP=SHR
//SYSLMOD DD DSN=NCP715.LOAD,DISP=SHR
//OBJ3705 DD DSN=NCP715.OBJ3705,DISP=SHR
//SYSPUNCH DD DSN=NCP715.OBJWORK,DISP=SHR
//ULIB DD DSN=NCP715.OBJ3705X,DISP=SHR
//STAGE2 DD DSN=NCP715.STAGE2,DISP=SHR
//SYSLIN DD DSN=NCP715.STAGE2(X25LOI2),DISP=SHR
//        DD DSN=NCP715.STAGE2(X25HII2),DISP=SHR
//        DD DSN=NCP715.STAGE2(X25INI2),DISP=SHR
//        DD *
//        ***** LINKAGE EDIT STATEMENTS *****
/*
```

PARTIAL GEN

Depending on the kind of changes that a user wants to make to his macros (NCP or X.25), it may be possible to do a partial NCP gen.

Appendix B in the ACF/NCP/VS Installation manual (SC30-3142) gives a detailed discussion on Partial Program Generation.

It is important to understand that the purpose of the X.25 Gen is to:

- convert the X.25 network description (i.e. X.25 macros) to equivalent NCP macros (i.e. GROUP, LINE, SERVICE, PU, LU and GENEND macros) to be included in the NCP Stage 1 gen,
- Create X.25 control blocks for NCP CSECTS \$SRCL0 and \$SRCHI, and
- Produce linkage-edit control statements (INCLUDE and ORDER) to include the appropriate pre-assembled X.25 NPSI modules in the NCP load module.

If changes are made to the X.25 macros, then the user would need to rerun both Stages 1 and 2 of the X.25 Gen. If the X.25 macros are the only changes, then this is equivalent to changing the GROUP, LINE, SERVICE, PU, LU or GENEND macros. Appendix B in the ACF/NCP/VS Installation should provide the user with sufficient information on the modules that need to be re-assembled.

If the changes do not involve X.25 macros, then the X.25 Gen need not be rerun. In this case, just follow the Partial Gen instructions given in Appendix B of the NCP Installation manual.

In any case, the Partial NCP Gen will involve specifying PARTIAL=YES and listing the modules to be reassembled in the CONDASM operand of the NCP BUILD macro. The NCP Stage 1 is then rerun, and a re-assembly is done on the selected modules. Finally the linkage-editing step is required to create a new NCP load module.

As a precaution, the user should refer to Chapter 4 in the ACF/NCP/VS Installation manual (p.4-2) on the naming considerations in the case of multiple NCP generations.

Since the X.25 and NCP generations are only a series of assembly and link-edit steps, it is not necessary to bring down the 3705 when the generation jobs are being run.

Once a new NCP load module has been successfully created, the user simply has to deactivate the old version of the NCP module and load in the new module using the VTAM activation command with the operand LOAD=YES.

Note that during activation VTAM will always check in the SYS1.VTAMLST library to determine if the NCP major node member has been changed. If the VTAMLST member has not changed and if there is a corresponding member in SYS1.VTAMOBJ then it will load the copy from SYS1.VTAMOBJ. Otherwise it will create its major node from the description in SYS1.VTAMLST.

If the newly generated NCP is a replacement of an existing NCP load module, remember to copy the NCP load module and resource resolution table (N043FX2 and N043FX2R) into the NCP load library, and to copy the NCP definition statements into the VTAMLST library before loading the new NCP module for the first time.

UNIQUE GENERATION NAMING

During the testing of the initial versions of the X.25 NPSI R2 and R3 program products at the Raleigh Systems Centre it was necessary to use multiple NCP load modules for the varying test configurations. To achieve this a method was developed for uniquely naming all facets of the generation process for the X.25 Stage 1 and 2, and the NCP Stage 1 and 2. The user may want to adopt a similar naming convention if he is anticipating to have multiple copies of NCP's for his 3705.

The following is a list of all the items that have a unique name during the generation process with library where stored and the member or reference name used in the examples throughout this guide:-

1. The X.25 network definition source statements in the TSO dataset NCP715.COMMON.X25(X25SRC2) is the input to the X.25 Stage 1 Gen and is referenced using the SYSIN DD statement in the "JCL for X.25 Stage 1 Gen" on page 48.
2. The job stream for the X.25 Stage 2 Gen is placed in the PDS NCP715.STG1.OUTPUT(X25STG12) by the X.25 Stage 1 Gen. This is done by using the SYSPUNCH DD statement as shown in the "JCL for X.25 Stage 1 Gen" on page 48.
3. The output produced by the X.25 Stage 2 Gen are nine members of a PDS dataset NCP715.STAGE2, namely

X25TBL2, X25BLK2, X25LOI2, X25HII2, X25INI2, X26L2, X25HIO2, X25INO2, X25NCP2.

The first two members are given names by the operands SRCHI and SRCLO in the X25BUILD macro. The other members of NCP715.STAGE2 are named using the operands NCPSTG1, INCL2HI, INCINIT, INCL2LO, ORDINIT, ORDL2HI and ORDL2LO in the X25END macro.

4. The NCP definition source statements in the TSO dataset NCP715.COMMON.X25(N715SRC2) is the input to the X.25 Stage 1 Gen and is referenced using the SYSIN DD statement in the "JCL for NCP Stage 1 Gen" on page 59.
5. The job stream for the NCP Stage 2 Gen is placed in the PDS NCP715.STG1.OUTPUT(N043FX2) by the NCP Stage 1 Gen. This is done by using the SYSPUNCH DD statement as shown in the "JCL for NCP Stage 1 Gen" on page 59.
6. During the NCP Stage 2 Generation assembly jobs, compiled object modules are placed into NCP715.OBJWORK PDS dataset. In our example "JCL for NCP Stage 2 assembly steps" on page 61 the following object modules are produced:-

N043FX2, N043FX2T, SYSX2000, SYSX2010, SYSX2001, SYSX2002, SYSX2006, SYSX2007, SYSX2008, SYSX200R, SYSX200C, SYSX200D, SYSX200E and SYSX2011.

The first 2 object modules produced use the NEWNAME operand in the NCP BUILD macro. The other modules use standard NCP names except for the 4th and 5th digits which are specified by the OBJQUAL operand in the NCP Stage 1 BUILD macro.

7. During the NCP Stage 2 Gen link edit job 3 load modules are produced, namely

N043FX2, and N043FX2R and N043FX2U.

The names for these modules is specified by the operand NEWNAME in the NCP BUILD macro. Our example is coded with N043FX2.

All the names that are highlighted in this section have one thing in common, that is they all contain the number 2. By varying this character position through all digits and alphabetic characters etc., this allows the the generation of many different NCP's using the same datasets providing the files have enough dasd space defined. You will have noticed that throughout the samples in this document there are references to this unique generation number as GENNO.

APPENDIX A. NRZI - A POTENTIAL TRAP.

NRZI encoding of transmitted data is NOT a part of the CCITT Recommendation X.25. It is NOT supported by any IBM X.25 attachment.

NRZI encoding is however an option of IBM SDLC. Confusion and error can be caused by the presence of this option on all IBM SDLC hardware when this same hardware is used for X.25 attachment.

When data is transmitted over a communication line the receiving device must first identify the timing of arriving bits and their state (1 or 0). This can be done in the receiving modem or in the controller which attaches to the modem. In the case of "medium speed" modems (2400 bps and above) it is typical for the modem to transmit data in such a way as to guarantee the correct reception of bit timings and states at the receiver. On slower speed circuits (600/1200 BPS), in order to achieve a lower cost, modems are often much simpler devices. On many modems (and on all IBM devices which use "internal clocking") the receive bit timing is derived from the received data. That means that the receiver (modem or controller) relies upon changes in state of the received data to determine the boundaries between bits. In this procedure the receiver senses a transition between the 1 and 0 states and assumes this is the beginning/end of a bit. When consecutive bits of the same state are sent, the receiver must just wait one bit time and assume the presence of the next bit. But communication lines can "skew" (lengthen/shorten the bits) also it is unlikely that the receive and transmit clocks will be precisely the same speed. So these kinds of modem (or controller) cannot receive long sequences of the same bit. In SDLC or LAPB (these are identical at the frame level) it is not possible to send (onto the line) long sequences of "1" bits because the transparency algorithm will insert a "0" bit after every 5 "1" bits. Long sequences of "0" bits however, are not only possible but normal (in core dumps etc.).

NRZI transformation is a method of transmitting the data which ensures that there will be no long strings of either "1" or "0" transmitted. Thus for SDLC devices NRZI is normally recommended for 1200 BPS modems and required whenever internal clocking (business machine clocking) is used.

The absence of NRZI as an option in X.25 has several important consequences for IBM users.

1. **Internal clocking (business machine clocking) cannot be used for any IBM X.25 attachment.** On some attachments (e.g. Series/1) when internal clocking is strapped at the hardware level, NRZI operation is forced. On other attachments (e.g. X.25 NPSI) it is possible (though not supported) to use internal clocking without NRZI but it probably would fail the first time the user tried to receive a full packet of X'00'.
2. Most 1200 BPS modems will not work for LAPB.

The effects as seen by the user are;

1. There is no problem when attaching to a public data network because such networks typically supply their own (externally clocked) modems which have been tested and will work with LAPB. It does mean that the user cost of attachment is somewhat higher than it would have been because of the requirement for a high cost modem. Of course in the longer term many networks will use digital attachments with an X.21 interface and the problem does not exist for digital circuits. (It does exist for X.21 bis since for all intents and purposes X.21 bis is only the new name for V.24 - and requires a modem.)
2. When using the IBM X.25 interface products to provide direct attachments over leased lines without the presence of a PSDN the user MUST take care to use appropriate modems. An example of such attachment could be the attachment of a NON-IBM CPU or terminal (using X.25) to a 3705 using the X.25 NPSI PP. Another example might be the connection of such devices to a Series/1 or the direct connection of one IBM X.25 device to another.

One way of ensuring appropriate modems is to use speeds of 2400 BPS or above.

NRZI was a specifiable option for NPSI in Release 1 (and in the preceding PRPQ) it is no longer supported.

3. It is possible to generate a Series/1 system to use NRZI if it is specified in the device sysgen (DDM). This would be an error - but it does work. Unfortunately, when generated that way the Series/1 will talk to itself and all the wrap tests work - but it won't talk to a network or to a 3705.

Whenever installing IBM X.25 devices (with or without a PSDN) the user should keep in mind the possibility of NRZI being specified (or strapped) in error.

APPENDIX B. NAMING CONVENTIONS

This naming convention covers the definition of names used during the X.25 and NCP generation processes described in this guide. It also provides naming conventions which may be implemented in other areas not covered by this manual.

VTAM and NCP Naming Conventions

Type of resource		Name
Application program major node		Assv....
Application program major node	CICS IMS NCCF TSO	AssCICSv AssIMSV. AssNCFv. AssTSOv.
Application program minor node	CICS IMS NCCF TSO	CICSssv. IMSSsv. NCFssv. TSOssv.
CDRM major node		M00v....
CDRM minor node	own domain other domain	Mssv. Mxxv.
CDRSC major node consisting of:	Applications e.g CICS	RxxAv.. RxxACICS
	logical units defined under a	NCP LOCAL non-sna sna
CDRSC minor node		Name of original definition statement

NOTE: A description of the nomenclature used may be found under the heading "Terminology" on page 78.

Type of resource		Name
Component		Cssliapt
Group		Gssg..
Line		Lsslia
Local Non-SNA	Major node Minor node	Hsslv... Hsslcuu
Local S N A	Major node Cluster Terminal	HssSv... HsscuuP Hsscuutt
LU/Terminal (Optional except for the following group of terminals)	Terminals LOCADDR 1-35	Tssliapt
	or whatever is acceptable by the system support staff, the operations staff, or the end users.	
First LU or terminal specified to SSS for a PU or control UNIT	3631 3614 3650 3663 3790	FAssliap FCssliap QEsliap QDsliap INssliap
NCP major node		Nssuu..
Path	Major node	DssPATH.
	Minor node	no name
PU/Control Unit SDLC PU/Control Unit BSC		Pssliap Bssliap*

NOTE: A description of the nomenclature used may be found under the heading "Terminology" on page 78.

X.25 Naming Conventions

Type of resource		Name
NCP major node		NssuuXn
X.25 Physical Circuit	MCH PU LU	XMsslia XPsslia XUsslia
X.25 Virtual Circuit (Names are) (automatically) (generated by the) (X.25 Stage 1.)	Group Line SOT PU LU	X25Pliag XLIialcn XCIialcn PUIialcn LUIialcn
		For SNA Virtual Circuits LLC types 2 and 3 use the naming conventions described on the previous page.

NOTE: A description of the nomenclature used may be found under the heading "Terminology" on page 78.

Naming Conventions Example

Type of resource		Name
NCP	subarea=04,cua=03F, X.25,genno=2	N043FX2
.LINE	interface=0A4	L040A4
..PU	polling addr=A(X'c1)	P040A4A
...LU	local addr=1	T040A4A1

X.25 Physical Circuit		
.MCH	interface=0A0	XM040A0
..PU		XP040A0
...LU		XU040A01

X.25 Virtual Circuit No 7(SVC)		
.LINE	interface=0A0	XL0A007
..PU		XP0A007

LOCAL	host suba=11,cua=371	H11L371

TSO	major node, suba=11	A11TSO
TSO	host suba=11, TCAS	TS011
.TSO	user address space	TS011001

CDRM	major node	M00
CDRM	minor node, suba=11	M11

TAF	operator, suba=11	TAF11001
CDRM	Full screen, suba=11	TAF11F01

Terminology

Meaning of Symbols: Capital letters are constants, lower case are variables as described below.	

cuu = 3 char physical address of the connection for local devices and clusters.	ss = 2 char subarea in this domain
g = group sequence: A-Z/1-9	t = LU sequence: A-Z/0-9
lcn = X.25 logical channel number: 001-999	v = variations within the same suba definition (for example lines originally active (A) or inactive (I))
lia = 3 char physical address of the connection for line internal attachment	xx = 2 char subarea number in other domain
n = unique generation number: 1-9/A-Z	yy = 2 char adj. NCP subarea number
p = PU sequence : A-Z/1-9	. = filler char
*P = CTRL address: x'40',A-Z	

APPENDIX C. 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 X.25 NPSI are documented in;

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

The NCP generation macro operands are documented in;

- Network Control Program System Support Programs Installation Release 2.1, SC30-3142
- Network Control Program System Support Programs Installation Release 3, SC30-3154

A description of the 3705 and its operation can be found in;

- IBM 3704 and 3705 Communications Controllers Principles of Operation, GC30-3004
- IBM 3705 Communications Controller Theory-Maintenance (3 volumes). SY27-0107

The Logic of the X.25 NPSI program is documented in;

- X.25 NCP Packet Switching Interface - Diagnosis Reference. LY30-3054.

What to do when a problem occurs in operation is described in;

- X.25 NCP Packet Switching Interface - Diagnosis Guide. SC30-3164.

The internal logic of NCP is described in;

- ACF/NCP/VS Network Control Program Logic Release 3, LY30-3057
- ACF/NCP/VS Network Control Program Logic Release 2, LY30-3041

Control blocks are documented in;

- X.25 NCP Packet Switching Interface - Reference Summary. Releases 2 and 3. SC30-3079-1
- Advanced Communication Function for Network Control Program/VS Program Reference Summary, Release 2, LY30-3043
- Advanced Communication Function for Network Control Program/VS Program Reference Summary, Release 3, LY30-3058

A tutorial on the logic flow of ACF/NCP Release 2 is available in;

- Advanced Communications Function NCP Release 2 Data Flow SR20-4621.

Details of the 5973-L02 (NIA) can be found in;

- IBM 5973-L02 Network Interface Adapter (Specify Code 7042) Product Description Manual. (Frontal NIA). GA11-8642
- IBM 5973-L02 Remote Network Interface Adapter (Specify Code 7043) Product Description Manual. (Remote NIA). GA11-8643



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