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X.25 SNA GUIDE

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Bulletin

X.25 SNA Guide

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This manual is the second of a series of X.25-related documents published by the IBM Raleigh International Systems Centre. Its purpose is to provide a guide for the successful implementation of SNA-to-SNA connections over an X.25 based Packet Switched Data Network (PSDN).

The discussions here will be centered mainly on the X.25 NCP Packet Switching Interface (X.25 NPSI) licensed program and the 5973-L02 Network Interface Adapter (NIA). The SNA-to-SNA connections can be:

- between two NCP's each equipped with the X.25 NPSI licensed program,
- between an NCP equipped with the X.25 NPSI licensed program and an SNA cluster connecting to the PSDN via a Remote NIA, or
- between a host system equipped with a Front NIA (attached either to a NCP or Integrated Communications Adapter) and an SNA cluster connecting to the PSDN via a Remote NIA.

It is assumed that the reader is already familiar with the X.25 NPSI Installation Guide (GG24-1567). Even if the user is not using an NCP and/or the X.25 NPSI licensed program, he will still find sections in that guide valuable especially in understanding the functions and protocols of CCITT Recommendation X.25 and planning for an X.25 network installation.

ENVIRONMENT

One of the primary objectives of this manual is to provide the user with tested, working examples. Working examples are taken from both the IBM Canada System Support Centre and the IBM Raleigh International Systems Centre. Although most of the discussions are OS/VS oriented, they should still apply to a DOS/VSE or System/34, System/38 environment.

ORGANIZATION OF THIS GUIDE

This Guide covers four main sections:

- Implementation.
- Operation Procedure.
- Problem Determination.
- Performance Tuning.

All three types of SNA-to-SNA connection over an X.25-based PSDN are covered. As such, most users will find parts of this Guide not applicable to their installations. For example, an X.25 NPSI user may not be interested in the Frontal NIA, or he may not plan to have an MSNF link over an X.25-based PSDN. The Guide is designed such that he can skip those sections or chapters without losing continuity of the context.

- Implementation

This section discusses the ordering and installation considerations:

- Chapter 2 describes the X.25/SNA interface products and how the virtual circuits are classified according to the sublayers of Logical Link Control (LLC) used.
- Chapter 3 describes the PSDN service and how one should plan for service installation, and what to expect at service installation time.
- Chapter 4 talks about the X.25 generation and NCP gen processes and how a VTAM switched major node can be defined to provide con-

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nection over a Switched Virtual Circuit (SVC). Although the discussion is centered mainly on the X.25 NPSI licensed program, users of the Frontal NIA in a VTAM/NCP environment may find sections in this chapter useful. A working X.25 and NCP specification example taken from the IBM Canada System Support Centre are also given here.

- Chapter 5 is meant for users intending to implement an MSNF link over an X.25 PSDN using the INN support function within the NCP. Two sample X.25 specifications taken from the IBM Raleigh International Systems Centre are given here. Users not intending to use the INN function may choose to skip this chapter.
- Chapter 6 describes both the Frontal and Remote NIA's and how to order and plan for their installations. Users whose virtual connection is between the NPSI and the Remote NIA may choose to skip sections referencing the Frontal NIA.
- Chapter 7 discusses the test planning and installation procedure and considerations for the NIA. Again users whose virtual connection is between the NPSI and the Remote NIA may choose to skip sections referencing the Frontal NIA.

• Operations

This section describes how the user can start up and control the various host and X.25 interface resources:

- Chapter 8 describes how the host environment and the X.25 physical and virtual circuits can be activated. It also talks about terminal operation via the Remote NIA and how SNA sessions over an X.25 virtual circuit can be initiated and terminated.
- The operation procedures for both the Frontal and Remote NIA's are the same. Chapter 9 describes such procedures as initial machine loading (IML), link level setup and virtual call setup and clearing.

• Problem Determination

Problem determination in an X.25 environment can be more complicated than in a leased or circuit-switched connection environment. Chapter 10 introduces a common-sense general checklist to help the user quickly diagnosis a problem. For the more involved problem, this section also describes the various diagnostic tools, such as the GTF trace, SNA RECMS and the Frontal NIA Event Log, that can be used.

• Performance Tuning

Good network performance can only result from good planning and network design. Chapter 11 analyzes the packet switching network characteristics and describes how various SNA parameters can be used to tune for better network performance.

Various other topics are also provided in the appendices:

- Appendix A is a set of worksheets that the user can adapt for NIA change control.
- Appendix B is designed to provide a quick reference on the meaning of the various NIA LED displays.
- Appendix C lists the various NIA specify codes to help the user with his order planning.
- Appendix D describes how outbound PIU segments are packetized to be transmitted as data packets through the network.
- Appendix E describes how the S/34 can be configured to support a Frontal NIA.
- Appendices F and G provide a working X.25 and NCP specification example taken from the IBM Raleigh International Systems Centre.
- Appendix H demonstrates how the NIA worksheets can be used.

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- **Appendix I describes the new event log function in the Frontal NIA and the Switched Network Backup feature in the Remote NIA.**

SNA/X.25 ARCHITECTURE

As mentioned in the "X.25 NPSI Release 2 & 3 Guide" (GG24-1567), there are two major considerations that a user must take into account when consider the use of a packet-switching service:

- 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 a higher level protocol to enable reliable end-to-end communication.

In the IBM 3705 NCP X.25 interface product support, a sublayer of architecture called Logical Link Control (LLC) has been introduced. In the IBM SNA X.25 support, virtual circuits are classified into five different types depending on the level of LLC required. Selection of the LLC to be used is dependent on the interface product used, or the support function required.

The five levels of LLC defined are as follows:

1. LLC level 0 for connection with native X.25 equipment.
2. LLC level 2 for communications with a SNA PU type 1 or 2 terminal/cluster connected to the PSDN using a Remote 5793-L02 NIA.

This is sometimes known as the PSH (Physical Services Header) function.

3. LLC level 3 or QLLC for INN support.
4. LLC level 4 for GATE support.
5. LLC level 5 for PAD support.

LLC 4 and 5 are extensions of LLC level 0.

In fact only two of the above are true logical link controls in the sense of end-to-end control (LLC 2 and LLC 3 - PSH and QLLC respectively). The others are simply a way of classifying the support features of X.25 NPSI and there is no end-to-end control necessarily implied.

In some interface products (e.g. NIA), only one level of LLC (e.g. PSH) is implemented. In some interface products (e.g. X.25 NPSI), multiple levels of LLC are available. In this case, the choice of the LLC is dependent on the connection requirement.

For example, if the connection is between an SNA host and an SNA peripheral node involving an NIA (regardless of whether only the Remote NIA and X.25 NPSI combination is used, or whether the connection is from Front NIA to Remote NIA), the LLC 2 (or PSH) protocol may be used. If the connection involves a TTY 33/35 compatible terminal attaching to an SNA host via an X.3 PAD, then the LLC 5 protocol is used.

The use of the various virtual circuit types are described in the "X.25 NPSI General Information" (GC30-3080) and "Installation and Operation" (SC30-3163) manuals. The reader should refer to them for more details.

X.25 NPSI

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. It can also be used to directly attach the IBM 3705 to a non-PSDN interface (working in either DCE or DTE mode). It requires the ACF/NCP/VS Version 1 Release 2.1 or Version 1 Release 3 licensed program as a prerequisite. Both Releases 2 and 3 of the X.25 NPSI are current

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releases. Release 2 is designed to operate with ACF/NCP/VS Version 1 Release 2.1, and Release 3 with ACF/NCP/VS Version 1 Release 3.

The X.25 NPSI uses a full duplex lineset (called multichannel link) to communicate with the PSDN DCE. The multichannel link (MCH) is the physical access line between the 3705 and the packet-switching network, and is defined as a SDLC link to the SNA host. All communications between DTE's over the PSDN are via virtual circuits. Both permanent and switched virtual circuits are supported by the X.25 NPSI and are defined as logical channels within the MCH. The switched virtual circuit (SVC) is seen by the NCP and the host SNA access method (VTAM or TCAM) as a switched SDLC link; and the permanent virtual circuit, as a leased SDLC link.

The actual data transfer between the DTE's over the PSDN is in the form of packets contained within frames. The packets are multiplexed over the MCH. The X.25 NPSI does the mapping between the physical line and the virtual circuits defined within the MCH.

Multiple multichannel links can be defined within the same NCP. As well, they can coexist with other conventional SDLC, BSC or start-stop links in a NCP or PEP environment. Other program products, such as NTO, can also coreside within the same NCP.

The user is asked to refer to the following manuals for more detailed descriptions on the X.25 NPSI licensed program:

- IBM X.25 NPSI General Information (GC30-3080)
- IBM X.25 NPSI Installation & Operation (SC30-3163)
- X.25 NPSI Release 2 and 3 Guide (GG24-1567)

NIA

The 5973-L02 Network Interface Adapter (NIA RPQ Y96 635) is a stand-alone unit that provides attachment capability for an SNA node to an X.25-based PSDN.

There are two models for the NIA:

- Frontal NIA (SC7042) which provides attachment for host system downstream support, and
- Remote NIA (SC7043) which provides attachment for an SNA terminal/cluster (PU types 1 or 2).

The NIA can be considered as an external protocol converter. It receives and sends SDLC frames from or to the SNA node, and transmits and receives HDLC frames and X.25 packets to or from the PSDN.

More on the NIA will be discussed in "Chapter 6. Network Interface Adapter" on page 45.

INTEGRATED X.25 ADAPTERS

As mentioned in the "X.25 NPSI Release 2 & 3 Guide", three RPQ X.25 integrated adapters have also been announced by IBM:

- An integrated X.25 adapter for the IBM 4700 financial communication system,
- An integrated X.25 attachment feature for the IBM 5251-12 Display Station, and
- An 8100 DPPX Integrated X.25 Attachment.

Generally speaking, these adapters are functionally equivalent to the NIA. Also since some of them are still not available for first customer shipment, discussions on these adapters will be limited in this document.

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The interested reader is asked to refer to his IBM representative for more details.

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PSDN SERVICE INSTALLATION PLANNING

The "Planning Considerations" chapter in the "X.25 NPSI Release 2 & 3 Guide" (GG24-1567) contains detailed discussions on packet switched service planning and ordering considerations. It is assumed that the user has already reviewed those considerations, discussed his installation plans with his PTT representative and ordered his X.25 access lines and virtual circuits accordingly.

The installation dates for the X.25 circuits should coincide approximately with the delivery dates of the NIA's and/or the X.25 NPSI licensed program. The user may want to schedule his X.25 circuit installations such that a host link and a terminal link will be installed first (for testing purposes), and the other end-user circuits afterwards.

The length of the testing period is dependent on the complexity of the installation environment and the level of the user's SNA and X.25 knowledge. The stability of the PSDN can also impact the duration of the installation testing. Assuming that the user is already familiar with SNA and is converting some SNA-to-SNA connections from leased line access to X.25 virtual circuit access, a testing period of two to three weeks is reasonable.

As the installation date draws near, the user should review his X.25 circuit subscription parameters with his PTT representative to make sure that there has been no misunderstanding. The X.25 NPSI and the NIA may not function properly if their specifications and settings do not match his PSDN subscription parameters. The user should give a copy of these subscription parameters to the IBM Customer Engineer when he comes to install the NIA.

PSDN SERVICE INSTALLATION

The PTT service representative is responsible for installing the X.25 access lines and digital datasets (modems).

Once the access line is installed, the PTT-supplied dataset should always be left powered-on in order to remain in synchronization with the network.

While the PTT representative is still there, ask him to demonstrate the signal indicators on the dataset. For example, there may be a "systems down" indicator which when lit will tell the user that there is a problem with the PSDN intelligent node. There may also be a "test" indicator, which when lit will tell the user that the PTT is running a loopback test from the intelligent node to the dataset.

On some datasets, there may be a "wrap" switch. If available, this will provide additional wrap or loopback test capabilities from the NIA or X.25 NPSI.

The PTT representative should provide to the user

- The access line circuit number. (Subscription Number).
- The logical channel number assignments for the PVCs.
- The logical channel range assignments for the SVCs.
- Confirmation of the subscription parameters.

Depending on the PSDN, the access line circuit number can be from eight to 15 digits long. This number is assigned by the PTT and for practical purposes can be considered to consist of an arbitrary string of digits. (The exact format is specified in the CCITT recommendation X.25). This number must be quoted when reporting troubles to the PTT. If there are SVC's associated with this physical access line, this is also the number to use when placing a virtual call from another X.25 access line.

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It would also be appropriate to ask the PTT representative to explain the trouble reporting procedure if the user has not been exposed to an X.25-based service before.

This chapter is mainly concerned with the X.25 NPSI licensed program implementation in an SNA host. Readers who will be using the Frontal NIA for their SNA-to-SNA connections may wish to skip this chapter

It is assumed that at this point the user has already reviewed the "X.25 NPSI Release 2 & 3 Guide" (GG24-1567), installed the ACF/NCP/VS and X.25 NPSI licensed programs, and is ready to define his SNA/X.25 networking environments.

The discussions here on the various X.25 and NCP macros are intended to illustrate how their operands can be used to define an SNA-to-SNA connection over an X.25-based PSDN. The user is asked to reference the "X.25 NPSI Release 2 and 3 Guide" (GG24-1567), the "X.25 NPSI Installation and Operation Manual" (SC30-3163) and the "ACF/NCP/VS Installation Manual" (SC30-3142 and SC30-3154) for detailed descriptions of the macros.

X.25 GEN

X.25 Macro Instructions

The following is only meant to serve as a reminder to highlight the considerations in a SNA-SNA connection environment:

- **X25BUILD**

The X25BUILD macro starts the generation process of the X.25 control blocks. One X25BUILD macro is required per NCP.

- **X25NET**

The X25NET macro is used to specify the PSDN characteristics. If LAPB is to be used, remember to code DM=YES or NO in accordance to whether the DM (Disconnect Mode) response is supported by the PSDN.

- **X25VCCPT**

This macro specifies the packet window size (VWINDOW) and maximum packet size (MAXPKTL) to be used in a virtual circuit connection. At least one X25VCCPT definition is required.

- **X25OUFT**

The X25OUFT macro is required only if the user intends to place outgoing calls on his SVC's. Make sure that the optional facilities coded are included in the service subscription with the PSDN.

If the user intends to place outgoing calls on his SVC's, it is worthwhile to plan the connection parameter (VCCPT) and user facility (OUFT) requirements and make sufficient provisions in his X.25 network definition. For example, for most in-country communications, the user may want to take advantage of the larger 256 byte packet size to minimize network usage charge, and use only the smaller 128 byte packet size for out-of-country, or inter-PSDN, communications. By having two X25VCCPT definitions, he can use a suboperand in the DIALNO operand in the PATH macro in his VTAM switched major node definition to point to the desired connection parameter entry. More on this will be discussed in "Switched Major Node Definition" on page 21.

- **X25MCH**

The X25MCH macro is used to define the multichannel link (i.e. X.25 physical access line). Various virtual circuit types can coexist on the same MCH link. The following are some key points that the user should take into account:

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- The MCH link requires a full duplex lineset connected to a type 2 or 3 communications scanner. Consequently two line interface addresses are required, one for transmit (xmt) and one for receive (rcv). The range of valid addresses is dependent on the scanner type and lineset to be used. The actual scanner addresses allocated for each physical line is pre-determined when the 3705 is built and so these addresses are obtained from the Customer Engineer when the 3705 is installed. Please refer to the LINE macro description in the NCP Installation Manuals for more details.
- Make sure that the SPEED operand correctly reflects the subscribed X.25 physical access line speed. The default, if not coded, is 4800.
- For SNA-SNA connections, DBIT=NO may be coded.(SNA connection does not use the "D" bit. However if NON-SNA connections are to be used on the same MCH then DBIT=YES is appropriate).
- Both types 2 and 3 virtual circuits can coexist on the same MCH link with other virtual circuit types. That is, GATE can be specified as NO, GENERAL or DEDICAT. With GATE=DEDICAT (i.e. using the DATE function), however, the MCH link will be controlled by a user written CTCP (Communication and Transmission Control Program) application. Although DATE can function as an extension to the support provided for virtual circuit types 2 and 3, its application is meant for a much more complicated environment and is beyond the scope of this manual, and will not be discussed further here.

In this manual, GATE=NO is assumed.

Subaddress is not available from all PSDN's. The user must check with the PTT regarding his subscription before coding SUBADDR=YES.

Note that SUBADDR only applies to an MCH coded as GATE=GENERAL.

- LCNO

The user should check with his PTT to find out whether logical channel number 0 is available for use as a virtual circuit in his PSDN. In most networks logical channel 0 is reserved for control and diagnostic packets that relate to the whole access line.

- PAD

Virtual circuit types 2 and 3 can share the same MCH link with type 5 virtual circuits. Code PAD=INTEG or TRANSP if such facilities are required.

Other operands are already discussed in detail in the X.25 NPSI Release 2 and 3 Guide, and therefore will not be elaborated further here.

• X25LCG

This macro signifies the beginning of a logical channel group description. In some networks, only LCG (Logical Channel Group) number 0 is allowed. The X25LCG macro must be placed in between the X25MCH macro and its ensuing X25LINE or X25VC macros.

If there is more than one LCG to be defined, then they must be specified in ascending LCG number order.

• X25LINE, X25PU and X25LU

For SNA-to-SNA connections, the user may prefer to use the X25LINE, X25PU and X25LU macros to define his virtual circuit, SNA cluster and associated logical units. Most of the operands for these macros are identical to those for the normal NCP LINE, PU and LU macros. Some additional operands are introduced to facilitate definition of the user's X.25 connections.

- In the X25LINE macro, the OUFINDX operand is only applicable to SVC's and points to an entry in the Optional User Facilities Table

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which is defined by the X25OUFF macros. On outgoing calls, this operand points to the default user facilities to be copied into the CALL REQUEST packet. As mentioned in the "X.25 NPSI Release 2 & 3 Guide", this operand can be overridden by a DIALNO suboperand in the VTAM switched major node definition. More on this will be given in "Switched Major Node Definition" on page 21.

The VCCINDX operand points to an entry in the Connection Parameters Table which is defined by the X25VCCPT macros. This operand specifies the maximum packet size and packet window size to be used for a virtual circuit connection, and is required for both PVC's and SVC's. As for the OUFINDX operand, for outgoing calls, this VCCINDX specification can be overridden by a DIALNO suboperand in the VTAM switched major node definition. For PVC's, however, the connection parameters cannot be changed without another X.25 and NCP generation.

An LCN is associated with each X25LINE macro definition. This represents the logical channel number within the logical channel group (which is defined in a preceding X25LCG macro) to be used for the virtual circuit connection.

Note that there is an error in the X.25 NPSI Installation and Operation Manual. The MAXLU operand, if required, should be coded in the X25PU macro instead of the X25LINE macro. More on this operand will be discussed later.

The RETVCCT and RETVTO operands together specify the retries for "physical services commands" across the network. When the NCP is activating the remote cluster the first command sent is "CONTACT". This "CONTACT" command is sent across the network by NPSI as a "PSCONT" command. When the NIA receives this command it commences polling the cluster by sending an SDLC "SNRM" command. When it receives a positive response to the command it replies to NPSI giving the physical address of the cluster in the PSCONT response packet. If the NIA cannot contact the cluster it replies with a negative response to PSCONT. At this point NPSI will retry the PSCONT. The parameter RETVCCT specifies the number of times the PSCONT should be retried and the parameter RETVTO specifies the time to be allowed between retries.

This is different from the operation of the "standard" NCP since "standard" NCP (on SDLC links) will continue to retry the contact operation forever. In an X.25 network however, charges are levied for each packet sent thus the user will often want to minimise the number of retries.

- The X25PU macro is used to produce a corresponding NCP PU macro and a SERVICE macro (if the X25LINE defines a PVC) for the SNA cluster. One X25PU must be coded with each X25LINE definition. Code the operands as in a normal NCP PU definition. Note however that dynamic reconfiguration is not allowed for the MCH and X.25 virtual circuits. Therefore operands such as PUDR=YES cannot be used. Also multipoint connection is not allowed for virtual circuits. Do not code more than one X25PU per X25LINE.

If the X25LINE macro represents an SVC connection, a MAXLU specification is required. Note that this operand should be coded in the X25PU macro and not in the X25LINE macro. MAXLU specifies the maximum number of logical units that may be associated with the physical unit. This number must be less than or equal to the NUMTYP1 (if the X25PU specifies a Type 1 PU) or NUMTYP2 (if the X25PU specifies a Type 2 PU) specification in the NCP LUDRPOOL macro.

Special considerations should be given to the MAXDATA specification. Both of these operands can affect network performance.

MAXDATA specifies the maximum amount of data, in bytes (including the transmission and request/response header) that the NCP can send to the physical unit in one segment. The size of the PIU or PIU segment actually transferred is dependent on the amount of user data, the NCP buffer size (BFRS), and the MAXDATA specification. A more detailed discussion on data segmentation is given in "Appendix D. Data Packetization" on page 113. For now, it is suf-

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ficient to note that MAXDATA should be specified in accordance with the characteristics of the physical unit. For example, the IBM 3684 Point-of-Sale controller does not support segmentation. Since the host transfer program can send up to 256 bytes of user data in one data transfer, any specification of less than 265 (256 bytes of user data + 6 bytes for TH + 3 bytes for RH) will cause an operations problem. If the physical unit is to be attached to the PSDN via a remote NIA, the user should also note that the NIA can only process a maximum PIU segment size of 265 bytes. Information on the SNA physical unit characteristics are available usually from the component description manuals for the PU.

- The X25LU macro produces LU macros to be included in the NCP Gen. Code as many X25LU's as necessary to define the logical units associated with the SNA cluster. Most NCP LU operands can be used in the X25LU definition. Note that X25LU specifications are not required for SVC's.

Some consideration should be given to the PACING operand. This operand regulates data flow from the NCP to the logical unit. Since the X.25-based PSDN is basically a store-and-forward service, generally speaking, the performance or throughput will not be as good as that of a leased line at the same access line speed. The user should be careful so as not to over-regulate the data flow to the remote cluster. Please refer to the discussion in "Tuning Considerations" on page 91 for more details.

- **X25VC**

Instead of using the X25LINE, X25PU and X25LU macros, the user may want to use the X25VC macro to define his virtual circuit and terminal characteristics. The X25VC macro is generally used to define SVC's or a range of virtual circuits with similar connection characteristics. The operands are similar to those for the X25LINE and X25PU macros. Therefore, they will not be repeated here.

- **GENEND**

The user should include a GENEND macro if there is other software (such as NTO) using the NCP Customization Facility that will be sharing the same NCP. This macro is discussed in detail in the "X.25 NPSI Release 2 & 3 Guide" and the X.25 NPSI Installation and Operation Manual.

X.25 Network Definition Sample

The following is an example of an X.25 network definition with two MCH's.

The first MCH (L3804C) has one PVC and one SVC. The PVC (L38201) is connected to an IBM 3276-12 cluster with only one display screen. The LU is controlled by a host network monitor application (NETMON) as soon as the connection is activated. The SVC (L28202) is available for both incoming and outgoing calls. It is defined such that virtual circuit types 0, 2 and 5 can be used for the virtual call.

The second MCH (L3804E) is reserved for future expansion use. Although there are two PVC's defined for the second MCH, it is normally set as INACTIVE. (See the ISTATUS operand for L3804E in the NCP definition.)

In this example, three connection parameter and three user facility entries were also coded to illustrate the use of the VCCINDX and OUFINDX operands. Later on, in the VTAM switch major node definition example, it will be demonstrated how the SVC's can make use of these table entries.

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```

COL-----+-----1-----+-----2-----+-----3-----+-----4-----+-----5-----+-----6-----+-----7
*****
*
*          GENERATION OF THE X25 BLOCKS WITHIN NCP
*
*  N38X25V2: MAY 28, 1982 - USED WITH RELEASE 2 OF X.25 NPSI PP
*          GENERATED FOR ACF/VTAM V2R1 AND ACF/NCP/VS R 2.1
*          USED IN X.25 NPSI STAGE 1 GENERATION
*          MODIFIED TO SUPPORT PVC AND SVC
*
*  CONTENTS:
*    1) (04C,04D) FDX MULTICHANNEL LINK FOR DATAPAC 3000
*    2) (04E,04F) DUMMY FDX MULTICHANNEL LINK
*    3) 201      LINE ADDRESS FOR PERMANENT VIRTUAL CIRCUIT
*    4) 202      LINE ADDRESS FOR SWITCHED VIRTUAL CIRCUIT
*    5) 301      LINE ADDRESS FOR PERMANENT VIRTUAL CIRCUIT
*    6) 302      LINE ADDRESS FOR PERMANENT VIRTUAL CIRCUIT
*    7) 026      LINE ADDRESS FOR SWITCHED LINE FOR FRONT NIA
*
*  NOTES:
*    1) INCLUDES DEFINITION FOR LLC LEVEL 1 FOR SERIES/1
*    2) PACKET WINDOW SIZE IS 3 AS OF 9/08/81
*    3) INCLUDES DEFINITION FOR INTEGRATED PAD
*
*****
*          X25BUILD -- PARMS TO DEFINE ENVIRONMENT AND
*                   SYSTEM RELATED NCP GENERATION OPTIONS
*****
N38X25 X25BUILD MCHCNT=2,          2 MCH LINKS - 1 DUMMY
                JOBCARD=YES,      USE JOBCARD FROM JOBCARD IN GEN3705X-
                MACLIB=MACX25,    DSNAM OF WORKING LIBRARY FOR STG 2 -
                QUALIFY=SYSXX,    QUALIFIER FOR MACLIB D/S
                SRCPRFX=X25,      DEFAULT PREFIXES FOR SRCLO/SRCHI MBR -
                SRCLO=X25TBL,     DEFAULT NAME FOR X25 TABLE IN MACLIB -
                SRCHI=X25BLK,     DEFAULT NAME FOR X25 BLKS IN MACLIB -
                TYPYSYS=0S        SYSTEM IS MVS 3.8 WITH ACF/VTAM V2R1
*****
*          X25NET -- USED TO SPECIFY NETWORK
*****
DATAPAC X25NET NETTYPE=2,        NETWORK IS DATAPAC
                DM=NO,            LAPB DM NOT USED - OP REQ'D BY R2 -
                CPHINDX=3,        HIGHEST INDEX USED IN X25VCCPT MACRO -
                OUHINDX=3         HIGHEST INDEX USED IN X25OUFT MACRO
*****
*          X25VCCPT -- VIRTUAL CIRCUIT CONNECTION PARAMETERS
*****
X25VCCPT INDEX=1,              CONNECTION PARAMETER TABLE 1 -
                MAXPKTL=256,     MAXIMUM PACKET SIZE IS 256 BYTES -
                VWINDOW=2        SUBSCRIBED PACKET WINDOW SIZE IS 2
X25VCCPT INDEX=2,              CONNECTION PARAMETER TABLE 2 -
                MAXPKTL=128,     MAXIMUM PACKET SIZE IS 128 BYTES -
                VWINDOW=2        SUBSCRIBED PACKET WINDOW SIZE IS 2
X25VCCPT INDEX=3,              CONNECTION PARAMETER TABLE 3 -
                MAXPKTL=256,     MAXIMUM PACKET SIZE IS 256 BYTES -
                VWINDOW=3        SUBSCRIBED PACKET WINDOW SIZE IS 3
*****
*          X25OUFT -- USED TO SPECIFY USER FACILITY IN CALL PACKET
*                   ONLY REQUIRED FOR SVC'S
*****
X25OUFT INDEX=1                NO OPTIONAL FACILITIES REQUIRED
X25OUFT INDEX=2,              SECOND INDEX FOR USER FACILITIES -
                OPTFACL=0101     REVERSE CHARGING FACILITY
X25OUFT INDEX=3,              THIRD INDEX FOR USER FACILITIES -
                OPTFACL=0102     HIGH PRIORITY CLASS TRAFFIC FACILITY
*****
*          X25MCH -- DEFINITION OF MULTICHANNEL LINK
*****
L3804C X25MCH CSBTYP=2,        ATTACHED TO TYPE 2 COMMUN SCANNER -
                ADDRESS=(04C,04D), ADDRESS OF FDX LINE WITHIN 3705 -
                LCNO=NOTUSED,     DATAPAC DOES NOT USE LCN #0 -
                LLCLIST=(LLC0,LLC2,LLC5), ALLOW PCNE, PSH & PAD ON SVC -
                PAD=INTEG,        X3./X.28/X.29 PAD USED -
                TRAN=ODD,         TRANSLATE TO EBCDIC FROM ODD PARITY -
                LCGDEF=0(2),      LOGICAL CHAN GRP 0, UP TO LOG CH #2 -

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GATE=NO, GATE/DATE NOT PART OF THIS TEST -
PKTMODL=8, THIS NETWORK USES MODULO 8 -
FRMLGTH=259, MAX FRAME SIZE IS PKT HDR(3) + 256 -
MWINDOW=7, MAX 7 HDLC FRAMES -
STATION=DTE, NCP PORT WILL OPERATE AS DTE -
PROTOCOL=LAP, TEST THE LAP SUPPORT -
NCPGRP=G384C, WANT THIS TO BE GROUP NAME IN NCP -
PUNAME=PU3804C, PU NAME FOR MCH -
LUNAME=LU3804C, LU NAME FOR MCH -
SPEED=2400 DATAPAC SERVICE IS 2400 BPS -
*****
* X25LCG -- IDENTIFIES LOGICAL CHANNEL GROUP TO BE USED *
*****
X25LCG LCGN=0 LGL CHNL GRP #0 DEFINED BY X25MCH
*****
* X25LINE -- DEFINITION OF PERMANENT VIRTUAL CIRCUIT *
*****
L38201 X25LINE LCN=1, LOGICAL CHANNEL #1 WITHIN GROUP 0 -
VCCINDX=3, NORMALLY USE INDEX 3 IN X25VCCPT -
LLC=LLC2, NIA ON THE OTHER END -
TYPE=PERMANENT, THIS IS A PERMANENT VIRTUAL CIRCUIT -
NCPGRP=G384CV1 1ST VC GROUP ON MCH 04C -
*****
* X25PU -- DEFINITION OF PU ATTACHED TO ABOVE LINE *
*****
PU38201 X25PU PUTYPE=2, THIS IS TO ATTACH TO A 3276-12 -
ADDR=C1, STATION ADDRESS IS C1 -
SPAN=(SPANLSSC), NCCF CONTROL -
ISTATUS=ACTIVE, ACTIVATE AS NCP COMES UP -
MODETAB=D3276S2, 3276-12 ONLY SCREEN IS 3276 -
DLOGMOD=S3276, -
BATCH=NO, MAKE LU'S INTERACTIVE BY DEFAULT -
IRETRY=YES, RETRY ON IDLE DETECT TIMEOUT -
MAXDATA=265, -
MAXOUT=7, MAX SDLC FRAMES BEFORE LINK RESPONSE -
PASSLIM=7, MAX PIU SEGMENTS IN ONE TX BURST -
LU38201 X25LU LOCADDR=2, ADDRESS OF THIS LU ON THE PU -
LOGAPPL=NETMON, LOG TO NETMON -
SPAN=(SPANLSSC), NCCF CONTROL -
ISTATUS=ACTIVE, ACTIVATE WITH PU -
*****
* X25LINE -- DEFINITION OF VIRTUAL CIRCUIT *
*****
L38202 X25LINE LCN=2, LOGICAL CHANNEL #2 WITHIN GROUP 0 -
VCCINDX=3, NORMALLY USE INDEX 3 IN X25VCCPT -
TYPE=SWITCHED, THIS IS A SWITCHED VIRTUAL CIRCUIT -
OUFINDX=1, DEFAULT IS NO USER FACILITY(X25OUFT)-
CALL=INOUT, TWO WAY CALLS ALLOWED -
NCPGRP=G384CV2 2ND VC GROUP ON MCH 04C -
*****
* X25PU -- DEFINITION OF PU ATTACHED TO ABOVE LINE *
*****
PU38SW0 X25PU PUTYPE=(1,2), ALLOW BOTH PU TYPES 1 AND 2 -
MAXLU=20 MAX NUMBER OF LU'S (MATCH LUDRPOOL) -
*****
* X25MCH -- DEFINITION OF MULTICHANNEL LINK *
*****
L3804E X25MCH CSBTYPE=2, ATTACHED TO TYPE 2 CONTIUN SCANNER -
ADDRESS=(04E,04F), ADDRESS OF FDX LINE WITHIN 3705 -
LCGDEF=0(2), LOGICAL CHAN GRP 0, UP TO LOG CH #2 -
FRMLGTH=259, MAX FRAME SIZE IS PKT HDR(3) + 256 -
MWINDOW=7, MAX 7 HDLC FRAMES -
STATION=DTE, NCP PORT WILL OPERATE AS DTE -
PROTOCOL=LAPB, USE LAPB -
NCPGRP=G384E, WANT THIS TO BE GROUP NAME IN NCP -
PUNAME=PU3804E, PU NAME FOR MCH -
LUNAME=LU3804E, LU NAME FOR MCH -
SPEED=2400 DATAPAC SERVICE IS 2400 BPS -
*****
* X25LCG -- IDENTIFIES LOGICAL CHANNEL GROUP TO BE USED *
*****
X25LCG LCGN=0 LGL CHNL GRP #0 DEFINED BY X25MCH
*****
* X25VC -- DEFINITION OF VIRTUAL CIRCUITS *
*****

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```
*****
L38301 X25VC LCN=(1,2), LOGICAL CHANNELS WITHIN GROUP 0 -
          VCCINDX=3, NORMALLY USE INDEX 3 IN X25VCCPT -
          LLC=LLC2, DEFAULT IS PSH -
          MAXLU=20, UP TO 20 LU'S PER PU -
          TYPE=PERMANENT, THIS GROUP USED PERMANENT VC -
          NCPGRP=G384EV1 WANT THIS TO BE GROUP NAME IN NCP -
*****
* X25END -- END OF X25 DEFINITIONS *
*****
X25END NCPSTG1=N38X25V2, MBR NAME IN MACLIB -
          X25VTAM=NO VTAM HAS NOT BEEN MODIFIED -
END
```

X.25 Gen

Once the user has defined his X.25 network environment, he is ready to run the X.25 stage 1 and 2 generations and use the output for his NCP gen. The X.25 gen procedure is already discussed in detail in the "X.25 NPSI Release 2 & 3 Guide", and therefore will not be repeated here.

NCP GEN

NCP Definition

The X.25 virtual circuits can coexist on the same 3705 with other SDLC, BSC or S/S lines running under NCP or PEP. In fact, the X.25 NPSI does not affect the definition of the NCP environment. One of the steps in the X.25 gen is to convert the X.25 macros into equivalent NCP macros so that they can be incorporated into the NCP definition for system generation. This procedure is described in the "X.25 NPSI Release 2 & 3 Guide".

The user should code his NCP definition in much the same way as when the virtual circuits are not used. However, he may want to give some special considerations to parameters that can affect NCP buffer usage and performance of the NCP and all the real and virtual circuits in his network. One of such parameters is the BFRS operand specification in the NCP BUILD macro.

It has been suggested that¹ in order to optimize SDLC line utilization, BFRS should be coded as 128. In an X.25 environment, however, such specification may not make optimal use of data packets. For example, with MAXDATA=265 specified in the X25PU macro and BFRS=128 specified in the NCP BUILD macro, 512 bytes of user data will be sent in 4 data packets to the SNA peripheral node. If BFRS=124 is specified instead, it would only require 3 data packets. (The interested reader can refer to "Appendix D. Data Packetization" on page 113 for a detailed discussion on SNA PIU segmentation.) This smaller number of packets not only can represent up to 25% savings in PSDN usage charge, but can also improve performance in terms of both 3705 cycle utilization and overall response time.

However such parameters can have an NCP-wide implication. If the NCP is used predominantly with SDLC leased and switched lines, where segmenting is performed by the NCP, and has only a few X.25 virtual circuits, the SDLC line utilisation can be optimised by specifying BFRS=128. On the other hand, if the NCP is used primarily to support a network of X.25 virtual circuits (or SDLC links which do not require NCP segmentation), the user may want to sacrifice some SDLC link performance for lower network usage charges and better network performance. He can do this by specifying BFRS=124 in the NCP BUILD macro.

¹ Please reference the "Segmentation" discussion in the "Tuning and Problem Analysis for NCP SDLC Devices" (G320-5366) Technical Bulletin written by D.L. Buckingham of the IBM Dallas Systems Centre.

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Further tuning suggestions are provided in "Chapter 11. Tuning for Performance" on page 87.

The X.25 NPSI licensed program can also operate in a remote NCP. That is, TYPGEN=NCP-R is allowed. Note however that the remote NCP must be loaded via a conventional leased or dialup SDLC line. There is no facility for the "down-line" loading of the NCP via X.25 virtual circuits.

NCP Definition Sample

The following is a sample NCP definition. The NCP macros produced from the X.25 gen for the X.25 definition given earlier is appended to the normal NCP definition. Some comments are also added (which are not part of the X.25 gen output) to facilitate easier understanding.

Note here that certain "VTAM ONLY" operands such as "OWNER=" may need to be manually added at this point since they are not allowed operands of the X25LINE macro but must be specified for VTAM purposes in the generated (NCP-VTAM) LINE macro.

The sample NCP definition has only one other conventional line used for dialup attachment via a frontal NIA.

```

COL----+----1----+----2----+----3----+----4----+----5----+----6----+----7
*****
* NCP38V2: GENERATED MAY 31, 1982.
* REQUIRES 009 ONLINE
* USES TYPE 2 CHANNEL ADAPTER.
* GENERATED FOR ACF/VTAM V2R1 AND ACF/NCP/V5 R 2.1
* X25 PP IS 5668-981 VERSION 2.0.
* SUBAREA = 38
*
* CONTENTS:
* 1) 026 DIAL LINE TO TEST SVC FOR FRONT NIA
* 2) (04C,04D) DATAPAC 2400 BPS MULTICHANNEL LINK
* 3) (04E,04F) DATAPAC 2400 BPS MULTICHANNEL LINK
* 4) 201 VIRTUAL LINE ADDR FOR PERMANENT VIRTUAL CIRCUIT
* 5) 202 VIRTUAL LINE ADDR FOR SWITCHED VIRTUAL CIRCUIT
* 6) 301 PVC USED WITH MCH 2
* 7) 302 PVC USED WITH MCH 2
*
* NOTES:
* A) AN X25 GEN IS FIRST REQUIRED. X25 NETWORK DEFINITION
* IS IN X.25 NPSI.CNTL(N38X25V2).
* B) OUTPUT FROM X25 STAGE 2 GEN IS INCLUDED IN THIS
* NCP DEFINITION - COPIED FROM SYS1.MACX25(N38X25V2).
* C) X25 GEN INCLUDED PAD SUPPORT.
* D) ACF/NCP R2.1 SYSTEM OBTAINED FROM CE IS PUT TAPE 8202.
*****
* PCCU -- VTAM ONLY PARMS FOR HOST OPERATIONAL CONTROL
*****
NCP38 PCCU CUADDR=009, 3705 ADDRESS DEFINED ON MVS -
AUTODMP=YES, AUTOMATICALLY DUMP NCP IF FAIL -
AUTOIPL=NO, NO AUTO IPL ON FAILURE -
AUTOSYN=NO, OPERATOR PROMPT FOR REFRESH/RELOAD -
DUMPDS=DUMP37, DUMP DDNAME IN NET PROC IS NCPDUMP -
INITEST=NO, BYPASS DOING 3705 WAKE UP EXERCISES -
SUBAREA=31, HOST IS LSSCMVS1 SUBAREA 31 -
MAXDATA=4680 MAX SIZE FOR VTAM TO NCP TRANSFER
*****
* BUILD -- PARMS FOR 3705 PHYSICAL CHARACTERISTICS AND
* FOR SYSTEM RELATED NCP GENERATION OPTIONS
*****
BUILD NEWNAME=NCP38V2, THIS NCP KNOWN TO VTAM BY THIS NAME -
MEMSIZE=512, THIS IS A 3705-II MODEL K04 -
CA=(TYPE4,TYPE4-1), 1ST FRAME-TYPE4; 2ND FRAME-TYPE4 -
CHANTYP=TYPE4, ONLY 1 ADAPTER IS ACTIVE -
SUBAREA=38, AVOID CONFLICT WITH OTHER NODES -
MAXSUBA=127, THIS MATCHES ATCSTRXX IN VTAMLST -
MAXSSCP=1, CAN TALK TO ONLY 1 SSCP AT ONCE -
MODEL=3705-2, 3705 IS MODEL II -
OLT=YES, INCLUDE ONLINE TEST CAPABILITY -
LTRACE=2, 2 NCP LINES CAN BE TRACED -

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CATRACE=(YES,32),    ALLOW CHANNEL ADAPTER TRACES      -
TRACE=(YES,256),    ADDRESS TRACE TABLE (10 IS CE REQMT) -
TYPGEN=NCP,         NETWORK CONTROL PROGRAM GENERATION -
SLOWDOWN=12,        ENTER SLOWDOWN WHEN 12% BFRS LEFT  -
ANS=YES,             INCLUDE AUTO NETWORK SHUTDOWN   -
ASMREF=NO,          NO X-REF LISTING FROM STG 2    -
BFRS=124,           OPTIMIZE PACKET USAGE           -
ABEND=YES,          INCLUDE ABEND FACILITY           -
TYP SYS=OS,         SYSTEM IS MVS 3.8 WITH ACF/VTAM   -
QUALIFY=SYSXX,      ACF/NCP 2.1 GENERATION           -
LOADLIB=NCPLIB,    SYS1.NCPLIB FOR NCP LOAD MODULE   -
OBJQUAL=25,        OBJECT QUALIFIER TO ALLOW CONCURR GEN-
OBJLIB=OBJX25,     DATASET FOR STAGE 2 OUTPUT       -
JOB CARD=YES,      USE JOB CARD FROM GEN3705       -
MACLIB=(MACX25,MAC3705X), X25 SYSGEN OUT/X25 MACROS -
USERLIB=OBJ3705X,  X25 OBJECT MODULES           -
UNIT=3330V         3330V FOR ASSEMBLY AND LKED STEPS -
*****
*   SYSCNTRL -- MODULES THAT SHOULD BE INCLUDED FOR VTAM'S BENEFIT. *
*   THIS DEFINITION NEED NOT BE CHANGED UNLESS 3705 *
*   STORAGE IS A REAL PROBLEM AND/OR THE NCP WILL BE *
*   COMMUNICATING WITH TCAM INSTEAD OF VTAM. *
*****
SYSCNTRL OPTIONS=(BHSASSC,ENDCALL,MODE,RCNTRL,RCOND,RECMD,RIMM,
NAKLIM,SESSION,SSPAUSE,XMTLMT,BACKUP,DVSINIT,LNSTAT,
SESINIT,STORDSP)
*****
*   HOST -- VTAM <=> NCP COMMUNICATION CONTROL *
*****
HOST31  HOST  SUBAREA=31,          LSSCMVS1 SUBAREA FROM ATCSTR00 -
          INBFRS=10,             UNITS OF NCP BUFFER ALLOC (OUTBOUND) -
          MAXBFRU=50,            UNITS OF VTAM BUFFER ALLOC (INBOUND) -
          UNITSZ=156,            SIZE OF VTAM I/O BUFFER (IOBUF SIZE) -
          BFRPAD=0,              REQD FOR ACF/VTAM UNDER MVS -
          STATMOD=YES,           MINIMIZE ASYNCH CHANNEL INTERRUPTS -
          TIMEOUT=30,           GIVE HOST 30 SECONDS BEFORE ANS -
          DELAY=0,               WHO CARES IN THIS ENVIRONMENT
*****
*   CSB -- DESCRIBE LOCATION, TYPE, AND CLOCKS OF SCANNERS *
*****
CSB      TYPE=TYPE2,             TYPE 2 COMMUNICATIONS SCANNER -
          MOD=0,                 IN BASE MODULE -
          SPEED=(134)            134.5 BPS BUSINESS MACHINE CLOCK -
CSB      TYPE=TYPE3,             TYPE 3 COMMUNICATIONS SCANNER -
          MOD=1,                 IN FIRST EXPANSION FRAME -
          SPEED=(150,600,1200)  150,600,1200 BPS CLOCKS -
CSB      TYPE=TYPE2,             TYPE 2 COMMUNICATIONS SCANNER -
          MOD=2,                 IN SECOND EXPANSION FRAME -
          SPEED=(134,300,600)   134.5, 300 AND 600 BPS CLOCKS
*****
*   POOL OF LU CONTROL BLOCKS FOR PU TYPE 1 AND 2 ATTACHMENT OVER *
*   SWITCHED SDLC LINKS. *
*   LUDRPOOL REQUIRED IF ACCESS METHOD IS ACF/VTAM R2 OR HIGHER *
*****
LUPPOOL38 LUDRPOOL NUMTYP1=32,   LU POOL FOR TYPE 1 PU'S -
          NUMTYP2=32            LU POOL FOR TYPE 2 PU'S
*****
*   G38SD -- LOGICAL GROUPING OF POLLED SDLC LINES *
*****
G38SD    GROUP LNCTL=SDLC,        ALL LINES IN THIS GROUP ARE SDLC -
          TYPE=NCP,              ALL LINES HERE ARE NCP -
          POLLED=YES,            THIS IS THE PRIMARY END OF THE LINK -
          DIAL=YES,              ALL DIAL LINES -
          REPLYTO=1.0            1 SECOND STATION TIMEOUT INTERVAL
*****
*   L38026 -- LINE 026 ON 3705#37 *
*   2400 BPS DIAL LINE FOR FRONT NIA ATTACHMENT *
*****
L38026  LINE  ADDRESS=(026),      ADDRESS OF LINE WITHIN 3705 -
          SPEED=2400,           SVC SERVICE IS 2400 BPS -
          CALL=INOUT,           FOR BOTH INCOMING & OUTGOING CALLS -
          CLOCKNG=EXT,          USE EXTERNAL CLOCKING ON THIS LINE -
          DATRATE=HIGH,         USE THE HIGHER MODEM DATA RATE -
          DUPLEX=FULL,          PHYSICAL FACILITY IS FULL DUPLEX -
          ISTATUS=INACTIVE,     ACTIVATE ONLY WHEN REQUIRED -

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NEWSYNC=NO,          NO USE OF NEWSYNC FEATURE -
NRZI=NO,            NIA CAN ONLY WORK IN NRZ MODE -
POLLED=YES,        THIS IS THE PRIMARY END OF THE LINK -
PAUSE=4.0,        POLL TIMEOUT FOR 2400 BPS - NIA PARM-
RETRIES=NONE,     LET DATAPAC HANDLE RETRY -
SPAN=(SPANLSSC)   ALLOW APPROPRIATE NCCF CONTROL
*****
* PU38SW1 -- DEFINITION OF SWITCHED PU *
*****
PU38SW1 PU PUTYPE=(2), ONLY PU TYPE 2'S CAN USE THIS LINE -
SPAN=(SPANLSSC),    ALLOW APPROPRIATE NCCF CONTROL -
MAXLU=20           MAX NUMBER OF LU'S
*****
* INSERT GENERATED NCP MACROS FROM STAGE 2 OF X25 GEN *
*****
* 1ST MCH *
*****
G384C 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
L3804C LINE UACB=(X25A04CX,X25A04CR),ADDRESS=(04C,04D),SPEED=2400
*****
* FOR THIS MCH, WE ADDED PASSLIM OPERANDS *
* NOTE: DATMOD=FULL ONLY VALID FOR PU 2 AND 4 *
*****
XC04C SERVICE ORDER=PU3804C
PU3804C PU ADDR=01,MAXDATA=261,PUTYPE=1,PASSLIM=254
LU3804C LU LOCADDR=0,ISTATUS=INACTIVE
*****
* 2ND MCH *
*****
G384E 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
L3804E LINE UACB=(X25A04EX,X25A04ER),ADDRESS=(04E,04F),SPEED=2400
XC04E SERVICE ORDER=PU3804E
*****
* FOR THIS MCH, KEEP PU, LU INACTIVE BECAUSE NO X25 CIRCUIT *
*****
PU3804E PU ADDR=01,MAXDATA=261,PUTYPE=1,ISTATUS=INACTIVE
LU3804E LU LOCADDR=0,ISTATUS=INACTIVE
*****
* PVC MACRO DEFINITIONS *
*****
* PVC ASSOCIATED WITH 1ST MCH *
*****
G384CV1 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
L38201 LINE ADDRESS=NONE,UACB=XA04C001
XC04C001 SERVICE ORDER=PU38201
PU38201 PU ADDR=C1,BATCH=NO,IRETRY=YES,MAXDATA=254,MAXOUT=7,PASSLIM*
=7,MODETAB=D3276S2,ISTATUS=ACTIVE,SPAN=(SPANLSSC),DLOGIO*
D=S3276,PUTYPE=2
LU38201 LU LOCADDR=2,SPAN=(SPANLSSC),LOGAPPL=NETMON,ISTATUS=ACTIVE
*****
* PVC ASSOCIATED WITH 2ND MCH *
* GENERATED FROM X25VC MACRO *
* NOTICE ONLY 1 LU PER PU *
*****
G384EV1 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
XL04E001 LINE ADDRESS=NONE,UACB=XA04E001
XC04E001 SERVICE ORDER=XP04E001
XP04E001 PU PUTYPE=2,ADDR=C1,MAXDATA=265
XU04E001 LU LOCADDR=1
XL04E002 LINE ADDRESS=NONE,UACB=XA04E002
XC04E002 SERVICE ORDER=XP04E002

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XP04E002 PU      PUTYPE=2,ADDR=C1,MAXDATA=265
XU04E002 LU      LOCADDR=1
*****
* SVC MACRO DEFINITIONS
*****
G384CV2 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
L38202 LINE CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA04C002
PU38SW0 PU      MAXLU=20,PUTYPE=(1,2)
*****
* END OF GEN
*****
GENEND INIT=BALINIMD,SRCHI=X25BLK,SRCL0=X25TBL,INCL2LO=X25LOI,*
ORDL2LO=X25LOO,INCL2HI=X25HII,ORDL2HI=X25HIO,INCINIT=X25*
INI,ORDINIT=X25INO,TMRTICK=BALTICK
*****
END

```

NCP Gen

Once the user has completed his NCP definition, he can start his stage 1 and 2 NCP generations. This generation procedure has been covered in the "X.25 NPSI Release 2 & 3 Guide", and will not be repeated here.

VTAM DEFINITIONS

The SNA-to-SNA connection support in the X.25 NPSI licensed program maps virtual circuits into real circuits. No special considerations are required in the host VTAM definitions, unless the user wants to place outgoing calls from his SVC's. In this case, he would have to follow the X.25 NPSI rules in coding the DIALNO operand in the PATH macro for his VTAM switched major node, since X.25 NPSI will have to compose a Call Request packet for connection to the remote node.

The user should consult the ACF/VTAM V1R3 Planning and Installation Reference (SC27-0584) or the ACF/VTAM V2R1 Planning and Installation Reference (SC27-0610) for details on the VTAM definitions. The only VTAM definition that will be discussed here is the VTAM switched major node definition.

Switched Major Node Definition

It is worthwhile to first review the hierarchy of macros required to completely define a VTAM switched major node:

```

VBUILD
  PU
    (PATH)
    ( : )
  LU
  :
  PU
  :

```

The VBUILD macro with TYPE=SWNET starts the switched major node definition. Multiple PU's or minor nodes can be defined within the switched major node. Multiple major nodes can be active in VTAM at the same time. The same PU definition can be used for both circuit-switched and packet-switched connections, although not simultaneously.

• VBUILD

In the VBUILD macro, the MAXNO operand specification must be larger than or equal to the number of unique DIALNO's there will be specified in all the PATH macros in the switched major node.

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- **PU**

For SNA-to-SNA connection via the X.25 NPSI, the ADDR operand must be specified because it is the address of the PU as it exists on the "line" between the remote NIA and the PU. This specification is checked by the NPSI code when the PU has been successfully contacted and the PSCONT response arrives in the 3705 from the NIA. However since the NCP never generates any "polling" across the network there is no further use of this operand. If the PU is also used for connection over normal circuit switched lines, then ADDR should be specified as the SDLC station address for the physical unit.

The call establishment flow is presented in detail in Chapter 6 (e.g. Figure 6-7) in the X.25 NPSI Installation and Operation Guide. Before VTAM will communicate with a remote SNA node, an XID (Exchange ID) sequence is required so that the correct PU/LU definitions can be selected for the session. VTAM constructs the XID from the IDBLK and IDNUM specifications in the PU definition. The IDBLK identifies the kind of SNA device to VTAM. This block number can be obtained from the component description manual for the device. For example, the IDBLK is 018 for a 3276, 017 for a 3274, and 023 for an 8100 DPPX system communicating to the host as a PU type 2 device.

The IDNUM is different for different devices. For example, it is the hex representation of the serial number for a 3276. For a 3274, it can be the hex representation of the serial number or it can be assigned any value by the user during the 3274 Customisation process. For the 8100 DPPX system, it has to match the WRITEID operand specification in the 8100 DASSDL macro. The user should review the appropriate device component description manual to determine the IDNUM for a given device.

A trick that the user may want to adopt for the IDBLK and IDNUM specifications is to first assign some number for IDBLK and IDNUM, activate the PU and then dial in from the remote location. When VTAM cannot find a match in the XID, it will send an error message with the remote station's ID to the operator console. The user then simply has to copy this address into the appropriate IDBLK and IDNUM operands.

If the user wants to disconnect the physical unit when the last logical unit terminates its session with its application program, he can code DISCNT=YES. In an X.25 connection, a CLEAR REQUEST packet will be generated by the X.25 NPSI to clear the SVC.

Make sure that the MAXPATH specification is at least equal to the number of PATH macros specified for this PU.

Other parameters that the user may want to pay some attention to are the MAXDATA, MAXOUT and PACING operands. These are already included in the X25PU macro discussion under the X.25 Gen earlier on.

- **PATH**

A PATH macro is only required if the user wants to call out from the SNA host. There can be multiple PATH macros associated with the PU definition.

The GRPNM operand specifies the symbolic name of a GROUP macro in an NCP definition that contains a group of SDLC circuit-switched links or X.25 switched logical channels that can be used for a dial out operation.

The DIALNO operand provides connection information to NCP and/or the X.25 NPSI.

In an X.25 environment, when a user wants to place an outgoing call to a remote DTE from an SVC, he will have to present a CALL REQUEST packet to the PSDN. An illustration of this packet layout can be found in Chapter 4 in the X.25 NPSI Installation and Operation Manual (SC30-3163).

Based on the "Called DTE Address" given by the user, the network will attempt to establish a virtual circuit connection with the remote DTE node. If the user wishes to invoke special optional facilities from the network (for example "Closed User Group", or priority service), he

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would need to specify this requirement in the "Facility Code" and "Facility Parameter" fields in the "Call Request" packet. If he wants to include some additional information to the remote DTE in the connection request (e.g. logon data), he can put this in the "Call User Data" field in the "Call Request" packet.

This procedure is slightly more complicated than in the normal circuit-switched environment where a user only needs to provide a telephone number in the DIALNO operand.

When using the PATH macro to define an outbound call request with optional parameters, make sure that the * is also coded. (See Chapter 4 of the SRL manual "X.25 NPSI Installation and Operation").

Note that for SNA-to-SNA connection, the ZZZZ parameter (CUD field) is not used.

- LU

No special considerations are necessary for the LU macro.

Sample Switched Major Node Definition

The following is a sample switched major node definition for connection to an IBM 3276-12 controller with only 1 screen. The PATH macros are defined such that it could use a manual dial on an SDLC line (Group G38SD) to access the 3276, or use an SVC (Group G384CV2).

The PATH's are all specified as USE=NO. When it is necessary to initiate a dialout on a particular path (e.g. PATH3), the operator activates this link with the following VTAM command:

```
v net,path=use,id=pu3276,pid=3
```

```
COL-----1-----2-----3-----4-----5-----6-----7
*****
* SW3276 -- DEFINITION OF SWITCHED X.25 CONNECTION. *
*          3 DIAL PATHS SET UP THAT CAN ACCESS THROUGH THIS DEF'N. *
*          ALL DIAL PATHS INITIALLY INACTIVE, OPERATOR MUST *
*          ACTIVATE APPROPRIATE PATH. *
*****
SW3276  VBUILD MAXGRP=3,          MAX NUMBER OF UNIQUE PATH GROUPS  -
          MAXNO=9,              MAX TOTAL NUMBER OF PHONES DEFINED  -
          TYPE=SMNET            THIS IS A SWITCHED MAJOR NODE
*****
*          PU DEFINITION FOR 3276 -12 *
*****
PU3276  PU      ADDR=C1,          HEX ADDRESS OF THIS PHYSICAL STATION  -
          SPAN=(SPANLSSC),       NCCF CONTROL *
          ISTATUS=ACTIVE,
          MODETAB=D3276S2,       3276-12, ONLY SCREEN IS 3276
          DLOGMOD=S3276,
          IDBLK=018,             ACCORDING TO COMP. DESCRIPTION
          IDNUM=0A116,           SERIAL NUMBER 41323
          BATCH=NO,              MAKE LU'S INTERACTIVE BY DEFAULT
          DISCNT=(YES,F),        BREAK CONNECTION WHEN SESSIONS DONE
          IRETRY=YES,            RETRY ON IDLE DETECT TIMEOUT
          MAXDATA=265,           UP TO 265 BYTES PER PIU SEGMENT
          MAXOUT=7,              MAX SDLC FRAMES BEFORE LINK RESPONSE
          MAXPATH=3,             NUMBER OF DIFFERENT PATHS
          PASSLIM=7,             MAX PIU SEGMENTS IN ONE TX BURST
          PUTYPE=2               THIS IS A SMART CLUSTER
PATH1   PATH    USE=NO,          OPERATOR MUST ACTIVATE THIS PATH
          DIALNO=4990062,        MANUAL DIAL - SDLC LINE
          GRPNM=G38SD,           GROUP NAME IN NCP38V2 FOR 3705#38
          GID=0,                 GROUP ID FOR THIS SET OF PATHS
          PID=1,                 PATH ID FOR THIS CONNECTION ROUTE
          REDIAL=1               REDIAL ONCE IF NOT SUCCESSFULL
PATH2   PATH    USE=NO,          OPERATOR MUST ACTIVATE THIS PATH
          DIALNO=401000622,      X.25 USE DEFAULT VCCINDX/OUFINDX
          GRPNM=G384CV2,         GROUP NAME IN NCP38V2 FOR 3705#38
          GID=0,                 GROUP ID FOR THIS SET OF PATHS
```

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```

PID=2, PATH ID FOR THIS CONNECTION ROUTE -
REDIAL=1 REDIAL ONCE IF NOT SUCCESSFULL -
PATH3 PATH USE=NO, OPERATOR MUST ACTIVATE THIS PATH -
DIALNO=4010006220301, X.25 USE VCCINDX 3 -
GRPNM=G384CV2, GROUP NAME IN NCP38V2 FOR 3705#38 -
GID=0, GROUP ID FOR THIS SET OF PATHS -
PID=3, PATH ID FOR THIS CONNECTION ROUTE -
REDIAL=1 REDIAL ONCE IF NOT SUCCESSFULL -
LU327601 LU LOCADDR=2, ADDRESS OF THIS LU ON THE PU -
LOGAPPL=NETMON, LOG TO NETMON -
SPAN=(SPANLSSC), NCCF CONTROL -
ISTATUS=ACTIVE ACTIVATE WITH PU -
*****

```

OTHER HOST CONSIDERATIONS

VTAM Start Procedure

In the VTAM start procedure, don't forget to include a DD statement for the NCP DUMP dataset. The symbolic name of this dataset should be the same as that specified in the DUMPDS operand in the NCP PCCU macro.

The following is the VTAM start procedure used in the System Support Centre in IBM Canada. In this example, there are two NCP's: one running under ACF/NCP/VS Release 3 and the other ACF/NCP/VS Release 2.1.

```

COL-----+-----1-----+-----2-----+-----3-----+-----4-----+-----5-----+-----6-----+
//ACFVTAM PROC VTAM=V2,NCP1=LSNCP30,NCP2=LSNCP21,PFX=LSSC
//*REFER: LSSC.PROCLIB(NET)
/**
/** NOTE THAT THE NAME OF THIS PROC IS DIFFERENT FROM THE LABEL
/** ON THE 'PROC' STATEMENT ABOVE.
/**
//VERSION2 EXEC PGM=ISTINM01,REGION=5120K,
// DPRTY=(15,14),TIME=1440,
// PERFORM=8
//VTAMLIB DD DSN=SYS1.VTAMLIB,DISP=SHR
//VTAMLST DD DSN=&PFX..&VTAM..VTAMLST,DISP=SHR
//VTAMOBJ DD DSN=&PFX..&VTAM..VTAMOBJ,DISP=SHR
//INITEST DD DSN=SYS1.&NCP1..SSPLIB,DISP=SHR
//NCPLIB DD DSN=SYS1.&NCP1..NCPLIB,DISP=SHR,DCB=BLKSIZE=13030
// DD DSN=SYS1.&NCP2..NCPLIB,DISP=SHR
//DUMP36 DD DSN=LSSC.NCP.DUMP36,DISP=SHR
//DUMP37 DD DSN=LSSC.NCP.DUMP37,DISP=SHR
//SYSABEND DD SYSOUT=A,FREE=CLOSE
//SYSUDUMP DD SYSOUT=A,FREE=CLOSE

```

X.25 Formatted Dump

Under error conditions, it may be necessary to get an NCP dump so as to pinpoint the problem. The X.25 NPSI control blocks are all addressed directly or indirectly from the UACB (User Adapter Control Block), which is the NCP Customization facility's main control block for adding line control to the NCP. The NCP dump utility (IFLDUMP) has to be extended if the X.25 control blocks are to be formatted in the NCP dump. PTF UR90035 will provide the necessary linkage extension for this utility.

The layout of the X.25 control blocks can be found in the X.25 NPSI Handbook (SC30-3079).

The following VTAM command can be used to dump an NCP:

```
F NET,DUMP,ID=ncp major node name
```

After the NCP dump is completed, the user can use a similar procedure as the following to obtain a formatted printout of the dump:

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```
COL-----1-----2-----3-----4-----5-----6-----+--
//NCPDUMP JOB (????,??????),'DSSC MA',MSGCLASS=X,CLASS=A,TIME=(10),
//  NOTIFY=????????,MSGLEVEL=(1,1)
//*MAIN  LINES=(010,W)
//DUMP   EXEC PGM=IFLDUMP
//STEPLIB DD  DSN=VS10543.NCP21.SSPLIB,DISP=SHR
//SYSUT2 DD  DSN=LSSC.NCP.DUMP37,
//          DISP=SHR,UNIT=SYSDA,VOL=SER=LIP005
//SYSPRINT DD SYSOUT=*
//SYSIN  DD  *
//          DUMP FORMAT=Y,BUF=N
/*
//
```


This chapter is mainly concerned with the INN (Intermediate Network Node) support function of X.25 NPSI. Readers who do not intend to use this facility may wish to skip this chapter.

RELEASE LEVEL CONSIDERATIONS

The prerequisite release levels needed to generate an NCP with X.25 INN links are:

- X.25 NPSI Rel 3
- ACF/NCP Rel 3

Installation and generation for X.25 NPSI Rel 3 can proceed exactly as described in the "Installation" and "Generation Procedure" chapters of Technical Bulletin GG24-1567-0, "X.25 NCP Packet Switching Interface Release 2 and 3 Guide". The examples of JCL given should be changed to use names which identify the Rel 3 datasets. In the examples which follow in this chapter, the first qualifier NCP720 is used to distinguish Rel 3 datasets from the Rel 2 datasets, which use the qualifier NCP715.

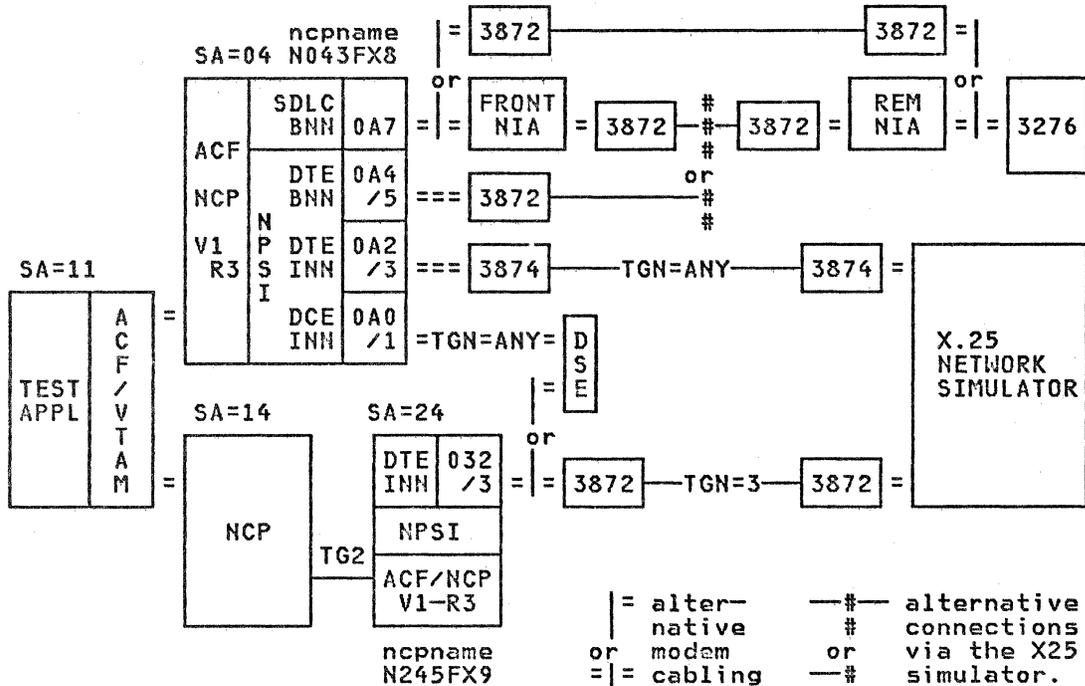
Before introducing the changes required for the X.25 INN links, it is recommended that any existing NCP/NPSI Rel 2 definitions should be regenerated and tested at release 3 level. This will entail the following steps:

1. The NPSI definitions do not need to be changed, except for possible reassignment of member names in the following places (depending upon installation practices):
 - 'X25BUILD' macro parameters SRCHI and SRCLO
 - 'X25END' macro parameters NCPSTG1, INCL2HI, INCINIT, INCL2LO, ORDINIT, ORDL2HI, ORDL2LO and X25END.
2. Regenerate the NPSI definitions at Rel 3 level.
3. Update the NCP definitions to ACF/NCP Rel 3 level. This will require changes to:
 - the PCCU and BUILD macros and the addition of PATH definitions for routing
 - SDLCST, GROUP and PU macros for any existing (non X.25) INN links.See SC30-3154-0 "ACF/NCP/VS Installation" for details.
4. Combine the stage 2 output from the NPSI generation with the updated NCP definitions and proceed through NCP Rel 3 generation.

SAMPLE CONFIGURATION

In the following discussion, the sample specifications are based on the configuration shown in Figure 1 on page 28. After generation the NCPs were successfully tested in this environment.

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SESSION ROUTING:

SSCP : VR7 = ER7 fwd => SA11-TG1-SA04 <= ret ER7

APPL : VR1 = ER5 fwd => SA11-TG1-SA14-TG2-SA24-TG3-SA04 <= ret ER1

Figure 1. TEST CELL CONFIGURATION

X.25 INN MACRO REQUIREMENTS

An X.25 INN uses a type 3 virtual circuit (QLLC). This cannot be specified on an X25VC macro so each INN link must be defined with an X25LINE and an X25PU macro.

The following should be considered when specifying X.25 macros for an INN link (items are shown in specification sequence):

- X25BUILD, X25NET and X25VCCPT: no special requirements
- X25OFT: remember to include one of these even though an X.25 INN is PVC only and there may be no SVCs in this node.
- X25MCH: ANS=CONTINUE is required
- X25LCG: no special requirements
- X25LINE: the following should be specified:

- TYPE=PERMANENT (required)
- LLC=LLC3 i.e. type 3 virtual circuit (required)
- MONLINK=YES

Note that MAXLU only applies to an SVC and so is not required.

- X25PU: The following should be specified

- PUDR=NO (required)
- ANS=CONTINUE

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- PUTYPE=4

When coding TGN= remember that an X.25 INN must have only one link (X.25 logical channel). The generation process will accept definitions that imply more than one link in the same INN TG, for example two X25PU macros with TGN=ANY. Therefore if such a specification is used, make sure that the two X25PUs can never be in contact simultaneously with the same subarea and TG number. A safer practice would be to specify a unique TG number for each X25PU if possible (see comments in "Sample 2" on page 32).

- X25LU: do not specify for INN
- X25END: no special requirements.

The above points are illustrated in the sample definitions which follow; in particular note these aspects:

- avoiding NPSI name duplication (see "Sample Output from an X.25 INN Generation" on page 38).
- SDLCST macros in an X.25 environment (see "Sample NCP Definition" on page 39).

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SAMPLE X.25 DEFINITIONS FOR AN INN LINK

SAMPLE 1

The following example provides the X.25 NPSI definitions required to add one INN logical channel on the physical interface 032/033 of subarea 24 (see Figure 1 on page 28). In this case the transmission group has been identified uniquely with TGN=3. Its MCH has been defined as a DTE for connection either directly to an adjacent MCH DCE for initial testing, or else to the X.25 network (DCE) for testing through the network.

```

*****
* X25 NPSI R 3 STAGE 1 INPUT *                NCP720.COMMON.X25(X25SRC9) *
*****
* THE UNIQUE GENERATION NUMBER (9) IS USED IN THE FOLLOWING PLACES: *
* 1 - IN 'SRCHI' AND 'SRCLO' IN THE 'X25BUILD' MACRO. *
* 2 - IN THE PARAMETERS 'NCPSTG1', 'INCL2HI', 'INCINIT', 'INCL2LO', *
*   'ORDINIT', 'ORDL2HI' AND 'ORDL2LO' IN THE 'X25END' MACRO. *
*****
*-----GENERATION SPECIFICATIONS-----*
* THIS GENERATION IS TO PROVIDE THE DEFINITIONS IN SUBAREA 24 FOR A *
* SINGLE X.25 INN LINK BETWEEN SUBAREA 24 AND ADJACENT SUBAREA 4 *
*****
*
* TEST 5
* CPU TO CPU QLLC TYPE 3 VIRTUAL CIRCUIT
* INN LINK
* MCH CHARACTERISTICS
*
* DCE END (SA=04)                                DTE END (SA=24)
* MCH ADDRESS = 0A0/0A1                          TG=3      MCH ADDRESS = 032/033
* MCH NAME    = XM040A0                          MCH NAME    = XM24032
* PU NAME     = XP040A0                          INN          PU NAME     = XP24032
* LU NAME     = XU040A0                          VIA          LU NAME     = XU24032
* M/WINDOW    = 7                                MODEM        M/WINDOW    = 7
* VIRTUAL CIRCUIT DATA ELIMINATOR 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--
*****
* TEST 6
* CPU TO CPU QLLC TYPE 3 VIRTUAL CIRCUIT
* INN LINK
* MCH CHARACTERISTICS
*
* DTE END (SA=04)                                DTE END (SA=24)
* MCH ADDRESS = 0A2/0A3                          TG=3      MCH ADDRESS = 032/033
* MCH NAME    = XM040A2                          MCH NAME    = XM24032
* PU NAME     = XP040A2                          INN VIA     PU NAME     = XP24032
* LU NAME     = XU040A2                          X25 NETWORK LU NAME     = XU24032
* M/WINDOW    = 7                                SIMULATOR  M/WINDOW    = 7
* VIRTUAL CIRCUIT DATA AS PSDN 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--
*****
* X25BUILD - THIS MACRO DESCRIBES THE GENERATION PROCESS. *
*****
WTCX252 X25BUILD IDNUMH=01, ID FOR NON-SNA SWITCHED SUPPORT C
JOB CARD=YES, USE OS JOB CARD FROM 'MODS.GEN3705' C
MACLIB=STAGE2, WORK DATA SET FOR NPSI STAGE 2 OUTPUT C
MCHCNT=1, 1 MCH LINK DEFINED C
QUALIFY=NCP720, USE NPSI R3 AND NCP R3 DATA SETS C
SNAP=NO, SNAP FACILITY NOT ALLOWED. C
SRCHI=X25BLK9, STAGE 2 OUTPUT MEMBER NAME (9 = GENNO)X
SRCLO=X25TBL9, STAGE 2 OUTPUT MEMBER NAME (9 = GENNO)X
SRCPRFX=X25, STAGE 2 OUTPUT TABLES & BLOCKS PREFIX C
TYP SYS=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=1, 1 ENTRY IN VIRTUAL CIRCUIT TABLE X
OUHINDX=1, 1 ENTRY IN THE OPTIONAL FACILITY TABLE
*****

```

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```

* 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
*****
* X25OUFTT - SVC USER FACILITIES AND CALL USER DATA TABLE. *
*****
X25OUFTT INDEX=1 TABLE ENTRY NUMBER (MANDATORY ENTRY)
*****
* X25MCH - DESCRIBE THE PHYSICAL MULTICHANNEL LINK. *
* - DTE END 032/033 *
*****
XM040A0 X25MCH ADDRESS=(032,033), 3705 FDX LINE ADDRESS C
CSBTYPE=3, COMMUNICATION SCANNER TYPE X
FRMLGTH=259, MAXIMUM FRAME LENGTH (+3 BYTE PKT HDR) C
LCGDEF=0(1), LOGICAL CHAN GRP 0, UP TO CHAN #1 X
MWINDOW=7, LINK ACCESS FRAME WINDOW SIZE (HDLC) C
ANS=CONT, DO NOT BREAK CONTACT IF ANS X
DBIT=NO, NO DELIVERY CONFIRMATION BIT SUPPORT C
GATE=NO, GATE OR DATE FUNCTION NOT REQUIRED C
LCNO=NOTUSED, LOGICAL CHANNEL 0 NOT USED C
LUNAME=XU24032, MCH LU NAME (SEE NAMING STANDARDS) X
NDRETRY=2, NP/TP SEQUENCE EXECUTED C
NPRETRY=4, I OR U FRAME TIMEOUT RECOVERY C
PAD=NO, PAD FUNCTION NOT REQUIRED 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=XP24032, MCH PU NAME (SEE NAMING STANDARDS) X
SPEED=9600, SPEED OF PHYSICAL CIRCUIT C
STATION=DTE, FOR CONNECTION TO A DCE (E.G.PSDN) X
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 A QLLC LINE FOR THE INN PVC *
*****
L240321 X25LINE LCN=1, LOGICAL CHANNEL WITHIN THIS GROUP X
TYPE=P, V C TYPE - P=PERMANENT, S=SWITCHED I
LLC=LLC3, QLLC - REQUIRED FOR SNA INN LINK I
VCCINDX=1, INDEX IN CONNECTION PARAMETER TABLE I
MONLINK=YES, MONITOR FOR ACTPU IF NO SSCP SESSION
** NOTE: RETRY DEFAULT IS 3 AT 30 SECONDS
*****
* X25PU - DESCRIBE A PU FOR THE INN PVC *
*****
P240321 X25PU PUTYPE=4, TYPE 4 PU X
ANS=CONT, DO NOT BREAK CONTACT IF ANS I
PUDR=NO, MANDATORY FOR X25 INN I
TGN=3, TG ID (ONLY ONE LINK ALLOWED IN A TG
FOR AN X.25 INN)
**
*****
* 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=X25NCP9, STAGE 2 OUTPUT MEMBER NAME (9 = GENNO)X
X25VTAM=NO, VTAM ACCEPT ADDRESS=NONE & AUTO=YES C
HSPDSEL=(00111111), SCANNER3 HIGH SPEED SELECT MASKS C
INCL2HI=X25HII9, STAGE 2 OUTPUT MEMBER NAME (9 = GENNO)X
INCL2LO=X25LOI9, STAGE 2 OUTPUT MEMBER NAME (9 = GENNO)X
ORDINIT=X25INO9, STAGE 2 OUTPUT MEMBER NAME (9 = GENNO)X
ORDL2HI=X25HIO9, STAGE 2 OUTPUT MEMBER NAME (9 = GENNO)X
ORDL2LO=X25LO9, STAGE 2 OUTPUT MEMBER NAME (9 = GENNO)X
SCANCTL=(2,2), SCAN LIMITS & ADDR SUBS

```

END

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Sample 2: In this next example, definitions have been added to an existing X.25 NPSI specification to provide one INN logical channel on each of the two physical interfaces at 0A0/0A1 and 0A2/0A3 in subarea 04 (see Figure 1 on page 28). The MCH for 0A0/0A1 has been defined as a DCE to allow local connection via a dataset eliminator to the DTE in subarea 24 for initial testing. The MCH for 0A2/0A3 has been defined as a DTE for connection to the DTE in subarea 24 via the X.25 network DCEs. Both X25PUs were defined with TGN=ANY so that either could connect with TGN=3 in subarea 24.

This specification was intended to illustrate that two X25PU macros in the same subarea can have TGN=ANY definitions without any generation problem, as will be seen from the output samples. A safer definition would be to provide say TGN=3 and TGN=4 for the respective subarea 04 interfaces and TGN=ANY for the single subarea 24 interface.

```

*****
* X25 NPSI R 3 STAGE 1 INPUT *                NCP720.COMMON.X25(X25SRC8) *
*****
* THE UNIQUE GENERATION NUMBER (8) IS USED IN THE FOLLOWING PLACES: *
* 1 - IN 'SRCHI' AND 'SRCLO' IN THE 'X25BUILD' MACRO. *
* 2 - IN THE PARAMETERS 'NCPSTG1', 'INCL2HI', 'INCINIT', 'INCL2LO', *
*   'ORDL2HI' AND 'ORDL2LO' IN THE 'X25END' MACRO. *
*****
*-----GENERATION SPECIFICATIONS-----*
* THIS GENERATION IS TO PROVIDE DEFINITIONS IN SUBAREA 4 FOR THREE *
* MCH LINKS INCLUDING TWO X.25 INN LINKS TO SUBAREA 24. *
* SIX TESTS CAN BE DONE, *
* 1. CPU TO CPU PCNE LLC TYPE 0 (2 MCH IN SAME NCP WITHOUT PSDN) *
* 2. CPU TO 327X LLC TYPE 2 PVC & SVC (1 MCH) VIA PSDN TO REMOTE NIA, *
* 3. CPU TO 327X LLC TYPE 2 PVC WITH FRONTAL AND REMOTE NIA VIA PSDN, *
* 4. CPU TO 327X LLC TYPE 2 SVC WITH FRONTAL AND REMOTE NIA VIA PSDN, *
* (NOTE: TESTS 3 and 4 ARE NOT DEFINED TO X.25 NPSI), *
* 5. CPU TO CPU QLLC LLC TYPE 3 (INN LINK WITHOUT PSDN), *
* 6. CPU TO CPU QLLC LLC TYPE 3 (INN LINK VIA PSDN). *
*****
*                                TEST 1 *
*                                CPU TO CPU PCNE TYPE 0 VIRTUAL CIRCUIT *
*                                MCH CHARACTERISTICS *
*                                DCE END (SA=04) *
*                                DTE END (SA=04) *
* MCH ADDRESS = 0A0/0A1 *
* MCH NAME = XM040A0 *
* PU NAME = XP040A0 *
* LU NAME = XU040A0 *
* M/WINDOW = 7 *
*                                MODEM *
*                                ELIMINATOR *
*                                M/WINDOW = 7 *
*                                DTE END (SA=04) *
* MCH ADDRESS = 0A2/0A3 *
* MCH NAME = XM040A2 *
* PU NAME = XP040A2 *
* LU NAME = XU040A2 *
* M/WINDOW = 7 *
*
* ****VIRTUAL CIRCUIT DATA**** *
* VC/NO TYPE PKT/SZ V/WNDW *
* --2---PVC---256-----3--- *
* --3---PVC---128-----7--- *
* --4---PVC---256-----7--- *
* --5---SVC---064-----2--- *
* --6---SVC---128-----2--- *
* --7---SVC---256-----2--- *
*
* ****VIRTUAL CIRCUIT DATA**** *
* VC/NO TYPE PKT/SZ V/WNDW *
* --2---PVC---256-----3--- *
* --3---PVC---128-----7--- *
* --4---PVC---256-----7--- *
* --5---SVC---064-----2--- *
* --6---SVC---128-----2--- *
* --7---SVC---256-----2--- *
*
*****
*                                TEST 2 *
*                                CPU TO 327X PSH TYPE 2 VIRTUAL CIRCUIT *
*                                MCH CHARACTERISTICS *
*                                REMOTE NIA *
* MCH ADDRESS = 0A4/0A5 *
* MCH NAME = XM040A4 *
* PU NAME = XP040A4 *
* LU NAME = XU040A4 *
* M/WINDOW = 7 *
*                                X25 NETWORK *
*                                SIMULATOR *
*                                M/WINDOW = 7 *
*                                AS PSDN *
*                                REMOTE NIA *
* VIRTUAL CIRCUIT DATA *
* VC/NO TYPE PKT/SZ V/WNDW *
* --1---PVC---256-----3--- *
* --2---SVC---128-----3--- *
*
* VIRTUAL CIRCUIT DATA *
* VC/NO TYPE PKT/SZ V/WNDW *
* --1---PVC---256-----3--- *
* --1---SVC---128-----3--- *
*
*****
*                                TEST 3 *
*                                CPU TO 327X PSH TYPE 2 VIRTUAL CIRCUIT *
*                                SVC *
*                                MCH CHARACTERISTICS *
*                                REMOTE NIA *
* FRONTAL NIA *
* LINE NAME = L040A6 *
*

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* PU NAME = P040A6A X25 NETWORK M/WINDOW = 7 *
* M/WINDOW = 7 SIMULATOR M/WINDOW = 7 *
* VIRTUAL CIRCUIT DATA AS PSDN VIRTUAL CIRCUIT DATA *
* VC/NO TYPE PKT/SZ V/WNDW VC/NO TYPE PKT/SZ V/WNDW *
* --1---SVC---256-----3---|=====|=====|--1---SVC---256-----3--- *
*****
* TEST 4 *
* CPU TO 327X PSH TYPE 2 VIRTUAL CIRCUIT *
* PVC *
* MCH CHARACTERISTICS *
* FRONTAL NIA REMOTE NIA *
* LINE NAME = L040A7 *
* PU NAME = P040A7A/C *
* LU NAME = T040A7A1/C1 X25 NETWORK *
* M/WINDOW = 7 SIMULATOR M/WINDOW = 7 *
* VIRTUAL CIRCUIT DATA AS PSDN 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--- *
*****
* TEST 5 *
* CPU TO CPU QLLC TYPE 3 VIRTUAL CIRCUIT *
* INN LINK *
* MCH CHARACTERISTICS *
* DCE (SA=04) DTE (SA=24) *
* MCH ADDRESS = 0A0/0A1 TG=3 MCH ADDRESS = 032/033 *
* MCH NAME = XM040A0 MCH NAME = XI124032 *
* PU NAME = XP040A0 INN PU NAME = XP24032 *
* LU NAME = XU040A0 VIA LU NAME = XU24032 *
* M/WINDOW = 7 MODEM M/WINDOW = 7 *
* VIRTUAL CIRCUIT DATA ELIMINATOR 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--- *
*****
* TEST 6 *
* CPU TO CPU QLLC TYPE 3 VIRTUAL CIRCUIT *
* INN LINK *
* MCH CHARACTERISTICS *
* DTE (SA=04) DTE (SA=24) *
* MCH ADDRESS = 0A2/0A3 TG=3 MCH ADDRESS = 032/033 *
* MCH NAME = XM040A2 MCH NAME = XI124032 *
* PU NAME = XP040A2 INN VIA PU NAME = XP24032 *
* LU NAME = XU040A2 X25 NETWORK LU NAME = XU24032 *
* M/WINDOW = 7 SIMULATOR M/WINDOW = 7 *
****VIRTUAL CIRCUIT DATA**** AS PSDN ****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--- *
*****
* X25BUILD - THIS MACRO DESCRIBES THE GENERATION PROCESS. *
*****
WTCX252 X25BUILD IDNUMH=01, ID FOR NON-SNA SWITCHED SUPPORT C
JOBCARD=YES, USE OS JOB CARD FROM 'MODS.GEN3705' C
MACLIB=STAGE2, WORK DATA SET FOR NPSI STAGE 2 OUTPUT C
MCHCNT=3, 3 MCH LINKS DEFINED C
QUALIFY=NCP720, USE NPSI R3 AND NCP R3 DATA SETS C
SNAP=NO, SNAP FACILITY NOT ALLOWED. C
SRCHI=X25BLK8, STAGE 2 OUTPUT MEMBER NAME (8 = GENNO)C
SRCLO=X25TBL8, STAGE 2 OUTPUT MEMBER NAME (8 = GENNO)C
SRCPRFX=X25, STAGE 2 OUTPUT TABLES & BLOCKS PREFIX C
TYP SYS=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

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INSLOW=(25,0), FREE BUFFER PERCENTAGE C
VWINDOW=7 PACKET TRANSMIT/RECEIVE WINDOW SIZE C
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 C
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 C
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 C
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 C
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 C
*****
* X250UFTT - SVC USER FACILITIES AND CALL USER DATA TABLE. *
*****
X250UFTT INDEX=1 TABLE ENTRY NUMBER (MANDATORY ENTRY)
*****
* 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=CONT, DO NOT BREAK CONTACT IF ANS I
DBIT=NO, NO DELIVERY CONFIRMATION BIT SUPPORT C
GATE=NO, GATE OR DATE FUNCTION NOT REQUIRED 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 REQUIRED C
TRAN=NO, NO TRANSLATION IF NO PAD FUNCTION C
PKTMODL=8, MODULO 8 PACKET NUMBERING C
PROTCL=LAPB, LINK ACCESS BALANCED PROTOCOL C
PUNAME=XP040A0, MCH PU NAME (SEE NAMING STANDARDS) C
SPEED=9600, SPEED OF PHYSICAL CIRCUIT C
STATION=DCE, FOR CONNECTION TO A DTE WITHOUT PSDN I
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 A QLLC LINE FOR THE INN PVC *
*****
L040A01 X25LINE LCN=1, LOGICAL CHANNELS WITHIN A GROUP I
TYPE=P, V C TYPE - P=PERMANENT, S=SWITCHED I
LLC=LLC3, QLLC - REQUIRED FOR AN X25 INN LINK I
VCCINDX=1, INDEX IN CONNECTION PARAMETER TABLE I
MONLINK=YES MONITOR FOR ACTPU IF NO SSCP SESSION I
** NOTE: RETRY DEFAULT IS 3 AT 30 SECONDS
*****
* X25PU - DESCRIBE A PU FOR THE INN PVC *
*****
P040A01 X25PU PUTYPE=4, TYPE 4 PU I
ANS=CONT, DO NOT BREAK CONTACT IF ANS I
PUDR=NO, MANDATORY FOR X25 INN I
TGN=(ANY) ALLOW ANY TG# TO ATTACH (EXPECT TG3)
** ONLY ONE LINK ALLOWED IN X25 INN TG
*****

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*      X25VC - DESCRIBE THE PCNE VIRTUAL CIRCUITS IN THIS GROUP      *
*****
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
      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.            *
*      - DTE END 0A2/0A3                                           *
*****
XM040A2 X25MCH ADDRESS=(0A2,0A3), 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 CRP 0, UP TO CHAN #7      C
      MWINDOW=7,             LINK ACCESS FRAME WINDOW SIZE (HDLC)   C
      ANS=CONT,              DO NOT BREAK CONTACT IF ANS            I
      DBIT=NO,               NO DELIVERY CONFIRMATION BIT SUPPORT   C
      GATE=NO,               GATE OR DATE FUNCTION NOT REQUIRED      C
      LCNO=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 REQUIRED                 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=XP040A2,        MCH PU NAME (SEE NAMING STANDARDS)     C
      SPEED=9600,            SPEED OF PHYSICAL CIRCUIT              C
      STATION=DTE,           FOR CONNECTION TO A DCE 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 A QLLC LINE FOR THE INN PVC              *
*****
L040A21 X25LINE LCN=1,        LOGICAL CHANNELS WITHIN A GROUP      I
      TYPE=P,                V C TYPE - P=PERMANENT, S=SWITCHED      I
      LLC=LLC3,              QLLC - REQUIRED FOR AN X25 INN LINK      I
      VCCINDX=1,             INDEX IN CONNECTION PARAMETER TABLE  I

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MONLINK=YES          MONITOR FOR ACTPU IF NO SSCP SESSION
**                  NOTE: RETRY DEFAULT IS 3 AT 30 SECONDS
*****
* X25PU - DESCRIBE A PU FOR THE INN PVC
*****
P040A21 X25PU PUTYPE=4, TYPE 4 PU I
                ANS=CONT, DO NOT BREAK CONTACT IF ANS I
                PUADR=NO, MANDATORY FOR X25 INN I
                TGN=(ANY) ALLOW ANY TG# TO ATTACH (EXPECT TG3)
**                  ONLY ONE LINK ALLOWED IN AN X25 INN
*****
* X25VC - DESCRIBE THE PCNE VIRTUAL CIRCUITS IN THIS GROUP
*****
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=SHA 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.
* - DTE 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(2), LOGICAL CHAN GRP 0, UP TO CHAN #2 C
                MWINDOW=7, LINK ACCESS FRAME WINDOW SIZE (HDLC) C
                ANS=STOP, BREAK CONTACT IF ANS C
                GATE=NO, NO DELIVERY CONFIRMATION BIT SUPPORT C
                LCNO=NOTUSED, GATE OR DATE FUNCTION NOT REQUIRED C
                LLCLIST=(LLC2), LOGICAL CHANNEL 0 NOT USED C
                LUNAME=XU040A4, ALLOW PSH ON THIS CIRCUIT C
                NDRETRY=2, MCH LU NAME (SEE NAMING STANDARDS) C
                NPRETRY=4, NP/TP SEQUENCE EXECUTED C
                PAD=NO, I OR U FRAME TIMEOUT RECOVERY C
                TRAN=NO, PAD FUNCTION NOT REQUIRED C
                PKTMODL=8, NO TRANSLATION IF NO PAD FUNCTION C
                PROTOCOL=LAPB, MODULO 8 PACKET NUMBERING C
                PUNAME=XP040A4, LINK ACCESS BALANCED PROTOCOL C
                SPEED=2400, MCH PU NAME (SEE NAMING STANDARDS) C
                STATION=DTE, SPEED OF PHYSICAL CIRCUIT C
                TDTIMER=1, FOR CONNECTION TO A DCE NETWORK NODE C
                TIME (SECS) BETWEEN ND RETRANSMISSIONS C

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TPTIMER=1.0          X25 T1 TIMER IN SECS
*****
* X25LCG - DESCRIBE THE LOGICAL CHANNEL GROUP. *
*****
X25LCG LCGN=0        LOGICAL CHANNEL GROUP NUMBER
*****
* X25LINE - DESCRIBE THE VIRTUAL CIRCUITS IN THIS GROUP *
*****
L040A4A 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
P040A4A X25PU PUTYPE=2, ATTACH TO AN SNA 3276 VIA REMOTE NIA C
ADDR=C1, NIA STATION ADDRESS IS ALWAYS 'C1' C
MAXDATA=137, DEPENDENT ON PU CONSTRAINTS C
PASSLIM=7, MAXIMUM PIU SEGMENTS IN TRANSMISSION C
MAXOUT=7, MAXIMUM SDLC FRAMES BEFORE LINK RESP C
ISTATUS=ACTIVE, ACTIVATE AT INITIALISATION C
SSCPFM=USSCS, LOGON FORMAT C
NODETAB=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
*****
* X25LINE - DESCRIBE THE VIRTUAL CIRCUIT. *
*****
L040A4B X25LINE LCN=2, 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 DTE C
VCCINDX=1, INDEX IN CONNECTION PARAMETER TABLE C
CALL=INOUT BOTH ENDS MAY ESTABLISH CALLS
P040A4B X25PU PUTYPE=(1,2), ALLOW BOTH PU TYPES 1 AND 2 C
MAXLU=1 1 LOGICAL UNIT
*****
* 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=X25NCP8, STAGE 2 OUTPUT MEMBER NAME (8 = GENNO)C
X25VTAM=NO, VTAM ACCEPT ADDRESS=NONE & AUTO=YES C
HSPDSEL=(00111111), SCANNER3 HIGH SPEED SELECT MASKS C
INCL2HI=X25HII8, STAGE 2 OUTPUT MEMBER NAME (8 = GENNO)C
INCINIT=X25INI8, STAGE 2 OUTPUT MEMBER NAME (8 = GENNO)C
INCL2LO=X25LOI8, STAGE 2 OUTPUT MEMBER NAME (8 = GENNO)C
ORDL2HI=X25HIO8, STAGE 2 OUTPUT MEMBER NAME (8 = GENNO)C
ORDL2LO=X25LO8, STAGE 2 OUTPUT MEMBER NAME (8 = GENNO)C
SCANCTL=(2,2) SCANNER 2 & 3 SCAN LIMITS & ADDR SUBS
END

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SAMPLE OUTPUT FROM AN X.25 INN GENERATION

The NPSI stage 2 generation output from the source definition given in "Sample 1" on page 30 is shown below. The output from "Sample 2" on page 32 has been edited into the NCP input definition shown in "Sample NCP Definition" on page 39. Comparing these two output files will show that the generation processor can produce duplicate names for GROUP macros, for example XNET11 occurs in both. Similar duplications could occur in other GROUP macros if identical interface IDs are referenced in more than one NPSI definition. These duplicate names will cause operating problems if they are referenced by the same host. They should be edited to conform with installation standards before proceeding with the NCP generation (in this particular example we changed XNET11 to XNET24 as it was to be included in the NCP definitions for subarea 24).

```
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=(X25A032X,X25A032R),ADDRESS=(032,033),SPEED=9600
XC032    SERVICE ORDER=XP24032
XP24032  PU    ADDR=01,MAXDATA=261,ANS=CONT,PUTYPE=1
XU24032  LU    LOCADDR=0,ISTATUS=INACTIVE
X25P032A 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
L240321  LINE MONLINK=YES,ADDRESS=NONE,IPL=NO,UACB=XA032001
XC032001 SERVICE ORDER=P240321
P240321  PU    TGN=3,ANS=CONT,PUDR=NO,PUTYPE=4
          GENEND SCANCTL=(2,2),HSPDSEL=(00111111),INIT=BALINIMD,SRCHI=X2*
          5BLK9,SRCL0=X25TBL9,INCL2LO=X25LOI9,ORDL2LO=X25L9,INCL2H*
          I=X25HII9,ORDL2HI=X25HIO9,INCINIT=X25INI9,ORDINIT=X25INO*
          9,TMRTICK=BALTICK
```

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SAMPLE NCP DEFINITION

The following shows the NCP definition for subarea 04 (see Figure 1 on page 28) after the X.25 NPSI generation output has been included. Note in these specifications that an X.25 INN does not require any SDLCST macro definitions (as is required for leased line INNs) and therefore there is no provision in the X.25 output for pointers to any SDLCST macros in the NCP definition. The absence of such pointers may not be acceptable in the NCP stage 1 processing if SDLCST macros have been defined in the NCP with which the NPSI stage 2 output has been combined. Be sure to check with your PSR for any relevant PTFs. These may be needed to ensure that the NCP stage 1 generation software will accept the PU-T4 definitions in the X.25 stage 2 output.

```

*****
*   NCP STAGE 1 INPUT           *   NCP720.COMMON.X25(N720SRC8) *
*****
* THE UNIQUE GENERATION NUMBER (8) IS USED IN THE FOLLOWING PLACES: *
*   1 - AS THE LAST DIGIT IN 'NEWNAME' BELOW. *
*   2 - 'NEWNAME' AND 'OBJQUAL' IN THE 'NCPBUILD' MACRO. *
*   3 - COMMENTS AHEAD OF THE INCLUDED X25 GENERATED NCP SOURCE CODE *
*****
*   NEWNAME = N043FX8           *   UNITSZ = 152 *
*****                               *   MAXDFRU = 25 *
*   ACF/NCP REL 3               *   MAXSUBA = 127 *
*   PUT LEVEL 8204              *   SUBAREA = 04 *
*                               *   3705 = 03F (REAL) *
*                               *   = 0FF (NVS) *
*****
* HARDWARE SPECIFICATIONS:- *
*   RPL IS INSTALLED (NOTE: CANNOT BE USED VIA AN X.25 INN LINK) *
*   512 K STORAGE *
*****
* CHANNEL ATTACHED TO SUBAREA 01 *
*****
*-- 3705 BASE FRAME -----*
*                               *   CHANNEL ADAPTER TYPE 1 (2 CHANNEL SWITCH) *
*                               *   SCANNER TYPE 3 *
*                               *   NO FEATURES USED *
*-- 3706 1ST EXTENSION -----*
*                               *   SCANNER TYPE 2 *
*   LINE ADDR   NEWSYNCH NRZI POLLED USE   ADAPTER*
*   A0/A1 X25 , FDX, NO NO NO STATION DCE (BNN & INN) 1D *
*   A2/A3 X25 , FDX, NO NO NO STATION DTE (BNN & INN) 1D *
*   A4/A5 X25 , FDX, NO NO NO STATION DTE (BNN) 1D *
*   A6 SDLC, HDX, NO NO NO FRONTAL NIA (SVC) 1D *
*   A7 SDLC, HDX, NO NO NO FRONTAL NIA (PVC) 1D *
*****
* PCCU SPECIFICATIONS - VTAM ONLY *
*   MEMORY SIZE IS 512K *
*****
VTAMV2R1 PCCU CUADDR=OFF, 3705 CONTROL UNIT ADDRESS X
                AUTODMP=NO, AUTODMP IF NCP FAILS X
                AUTOIPL=NO, AUTOIPL AND RESTART X
                AUTOSYN=YES, USE THE ALREADY LOADED NCP IF OK X
                CHANCON=COND, CONDIT. CONTACT REQ. SENT TO NCP R
                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
*****
* BUILD MACRO SPECIFICATIONS *
*****
NCPBUILD BUILD ABEND=YES, X
                ASMXREF=NO, NO ASSEMBLER CROSS-REFERENCE X
                BFRS=128, NCP BUFFER SIZE X
                CA=(TYPE1), CHANNEL ADAPTER TYPES X
                CSMHDR=27F5C711C3F0405C40C8C4D9405C, 3270 CRITSIT HEADERX
                CSMHDC=40E3C5E7E3405C5C, 3270 CRITST HEADER EXTRA TEXT X
                CSMMSG=C3D9C9E3E2C9E35A40E385819440F040, CRITSIT MESSG X
                CSMMSGC=6040C1D5E240828587A4954B, CRITST MESSG EXTRA TEXT X
                CUID=, NO SWITCHED BSC ID SEQUENCE DEVICES X

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```

CWall=20, MIN. BUFFERS BEFORE SLOWDOWN R
DELAY=0.2, CA ATT. DELAY FOR REL 3 R
ENABLTO=6.5, IBM 386X REQUIRE 6.5 AS MINIMUM X
JOBcards=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
NCPCA=ACTIVE, CHANNEL ADAPTER STATUS R
NEWNAME=N043FX8, NAME OF THIS LOAD MODULE (8 = GENNO)X
NUMHSAS=6, 6 HOSTS COMMUNICATE CONCURRENTLY R
OBJLIB=OBJWORK, LIBRARY FOR ASSEMBLER OUTPUTS X
OBJQUAL=X3, X = X25, 8 = GENNO. X
QUALIFY=NCP720, 1ST LEVEL QUALIFIER X
USERLIB=OBJ3705X, X25 OBJECT CODE LIBRARY X
MCLIB=(STAGE2,MAC3705X), X25 SOURCE CODE FOR NCP GEN X
PRTGEN=(NOGEN,NOGEN), GENERATED STATEMENTS NOT PRINTED X
RENLOAD=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
TIMEOUT=(120), ANS BEGINS AFTER THIS DELAY R
TRACE=(YES,64), USE 64 16-BYTE ENTRIES X
TYPGEN=NCP, NCP ONLY X
PARTIAL=NO, PARTIAL GENERATION NOT REQUIRED X
TYP SYS=OS, OS USED FOR STAGE 2 X
VRPOOL=20, NO. OF VR'S ENDING + DEACT/REACTR X
UNIT=SYSDA, DATA SET FOR ASSEMBLY AND LINK EDIT X
*****
* SYSCNTRL MACRO SPECIFICATIONS *
*****
NCPSSYC SYSCNTRL OPTIONS=(MODE,NAKLIM,SESSION,XMTLMT, X
BHSASSC,STORDSP, X
RCNTRL,RCOND,RECMD,RIMM,ENDCALL,SSPAUSE) X
*****
* 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, MINIMISE 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 *
*****
NCPCSB0 CSB SPEED=(150,600,1200), BUS MACH CLOCKS X
MOD=0, SCANNER ADDRESS 020 TO 03F X
TYPE=TYPE3, TYPE 3 COMM SCANNER X
NCPCSB1 CSB SPEED=(134,300,600,1200), BUS MACH CLOCKS X
MOD=1, SCANNER ADDRESS 0A0 TO 0CF X
TYPE=TYPE2, TYPE 2 COMM SCANNER X
*****
* SWITCHED LINE LU POOL *
*****
SWPOOLU LUDRPOOL NUMTYP1=10,NUMTYP2=10
**
*****
* PATH SPECIFICATIONS TO OTHER NCP'S AND HOSTS *
*****
NCP4 PATH DESTSA=11, R
ER1=(24,3),ER7=(11,1)
*****
* 327X DEFINITION FOR FRONTAL TO REMOTE NIA MCH SVC *
*****
G04NIAS GROUP LNCTL=SDLC, ALL LINES IN THIS GROUP ARE SDLC X
CLOCKNG=EXT, USE EXTERNAL CLOCKING FOR ALL LINES X
DIAL=YES, ALL DIAL LINES X
NEWSYNC=NO, NO USE FOR NEWSYNC FEATURE X
NRZI=NO, NIA CAN ONLY WORK IN NRZ MODE X

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```

POLLED=YES,          THIS IS THE PRIMARY END OF THE LINK X
REPLYTO=1.0,        1 SECOND STATION TIMEOUT INTERVAL X
RETRIES=NONE,       LET THE PPSN HANDLE THE RETRIES X
TYPE=NCP            ALL RESOURCES ARE NCP X
L040A6  LINE  ADDRESS=(0A6),  3705 LINE ADAPTER ADDRESS X
CALL=INOUT,         ALLOW INCOMING AND OUTGOING CALLS X
DATRATE=HIGH,      USE THE HIGHER MODEM DATA RATE X
DUPLEX=FULL,       PHYSICAL FACILITY IS FULL DUPLEX X
ISTATUS=INACTIVE,  INITIALIZATION WILL NOT ACTIVATE X
MAXPU=1,           MAXIMUM PU'S ON THIS LINE X
PAUSE=4.0,         NIA POLL TIMEOUT X
SPEED=2400         LINE SPEED X
P040A6A  PU  PUTYPE=2,    ONLY PU TYPE 2'S CAN USE THIS LINE X
MAXLU=3           MAXIMUM NO OF LU'S X
*****
* 327X DEFINITION FOR FRONTAL TO REMOTE NIA MCH PVC *
*****
G04NIAP  GROUP LNCTL=SDLC,  ALL LINES IN THIS GROUP ARE SDLC X
CLOCKNG=EXT,      USE EXTERNAL CLOCKING FOR ALL LINES X
DIAL=NO,          NO DIAL LINES X
NEWSYNC=NO,       NO USE FOR NEWSYNC FEATURE X
NRZI=NO,          NIA CAN ONLY WORK IN NRZ MODE X
POLLED=YES,       THIS IS THE PRIMARY END OF THE LINK X
REPLYTO=1.0,     1 SECOND STATION TIMEOUT INTERVAL X
RETRIES=NONE,    LET THE PPSN HANDLE THE RETRIES X
TYPE=NCP         ALL RESOURCES ARE NCP X
L040A7  LINE  ADDRESS=(0A7),  3705 LINE ADAPTER ADDRESS X
DATRATE=HIGH,    USE THE HIGHER MODEM DATA RATE X
DUPLEX=FULL,     PHYSICAL FACILITY IS FULL DUPLEX X
ISTATUS=INACTIVE,  INITIALIZATION WILL NOT ACTIVATE X
MAXPU=3,         MAXIMUM PU'S ON THIS LINE X
PAUSE=4.0,       NIA POLL TIMEOUT X
SPEED=2400      LINE SPEED X
P040A7A  SERVICE ORDER=(P040A7A,P040A7B,P040A7C)
PU  ADDR=C1,      NIA REQUIRES FOR SVC X
MAXDATA=265,     MAXIMUM DATA INCLUDES OVERHEADS X
PUTYPE=2,        ONLY PU TYPE 2'S CAN USE THIS LINE X
MAXOUT=3,        NIA ALLOW IN MULTIPOINT CONFIG X
PASSLIM=7,       MAXIMUM PIU'S IN TRANSMISSION X
ISTATUS=INACTIVE,  ACTIVATE WHEN REQUIRED X
SSCPFM=USSSCS,  VTAM LOGON FORMATTING X
USSTAB=US3276,  USS TABLE REFERENCE FOR VTAM X
MODETAB=MT32763  MODE TABLE REFERENCE FOR VTAM X
T040A7A1  LU  LOCADDR=2,  ADDRESS OF LU X
ISTATUS=ACTIVE  ACTIVATE WITH PU X
P040A7B  PU  ADDR=C2,      NIA REQUIRES FOR SVC X
MAXDATA=265,     MAXIMUM DATA INCLUDES OVERHEADS X
PUTYPE=2,        ONLY PU TYPE 2'S CAN USE THIS LINE X
MAXOUT=3,        NIA ALLOW IN MULTIPOINT CONFIG X
PASSLIM=7,       MAXIMUM PIU'S IN TRANSMISSION X
ISTATUS=INACTIVE,  ACTIVATE WHEN REQUIRED X
SSCPFM=USSSCS,  VTAM LOGON FORMATTING X
USSTAB=US3276,  USS TABLE REFERENCE FOR VTAM X
MODETAB=MT32763  MODE TABLE REFERENCE FOR VTAM X
T040A7B1  LU  LOCADDR=2,  ADDRESS OF LU X
ISTATUS=ACTIVE  ACTIVATE WITH PU X
P040A7C  PU  ADDR=C3,      NIA REQUIRES FOR SVC X
MAXDATA=265,     MAXIMUM DATA INCLUDES OVERHEADS X
PUTYPE=2,        ONLY PU TYPE 2'S CAN USE THIS LINE X
MAXOUT=3,        NIA ALLOW IN MULTIPOINT CONFIG X
PASSLIM=7,       MAXIMUM PIU'S IN TRANSMISSION X
ISTATUS=INACTIVE,  ACTIVATE WHEN REQUIRED X
SSCPFM=USSSCS,  VTAM LOGON FORMATTING X
USSTAB=US3276,  USS TABLE REFERENCE FOR VTAM X
MODETAB=MT32763  MODE TABLE REFERENCE FOR VTAM X
T040A7C1  LU  LOCADDR=2,  ADDRESS OF LU X
ISTATUS=ACTIVE  ACTIVATE WITH PU X
*****
* X25 DEFINITION - FROM X25 STAGE2 OUTPUT *
*****
* PLACE GENERATED X25NCP8 (8 = GENNO) NCP DEFINITION STATEMENTS HERE *
* FROM LIBRARY 'NCP720.STAGE2' BEFORE END STATEMENT. *
* CHECK FOR NAMES (LEFT COLUMN) WHICH MAY BE DUPLICATED IN OTHER *
* SUBAREAS, AND WHICH ARE KNOWN TO THE SAME HOST; ALTER AS NEEDED. *

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*****
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=CONT,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=CONT,PUTYPE=1
XU040A2  LU   LOCADDR=0,ISTATUS=INACTIVE
XM040A4  LINE UACB=(X25A0A4X,X25A0A4R),ADDRESS=(0A4,0A5),SPEED=2400
XC0A4    SERVICE ORDER=XP040A4
XP040A4  PU   ADDR=01,MAXDATA=261,ANS=STOP,PUTYPE=1
XU040A4  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=(BALNAVLXL,BALNAVXS,BALNAVXI,BALN*
          AVXK),DIAL=NO
L040A01  LINE MONLINK=YES,ADDRESS=NONE,IPL=NO,UACB=XA0A0001
XC0A0001 SERVICE ORDER=P040A01
P040A01  PU   TGN=(ANY),ANS=CONT,PUDR=NO,PUTYPE=4
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=(BALNAVLXL,BALNAVXS,BALNAVXI,BALN*
          AVXK),DIAL=NO
L040A21  LINE MONLINK=YES,ADDRESS=NONE,IPL=NO,UACB=XA0A2001
XC0A2001 SERVICE ORDER=P040A21
P040A21  PU   TGN=(ANY),ANS=CONT,PUDR=NO,PUTYPE=4
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=(BALNAVLXL,BALNAVXS,BALNAVXI,BALN*
          AVXK),DIAL=NO
L040A4A  LINE ADDRESS=NONE,UACB=XA0A4001
XC0A4001 SERVICE ORDER=P040A4A
P040A4A  PU   ADDR=C1,MAXDATA=137,MAXOUT=7,PASSLIM=7,MODETAB=MT32763,S*
          SCPFM=USSSCS,USSTAB=US3276,ISTATUS=ACTIVE,PUTYPE=2
T040A4A1 LU   LOCADDR=2,ISTATUS=ACTIVE
X25S0A4B GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*
          PE=NCP,USERID=(5668981,BALSBDT),TIMER=(BALNATER,BALNATRA*
          ,BALNATST,BALNATLS),XIO=(BALNAVLXL,BALNAVXS,BALNAVXI,BALN*
          AVXK),DIAL=YES
L040A4B  LINE CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A4002
P040A4B  PU   MAXLU=1,PUTYPE=(1,2)
X25S0A2B GROUP LNCTL=SDLC,LEVEL2=BALNAVL2,LEVEL3=BALNAVL3,LEVEL5=NCP,TY*
          PE=NCP,USERID=(5668981,BALSBDT),TIMER=(BALNATER,BALNATRA*
          ,BALNATST,BALNATLS),XIO=(BALNAVLXL,BALNAVXS,BALNAVXI,BALN*
          AVXK),DIAL=YES
XL0A2007 LINE CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A2007

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```
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=BALINIMD,SRCHI=X2*
5BLK8,SRCL0=X25TBL8,INCL2LO=X25LOI8,ORDL2LO=X25L8,INCL2H*
I=X25HII8,ORDL2HI=X25HIO8,INCINIT=X25INI8,ORDINIT=X25INO*
8,TMRTICK=BALTICK
END
```


The 5973-L02 Network Interface Adapter (NIA RPQ Y96 635) is a microcode loaded SNA/X.25 protocol converter produced by IBM Special Engineering. Detailed description of the NIA can be found in the following manuals:

- IBM 5973-L02 Frontal NIA Product Description GA11-8642
- IBM 5973-L02 Remote NIA Product Description GA11-8643

This discussion is intended to update and clarify the facilities available and operational procedures.

PRODUCT DESCRIPTION

The NIA is composed of a control unit, two synchronous line adapters, an operator panel with a keyboard and a two character LED display, and an integrated mini-cassette reader.

There are two models of the NIA: a Frontal model and a Remote model.

The Frontal NIA provides X.25 attachment capability to an SNA host with an integrated communications adapter or a 3705 communications controller operating under the control of an NCP (Network Control Program). The Remote NIA is to allow SNA-to-SNA attachment over an X.25-based PSDN for an SNA PU type 1 or 2 cluster controller.

The difference between the Frontal and Remote NIA models is that the Frontal NIA has 32K-bytes of memory and the Remote NIA has 24K-bytes. Different microcodes are required for the Frontal and the Remote. "Remote" microcode will execute correctly in a "frontal" NIA but "frontal" microcode will not execute at all in a "remote" NIA. The NIA memory is partitioned into microcode program storage and data buffering areas.

Of the two synchronous line adapters, one is used to connect the NIA to the dataset (or modem) for access to the PSDN. The physical interface conforms to the CCITT Recommendation X.21bis. (For practical purposes X.21bis is simply a new name for the interface called "V.24" outside the USA or "EIA" (RS-232-C) within it). The logical interface complies with the frame and packet level of the CCITT Recommendation X.25 and operates in a full duplex mode. If a given PSDN presents only the X.21 native interface, a specific X.21 to X.21bis converter is required between the DCE and the NIA.

The second synchronous line adapter is used to connect the 5973-L02 to the SNA device. The physical interface conforms to the CCITT V.24 recommendation and the logical interface uses SDLC protocol in half duplex mode.

Both synchronous line adapters support link speeds from 1200 bps to 9600 bps. On the synchronous link to the PSDN, external clocking is required from the PTT or common carrier modem or dataset. To the SNA node, the NIA provides a direct interface that "looks like" a clocked modem to the device.

The operator panel is composed of a 18-key keyboard and a two hexadecimal character LED display. Refer to appendix B "Appendix B. NIA LED Displays" on page 105 for a table on the various states as indicated by the LED display. There is also a machine check indicator, a power on indicator and a power ON/OFF switch. The operator panel is used for visual checking of the NIA status and problem determination. In case of SVC connections, the keyboard is used for the setup and clearing of virtual calls. The operator panel may also be used by the IBM Customer Engineer for problem diagnosis and to enter temporary microcode fixes under certain error situations when a new microcode (sometimes referred to as an Engineering Change) cannot be delivered to the customer in the time frame required.

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FEATURES

The NIA will support packet lengths of either 128 and 256 characters. Some additional supported network facilities and options are:-

- LAP or LAP-B
- Switched or Permanent Virtual Circuit
- Lower Virtual Circuit Address of 0 or 1
- Reverse Charging
- Closed User-Group
- Priority Service
- RNR packet from DCE to DTE

The CCITT Recommendation X.25 network facilities and options that are not supported by the IBM 5973-L02 (NIA) are as follows:-

- Datagram (neither received or sent)
- Fast Select
- The More Data bit (M-bit)
- The Qualified Data packet
- Modulo 128 Packet Sequence Numbering
- Delivery Confirmation bit (D-bit)
- RNR packet from DTE (NIA) to DCE (Network)
- Interrupt packet Handling (neither received or sent)
- Reject packet (neither received or sent)

The X.25 time out delay (seconds) can be set at 0.5, 1 or 2. The X.25 retry count (N2) is fixed at 10 and the SDLC link retry count (N2) is fixed at 5.

The SNA INN (Intermediate Network Node) function is not supported via the NIA, it means that 3705's and 4331's cannot communicate with each other using the IBM 5973-L02.

CRYPTOGRAPHIC SUPPORT

Link encryption devices, of course, cannot be used end to end through an X.25 network since these devices encrypt all the data presented to them. Thus the packet headers could not be understood by the network until the packets had been decrypted. Encryption mechanisms that encipher only the data portion of the record will work well however.

The following IBM cryptographic subsystem products can be used with IBM X.25 products.

- The Programmed Cryptographic-Facility Program Product, 5740-XY5 for OS/VS2 (MVS), and 5740-XY6 for OS/VS1.
- ACF/VTAM Encrypt-Decrypt feature number 6010, program number 5735-RC2 announced for OS/VS2 (MVS) and OS/VS1.
- IBM 3274 or 3276 control-unit display station, Encrypt-Decrypt feature number 3680.
- IBM 3600/4700 (3624) encryption facilities.

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FRONTAL NIA

As mentioned earlier, the Frontal NIA is to allow an SNA host system to attach to a PSDN. The other end of the connection must be a remote NIA or an integrated SNA/X.25 adapter (e.g. the 4700 X.25 Attachment RPQ feature) connected to an SNA PU type 1 or type 2 cluster controller.

The Frontal NIA can be attached to the integrated communications adapter of an SNA host which can be an IBM 4331, 8130, 8140, 8101, 5340(S/34) or 5381(S/38). The Frontal NIA can be used with the 3705 as well. Under some circumstances, this may provide a useful alternative such as when only a few X.25 type 2 virtual circuit connections are required or if the 3705 does not have sufficient storage to include the X.25 NPSI.

Only one physical access line is required between the Frontal NIA and the PSDN. This is seen as an SDLC line operating in half-duplex mode with non-return-to-zero coding (NRZ). The SDLC window inbound to the host is fixed at seven. The maximum number of SDLC frames outbound from the host is controlled by the MAXOUT specification. This is discussed in detail in "Frontal NIA Installation" on page 52.

Either 1 SVC or up to 4 PVC's can be supported on this physical access line. When more than one PVC is employed, each PVC will be considered as a drop on a multipoint line by the SNA host.

The support is mainly down-stream, and is restricted to SNA terminal types that can normally be supported by the host system. Peer connection except for the 5340 via SSPICF is not supported. This means, for example, for an 8100, the Front NIA can only be used to communicate with a 3276, 3601 or 3602, or another 8100 system operating as a SDLC secondary station.

The PSDN frame (or LAP) window size is fixed at 7 for both incoming and outgoing packets.

REMOTE NIA

The Remote NIA allows a single SNA PU type 1 or 2 terminal/cluster to attach to an SNA host over a PSDN. The host can be attached to the PSDN either via the X.25 NPSI licensed program or the Frontal NIA. As far as the SNA host or cluster is concerned, the X.25 virtual circuit appears as a normal SDLC link. The NIA and the X.25 NPSI handle the SNA/X.25 protocol conversion. This means that even if the SNA peripheral node is a cluster controller with multiple LU's attached, only one virtual circuit is required.

The Remote NIA is attached to the PSDN through a physical access line. If LAP is used, then either 1 PVC or 1 SVC can be associated with the NIA. However, if LAPB is used, either 1 PVC and/or 1 SVC can be employed. In this case, if the PVC is used, the SVC is considered as a switched back up link. Only the PVC or the SVC can be active at one time.

The list of attachable terminals or clusters are:-

- IBM 3271 models 11 and 12.
- IBM 3274 models 1C, 21C, and 51C to communicate with a 3705 or 4331-ICA, allowing 3279 support.
- IBM 3275 models 11 and 12.
- IBM 3276 models 11, 12, 13, 14, 1, 2, 3 and 4, allowing 3279 support.
- IBM 3601, IBM 3602 and IBM 5995.
- IBM 3651 models A50, B50, A60, B60, A25, B25, A75, B75, C75 and D75.
- IBM 3680.
- IBM 3771, IBM 3774, IBM 3775, IBM 3776 and IBM 3777.
- IBM 3791 and IBM 3730 based on 3791.

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- IBM 4700 Finance Communication System.
- IBM 5251 for communication with S/34 (5340) and S/38 (5381) hosts.
- IBM 5320 (S/32), IBM 5340 (S/34), under ACF/VTAM in related host.
- IBM 5340 secondary to communicate with IBM 5340 primary.
- IBM 5381 (S/38) under IMS or CICS in related host.
- IBM Series/1 using EDX or RPS SNA support.
- IBM 8130, IBM 8140 and IBM 8101.
- IBM 8775 models 11 or 12 with 'non-continuous carrier' operator option.

ORDER INFORMATION

Customers wishing to order an NIA should contact their IBM representative for details of the ordering procedure. Note that the NIA may not be available in all countries. Information such as number of NIA units, network configuration including terminal types, locations and host access method, X.25 PSDN type (e.g. Datapac, Transpac), and host X.25 interface facility (e.g. X.25 NPSI or Frontal NIA) are required to accompany the order. When the order is processed, a transmittal will be provided which contains the feature codes specified.

As an example, the following are the options chosen for a Remote NIA that is used in the System Support Centre in Canada:

7043	Remote NIA
2934	Canadian-English Panel
9698	15 metre cable
9901	120v 60 Hz
7051	Lowest virtual circuit address is 1
7049	Switched Virtual Circuit
7036	256 byte packet size
7053	Packet window-size of 3
7158	Use LAPB link-access procedure
7062	2 sec. time-out delay (LAP)
7033	Terminal SDLC frame window-size of 3
7047	9600 bps terminal signalling rate

The feature code specifications are required for the NIA order. Since these relate directly to details of the subscription ordered from the PTT, the customer should determine his network subscription parameters before placing the NIA order. Most of these features specify how the micro-switches and jumpers within the NIA should be set before shipment to the customer and therefore can be changed in the field by the Customer Engineer. However, some feature codes have model or function dependencies. For example, feature code 7042 specifies a Frontal NIA, and 7043 a Remote. When the Frontal model is specified, the NIA shipped will have 8K bytes more storage and will be equipped with a set of microcode tapes that will allow the NIA to attach to an SNA host. Another example is the 7038 and 7158 feature codes. Since July 1982, a new level of microcode is developed to provide added functions to the Frontal and Remote NIA's when the attachment to the PSDN uses the LAPB link access procedure. Feature code 7158 together with 7042 or 7043 specify that the new frontal or remote LAPB microcode tape should be shipped with the NIA. (The new LAPB microcode functions are described in Appendix J "Appendix I. NIA New Microcode Function" on page 147.)

Details of the NIA feature code specifications are given in the NIA product description manuals and in the transmittal provided by IBM Special Systems Marketing when the NIA RPQ is approved. These features are also described in "Appendix C. NIA Specify Codes for Ordering" on page 109.

INSTALLATION PLANNING

Before placing an order a user can get details of the approximate delivery lead times from his IBM representative. After placing an order, the user will get a scheduled delivery date from his IBM representative and should take care to coordinate this with the installation of his X.25 access lines.

The systems programming and network support staff should first become familiar with the NIA before the unit is shipped to the end-user. It is a good idea to have a virtual circuit connected from the host to the systems programming area and have the first NIA installed there. This may require an additional X.25 network subscription to be specially ordered for the purpose but in any large network situation the cost will be repaid many times over. After the initial testing is completed, then the customer can discontinue the systems programming end of the virtual circuit connection and ship the NIA unit to the end-user's location. This way it will be a lot less frustrating for the support staff to get the network up and running, and they would have a better appreciation of the likely problems that the end-user may run into.

While the systems programming and operation staff still have the test circuit and the Remote NIA, they should develop an Operations Guide for the remote end-user. This should include such topics as:

- operation instructions;

For example, how to power on the terminal and NIA, how to establish a virtual circuit (permanent or switched) connection with the host, how to disconnect.

- problem determination;

For example, from the LED display on the NIA, the signal indicators on the PTT-supplied dataset (modem), or operator information area, how to determine if the connection is functioning properly.

- error reporting procedure;

For example, how and to whom to report the error condition. What are the pertinent information to record and report. How to determine if the error is not caused by a local operator procedural problem.

- backup procedure.

For example, how to use an SVC to establish a connection with an alternate host.

NIA TEST PLANNING

Data communications over a PSDN introduce an additional level of complexity over those connections using conventional leased and circuit-switched facilities. The customer should not attempt to install a remote NIA or integrated SNA/X.25 adapter in an end-user's location without his systems programming and operations staff first understanding the operational characteristics of the NIA (or integrated SNA/X.25 adapter) and the X.25 environment.

As suggested earlier in "Installation Planning" on page 49, the customer should consider having the first X.25 virtual circuit and remote NIA installed in the systems programmers area. The attached SNA cluster/terminal should be as close to the type that the end-user would be using as possible. The benefits of such an approach are as follows:

- With both ends of the virtual circuit close at hand, the systems programmer(s) can easily verify his network specifications (i.e. X.25 NPSI and/or NCP gen parameters, ACF/VTAM or ACF/VTAME definitions) with respect to circuit subscription parameters and terminal settings.

In case of setup problems, he can easily start a host trace (e.g. VTAM line trace) or use monitor devices (e.g. the IBM PT2) to determine which end of the virtual circuit is in error.

If this is the first time that the systems programmer is exposed to packet switching technology, some learning time will be required to become familiar with it. For example, he will have to understand the link access procedure (LAP or LAPB) required to set up the physical access line and the control packet flow required to setup and control the virtual circuits.

It is operationally very difficult to test and adjust a system from a user site.

- For operation staff to become familiar with the Remote NIA.
- To test the Remote NIA Operators Guide which should be completed prior to the NIA installation at the end user location.
- Start initial remote operator training at the host location.

If the customer is using the X.25 NPSI licensed program, he can even install the remote NIA at the host location without an X.25 circuit subscription. In this case, he can wire an in-house link (with a modem at each end) between the NIA and the X.25 NPSI. The port at the 3705 will have to be defined to the X.25 NPSI as a DCE (i.e. in the X25MCH macro definition). However, in this case, the support staff will not have the benefit of working with a live X.25 PSDN service.

As part of the test plan, the user may also want to test out his VTAM/NCP/host application environment on a leased SDLC line. This way, he can narrow down on the number of variables in the testing before moving to the more complicated X.25 environment.

INITIAL SETUP

Once the NIA has been delivered it must be installed by the IBM Customer Engineer.

It is essential that the user have his X.25 circuit subscription parameters available when the IBM CE arrives. Although the micro-switches and jumpers will have been preset at the IBM plant before the NIA is shipped, it is still necessary to check them to ensure that they match with the user's X.25 circuit subscription.

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Successful installation usually follows good test planning and change control. It is worthwhile to document the NIA settings so that during installation testing, if there are problems, the inconsistencies can be pinpointed. This will also be useful later on as a change control document if modifications to the user's X.25 circuit subscription is required.

NIA WORKSHEETS

During product testing in the Raleigh International Systems Centre, various NIA settings were tried. To provide an easy method of changing the NIA jumpers and micro-switches, and also to provide a means of documenting these changes, a set of six worksheets were designed. A copy of these are given in "Appendix A. NIA Worksheets" on page 99. The interested reader is encouraged to adopt them for his installation's use.

The six worksheets can actually be considered as two subsets: one for the Frontal NIA model, and one for the Remote. The first two worksheets in each subset describe the NIA options and their relevant micro-switch settings for LAP and LAPB respectively. The last worksheet in each subset is a representation of the NIA circuit board A and depicts the location of the DTE speed straps and the option switches. Space has been provided on the worksheets to enter the serial number and location of the NIA.

"Appendix H. NIA Switch Settings and Strapping Examples" on page 135 contains examples of completed worksheets as used in the NIA testing in the Raleigh International Systems Centre. Four of the worksheets correspond with the four versions of the NIA microcode cassettes as referenced in the section "New Microcode" on page 110.

If the user wishes to adopt these worksheets as part of his installation's documentation, he can make copies of the worksheets, complete them, and give a copy to the IBM Customer Engineer so that he can check out the NIA jumpers and micro-switch settings. As he works on the NIA, it would also be appropriate to ask him to ensure that the correct microcode cassettes have been received. He can verify the part number and E/C level by checking against the information recorded on the IBM RETAIN/370 system.

Documents such as these sample worksheets are especially useful when the NIA is in a remote location and some form of central change control is required to keep track of the status of the NIA.

In addition to keeping a copy of the completed worksheet for each remote NIA in the central location, the user may also want to include a copy in the Remote Operator's Guide. This way, if changes are required at the remote location, the information can be related to the IBM CE more accurately.

FRONTAL NIA INSTALLATION

(The discussion here is intended for users who will be using a Frontal NIA instead of the X.25 NPSI licensed program. The X.25 NPSI user, should skip this subsection and go to "Remote NIA (Specify Code 7043)" on page 55.)

The Frontal NIA is installed between the PTT-supplied dataset and the host system communications adapter. The communications cable from the host system is plugged into the back of the NIA. The NIA EIA RS-232-C (or V.24) interface is connected to the back of the PTT-supplied dataset.

The "NIA Product Description Manual" (GA11-8642) contains detailed descriptions and illustrations on how the NIA should be connected.

The Frontal NIA has two versions of microcode depending on the X.25 link access procedure used: LAP or LAPB. Refer to the section "New Microcode" on page 110 for more information on this topic.

The installed PSDN service must have the following attributes:

- The LAP (link access) window size must be equal to 7.

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- The speed of the physical access line must be 1200 bps, 2400 bps, 4800 bps or 9600 bps. (Of course, since the modem supplies the clocking, any speed up to 9600 bps will work).
- The physical access line can have one switched logical channel (SVC) or up to 4 permanent logical channels (PVC's) attached.
- If the physical access line supports multiple PVC's, each of these must have the same packet (PLP) window size. The packet window size can range from 2 to 7. If the Frontal NIA supports more than 2 PVC's, the packet window size must be 3 or lower.

Note that the packet window setting in the NIA must match the packet window subscription defined in the PSDN. If the PSDN packet window is larger than that set in the NIA, output from the host may be impeded because in some PSDN's (e.g. Datapac), an RR (Receive Ready) packet is not sent until the packet window closes.

- The packet length must be the same for all the permanent virtual circuits (PVC's) and can be either 128 or 256 bytes.

Note that the maximum packet size for both ends of a virtual circuit connection must be the same.

The link from the host system to the Frontal NIA needs to be defined to the host system. The following rules apply to this connection:-

- The link must be defined as an SDLC line working in half-duplex mode.

(Note that the physical access link between the NIA and the PTT supplied modem is full duplex.)

If the NIA supports 1 SVC, then the link should be defined as switched. The user can specify whether the host can initiate outgoing calls (i.e. CALL=OUT, CALL=INOUT, or CALL=IN). Note that the NIA does not have an auto-call facility. The operator has to compose a CALL REQUEST packet manually (see "NIA Switched Virtual Circuit Call Establishment" on page 69) every time he wants to establish a switched virtual circuit connection with a remote SNA cluster.

If the NIA is to support PVC's, then the link should be defined as leased. If the PSDN physical access line supports multiple PVC's, then the link should be defined as a multipoint leased line with each cluster appearing as a drop on the line.

- The address for the SNA stations on the line depend on the logical channel numbers used. They must be specified contiguously as xxxx01, xxxx10, xxxx11 and xxxx00 with the station associated with the lowest logical channel number (0 or 1, depending on the PSDN) taking on the first SDLC station address and so on.

For example, the following station address specifications can be used:

- C1 for one PVC or SVC
- C1, C2 for two PVC's
- C1, C2, C3 for three PVC's
- C1, C2, C3, C4 for four PVC's

The station addresses have to correspond to those defined in the SNA cluster. When the host wants to activate the SNA stations, it will send an SNRM (Set Normal Response Command) to each cluster on the SDLC line. The Frontal NIA will convert these to PSCONT PSH (Physical Services Header) control commands and send them to the remote NIA's as data packets.

The PSCONT response from each SNA cluster will contain its SDLC station address in byte 3 of the PSH. This address is used by the Frontal NIA to respond to the polling from the host system.

- The RTS (Request-to-Send) signal should be active only when sending data.

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This means that if the Frontal NIA is attached, for example, to a type 3 communications scanner in an IBM 3705, the line should be specified as working in DUPLEX=HALF.

- The speed of the link between the Frontal NIA and the host is set by a jumper within the NIA.

The SDLC Contact or Poll timeout must last at least 1.5 seconds for a 9600 bps link, 2.5 seconds for a 4800 bps link, 4.0 seconds for a 2400 bps link or 7.5 seconds for a 1200 bps link.

- The MAXOUT value is restricted by the number of virtual circuits serviced by the Frontal NIA. Specify MAXOUT=3 or less when there are more than 2 PVC's associated with the physical access line. For SVC connection or when the number of PVC's is 2 or less, MAXOUT=7 or less is acceptable.
- The maximum RU size that can be handled by the NIA is 256 bytes. This means, for example, for a virtual circuit connection with a PU type 2, MAXDATA must be specified as 265 or less.

(For IBM 8100 systems. Note that the MAXDOUT operand in DASSDL macro is used to define the maximum RU size for both up- and downstream support in the 8100 DPPX system. This operand does not include TH and RH as in the MAXDATA operand used with PU definition in NCP, ACF/VTAM, or ACF/VTAME. Therefore MAXDOUT must be specified as 256 or less in this case.)

- Data coding must be defined as NRZ (or NRZI=NO) for the link. NRZI is not supported by the Frontal NIA.

Note that if the Frontal NIA is to be used with the 8100 DPPX system for downstream support over an SVC, the Synchronous Data Link Control Auto-Answer PRPQ (Program Number 5799-BDE, PRPQ Number ML2503) is required as when a circuit-switched line is used.

"Appendix E. System/34 Definitions for X.25 Connection" on page 117 provides further details on the definitions required to allow a System/34 to make use of the Frontal NIA to attach to a PSDN.

"Appendix G. NCP Definition Sample" on page 129 contains examples of the NCP macros required to support a link to a Frontal NIA. In this example, the NCP GROUP macro 'G04NIAS' starts the SDLC description of the SVC connection, whereas the LINE, SERVICE, PU and LU macros following the GROUP macro 'G04NIAP' together define the multipoint leased line which represents three PVC connections via a Frontal NIA. The micro-switch settings and strapping for the Frontal NIA used for these tests is reflected in "Appendix H. NIA Switch Settings and Strapping Examples" on page 135. Test 3/3 is for SVC link 'L040A6' and test 3/4 is a sample of the settings for a PVC link 'L040A7'. 'Test 3/3' refers to Generation number 3 Test number 3. These test examples are also described in the comments section at the beginning of the X.25 NPSI example in "Appendix F. X.25 Network Definition Sample" on page 123.

The following table provides a summary of the rules governing the link between the Frontal NIA and a host system. Also included in this table are the required ACF/NCP/VS, ACF/VTAME and System/34 parameters to define these functions.

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- Usually only one logical channel (switched or permanent) can be associated with the physical access line attached to the Remote NIA. That is, only 1 PVC or 1 SVC can be used with the Remote NIA.

However if the subscribed X.25 link access procedure is LAPB, and the Remote NIA has specify code 7158 included as one of its features, and if the first logical channel on the physical access line (logical channel number 0 or 1, depending on the PSDN) is a PVC, then an additional SVC can be used to serve as a backup to the PVC. It should be noted that only one virtual circuit can be active at a time. That is, if the SVC is to be used as backup or for access to an alternate host, then the PVC will first has to be inactivated. Please refer to "Appendix I. NIA New Microcode Function" on page 147 for more details on the SVC backup function.

Note that the link access procedure has local significance only. That is, if he wants, the user can have one end of a virtual circuit operating under LAP and another end under LAPB.

- The LAP (link access) window size must be equal to 7.
- The packet (PLP) window size can from 2 to 7.

The micro-switch setting within the Remote NIA must match the packet window size subscribed for the virtual circuit otherwise inbound traffic from the NIA to the host may be impeded.

Note that the packet window size usually has local significance only. That is, for most PSDN's, the packet window sizes at the two ends of a virtual circuit can be different from each other. The user should verify this with his PTT representative.

- The packet length can be either 128 or 256 bytes.

The maximum data packet size that can be handled by the NIA is controlled by a micro-switch setting within the NIA. This value must be the same for both ends of the virtual circuit. For example, if the the other end is via a Frontal NIA, then the A2 and B2 micro-switches in both the Frontal and Remote NIA's must be set identically. If the Remote NIA is set to handle maximum data packet sizes of 128 bytes and if the X.25 NPSI is used, then the virtual circuit must point to an entry (via the VCCINDX operand) in the VC connection table (VCCPT) that has a MAXPKTL specification of 128.

The above restriction that packet size must be the same is an implementation restriction of the PSH protocol in the NIA. The restriction is not inherent in X.25 and does not apply to the "QLLC" protocol nor to "PSH" when implemented in the X.25 NPSI PP.

Depending on the terminal type, the station address, terminal characteristics and the link between the SNA terminal/cluster and the Remote NIA may be defined by following appropriate customization procedures (e.g. using micro-switches within an IBM 3276, or defining this on the 3274 diskette), or via macro definitions (e.g. 8100, Series/1). The following rules apply generally in the terminal definitions:

- The link between the SNA terminal/cluster and the Remote NIA must be defined as an SDLC link operating in half duplex mode.

(Note that the physical access link between the NIA and the PTT supplied modem is full duplex.)

- The RTS (Request to Send) circuit must not be permanently on.

For example, if the SNA cluster is an IBM 3274, the user should specify a "0" in response to question number 342 during the customization procedure.

- The link should be defined as switched or non-switched according to whether a SVC or PVC is subscribed. As a general rule, however, if the terminal/cluster can support the SDLC XID (Exchange Id) command, the link can be defined as non-switched or leased even if SVC is used.
- Data coding must be defined as NRZ (or NRZI=NO) for the terminal equipment. NRZI is not supported.

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- The station address must be of any value from X'01' to X'FE'.

When the host system generates an ACTPU (activate PU) to start up the remote SNA cluster, a data packet containing a PSCONT command will be transmitted by either the Frontal NIA or the X.25 NPSI down the virtual circuit. This will be converted by the Remote NIA to a SHRM (set normal response mode) command with a broadcast address of X'FF' to the attached SNA station. The SNA terminal/cluster will return with the SDLC station address that it has been defined with (e.g. via the "A" micro-switch setting in the 3276, or the WRITEID operand specification in the 8100 DPPX DASSDL macro). The Remote NIA will relate this information back to the host by means of a data packet which indicates a PSCONT response with the SDLC station included as the third byte.

If the host end is connected to the PSDN via the X.25 NPSI, or a Frontal NIA that supports 1 PVC or 1 SVC only, this station address must correspond to the address defined at the host location.

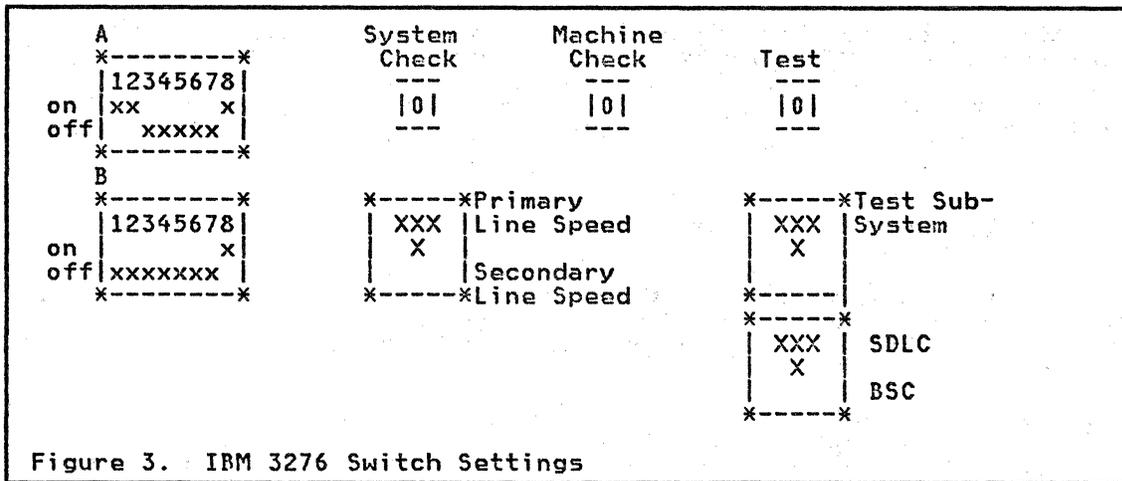
However, if the connection is via a Frontal NIA with multiple PVC's attached, then the returned SDLC address is important. This must correspond with the polling address defined for that cluster within the host. The reason is that the Frontal NIA simulates a multipoint SDLC line to the host. It needs to distinguish input and output traffic for the different clusters connected on different PVC's. Please refer to the SDLC station address discussion in "Frontal NIA Installation" on page 52.

The following is a sample CLIST used to define the link used with the Remote NIA in an 8100 DPPX environment. Note that since the 8100 can respond to an SDLC XID command, the host link from the 8100 to the Remote NIA can be defined as a leased line regardless of whether an SVC is used:

```
COL-----1-----2-----3-----4-----5-----6-----
DEFINE DEFAULTS P1(HOSTLINK) P2(11) P3(C1) MAXDOUT(245)
DASSDL &1 ADDRESS(&2) PIL(3) SIL(2) STADDR(&3) NRZI(NO) DPLX(NO)
/* DEFAULTS USED ARE: DTR(YES), LINE(LEASE), TONE(NO) */
/* WRITEID(0000) */
&1.&3
EXIT:RETURN
```

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The micro-switch settings for an IBM 3276 when attached to a remote NIA are shown in the following figure:-



NOTE: The SDLC/BSC switch as shown in the above figure may not apply to all models of the 3276.

Figure 2 above represents a picture of the 3276 panel. In this example, the station address is set at X'C1' (switches A). In the B set of micro-switches, number 8 is set to "on" to indicate HDX (half duplex) link operation, and number 7 is set to "off" to specify NRZ operation.

"Appendix F. X.25 Network Definition Sample" on page 123 contains examples of NPSI macro definitions for a X.25 link to a Remote NIA. A diagram with X.25 multi-channel characteristics can also be found in the comments section at the beginning of this sample and is referenced as 'TEST 2'. The PVC NPSI macros are referred to by label 'L040A4A' and the SVC macros by label 'L040A4B' in this example. The Remote NIA settings that apply to this test can be found in Appendix I "Appendix H. NIA Switch Settings and Strapping Examples" on page 135.

The discussion here is intended mainly for the MVS customer with both ACF/VTAM and ACF/NCP/VS installed. However, the DOS/VSE or System/34, System/38 user may still find parts of this chapter useful. He is advised to selectively skip the sections that are not pertinent to his environment.

HOST OPERATION

For the sake of illustration, the examples used in this chapter were taken from the procedures used in the IDM Raleigh International Systems Centre. The X.25 and NCP specifications are given in appendices F and G respectively.

The environment included an MVS system with ACF/VTAM V2R1 and ACF/NCP/VS V1R2.1. NCCF and TSO were active whenever the system was up. The NCP with the X.25 definitions and the switched major node were normally not activated.

In the operator command examples used here, the SCOPE operand was used quite extensively. The intention is to demonstrate how a user can control the activation of the various resources (e.g. NCP, LINE, PU and LU) individually. The activation process can be a lot less cumbersome if the user includes an "ISTATUS=ACTIVE" operand in his LINE, PU and LU macros, and ignores the "SCOPE=ONLY" operand in his NCP activation operator command.

Loading the NCP

The NCP needs to be loaded before the host system can communicate with its terminal/clusters over a PSDN. The activation of the NCP may be automatic by including the NCP major node name in the VTAM start configuration list (e.g. in the ATCCON00 member in SYS1.VTAMLST), or via operator commands. In the example here, the following command was used to load the NCP:

```
v net,act,id=N043FX3,scope=only,load=yes
```

Note that before the NCP can be loaded, a copy of the NCP source definitions (i.e. the input for the NCP stage 1 gen) must be included in the SYS1.VTAMLST dataset. A DD statement for the NCP library which contains the NCP load module must also be included in the VTAM start procedure. The DDNAME in the DD statement must be the same as the dataset name specified in the LOADLIB operand in the NCP BUILD macro. The NCP library itself must also have been authorized to the MVS system using SYS1.PARMLIB(IEAAPF00).

The channel unit address (CUADDR) specified in the NCP PCCU macro must be defined to the MVS system, and activated before the NCP can be loaded.

Host X.25 Link Activation

X.25 NPSI

In NCP/X.25 NPSI environment, the PSDN access line (referred to as a multichannel link - MCH) is seen as a leased SDLC full-duplex line. There is a dummy PU and a dummy LU associated with it.

Under SNA-to-SNA connections, the MCH's and their associated PU's (e.g. XM040A4 and XP040A4) must be active, while the LU's (e.g. XU040A4) should stay inactive. (See "Appendix F. X.25 Network Definition Sample" on page 123 for an example of the MCH, PU and LU definition.)

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Each virtual circuit residing within an MCH is seen by VTAM and by the NON-X.25 parts of NCP as a point-to-point SDLC half duplex line. A PVC is mapped into a leased line and an SVC as a dialup line. In order for the terminal/cluster to be able to access the SNA host over the PSDN, the LINES representing the PVC's and SVC's, and their associated PU's and LU's must be active. (In the case of SVC connections the activation of the PU and LU takes place when the dialed connection is made).

Activation of the MCH's, virtual circuits, PU's and LU's (except for the MCH LU) can be simplified by giving them an initial status (ISTATUS) of active. In this case, after the NCP has become active, the various resources will be activated automatically by VTAM.

Alternatively, the user can choose to activate each resource individually (this works even with ISTATUS=ACTIVE being specified) by using the SCOPE=ONLY operand in the VARY ACTIVE operator command.

- MCH Activation

For example, the following operator command starts up the the X.25 physical access line only:

```
v net,act,id=XM040A4,scope=only
```

An ACTLINK SNA command is sent by VTAM as a result of this operator command which causes the link station to set the DTR (Data Terminal Ready - Pin 20 on the EIA RS-232-C interface) circuit on. A positive response is returned to VTAM when the DCE replies with a DSR (Data Set Ready - Pin 6), and the MCH link becomes active. The MCH PU can next be activated with the following command:

```
v net,act,id=XP040A4,scope=u
```

This command will result in a CONTACT and an ACTPU SNA command to be sent from VTAM to the MCH link station. On receipt of the CONTACT command, the X.25 NPSI will attempt to set up link access procedure with the PSDN's DCE.

If the MCH link is defined to operate under LAP (via the PROTOCOL operand specification in the X25MCH macro), a SARM (Set Asynchronous Response Mode) HDLC command will be sent. If the MCH is defined to work under LAPB, then a SABM (Set Asynchronous Balanced Mode) HDLC command will be sent. (This means that the link does not "start" operation until the MCH_PU is activated).

Once the proper link access protocol has been exchanged between the X.25 NPSI and the DCE (e.g. DISC from DTE, UA from DCE, SABM from DTE, UA from DCE, Restart Indication from DTE, and Restart Confirmation from DCE), the MCH PU becomes active.

(Please see Chapter 6 in the X.25 NPSI Installation and Operation manual, SC30-3163, for more detail on the MCH link activation procedure.)

Under certain error situations, especially with LAP, the user may have trouble activating the PU associated with the MCH (i.e. the PU stays in an INOP state). This usually occurs during the physical access (MCH) link reinitialization if the MCH or NCP has become inactivated previously when there were no traffic in either direction with the PSDN. Under such circumstance, the user can usually force a restart on the MCH by unplugging and re-plugging the PTT-supplied dataset (modem), and use the operator command to re-activate the MCH LINE and PU again.

NOTE: The Virtual Circuit activation should not be attempted until the above procedure has completed successfully. The PSDN will reject any CALL REQUEST packets for SVC startup and DATA packets containing a PSCONT (CONTACT command) until both sides of the PSDN have completed link level establishment. This however applies only to SVC startup. For PVCs the SSCP may request activation before the MCH is activated and the X.25 NPSI will queue the activation request until the MCH link has been activated.

- PVC Activation

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After the MCH LINE and PU has become active, the following command can be used to activate a virtual circuit residing within the MCH link together with all its subordinate resources (i.e. PU and LU's) with ISTATUS=ACTIVE defined:

```
v net,act,id=L040A4A,scope=u
```

An SNA ACTLINK command will be sent to the virtual circuit link station by VTAM as a result of this operator command. The X.25 NPSI will return a positive response immediately regardless whether the MCH PU is operational or not. Therefore, sometimes when the user has trouble activating the SNA terminal/cluster PU, even if the virtual circuit indicates an active status, he should still look at the MCH LINE and PU to ensure that they are first operational.

After the virtual circuit link station is active, an SNA CONTACT command will be issued for the SNA terminal/cluster. On receipt of this SNA command, the X.25 NPSI converts it to a PSCONT PSH command and places this in a DATA packet to be transmitted to the Remote NIA. It is the Remote NIA's responsibility to convert this back to a SNRM SDLC command to activate the data link station associated with the SNA PU.

The PSCONT response returned from the Remote NIA (as a result of a UA response from the SNA PU) will cause a CONTACTED response to be sent to VTAM. This will trigger SNA ACTPU and ACTLU SNA commands to be sent to the terminal/cluster as in normal SNA-to-SNA connections.

- **SVC Activation**

The startup procedure for a Switched Virtual Circuit is similar to that for the PVC. The following command contains an example for such process:

```
v net,act,id=L040A4B,scope=u
```

As in the case of the PVC, this command generates an ACTLINK SNA command from VTAM. After the virtual circuit becomes active, the associated PU is also activated. The SVC link station is now ready to generate a CALL REQUEST packet or accept an INCOMING CALL packet to set up a virtual circuit connection depending on whether the SVC LINE has been defined for CALL=OUT, CALL=INOUT, or CALL=OUT.

Note that with an SVC, a connection cannot be made if the appropriate PU and LU's within a Switched Major Node has not been activated for the connection. Please refer to "Virtual Call Setup Control Flow" on page 70 to obtain a complete picture of the SNA control flow required for an SVC connection.

Frontal NIA

As mentioned earlier in the NIA product description on "NIA" on page 6, the NIA is essentially an external protocol converter. The Frontal NIA responds to polling from the SNA host and handles the SDLC/HDLC conversion. The fact that the SNA-to-SNA connection is over an X.25-based PSDN is of little concern to the host system. Therefore even when the Frontal NIA is used, the operator still controls the LINE, PU and LU's as if the connection is over conventional leased or circuit-switched facilities. One big difference, however, is that he must understand the function of the NIA device. The NIA device is installed in between the SNA node and the network. Before a virtual circuit connection can be established, the NIA must be properly initialized (i.e. the link level procedures established). In case of problems, additional information will be displayed on the NIA, he must be able to make use of this to determine and fix the error situation. He must also understand that if there are multiple PVC's supported in the PSDN physical access line connected with the Frontal NIA, the connection to the various SNA terminal/clusters appears as a multipoint SDLC line to the SNA host. If the virtual circuit is an SVC, then this is an SDLC switched line with auto-answer capability only. Outgoing calls from the SNA host requires that the operator manually dials the remote access line.

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The following summarizes the procedure required to activate the host end of the physical access line and virtual circuit connections:

- NIA startup procedure.

The NIA is a micro-code programmed device. Before the user can establish a virtual circuit connection, the program must first be loaded into the NIA. This IML (Initial Machine Loading) procedure is described in detail in "Initial Machine Loading" on page 67 in the next chapter.

- Link Level procedure.

Once the NIA is loaded, it will attempt to establish synchronization (link access procedures) with both the SNA host and the PSDN DCE. The PTT-supplied dataset (modem) must be powered on, and the line representing the SDLC connection between the host and the remote SNA terminal/cluster(s) must have been activated. This is described in detail in "Link Level Procedure" on page 68 in the next chapter.

- Virtual Circuit Setup procedure.

Only after the link level procedures have been successfully completed can the user try to establish a virtual circuit connection with a remote SNA terminal/cluster. If this is a PVC, the virtual circuit connection will be made once the Remote NIA has established link level procedures with the PSDN and the SNA terminal/cluster. If this is an SVC, the Frontal NIA will be in a ready state to accept an incoming call or ready for the user to place an outgoing call.

This procedure is described in more detail in "Virtual Circuit Setup Procedure" on page 69 and "NIA Switched Virtual Circuit Call Establishment" on page 69 in the next chapter.

Activate Switched Major Nodes

A VTAM switched major node is used to define the physical and logical units that can be dialed into or dialed out from an SNA host. Before a virtual call (SVC) connection can be established, the switched major node and its appropriate subordinate PU and LU's must first be active.

This activation can be automatic by including the switched major node name in the VTAM start configuration list (e.g. ATCCON00), or can be via a VTAM operator command such as the following:

```
v net,act,id=sw3276
```

In this example, a switched major node which contains a PU and LU minor node definition for an IBM 3276 is activated. (See "Switched Major Node Definition" on page 21 for the SW3276 definition.) Within a switched major node, there can be multiple sets of switched devices defined. If he wants, the operator can use commands to activate only a selected subset of the devices.

For dial-in operations, the following resources must be active:

- the MCH LINE and its associated PU.
- the LINE representing the SVC and its associated PU.
- the Switched Major Node and the appropriate subordinate PU and LU's.

When the operator activates the PU's and LU's within a Switched Major Node, they will be placed in a Connectable (CONCT) state. As in any switched connection involving SNA nodes, one of the first SNA commands in the setup procedure is an Exchange Identification (XID) command. Based on the ID returned from the remote SNA terminal/cluster, VTAM will search the PU's that are in a CONCT state for a match in ID number (supplied by the IDBLK and IDNUM operands in the PU macro). Once the appropriate PU is selected, the details for the SNA connection (e.g.

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LOGMODE table, PU type, etc.) are obtained from the PU and associated LU definitions.

Activation of the SNA terminal/cluster will be completed if there are sufficient free control blocks reserved in the NCP pool (as defined by the LUDRPOOL NCP macro) to handle the number of LU's associated with the physical unit, and the remote terminal/cluster accepts the BIND parameters furnished by the SNA host.

For dial-out operations, in addition to the above resources being activated, there must also be a dialout path (as defined in the PATH macro within the PU in the switched major node) available for the connection.

The GRPNM operand within the PATH macro identifies the name of the GROUP of switched LINES that can be used for the outgoing call. VTAM hunts for a free active LINE starting from the top of list within the GROUP as defined in the NCP.

The PATH can be made available by coding the operand USE=YES. This way as soon as the PU is active, the dialout PATH is available for use. Alternatively, the user can control the availability of a dialout PATH by means of an operator command.

In VTAM, up to 256 PATHS can be associated with a switched PU. By activating the appropriate PATHS, the user can actually make use of the same PU definition to dialout to different terminal/cluster locations or ask for different connection parameters (e.g. maximum data packet sizes etc.).

The following is an example of how a PATH can be made available:

```
v net,id=pu3276,path=use,pid=1
```

In this example, the PU (PU3276) had 3 available dial-out paths (see "Switched Major Node Definition" on page 21): PATH1 - PATH3. All these paths were given an initial status of USE=NO.

So as to ensure that the correct dialout PATH is used, the user should only make the desired PATH available. He can find out about the status of all the PATHS within a switched PU with a display operator command such as the following:

```
d net,id=pu3276,p
```

If he wants to deactivate an available PATH he can do so with an operator command similar to the following:

```
v net,id=pu3276,path=nouse,pid=1
```

Note that in the examples here, only the PID operand is used. The reason is that in the sample switched major node definition, this is sufficient to uniquely identify the PATH within the PU. In the user's operating environment, he may need to use both the PID and GID operands in order to achieve the same result.

Once the switched node and a path have been activated, it is ready for connection to a remote SNA terminal/cluster. The call out operation is usually initiated from an application that has been defined to VTAM as having AUTH=ACQ. The call out sequence can be automatic if the application name is included in the LOGAPPL operand of the switched PU or a subordinate LU, or it can be via a "v act" operator command such as the following:

```
v net,act,id=pu3276,logon=tso
```

As the switched PU and its associated LU's are activated, VTAM will issue a CONNECTOUT SNA command to the NCP. If the X.25 NPSI is used, this will cause a CALL REQUEST packet to be generated automatically. The called number will be based on the information provided in the DIALNO operand in the PATH macro that is made available. If the Frontal NIA is used, then an operator message will appear. The operator is required to use the panel in the Frontal NIA to compose a CALL REQUEST packet. This procedure is

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discussed in detail in "NIA Switched Virtual Circuit Call Establishment" on page 69.

TERMINAL OPERATION

As mentioned earlier in the NIA product description on "NIA" on page 6, the NIA is essentially an external protocol converter. It uses the X.25 protocol to communicate the PSDN on one hand and an SDLC protocol to communicate with the SNA terminal/cluster on the other. Before a virtual circuit connection can be established, the links on both sides of the NIA must be initialized and activated. The other end of the virtual circuit connection must be a logical channel in a PSDN physical access line terminating in an NCP with the X.25 NPSI licensed program or a Frontal NIA.

Terminal/NIA Link Activation

The SDLC link between the Remote NIA and the SNA terminal/cluster can be activated before or after the Remote NIA is activated.

In some terminal/clusters (e.g. the IBM 3270), activating the SDLC link simply means powering on the terminal. Provided that the terminal/cluster has been configured correctly (e.g. via the micro-switches inside the 3276), the link becomes active as soon as the terminal/cluster is IMLed (Initial Machine Loaded).

For some programmable SNA terminal/clusters (e.g. the IBM 8100 or System/370 acting as a PU type 2), the link has to be activated by means of operator commands.

In either case, part of the link activation process includes turning on the DTR (Data Terminal Ready) circuit (Pin 20 in the EIA RS-232-C interface). The link is considered as active by the terminal/cluster when the DSR (Data Set Ready) circuit (Pin 6) is turned on by the NIA which happens when the NIA completes its IML procedure.

Remote NIA Activation

The Remote NIA is a micro-code programmed device. Before it can be perform its protocol conversion function in the virtual circuit, the micro-code must first be loaded and the link level procedures initialized with the SNA node and the PSDN intelligent node.

The following summarizes the procedure required to activate the physical access line and virtual circuit connections:

- NIA startup procedure.

There is an integrated mini-cassette reader under the covers of the NIA (both Frontal and Remote). It is started automatically when the NIA is powered on to read in the micro-coded program. This IML (Initial Machine Loading) procedure is described in detail in "Initial Machine Loading" on page 67 in the next chapter.

- Link Level procedure.

Once the NIA is loaded, it will attempt to establish synchronization (link access procedures) with both the SNA node and the PSDN DCE. The PTT-supplied dataset (modem) must be powered on, and the SDLC link between the SNA terminal/cluster and the Remote NIA activated. This is described in detail in "Initial Machine Loading" on page 67 in the next chapter.

- Virtual Circuit Setup procedure.

Only after the link level procedures have been successfully completed can the virtual circuit be established.

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If this is a PVC, the virtual circuit connection will be made once the host end of the virtual circuit is up (i.e. the host link is active and the X.25 NPSI or Frontal NIA has established link level procedure with the PSDN - see discussion earlier on under Host Operations).

If this is an SVC, the Remote NIA will be in a ready state to accept an incoming call or ready for the user to place an outgoing call.

This procedure is described in more detail in "Virtual Circuit Setup Procedure" on page 69 and "NIA Switched Virtual Circuit Call Establishment" on page 69 in the next chapter.

If the user wants to make use of the SVC which is installed as a backup link to the PVC (Note: this feature is only available for the NIA with feature code 7158 and using the LAPB link access procedure), the PVC must first be disabled. (See "Switched Network Backup (SNBU) Function." on page 153.) The SVC connection then can be made.

Cluster/terminal Operation

Once a virtual circuit has been established, the terminal/cluster physical and logical units are activated via ACTPU and ACTLU commands as under normal SNA control.

After the PU and LU's have been successfully activated, the user can log onto host applications. The virtual circuit is completely transparent to the user. The procedure of operation is no different from that using conventional communications facilities.

SESSION TERMINATION

A PVC connection is analogous to a leased SDLC line, and an SVC a switched line.

With a PVC connection, after all sessions between the terminal LU's and the host has completed, the user can leave the virtual circuit active as in normal leased line operations or he can simply power-off the NIA (Frontal and/or Remote) which will deactivate the virtual circuit. When the user powers-on the NIA again, after the NIA has been successfully INI'ed, the PVC can be automatically re-activated.

The user can also use operator commands to deactivate the LINE or PU associated with the PVC. The virtual circuit connection can be reestablished when he activates the LINE or PU again, provided of course that the NIA(s) stayed powered on in the mean time.

With an SVC, the virtual circuit can be disconnected automatically or under operator control.

The disconnection can be automatic if the user has coded DISCNT=YES in the PU macro used for the SVC connection. This operand will cause the NCP to break connection with a switched link automatically when there are no active sessions between the host and a Remote PU. In this case, as soon as the last LU has logged off, VTAM disconnects the PU (i.e. clears the virtual circuit) and the logical channel is ready for another virtual call.

Alternatively, the user can break connection by pressing the "C" and the ENTER key on either the Remote or Frontal (if used) NIA.

Either case, this will cause a CLEAR REQUEST packet to be sent to the DCE. After the SVC is disconnected, the switched logical channels at both the host and terminal end are available for another virtual call.

This operator controlled disconnection procedure is described in more detail in "Clearing a Virtual Call" on page 72 in the next chapter.

This chapter is intended to clarify and supplement the operation procedures described in the NIA Product Description manuals (GA11-8642 and GA11-8643). Unless otherwise stated, the procedures discussed here apply to both the Frontal and Remote models of the NIA.

INITIAL MACHINE LOADING

As mentioned earlier, the NIA is a microcode programmed device. There is an integrated mini-cassette reader provided under the covers of the NIA. The major difference between the Frontal and the Remote NIA's is the function of the microcode program.

Every time when the NIA is powered on, the following actions take place automatically:

- The microcode will be loaded from the cassette tape into storage.

The microcode program is recorded several times on the cassette tape (one side only). As soon as the NIA is powered on, the LED indicator should display an '0F' and then changed to a flashing '0' on the left hand display. This flashing '0' indicates that the mini-cassette reader is running and is searching for the beginning of the microcode program.

If there is no display shown on the LED, this means that the mini-cassette reader has reached the end of the tape and is rewinding. The above-mentioned sequence should repeat after the tape is rewound.

If the LED shows a '5E' instead, this means it has not detected a DSR from the PTT-supplied dataset. Check that the modem interface cable is plugged into the J2 position at the back of the NIA, and that the modem has been powered on.

If the LED display alternates between '0F' and '0E' persistently, this usually means that the cassette reader has trouble reading the tape. The user should power off the tape, make sure that the correct side of the tape is loaded into the reader (i.e. the side with writing is facing towards the operator, since the program is recorded on one side only), and start up the NIA again. If the problem persists, the user should try IMLing with the backup tape. If that too fails, the head on the reader may be dirty. The user can clean this by putting a drop of rubbing alcohol on the reader head. If the problem does not go away, or happens frequently, a service call should be placed on the NIA.

- Once the program is loaded the NIA goes through a hardware self-diagnostic routine. The left LED display should flash the numbers 3, 5 and 6 in succession.

If the loading process stops at any of these numbers (i.e. a numeric digit is displayed steadily), this means that the NIA has detected a hardware error and could not complete its IML procedure. The user should power off the NIA, check that the proper connections are in place and power on the unit again. If the problem persists, a service call should be placed on the NIA.

- If the microcode has been loaded into the NIA successfully, and if LAPB is used, then the left LED will display a 'D' followed by an 'A'. The NIA is now ready to establish the link level procedure with the X.25 PSDN and the SNA node.

Sometimes, instead of an 'A' display, the user may see a flashing 'A1'. This indicates that the SDLC link between the NIA and the SNA node has not been activated. The user should bring up this link immediately (e.g. power on the 3276, or use an operator command to start up the host link) so that the NIA can start establishing the link access procedure with the PSDN.

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For this reason, although it is not necessary to first bring up the SDLC link between the NIA and the SNA node (i.e. host or terminal/cluster), it is found to be less confusing to the operator if the operation procedure is defined such that this is done before the NIA completes its IML procedure.

The user should note that in the Problem Determination chapter in the NIA Product Description manuals (GA11-8642 and GA11-8643) there are detailed flow charts designed to help identify the problems that may occur during various stages of the operation.

LINK LEVEL PROCEDURE

Once the NIA is IMLed, the exchange of the link level protocol between the NIA and the X.25 DCE is also automatic and should be of little concern to the user. The following description is provided to help the user understand the procedure in case there are startup problems and the user needs to interface with the PTT.

- If the NIA and the access line are set up to use the LAPB access procedure, as soon as the NIA has IMLed successfully, it will send a DISC (Disconnect) command to the PSDN DCE (Data Circuit terminating Equipment) followed by an SABM (Set Asynchronous Balanced Mode) command to get the X.25 link level initialized. The network (DCE) will reply with a UA (Unnumbered Acknowledgement) response to the DISC, then another UA to the SABM.

At this point, if the NIA is used to support PVC's, a 'E' will appear on the left hand LED display. If SVC is used, then a 'B' will be indicated instead.

- If the NIA and access line are set up to use the LAP access procedure, then after the NIA has been IMLed successfully, it will send a SARM (Set Asynchronous Response Mode) command to the network which would reply with an UA response. At this point, the NIA will show an 'A' on its left hand LED display. The network will next send a SARM command back to the NIA. After the NIA returned with an UA response, the link is initialized. If the NIA is used to support PVC's, a 'E' will appear on the left hand LED display. If SVC is used, then a 'B' will be indicated instead.

(The reason for this two SARM command flow is because that under LAP, instead of having a combined primary/secondary station within the DTE and DCE as in LAPB, the DTE (i.e. the NIA) and the DCE each comprise of a separate primary and a secondary station. For the link to be active, there must be a path established between the primary station in the NIA and the secondary station in the DCE and vice versa.)

Under some re-initialization circumstances, it has been known that LAP can cause a deadlock situation. For example, if after a link is initialized and there is no active data being transferred in either direction, if the NIA is powered off and on again, although an SARM command is sent by the NIA after it has completed its IML procedure, the DCE may not send the SARM command to the NIA to set up the primary-secondary link in the reversed direction. Under such conditions, after waiting for an appropriate time out period, the NIA would display a flashing 'A4' or 'A5' to indicate a time out error while waiting for an SARM command. When such situation occurs, the user should depress the "D" and ENTER keys five times, then the "A" and ENTER key once, and wait for about 20 to 30 seconds. If the LED display does not change to a 'E' or 'B', try the sequence again. If this still does not work, power the NIA off and on again to restart the IML procedure. If after the second IML, the link level procedure still cannot be established, the user can try to power off the PTT-supplied dataset (e.g. "pull the plug"), wait approximately 20 seconds for any capacitor to drain, and power on again. This last step should cause the DCE to send an SARM command. If this still fails, the user should notify his PTT service representative.

- In some networks, after the link is initialized, a RESTART INDICATION packet may be sent from the network to reset all virtual circuits sup-

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ported on the access line. The NIA will respond with a RESTART CONFIRMATION packet.

VIRTUAL CIRCUIT SETUP PROCEDURE

PVC A PVC connection is analogous to a leased link. After the link level procedure is established, a 'E' will appear on the left LED display. If the other end of the PVC connection is also ready, the virtual circuit connection will be established automatically (provided that the LINE representing the PVC is defined with an initial status of active, for example). At this point, a steady 'F' will be displayed on the NIA.

If a flashing 'EE' is displayed on the NIA LED instead, this would indicate that there is a procedure error while the NIA is trying to establish the PVC connection. The cause can be due to the other end of the virtual circuit connection is not up yet, or the network is not ready to service the PVC. In any case, the user should find out the cause of the failure by pressing the ENTER key on the NIA. Please refer to the discussions in "Chapter 10. Problem Determination" on page 73 for more details on the problem determination procedure.

SVC If an SVC is used, after the link access procedure has been established successfully, the NIA should show a 'B' on its left LED display. This indicates that the switched logical channel is ready to receive an incoming call or for a dial access to a switched logical channel associated with another PSDN access line.

SNBU If the NIA is a remote model operating under LAPB and is equipped with specify code 7158, and the PSDN access line includes a switched logical channel in addition to the PVC, the user can activate the switched network backup feature of the NIA by pressing the "B" and ENTER key after the link access procedure has been established (i.e. a 'E' is shown on the left LED display - regardless whether flashing or not). The left LED display should show a 'B' to indicate that the NIA is ready for dial access to another PSDN access line.

NIA SWITCHED VIRTUAL CIRCUIT CALL ESTABLISHMENT

A virtual call set up is only required if a switched logical channel is used or if the user is activating the switched backup logical channel for his permanent virtual circuit.

Outgoing virtual calls are only allowed on switched logical channels that are subscribed with one way outgoing or two way capabilities. The SVC can use only logical channel number 1 or 2 (or, 0 or 1, if logical channel number 0 is assignable for virtual circuit usage). The switched logical channel on the other end must have two way or incoming call capability subscribed.

The procedure for call establishment from the NIA is described in the Section "Calling the Host" or "Calling From the Host" in the NIA Product Description Manuals (GA11-8643 and GA11-8642). It is repeated here so as to provide a complete set of NIA procedures to the user:

1. Check that the 5793-L02 is ready to place a call; i.e. a 'B' is displayed.
2. Press "B" on the keyboard and the ENTER key.

Check that the LED display does not change. If as the "B" key is pressed, a "B" appears on the right LED display, this indicates that the NIA is already in a ready state to set up a virtual call. The user should press the ERASE key to cancel the "B" key depression.

If after the "B" and ENTER key is pressed, the LED display changes to a flashing 'BF', this would indicate that there was an operator proce-

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sure error. The user should press the "B" and ENTER keys again to get a steady 'B' on the left LED display and then repeat this step.

3. Enter the called PSDN circuit number (e.g. host if this is from a remote NIA).

The circuit number is provided by the PTT and is usually marked on the PTT-supplied dataset.

As each number is entered, make sure that they appear on the right LED display. Any time that the user pauses, the entered number will be displayed cyclically on the right LED.

4. Press "F" on the NIA keyboard to mark the end of the called number.

The "F" key should be pressed only after the user has verified from the right LED display that the called number has been entered correctly. If the entered circuit number is not correct, he can cancel that with the ERASE key and repeat the previous step again.

5. Optionally, enter the circuit number of the access line to which the NIA is attached.

For most PSDN's, this calling number is not required as the intelligent node within the network should be capable of providing this information.

6. Press "F" to mark the end of the calling number entry.

This step is required even if the user chooses not to enter the calling circuit number.

7. Optionally, enter the user facility required.

The user facilities can only be requested if they are included in the customer's service subscription and that the access line on the other end has similar facilities subscribed.

8. Press "F" to mark the end of the user facility request.

Note that even if no user facility is requested, the "F" key still need to be entered.

9. Enter call user data, if any, on the NIA keyboard.

Note that the NIA will automatically generate X'C2' as the first byte in the Call User Data field in the CALL REQUEST packet to signify to the host X25NPSI or Front NIA that logical link control (LLC) level 2 is to be used. The X.25 NPSI licensed program or the NIA, however, will not make use of any other user data that may be present in the CALL REQUEST packet.

10. Press the ENTER key on the NIA to send the CALL REQUEST packet to the PSDN.

After the ENTER key (in step 10) is depressed, the NIA builds a CALL REQUEST packet and sends this to the DCE. A steady 'E' in the left LED display indicates that the CALL REQUEST packet is accepted and forwarded by the DCE.

When the call is accepted by the called DTE, a CALL CONNECTED packet will be returned to the NIA by the PSDN and the left LED display changes from a steady 'E' to an 'F'.

If for any reason that the virtual call cannot be established, the LED display on the NIA will change to a flashing 'BE'. The user should press the ENTER key to find out the cause of the failure. This is discussed in detail in "Chapter 10. Problem Determination" on page 73.

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VIRTUAL CALL SETUP CONTROL FLOW

Once the virtual call is established, a series of SNA control flows is required to set up the SNA session between the host and the terminal/cluster.

This control flow is transparent to the user/operator. This information is provided here to give the systems programmer an idea of the flow and to help him debug any startup problems that he may have.

After the virtual call is established (i.e. a CALL CONNECTED packet is received at the originating SNA node), the following takes place:

- An SDLC XID (Exchange Identification) command is issued from the SNA host (NCP, ACF/VTAME or equivalent).
- The host SNA/X.25 interface (X.25 NPSI or Frontal NIA) converts this XID command into a PSH (Packet Services Header) PSXID command, places this in a data packet and sends it to the Remote NIA via the PSDN.
- Upon receipt of the data packet with the PSXID command, the Remote NIA changes this back to an SDLC XID command and directs this to the SNA terminal/cluster.
- The SNA terminal/cluster responds with its station ID.

The ID is a 48-bit address that is dependent on the terminal type. For some terminals, e.g. 3276, part of the ID is the serial number. For some programmable terminal types, the ID is defined in the remote system (e.g. with the WRITEID operand specification in the 8100 DPPX DASSDL macro, or specified as PUID in step 8 of the 3274 Initial Customizing Procedure). The XID is no different from the normal SNA XID sequence used when communicating with circuit-switched lines. The user can obtain more information by referring to the product component description manuals, customizing guides and the ACF/VTAM Planning and Installation manual.

- The Remote NIA converts the responded XID into a PSH PSXID response and places this in a data packet for the host SNA/X.25 interface which changes this back to an XID response for the host system.
- Based on the XID returned, the host access method (ACF/VTAM, ACF/VTAME or equivalent) will try to find a match in the ID's of the PU's defined (e.g. as provided in the IDBLK and IDNUM operands in the PU macros defined in the switched major node in ACF/VTAM or ACF/VTAME).

If a match is found, the SSCP (Systems Services Control Point - i.e. the access method) will send a SETCV (Set Control Vector) command to initialize the NCP PU control block to reflect the characteristics of the PU which has been recognized.

If a match is not found, a message will appear on the host network operator console (e.g. an IST690I VTAM message) and the connection request is denied. In VTAM, the station address returned from the SNA terminal/cluster will also be displayed so that the systems programmer can use this information to verify if the correct ID is specified in the host and the remote terminal/cluster. This message is also useful to check if an unauthorized party is attempting to access the host system.

- After a positive response is received (from NCP, if a 3705 is used) for the SETCV command, the SSCP will send a CONTACT command to the terminal/cluster to initiate the data link control (DLC) level procedure.

This is converted into a data packet containing the PSH PSCONT command by the SNA/X.25 interface products and back to an SDLC SNRM command enroute to the terminal/cluster.

- After the DLC contact procedure is completed, the terminal/cluster sends a CONTACTED response back to the host.

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(The Remote NIA converts this to a PSCONT data packet for transportation over the PSDN. The host SNA/X.25 interface changes this back to a CONTACTED response.)

- Once the SSCP is satisfied that the SNA DLC level procedure is established, it sends an ACTPU command to activate a session between itself and the terminal/cluster PU.

(Note that after the CONTACTED response is received, the SSCP can start exchanging messages with the PU using the assigned addresses. (i.e. all messages transmitted on the VC are now in the SNA PIU format with a transmission Header, TH, and a Request/response Header, RH). The SNA control command PIU's (e.g. ACTPU) are placed without conversion inside the data packets just like any other data PIU.)

- When a positive response is returned from the terminal/cluster, if a 3705 is used, the SSCP sends a RNAA (Request Network Address Assignment) command to the NCP to provide network addresses for the LU's associated with the PU.

The NCP would first of all check to see if there are sufficient LU control blocks available in the pool (which is reserved by the LUDRPOOL NCP macro specification). If there is, a positive response will be returned to the SSCP. Otherwise, the connection will be abandoned.

- The next command, if a 3705 is used, is a SETCV command from the SSCP to the NCP to initialize the newly allocated LU control blocks.
- The SSCP next sends an ACTLU (Activate LU) command to establish a session with each logical unit associated with the terminal/cluster PU.

When a positive response is received, the SSCP is in session with the LU and the end user can initiate a logon to a host application, or if the LU has a default application defined (e.g. with the LOGAPPL specification in the LU macro in the switched major node), the LU-LU session with the application will be started automatically.

Clearing a Virtual Call

For SVC's, when connection with a host is no longer required, after all sessions from the terminal/cluster have been logged off, the user at the Remote NIA end can end the virtual call by pressing the "C" and the ENTER key on the NIA. This will cause a CLEAR REQUEST packet to be sent to the DCE. The NIA will display a 'B' to signal that it is ready for another virtual call. A CLEAR INDICATION packet will be propagated to the host DTE and the virtual circuit will be cleared freeing up the logical channel for another call.

Alternatively, the user can code DISCNT=YES in the PU macro in the switched major node (see the example in "Switched Major Node Definition" on page 21). This operand will cause the NCP to break connection with a switched link automatically when there are no active sessions between the host and a Remote PU. In this case, as soon as the last LU has logged off, VTAM disconnects the PU (i.e. clears the virtual circuit) and the logical channel is ready for another virtual call. At the Remote NIA, a flashing 'B E' will appear on the LED display. The NIA is ready to accept another call in this state, or the remote user can initiate another virtual call by first pressing the "B" and the ENTER key on the NIA and following the calling procedure as described in "NIA Switched Virtual Circuit Call Establishment" on page 69.

The host operator can also disconnect the virtual call by using the ACB/VTAM "v inact" operator command on the switched PU minor node.

Note that in all three cases, after the switched virtual circuit connection is broken, the PU and LU's in the switched major node will be placed in a CONCT (Connectable) state.

The objective of this chapter is to provide the user with a handy reference to overcome some common problems that he may encounter with the NIA and the X.25 NPSI. It is not meant to cover all possible situations. The user is asked to refer to the X.25 NPSI Installation and Operation manual (SC30-3163), the NIA Product Description Manuals (frontal GA11-8642 and remote GA11-8643), the X.25 NPSI Diagnosis Guide (SC30-3164) and the ACF/VTAM and ACF/NCP Installation manuals for more detail and complete discussions on the topic.

General Checklist

The following is a general checklist that the user may want to go through when a problem occurs, especially at startup time, before using more exhaustive means of problem determination:

- NIA Problems

- Has the microcode been loaded into the NIA? That is, can you get a 'A', 'B', 'E' or 'F' display in the NIA left LED? If not,
 - Have you followed the IML procedure correctly?
 - Are the carrier-supplied datasets (or modems) powered on? (NIA LED displays '5 E').
 - If there is a "system down" indicator on the PTT-supplied dataset, is it flashing on either ends of the virtual circuit connection? Or, is the dataset "tast" light on? Notify the carrier if either or both of these conditions occur.
 - Has the connecting cable from the NIA been plugged into the PTT-supplied dataset? (NIA LED displays '5 E'.)
 - Is the NIA machine "CHECK" light on?

If so, try flipping the power on-off switch a couple of times and see if the condition can be cleared. If not, call the IBM CE, you have a hardware problem with the NIA.

- Is NIA the cassette reader working? (NIA LED displays '0 E' or '0 F').

The cassette reader usually back up slightly when powered on and start reading about 30 seconds later. You can watch the cassette reader in operation by flipping up the T-cover on the back panel of the NIA. Try to turn power on and off a couple of times to get the cassette reader going.

If there is no LED display, and the cassette reader is not rewinding, power off the NIA and take out the mini-cassette tape. If the cassette tape is twisted, replace it with the backup tape and notify the IBM CE. If the tape appears in good shape, put it back in the reader. Make sure that the tape is loaded properly. A good way is to slant the cassette to ensure that the tape is in contact with the head before pushing it down and in. The microcode is only recorded on one side of the tape. Make sure that the side with the microcode number written on it is facing you. It may be a good idea to use a drop of rubbing alcohol to clean the head before replacing the cassette tape.

If the NIA still cannot load in the microcode, contact the IBM CE.

- Is the NIA LED display alternating between '0 E' and '0 F' for more than five minutes?

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This indicates that the NIA has trouble reading the cassette tape. This can be caused by the header on the reader being dirty, or some recording problem in the tape. Take out the tape, put a drop of rubbing on the head, and load in the back-up tape.

- Has Link Access Level (LAP) procedure been established? That is, can you get an 'E', 'B' or 'F' display on the left LED display? If not,
 - Is the cable from the host (if Frontal NIA is used) or terminal/cluster plugged into the NIA? Is it plugged to the correct adapter at the other end? (For example the 8100 has multiple ports and it is important to use the correct one). (NIA LED displays 'A 1'.)
 - Is the NIA strapped according to the subscribed environment? Make use of the applicable NIA worksheet to verify the subscription parameters with the PTT representative. If everything seems to be in order, ask your IBM CE to verify the microswitch settings and the speed strapping.
 - Is the SDLC link between the NIA and SNA node (host or terminal/cluster) defined as working in NRZ and half duplex mode (e.g. with NRZI=NO and DUPLEX=HALF definitions, or via appropriate microswitch settings in the terminal/cluster)?

The main objective of the half-duplex specification is to make sure that the RTS (Request-to-Send) circuit is only active when sending data.
 - Were you ever able to establish LAP procedure with the PSDN? If not, then there may be a mismatch in the LAP subscription and setting in the NIA (i.e. LAP on one and LAPB on the other). Notify either the PTT representative or the IBM CE.

If you were able to establish LAP procedure before, and this is a problem occurred during link setup reinitialization, follow the procedure described in "Link Level Procedure" on page 68 and see if you can get the LAP procedure established. If not, call the PTT representative.
- Are you having trouble reaching the other end of the connection?
 - Is the other end ready for connection? For example, is the SDLC link between the host and the Frontal NIA active? Has link level procedure been established?
 - If using SVC, are you dialing to the right number? Check your PSDN subscription data.
 - Have you subscribed to the requested user facilities? Are the codes correct? Is other end aware of these facilities? Check your PSDN subscription data.
 - What is the reason that the call is not accepted? Is the called number busy or is it not ready for connection? Have you followed the dialing procedure correctly? Is the network congested?

If for any reason that the call cannot be established, or the virtual circuit is cleared, the LED will display a flashing 'B E'. The user can find out the cause of the failure by pressing the ENTER key. Please refer to "Problem Determination with the NIA" on page 76 for more details.

It is usually a good idea to try at least a second time to establish the connection.
 - If a PVC connection cannot be established, at the remote end, the LED display will show a flashing 'E E'. This usually means that the host end is not ready for the connection. The remote operator should notify the host operator to ask him to activate the host link and virtual circuit or Frontal NIA.

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- Additional Frontal NIA Problems:

The following list includes some additional common problems that the user may encounter when the Frontal NIA is used:

- If there are multiple PVC's supported in the physical access line, can a virtual circuit connection be made to any of the SNA terminal/clusters?

If not, is the multipoint SDLC line representing the PVC connections active? Do all the virtual circuits have the same subscription parameters (e.g. packet window sizes)? If there are more than two PVC's, is the subscribed packet window size for each virtual circuit equal to 3 or less? Are the SDLC station addresses for the PU's connected via the PVC's unique, and do they follow the convention as outlined in "Frontal NIA Installation" on page 52?

- If there are one or more PVC's on the physical access line, and if any of the virtual circuit connections cannot be established or reset, the NIA will display a flashing 'E E'. The host operator can identify the failure cause and the virtual circuit involved by pressing the ENTER key. The LED will display cyclically:

```
-----  
| A | i |   | x | x |   | y | y |   | z | z |  
-----
```

where "i" represents the logical channel number of the PVC that has failed, and "xx", "yy" and "zz", the type, failure cause and reason respectively.

Please refer to "Problem Determination with the NIA" on page 76 for more details.

- The NIA can handle RU's that are 256 bytes or less in length. Are you trying to send larger RU's than it can handle?

- X.25 NPSI Problems:

At the host end, if the X.25 NPSI licensed program is used, there are facilities of VTAM (or NCCF) which will be able to give a clearer indication on the general welfare of the physical access line and its associated virtual circuits. Some of the points here also apply to the case when a Frontal NIA is used.

- Has the multichannel link (MCH) and its attached virtual circuits been successfully activated at the host? Display the status of the MCH and VC's using ACF/VTAM operator commands.

Note that the virtual circuits can show an active status even after the MCH has gone down. However, no data can be transmitted or received if the MCH and/or its associated PU are not active.

- Is the MCH PU active?

If the MCH LINE is active and its PU is not, this usually indicate a LAP procedure problem. Make sure that the subscribed LAP procedure is the same as that defined for the MCH.

If the LAP procedure is used, under certain reinitialization conditions, there may be problems in getting the link level procedure set up, please refer to "Host X.25 Link Activation" on page 59 for more details.

- Does the PTT-supplied dataset appear to be in working order? For example, the "System Down" or "Test" indicator lights are not on? Is the cable from the 3705 plugged into the modem? Is it plugged into the correct lineset address? Is the lineset operating in full duplex mode?
- If there are problems with some of the virtual circuits in the MCH link only, do the logical channel group number and logical channel numbers defined for the virtual circuits correspond to those pro-

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vided by the PTT? Check that your PSDN subscription data matches those defined in the X.25 NPSI macros.

Are you trying to use logical channel number 0 in your multichannel link for your virtual circuit? This is a NPSI generation option and is only provided by some PSDNs.

- Are the PU's and LU's associated with the SNA nodes activated?
- If SVC's are used,
 - Is the switched major node activated?
 - Are you trying to callout on switched logical channels that are designated to receive incoming calls only, or vice versa? Does the host definition for the virtual circuit correspond to the subscription (e.g. CALL=IN defined for one way incoming or two way switched logical channels)?
 - Is the cause of the incoming call refusal due to "Called Number Busy" (i.e. all the subscribed switched logical channels are in use)?
 - Do you have a high enough LUDRPOOL defined in NCP? Check your ACF/NCP generation LUDRPOOL or LUPOOL macro definitions.
 - For outgoing calls, have you activated the appropriate path?
 - Do the IDBLK and IDNUM operands in the PU macro correspond to with the ID defined in the SNA terminal/cluster? This is important for proper terminal id exchange (XID).
- Does your X.25 line or virtual circuit point to the correct parameter table? Does it provide the correct level of logical link control (LLC) for your terminal/cluster? Check your X.25 generation X25MCH macro definition parameters.

If the problem cannot be quickly identified from the above general check list, the user can go to other exhaustive means to help isolate and fix the problem.

PROBLEM DETERMINATION WITH THE NIA

"Appendix B. NIA LED Displays" on page 105 provides a summary of the NIA LED displays and their interpretation.

Four problem determination aids are also described in the NIA Product Description manuals (GA11-8642 and GA11-8643). They are useful in isolating the problem symptom.

In general, if the left LED shows anything other than a 'B' (for SVC), 'E' (for PVC) or 'F' (indicating that there is a virtual circuit connection), the problem is usually concerned with the link level procedure establishment. Please refer to "Link Level Procedure" on page 68 for details.

Problem Determination Aid 2 is not supported by some PSDN's (e.g. Datapac) if there is no LOCAL LOOP capability on the PTT-supplied digital dataset.

Problem Determination Aid 3 is useful in identifying a problem that has occurred during call setup or data transfer time. Under such circumstances, a flashing 'B E' (for SVC) or 'E E' (for PVC) will appear on the LED display. When this occurs, the user should press the ENTER key on the NIA to find out the reason for the failure.

On a Remote NIA, the LED will display cyclically:

```
-----  
| x | x |   | y | y |   | z | z |  
-----
```

On a Frontal NIA, it will be:

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```
-----  
| A | i | | x | x | | y | y | | z | z |  
-----
```

In the case of a Frontal NIA the first two digits displayed in the LED's is 'Ai', where "i" is the VC number of the circuit that has the problem. This sequence may be repeated for different circuits if other virtual circuits in the Frontal NIA also have a problem.

The "xx" code identifies the Control Packet Type received from the PSDN that has caused the virtual circuit connection to be broken. It can be "FB" (for Restart), "13" (for Clear) or "1B" (for Reset).

The "yy" field is the Cause Code taken from the Control Packet. It provides information as to why the virtual circuit connection has failed.

The "zz" field is the Diagnostic Code taken from the Control Packet. It provides additional information on the reason for the failure. In some PSDN's (e.g. Datapac), no Diagnostic Code is provided in some Control Packets. Therefore "zz" has no significance in these cases.

The following summary is designed to help the user determine the problem with his virtual circuit connection when such control packets are received.

Clear Request/Indication Packet

If the Remote or Frontal NIA is set up for use with an SVC and if for any reason the virtual call cannot be established, or the SVC connection is broken, the NIA LED will display a flashing 'B E'. If the user presses the ENTER key on the NIA, the LED will change to "13-yy-zz" (on the Remote NIA) or "A1-13-yy-zz" (on the Frontal NIA). (A1 because the Frontal NIA can only support 1 SVC or up to 4 PVC's. In this case, being with an SVC, the error condition is in the first logical channel.)

This indicates that a CLEAR INDICATION packet has been received from the DCE, or a CLEAR REQUEST packet has been generated in the DTE, and the virtual call is disconnected.

The CLEAR INDICATION or CLEAR REQUEST packet has a packet type identifier X'13', and carries a Clearing Cause and an optional Diagnostic Code field which may not be supported by some PSDN's. (For example, although Datapac currently supports the Diagnostic Code field in the RESET packet, this support is not extended to the CLEAR and RESTART packets until sometime in 1983 when Datapac Release 10 is implemented.)

The cyclic LED display seen on the NIA are actually extracts of the field contents from the Clear Request or Clear Indication packets. (That is why "13" indicates a Clearing condition.) The Clear Cause field which is extracted and displayed as the second set of numbers on the NIA ("yy") is a coded message explaining the cause of the disconnection. In some cases, the cause code (e.g. "00" meaning DTE originated) does not give the user much information as to why the call is cleared. The following is a list of the meaning of the Clearing Cause code and some of the probable reasons why the CLEAR REQUEST is generated or the CLEAR INDICATION is received.

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Clearing Cause Code -----	Meaning -----	Probable Cause -----
00	<ul style="list-style-type: none"> . Call not accepted by Remote DTE . Call cleared by DTE (local or remote) 	<ul style="list-style-type: none"> . Facility requested not defined in X.25 NPSI . Remote DTE gone down . Session completed . Call cleared by operator . Incompatible XID . BIND parameters unacceptable
01	<ul style="list-style-type: none"> . Called number busy 	<ul style="list-style-type: none"> . No free switched logical channel available . Call collision
03	<ul style="list-style-type: none"> . Invalid facility request . Invalid Call 	
05	<ul style="list-style-type: none"> . Network congestion 	<ul style="list-style-type: none"> . Network problem. Too much traffic in network.
09	<ul style="list-style-type: none"> . Out of order 	<ul style="list-style-type: none"> . DTE/DCE interface not working (probably in remote) . MCH Line, PU or VC not active in NCP . Network problem
0B	<ul style="list-style-type: none"> . Access barred 	<ul style="list-style-type: none"> . Closed user group not included in Call Request packet
11	<ul style="list-style-type: none"> . Remote procedure error 	<ul style="list-style-type: none"> . MCH or VC not functioning properly (e.g. not active) . Remote DTE/DCE interface exiting Data Transfer state . Remote DTE/DCE violating X.25 protocol . Remote DTE/DCE interface has timed out or retry problem
13	<ul style="list-style-type: none"> . Local procedure error 	<ul style="list-style-type: none"> . Operator procedure problem . Local operator cleared call
19	<ul style="list-style-type: none"> . Reverse charging acceptance not subscribed 	
21	<ul style="list-style-type: none"> . Incompatible destination 	<ul style="list-style-type: none"> . Incorrect Called Number entered on NIA

The Diagnostic field which is extracted and displayed as the third set of numbers on the NIA ("zz") is a coded message usually generated by the responsible DTE to explain the reason of the disconnection. Some PSDN's (e.g. Datapac) does not provide a facility for this Diagnostic code. "zz" is therefore insignificant when this field is not supported by the network. Furthermore, the meaning of the Diagnostic Code, if present, is dependent on the DTE's X.25 implementation. For the IBM SNA/X.25 interface products, this code is explained in detail in Appendix C in the X.25 NPSI Diagnosis Guide (SC30-3164) and will not be repeated here. Customers who are using the Frontal NIA instead of the X.25 NPSI licensed program is still encouraged to refer to this manual as it provides additional diagnostic information which they may also find useful in an NIA-to-NIA connection.

Even in this problem determination state, the NIA is ready to receive an incoming call. The user can also press the "B" and ENTER keys on the NIA to get it ready to place an outgoing call.

Reset Request/Indication Packet

If for any reason a virtual circuit connection is broken or the logical channel is re-initialized during data transfer (usually with a PVC), the

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NIA LED will display a flashing 'E E' (or 'B E', for SVC). If the user presses the ENTER key on the NIA, the LED will change to "1B-yy-zz" (on the Remote NIA) or "Ai-1B-yy-zz" (on the Frontal NIA).

The Frontal NIA can support up to 4 PVC's. To the host system the SNA node at each end of the PVC appears as a drop on a multipoint SDLC line. "Ai" indicates that a RESET REQUEST or RESET INDICATION packet has been received for the ith PU defined on the SDLC line. If multiple PVC's are reset (say 1 and 2) in the Frontal NIA, then the LED will display all reset situations cyclically (e.g. "A1-1B-yy-zz", "A2-1B-yy-zz", "A1-1B-yy-zz", "A2-1B-yy-zz" and so on).

The RESET REQUEST and RESET INDICATION has a packet type identifier X'1B', and carries a Reset Cause and an optional Diagnostic Code field which may not be supported by some PSDN's. (Note that although currently Datapac does not provide a Diagnostic Code field in its CLEAR and RESTART packets, this field is supported in the RESET packets.) The Reset Cause field which is extracted and displayed as the second set of numbers on the NIA ("yy") is a coded message explaining the cause of the reset. The following is a list of the meaning of the Reset Cause code and some of the probable reasons why the RESET REQUEST is generated or the RESET INDICATION is received.

Reset Cause Code -----	Meaning -----	Probable Cause -----
00	. DTE reset (local or remote)	. Remote DTE going down . Session completed . Circuit reset by operator
01	. Out of order	. DTE/DCE interface not working (probably in remote) . NCP or ICA down . MCH Line, PU or VC not active in NCP . Network problem
03	. Remote procedure error	. MCH or VC not functioning properly (e.g. not active) . Remote DTE/DCE interface exiting Data Transfer state . Remote DTE/DCE violating X.25 protocol . Remote DTE/DCE interface has timed out or retry problem
05	. Local procedure error	. Operator procedure problem . Local operator disconnected connection
07	. Network Congestion	. Network problem. Too much traffic.
09	. Remote DTE operational	
0F	. Network operational	
11	. Incompatible destination	. Incompatible subscription parameters (e.g. packet size)

The Diagnostic field which is extracted and displayed as the third set of numbers on the NIA ("zz") is a coded message usually generated by the responsible DTE to explain the reason of the reset. Some PSDN's does not support this field in its RESET packets, therefore "zz" would have no significance in these cases. The meaning of the Diagnostic Code, if present, is dependent on the DTE's X.25 implementation. For the IBM SNA/X.25 interface products, this code is explained in detail in Appendix C in the X.25 NPSI Diagnosis Guide (SC30-3164) and will not be repeated here.

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Restart Request/Indication Packets

The restart procedure is used to initialize or re-initialize the packet level of the DTE/DCE interface. The DTE can request a restart by sending a RESTART REQUEST packet to the DCE. The DCE can also indicate a restart condition by passing a RESTART INDICATION packet to the DTE. The RESTART packets affect the entire PSDN physical access line. After a confirmation is returned from the other party, all the logical channels in the physical access line will be initialized or re-initialized. That is, all the PVC's will be as if they have been reset, and all the SVC connections, if any exists at the time of restart, will be broken.

At the NIA the cyclic code displayed will be "FB-yy-zz" (for the Remote) or "A1-FB-yy-zz" (for the Frontal NIA). "yy" is the cause code for the RESTART condition. Its meaning is as follows:

<u>Restart Cause Code</u>	<u>Meaning</u>	<u>Probable Cause</u>
01	. Local procedure error	. Operator error
03	. Network congestion	. Network problem. Too much Traffic
05	. Network Operational	. Clears previous network problem

"zz" represents the Diagnostic Code field and is only meaningful if the field is supported by the PSDN. This field is generated usually by the DTE. The meaning of the Diagnostic Code field as produced by the IBM SNA/X.25 interface products should be the same as those for the CLEAR and RESET packets.

A RESTART condition normally indicates that there is a problem with the host application, Frontal NIA or the X.25 NPSI. If the condition happens quite frequently, the user should carefully review his application and NCP/X.25 NPSI parameters. If the problem persists, he should contact the IBM PSR for support.

A line monitor may be used to obtain a better understanding of of the problem by examining the data flow between the remote NIA and the PSDN DCE.

Frontal NIA Event Log

If the user has a Frontal NIA with specify code 7158 and operating under LAPB, there is an Event Log facility provided in the NIA that can further help him isolate a problem situation.

The Event Log function for the Frontal NIA is described in detail in Appendix J, "Appendix I. NIA New Microcode Function" on page 147. Basically, there are two types of statistics kept in the Frontal NIA: Quantitative and Qualitative. Together, they will give an indication of the quality of the PSDN and virtual circuit connections. For example, with the quantitative statistics, the user can find out whether he has been receiving a lot of link level (or level 2) problem events. Further, if he goes to the qualitative display and finds that most of the recent events are caused by bad FCS (Field Sequence Check - Code 2E), he can conclude that there is probably a connection or line problem on the PSDN physical access line.

The user with the Frontal NIA operating under LAPB is encouraged to refer to Appendix J for more information.

PROBLEM DETERMINATION WITH X.25 NPSI

Error Reports

When an invalid request or abnormal condition is encountered, the NCP reports the occurrence to VTAM via the Exception Response, Inoperative (INOP) or Record Maintenance Statistics (RECMS) messages. This is discussed in detail in the X.25 NPSI Diagnosis Guide (SC30-3164) and the X.25 NPSI Diagnosis Reference (LY30-3054). These messages are displayed on the system and NCCF consoles to keep the host operator informed of the error situations.

In general, an Exception Response is generated by the NCP when:

- the NCP detects an invalid PIU request, or
- the PIU is valid, but the NCP detects an abnormal condition. For example, when transmission is attempted on an active virtual circuit, but the MCH link is inactive.

An Inoperative (INOP) Message is generated by the NCP when it detects an abnormal condition that is not caused by a PIU request. For example, a modem check on the MCH link, or an invalid control packet received on a virtual circuit. The abnormal condition can cause a resource to be no longer available. Depending on the situation, ACF/VTAM may not be able to recover the resource automatically without operator intervention. In some situations, only RECMS messages may be generated.

The INOP message is usually followed by one or more RECMS (Record Maintenance Statistics) messages which contain more detail on the error condition.

The INOP condition can apply to the MCH link, MCH PU, Virtual Circuit link, or station.

The INOP MCH LINK messages usually are generated by the X.25 NPSI in case of hardware problems with the PSDN physical access line only. An INOP STATION message is only generated for the MCH PU if the number of link level retries has been exceeded.

At the Virtual Circuit level, an INOP STATION will be generated if the virtual circuit has failed as a result of an abnormal condition detected at the:

- Physical Circuit (MCH) level,
- Virtual Circuit Manager level (e.g. a call collision),
- Packet Level Procedure (e.g. invalid send/receive sequence numbers), or,
- Logical Link Control level (e.g. invalid PU type in XID).

Three types of RECMS messages can be generated. They can be identified by the Record Mode (byte 7) in the RU:

1. RECMS for Link errors: Record Mode = X'72',
2. RECMS for Station errors: Record Mode = X'73', and
3. RECMS for Statistics: Record Mode = X'76'.

If one of the following PTF's have not been installed in the NCP, the Record Modes of the above RECMS messages will be X'82', X'83' and X'86' instead of X'72', X'73' and X'76' respectively:

- For ACF/NCP R2.1
 - UR03062 (OS)
 - UR03064 (DOS)
- For ACF/NCP R3
 - UR03063 (OS)

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- UR03065 (DOS)

When the RECMS messages appear as X'82', X'83' or X'86', they are treated as ordinary SDLC records. Depending on the circumstance, the user may not want to install the above PTF's.

When an abnormal condition occurs, one or more RECMS messages are generated by the X.25 NPSI. These are passed to the SSCP to be displayed on the system or NCCF consoles. At the operating systems level, these messages are recorded in SYS1.LOGREC for an OS/VS system and SYSREC for a DOS/VSE system. If the user has NPDA installed and the application is not set to filter out RECMS records, then these maintenance records when appearing as record mode X'82', X'83' or X'86' will also be recorded automatically in the NPDA database. However, if the above-mentioned PTF's are installed, the X.25 NPSI will forward the REMS messages under X'72', X'73' or X'76'. At the NPDA level, they will be discarded as unsupported record types and not recorded in the NPDA database.

There are pros and cons as to whether the PTF's should be installed:

- If the PTF's are installed, then under error situations, the IBM PSR (Program Services Representative) will be able to get into the system database (e.g. SYS1.LOGREC) and extract X.25 related RECMS records readily.
- If the PTF's are not installed, then when a user reports a problem, the host operator can go into NPDA and display the most recent RECMS message concerned with the SNA station in detail. Although NPDA does not interpret the extra fields of data contained in the X.25-related RECMS, the complete record can be displayed in hex on the NPDA screen. To a trained operator, these extra fields can be spotted easily. They provide a richness of information that can help identify the error situation precisely.

However, if the PTF's are not installed, other future PTF's may rely on them as pre-requisites and therefore can create an undesirable situation.

It has been suggested that the user should installed the PTF's as suggested in the X.25 NPSI program directory. To resolve error situations, the user can:

1. Use the EREP (Environmental Recording Editing and Printing) program to extract the RECMS records.

The sample JCL is provided in Chapter 3 of the X.25 NPSI Diagnosis Guide (SC30-3164).

2. Or, develop an NCCF user exit routine that will convert RECMS types X'72', X'73' and X'76' into X'82', X'83' and X'86' before passing to the NPDA for recording. This way, the correct records will be recorded in the system dataset, and the user can make use of NPDA.

The user systems programmer is urged to become familiar with the X.25 NPSI Diagnosis Guide (SC30-3164) and understand the structure of the X.25-related RECMS messages. They carry not only information that can help determine a problem condition, but also statistics concerning the quality of the connection (e.g. how many FCS checks and RNR received) and the well-being of the X.25 NPSI at the time of failure.

GTF Traces

In some error situations, the RECMS records may not provide sufficient information to identify the problem. In such cases, other exhaustive means may be required, such as using the General Trace Facility (GTF) to do line, buffer or IO traces or the X.25 SNAP facility.

Before spending time and effort on the trace facilities, it may be a good idea to first try to describe the error symptoms and attempt to isolate the problem component. The user should also contact the remote operator, understand the procedure used and circumstance when the problem occurs, note the LED display on the NIA and see if this can help him identify the

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problem. Then he should review the X.25 NPSI, NCP and VTAM macros and operands, and network subscription parameters to make sure that they have been properly coded and correctly reflect the installed network environment. The console or NCCF log (e.g. VTAM messages) may also supply additional information to help resolve the problem. In addition, he may want to refer to Change Management documents to see if the problem is not caused by some recent changes to the environment.

The VTAM line trace facility is useful in providing a description of the data traffic between the NCP and the DCE.

If the line trace is required, the user should first start GTF with the USR option. He can then use the VTAM modify operator command to turn on the line trace on the MCH that supports the virtual circuit with the problem. Line trace on the virtual circuits are not allowed because they have no real line addresses. For example, in our case, we used the following command:

```
f net,id=XM040A4,trace,type=line
```

Since there may be multiple virtual circuits active on the MCH link, the user can appreciate that such a line trace can produce a significant amount of data. If the mission is to determine the problem on a certain virtual circuit, he may want to schedule the line trace to be run at a time when it is least likely that the virtual circuit will be sharing the physical access line with other end users.

After the error is duplicated and recorded, he can use ACFTAP or the AMDPRDMP service aid to print the line trace.

If ACFTAP is used, choose the SDPRT=YES option. The user should be aware that the MCH link is a full duplex link. This means that ACFTAP does not necessarily correlate and report the messages on the transmit and receive legs in the correct time sequence. He would have to examine the send and receive sequence numbers in both the frame control field and packet header if he wants to chart the correct sequence of events.

The user would need some knowledge of the X.25 protocol in order to distinguish the various packet types and to decode the messages.

In the line trace, each message will represent an X.25 frame. The first byte is the DTE/DCE address field (01 or 03), the second byte is the frame control field. If the frame is an I (or Information) frame, this frame header will be followed by the data field. The data field can represent a control packet (e.g. Incoming Call, Reset Request) or a data packet. The FCS (Frame Check Sequence) which constitutes the last two bytes in the frame follows the data field immediately.

For Supervisory (e.g. RR, REJ) and Unnumbered (e.g. SABM, UA) frames, there are no data fields. In the I frame, the data field is either a control or data packet.

The packet is usually consisted of a three byte header. (In some networks which support a packet level Modulo 128 scheme, the packet header is four bytes long.) Octet 3 (or Byte 3) in the packet header is the packet type identifier. The length of the packet is dependent on the packet type, the maximum size of the data packet allowed and the amount of user data. In some control packets (e.g. RR, RNR, Clear Confirmation), the packet header makes up the entire data field in the frame. Description of the packet formats can be found in Section 6 of the CCITT Recommendation X.25 document or Section 6 in the "X.25 Interface for Attaching IBM SNA Nodes to Packet-Switched Data Networks, General Information" manual (GA27-3345).

The following is a summary of some of the packet types:

Packet Type Identifier

	Packet Type From DCE to DCE	Packet Type From DTE to DCE	Octect 3 (hex)
a) Call Set-up & Clearing			
Incoming Call		Call Request	'0B'
Call Connected		Call Accepted	'0F'
Clear Indication		Clear Request	'13'

As mentioned in Chapter 4 of the "X.25 NPSI Release 2 & 3 Guide" (GG24-1567), a packet-switched data network is a "store-and-forward" network. Compared to a conventional leased or circuit-switched line environment where the communications facilities is relatively transparent once the link is established, connection via an X.25-based PSDN is more complicated. Before one could tune his network for better performance, it is important to first understand the effect of such a "store-and-forward" network service. This can be illustrated by considering an example where a terminal operator is inputting an inquiry to a host system.

PSDN DATA FLOW

The following diagram depicts an SNA host to an SNA peripheral node connection over an X.25 PSDN via the X.25 NPSI and a remote NIA. It should be noted that although an SNA example is used here, most of the discussions here actually apply to all X.25 connections.

For example, if the Frontal NIA is used instead, the references to the X.25 NPSI licensed program can easily be replaced by the Frontal NIA. Notice however that there can be one big difference. The X.25 NPSI being capable of operating as an integral component within the 3705 can represent one less hop in the "store-an-forward" process, as oppose to an external protocol converter such as an NIA.

The data flow consists roughly of the following steps:

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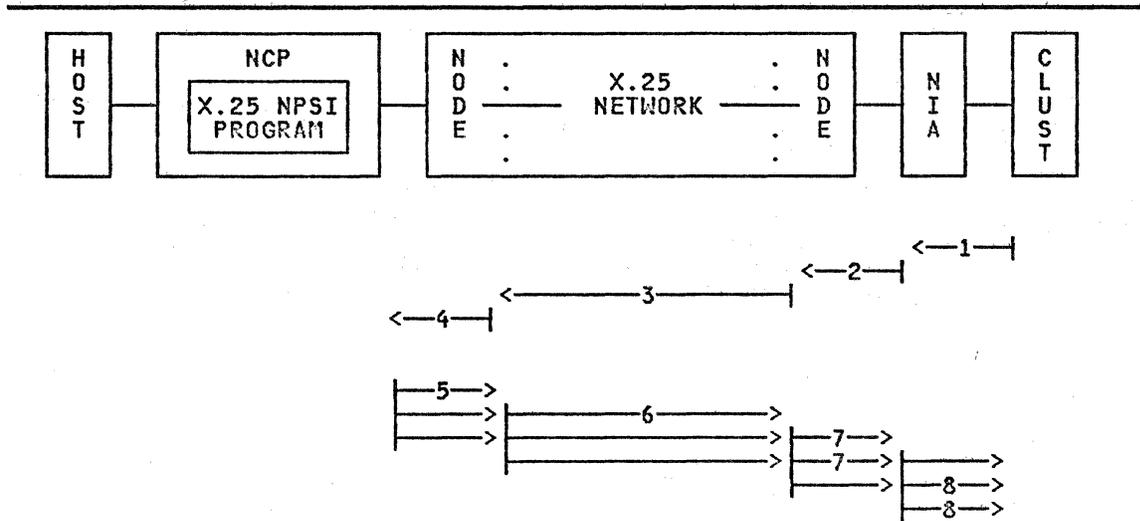


Figure 4. "Store-and-Forward" Data Flow in a PSDN

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- After the enter key is depressed, the inquiry will first be converted into one or more SNA PIU's (Path Information Unit) and scheduled for transmission to the remote NIA.

The delay will be dependent on how many active logical units are attached to the SNA cluster and their traffic volume. The transmission will be sent at the signalling rate of the connection between the SNA cluster and the NIA, and in the form of SDLC information frames. (That is, with SDLC framing fields around each PIU.)

- On receipt of the SDLC information frame(s) from the terminal, the NIA will create X.25 data packets (multiple packets per PIU if necessary), insert the Physical Services Header (PSH)² and add on the appropriate flag, address, control and frame check sequence fields so that the data is acceptable as X.25 information frame(s) for transmission over the PSDN.

It should be noted that the Remote NIA will not packetize the SDLC frame until it has received the last bit of a data frame from the SNA cluster and verified that it has been received without transmission error from the SNA cluster. The packetized frame will then be queued for transmission to the PSDN's DCE node.

(Notice that in the discussions here, the term "DCE" includes the PTT's dataset (modem) and the first intelligent node associated with the physical circuit.)

The queueing time will be dependent on whether the PSDN is ready to service the virtual circuit (i.e. whether the "Packet Window" is open), how busy the network intelligent node is and the transmission speed of the DCE access facility.

- After the DCE has received the last bit of an X.25 information frame from the NIA and verified that there are no transmission errors, it will queue the information frame (which contain a data packet) for transmission to the destination DCE associated with the host system.

The information frames are usually transmitted on high speed trunk lines connecting the PSDN's intelligent nodes. This may involve one or more intervening nodes before the frames arrive at their destination DCE node. The transit delay will be dependent on the total traffic volume that each PSDN node has to handle.

The "network transit time" as published by most PSDN's is actually the delay it takes to deliver an information frame from a source to a destination DCE node after the last bit in the information frame has been received without error from a DTE. No provisions are given to any delay that the DTE may experience in waiting for the "frame" or "packet" windows in the involved physical and virtual circuits to be open for transmission, and the delay in delivering the packets to the PSDN. It is also a peak load objective, which means that some frames may be delivered with a shorter delay, and some maybe longer.

- After the destination DCE has received the information frame(s) and verified that there are no transmission errors, it will queue them for transmission to the host system.

The queue will be dependent on the speed of the physical access line between the host system and its DCE (i.e. MCH link), the packet traffic volume from other virtual circuits sharing the same MCH link, and whether the DTE (host) is ready to receive the information frame(s) (i.e. whether the "packet window" is open).

Once the X.25 NPSI has received the frame(s) correctly, it will examine the address and control fields in the frame. If this is an information frame, it will pick out the data packet, strip off the packet and PSH headers, recombine several data packets into an SNA PIU (if necessary), and pass this to the host application.

² For a detailed discussion on the type 2 virtual circuit support including the PSH please see "The X.25 Interface for Attaching IBM SNA Nodes to Packet-Switched Data Networks. General Information Manual". (GA27-3345).

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An acknowledgement will also be sent to the PSDN to notify the DCE (e.g. via a RR packet) that the data packet has been correctly received.

- After the host has finished processing the inquiry, it will send the output to the NCP and the X.25 NPSI for transmission to the remote terminal. The X.25 NPSI will convert the SNA PIU segments into X.25 data packets and information frames.

Depending on the amount of output and the VTAM/NCP MAXDATA and BFRS specifications, the output data may be sent as one or more PIU segments. Depending on the actual PIU segment size and the maximum data packet size allowed on the virtual circuit, the X.25 NPSI may have to send each PIU segment as multiple data packets. (Please see "Appendix D. Data Packetization" on page 113 for a detailed discussion on SNA PIU segmentation and how the segments are packetized.)

Transmission to the PSDN's DCE node will again be dependent on the traffic volume on the physical access line (MCH) and whether the "packet window" for the virtual circuit is open. If the output involves multiple data packets, then during the transmission, the "packet window" may be closed and then re-opened several times. (Please see "Packet Window" size discussion later on in the Tuning Considerations section.)

- The data packets will then be transmitted to the remote terminal in a "store and forward" manner via the DCE nodes and the remote NIA as discussed earlier.

As illustrated in Figure 4 on page 88, if the output involves multiple data packets, some overlap in transmission is possible. For example, the intelligent node associated with the host system can start transmitting the first output data packet to the remote intelligent node while it is receiving the second and even the third output data packets from the host.

Notice that the NIA will only forward complete PIU segments to the SNA cluster. That is, if a PIU segment has to be sent as more than one data packet, based on the PSH, the NIA will assemble them back into a PIU segment and forward this to the SNA cluster. If the packet window(s) were closed in the course of the transmission, the NIA will hold and wait for the final data packets of the PIU segment to arrive.

From the above discussion, it can be seen that the data flow is considerably more complicated than in a conventional leased or circuit-switched line, especially if response time is measured as the time it takes to have the complete output back at the remote terminal.

RESPONSE TIME CALCULATION

The total network transit time can be estimated by examining each of the transmission links.

Suppose in the above example that the inquiry is 30 characters long and the response is 512 characters and can be contained in 3 data packets (please see the example given in "Appendix D. Data Packetization" on page 113), the signalling rate between the NIA and the SNA cluster is strapped to 9600 bps, the X.25 physical access line speeds for the host and NIA are 9600 bps and 4800 bps respectively, the response time can be calculated as follows:

$$r1 = t1 + t2 + t3 + t4 + t5 + t6 + t7 + t8 + c1 + q1 + p1 + e1$$

where $t1$ = transmission delay required to get the complete inquiry on the line to the remote NIA.
= transaction length in bits/NIA signalling rate
= $(30 + \text{SNA headers} + \text{SDLC framing}) * 8 / 9600 \text{ sec.}$
= $(30 + 9 + 6) * 8 / 9600 \text{ sec.}$ (Assuming FID2)

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- t2 = transmission delay required to get the complete inquiry on line to the remote DCE.
= input packet length in bits/remote access line speed
= $(30+SNA\ headers+PSH\ header+X.25\ overhead)*8/4800\ sec.$
= $(30+9+2+9)*8/4800\ sec.$
- t3 = propagation delay required to traverse the PSDN to get from a source DCE to a destination DCE.
This can be taken as the network transit time that is provided by the PTT.
- t4 = transmission delay required to get the complete inquiry on line from the DCE to the host.
= input packet length in bits/host access line speed
= $(30+SNA\ headers+PSH\ header+X.25\ overhead)*8/9600\ sec.$
= $(30+9+2+9)*8/9600\ sec.$
- t5 = transmission delay required to get the first packet of the response on line from the host to the DCE.
It is assumed that the data are optimally segmented to transmitted in 256 bytes maximum packet size.
= total data frame length in bits/host access line speed
= $(first\ PIU\ segment\ lengths + X.25\ overhead)*8/9600\ sec.$
(See example in "Appendix D. Data Packetization" on page 113)
= $(228+9)*8/9600\ sec.$
- t6 = network transit delay required to transmit output to the remote DCE node.
This transmission can overlap with data delivery from host to local DCE node, and remote DCE node to NIA.
(See Figure.)
= network transit delay to deliver the first segment to the remote DCE node.
= t3
- t7 = transmission delay required to get the complete output on line from remote DCE node to the NIA.
= total data frame lengths in bits/remote access line speed
= $(total\ data\ packet\ lengths + X.25\ overhead)*8/4800\ sec.$
= $(228+256+55+3*9)*8/4800\ sec.$
- t8 = transmission delay required get the last PIU segment on line from the NIA to the terminal cluster + wait time (if any) for the second last PIU segment to complete transmission.
= $(last\ PIU\ segment+SDLC\ framing)*8/NIA\ signalling\ rate + (difference\ in\ transmission\ delay\ for\ the\ second\ last\ PIU\ segment\ to\ get\ to\ the\ terminal\ and\ the\ delay\ in\ transferring\ the\ last\ PIU\ segment\ from\ the\ DCE\ to\ the\ NIA,\ if\ >0).$
= $(last\ two\ PIU\ segments+SDLC\ framing)*8/9600 - (Last\ PIU\ segment+PSH+X.25\ overhead)*8/4800\ sec.$
= $(254+53+2*6)*8/9600 - (53+2+9)*8/4800\ sec.$
- c1 = cpu time required to process the transaction.
q1 = total of queueing delays incurred at each hop.
p1 = total packet window rotation delay (if any).
More on this will be discussed under "Packet Window" in the "Tuning Considerations" section.
e1 = total error/retransmission time.

TUNING CONSIDERATIONS

Once the various "store and forward" stages are understood, it becomes easy to define most of the tuning parameters for a PSDN. However, before the user expands all kinds of efforts to try to fine tune his network, it may be worthwhile to first take inventory of his environment (e.g. terminal types, access line speeds, network costs, current response time). Then he should define a set of realistic objectives (e.g. so many seconds of response time 90% of the time, an upper limit for the network costs,

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etc.). He should also be aware of the diminishing returns in trying to over-design his network.

The following are some of the tuning parameters that the user may wish to consider:

- Host/Remote physical access line speed.
- NIA signalling rate.
- Packet window size.
- Packet size.
- Priority class of service.
- SNA flow control parameters.
- Higher level protocols.
- User/application dialog.
- DTE buffer capacity.
- Compression/compaction.
- Host link congestion.

Each of these topics are discussed in detail in the following subsections.

Access Line Speed

Perhaps one of the most obvious operands is to minimize the delay required to get the messages (i.e. data) on line for transmission.

The effect of the transmission delays of the access lines can be seen from the formulae provided in "Response Time Calculation" on page 90.

However, before the user goes to order the highest speed available for his host and terminal physical access lines, he must not lose sight that part of his networking objective may be to reduce the overall network costs. The access line speeds should be considered in light of their contribution to the overall response time. For example, an user may find that by increasing a remote access line speed from 2400 bps to 4800 bps he can get a more significant improvement in terms of price/performance, compared with that obtained when the speed is increased to 9600 bps from 4800 bps.

Because of the store-and-forward nature of the network, it is worth noting again that the host and remote physical access lines do not have to be of the same speed. Usually because the host access line supports multiple virtual circuits and there is only one virtual circuit associated with the terminal end, the user may want to have the host access line running at a higher speed so as to minimize the queueing delay in servicing the virtual circuits.

NIA Signalling Rate

The signalling rate is the line speed between the NIA (Frontal or Remote) and the SNA node (host or cluster). This is a strapable option within the NIA and can be set for 1200, 2400, 4800 or 9600 bps.

In order to minimize transmission delay, it is advantageous to have the NIA signalling rate set at the highest speed that is supported by the attached SNA node.

Please note that the NIA signalling rate does not have to match the speed of the physical access line. In fact, since the NIA-to-SNA node is a half-duplex link, whereas that between the NIA and X.25 DCE is full

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duplex, the signalling rate should have a higher speed than the physical access line in order to take advantage of the available bandwidth.

Also there is no mechanism provided for the remote NIA to control the polling rate to the attached station. This means that when no data is flowing between the NIA and the remote cluster, the idle polling which will be paced at the the NIA signalling rate may impede performance of the attached cluster (e.g. an 8100 system).

Packet Window Size

The "Packet Window" is a control mechanism employed to regulate data flow across the DTE/DCE interface. There is a packet window associated with each direction of transmission on each virtual circuit.

A packet window can be defined as the maximum number of consecutive packets that are authorized to cross the interface. Consider the following example where the DTE/DCE interface has a packet window size of 2 and there are 5 data packets to be transmitted to the remote end. Assuming that the packet window is fully open initially, the source DTE is allowed to send a full window of data packets (i.e. 2). The packet window is then closed until an acknowledgement is received via a returning data or RR (Receive Ready) packet. Depending on the receive sequence number P(R) on the acknowledgement packet, the window may be rotated to allow one or more (up to the full window size) data packets to be sent.

Depending on the PSDN, P(R) may be used to convey local or end-to-end acknowledgement. End-to-end means that the P(R) value has to be propagated from the destination DTE.

Although it is not generally publicized, in most PSDN's, there is an internal packet window associated with each virtual circuit that is generally known as the "subnet" window. The actual number of data packets that can be in transit in the network is largely dependent on this subnet window size. For networks that provide such subnet windows, the RR packet usually has local significance only. Consider the example again. Suppose the virtual circuit has a packet window size of 2, a subnet window size of 5 and there are 5 packets of data to transmit. After the DCE has received the initial 2 data packets from the DTE, there are still reserved buffer space left in the intelligent node associated with the virtual circuit. An RR packet is therefore returned to the DTE with the P(R) value set to acknowledge correct receipt of the first two packets. (Note that in most networks, an RR packet is not sent until the packet window is closed.) Based on the P(R) value, the packet window is rotated. In this case, the DTE can again send a full window of data packets (i.e. 2). Upon receipt of data packets number 3 and 4, if the DCE still has not received an acknowledgement from the next intelligent node on the correct reception of the first two packets, it knows that there is only 1 buffer space left. An RR packet is again sent. However, the P(R) value will only acknowledge the third packet. This means that at the DTE/DCE interface, the packet window is only rotated by 1, and the DTE is allowed to forward the fifth data packet.

The sending of the RR packets and acknowledgements between intelligent nodes within the PSDN (note: the RR packet is not necessarily used within the PSDN) can be overlap with data packet transmissions in the other direction. In the above discussions, it is conceivable that as the DTE is sending the fifth data packet, an acknowledgement is received at the DCE to signify that the next intelligent node has received the first data packet. This would prompt the DCE to send an RR (overlapping with the fifth data packet transmission in the other direction) to the DTE to keep the packet window open.

Obviously, for throughput oriented applications (e.g. RJE), it is desirable to subscribe large enough packet and/or subnet window sizes so that the DTE never has to wait for the packet window to rotate. The required window sizes are a function of the length and quantity of data packets involved in one transmission of the output, the speed of the access line and the network transit delay.

However, since a large window sizes require correspondingly large buffer storage space in the network's intelligent nodes, the user should not be

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surprised to find that most PTT's would resist a large window assignment, especially when the networks perform best without any storage constraints.

The default packet window size for most PSDN's is 2. Some PTT's will allow a larger packet and/or subnet window subscription. (Note that, if the subnet window is available, e.g. in Datapac, this is a far more important parameter.) For PVC's, once a packet window size is subscribed, that value will be in effect every time the PVC is active. For SVC's, if the user has subscribed to the "Nonstandard Default Window Sizes" user facility option, he can negotiate for window sizes other than the default ones at call setup time by means of the "Flow Control Parameter Negotiation" X.25 facility. However such negotiation facility may not be available in all PSDN's. The user should discuss this with his PTT regarding the availability and procedure of such option.

Another point to note is that in most PSDN's and in the NIA operation, an RR packet is only sent (by the DCE or NIA) when the packet window closes. It is therefore important that the packet window size within the NIA is set identical to that subscribed for the virtual circuit.

Packet Size

Understanding that there can be considerable transit delay in delivering a data packet from the source DTE to a destination DTE, and that its flow can be further constrained by flow control parameters such as packet windows, it makes good sense to try to pack as much information into a data packet as possible. (Unless, of course, that the number of input/output data packets are small and the packet window are large enough. In this case, the smaller packets can improve throughput in that they result in shorter propagation delay.)

In the X.25 specification, the maximum user data field length in a data packet can be 16, 32, 64, 128, 256, 512 or 1024 bytes. The standard maximum User Data field length is 128 bytes. However not all of these packet sizes are available in a PSDN. For example, in Datapac, the user can use either data packets with maximum user data field of 128 bytes or 256 bytes. In Transpac, the maximum user data field allowed is 64 or 128 bytes.

Under normal data transfer conditions, it is thus advisable to use the largest data packet size allowed in a network and make each packet count so that there will be as little packet window rotation required as possible.

It is interesting to examine how the various parameters can be specified to optimize packet utilization for inbound and outbound traffic.

- Outbound from host.
 - If the X.25 NPSI licensed program is used, make sure that there is an X25VCCPT macro included in the X.25 gen with the MAXPKTL operand and specification equal to that of the largest data packet length allowed in the PSDN and a VWINDOW specification equal to the packet window size in the virtual circuit subscription. For the PVC and SVC's, make sure that the VCCINDX operand in the X25LINE or X25VC macros point to this X25VCCPT parameter table entry. If an SVC is used for outgoing calls, this VCCINDX and be overridden by the "XX" suboperand in the DIALNO operand in the PATH macro for the PU definition in the VTAM switched major node. (See the discussion of this operand in the X.25 NPSI Installation and Operation manual (SC30-3163). So be careful with this specification as well.)
 - In the NIA (Frontal and Remote model), there is a microswitch inside the box that can be set to allow the NIA to communicate in either 128 byte or 256 byte maximum packet size. So ask the IBM CE to set this microswitch according to the virtual circuit requirement.
 - If an NCP is used at the host end (regardless of whether the X.25 NPSI licensed program or the Frontal NIA is used), specify the

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BFRS operand in the NCP BUILD macro such that the output data packet utilization can be optimized. For example, if BFRS=124 is specified and RU segmentation occurs, then the middle PIU segments in the RU output chain directed to a PU type 2 terminal/cluster will be 254 bytes long. If the connection involves an NIA (i.e. type 2 virtual circuit), after adding the 2 bytes of PSH header, the data packets will be taking full advantage of the allowable maximum 256 byte user data field.

The impact of this can be better appreciated if the 512 bytes data output case is examined again.

In the discussion in "Appendix D. Data Packetization" on page 113 it was demonstrated that if BFRS=124 is specified, the 512 bytes of user data will be sent in 3 packets: 223 bytes, 256 bytes and 55 bytes. Suppose the packet window size is 3. Then these three packets can be sent in one opening in the packet window.

If BFRS=128 is specified instead, then the 512 bytes of data will be transmitted in 4 packets: 236 bytes, 256 bytes, 10 bytes and 39 bytes. (Again see the example in "Appendix D. Data Packetization" on page 113.) If the packet window size is 3, then the remote DTE will have to wait for a window rotation before it gets all the output data. The response time will also be worse by the transit delay required to send one more data packet across the network.

Thus it can be seen that an optimal BFRS specification not only can save network usage charges, but can also improve terminal response time.

It should be pointed out again that the BFRS specification has an NCP-wide implication. Before the user changes this operand, he is asked to refer to the BFRS discussion in the "NCP Definition Sample" on page 18.

The optimal BFRS specification vs maximum packet size for a type 2 virtual circuit can be summarized as follows:

Maximum Packet Size	BFRS Specification
64 bytes	56
128	120
256	124
512	124
1024	124

Please note that in an NCP environment, the MAXDATA operand in the PU macro influences whether an outbound RU should be segmented. It also dictates how many NCP buffers of data can be put into one output PIU segment. However, the actual size of the middle PIU segment is dependent on the BFRS specification. This segmentation process is discussed in detail in "Appendix D. Data Packetization" on page 113 and will not be repeated here.

- Similar tuning parameters are available in other SNA systems to allow the user to optimize his data packet utilization.

For example, if the user is using an integrated communications adapter (ICA) in a 4331 for the Frontal NIA attachment, the RU segmentation is dependent mainly on the MAXDATA specification in the PU macro under ACF/VTAME (since there is no NCP buffers to be concerned with any more). In this case, if he specifies MAXDATA=254 then the maximum PIU segments produced (this includes TH and RH) will be 254 bytes long. When the PSH header is added, the maximum data packet length will be exactly 256 bytes. Note however that, as in the MAXDATA discussion in "NCP Definition Sample" on page 18, some SNA clusters (e.g. 3684) do not support PIU segmentation and there is a restriction on the MAXDATA specification (e.g. 265 for the 3684). The user should refer to the terminal components description manual.

- Inbound to host.

- On data input from the terminals, sometimes there is not much that can be done to improve on data packet utilization.

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For example, the 3270's are hard-wired to generate 265 bytes of maximum PIU's. Assuming that the maximum allowable data packet size is 256 bytes, if an input message contains more than 245 bytes of data, then each PIU is liable to be broken up into 2 data packets by the NIA for transmission over the PSDN to the host. (A full 256 byte packet that contains 245 bytes of user data + 6 bytes of TH + 3 bytes of RH + 2 bytes of PSH header, and a smaller data packet that contains 2 bytes of PSH header + up to 11 bytes of user data.)

- On some programmable terminals, for example an 8100 system, it is possible to specify the maximum PIU size as 254 bytes (e.g. specify MAXDOUT=245 in the DASSDL macro used in 8100 host link definition. Note that this operand does not include TH and RH as in MAXDATA).
- The user may attempt to specify the inbound RU size such that input from the terminal will be sent in chains with each element less than 256 bytes.

For example, if RUSIZE operand is specified as X'7587' in the MODEENT macro that is used to define the logmode table entry for the terminal (pointed to by the DLOGMODE and MODETAB operands in the PU macro), then the maximum RU size that can be sent by this secondary LU will be 7 times 2 to the fifth power, or 224 bytes. The maximum RU size sent by the host can be 8 times 2 to the seventh power, or 1024 bytes.

Notice, however, that such specification does not necessarily work in all situations. For example, for some terminals (e.g. 3276), any input RU specifications of less than 256 (i.e. RUSIZE<X'85xx') is not acceptable as a BIND parameter. Also for some host subsystems, e.g. CICS/VS and IMS/VS, as the user is establishing an SNA-to-SNA session between the terminal LU and the application LU, an SNA BIND command will be sent from the host. There is a maximum RU size specification (for both input and output) included within this BIND command. The value is taken from the macro (e.g. DFHTCT) that is used to gen the terminal to the subsystem, and will override the RUSIZE specification in the Logon Mode Table.

- Another way for restricting the maximum inbound RU size may be to design the application such that no more than 245 bytes of data will be input at a time.

Priority Service

In some PSDN's, e.g. Datapac, it is possible to request for a high priority class of service. Usually with this class of service, the user data packets are guaranteed a faster network transit time and has a premium surcharge. There is also a more stringent restriction on the maximum data packet size (e.g. in Datapac the priority data packet must be less than or equal to 128 bytes compared to 256 bytes for normal service packets).

The user may want to make use of this class of service to get faster response time for transactions with short input/output data length characteristics. For applications whose input or output that may span over several normal size packets, however, it is doubtful whether the better throughput obtained as a result of shorter network transit and propagation delay with the priority class of service will produce a better overall response time when one considers that more data packets will be required which can be further constrained by the network's flow control apparatus.

SNA Flow Control Parameters

The user may want to review the SNA flow control parameters to make sure that he is not unnecessarily restraining the input/output capability of

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the SNA devices, especially if he is converting from conventional leased facilities to an X.25-based PSDN and the application is throughput oriented (e.g. RJE).

For example, the PACING parameter is used to regulate the output rate to an SNA device. The pacing count (N) determines the number of normal flow RU's that can flow before a pacing response is required to allow the next group of N to continue. The purpose is to prevent the host from flooding the cluster's link buffer pool area. In an X.25 environment, because of possible longer network transit time and additional X.25 flow control, by the time new data arrives at a terminal, the old data might already have been processed. Hence there might be little chance of buffer overrun. Depending on the circumstance, the user may even want to take away PACING (i.e. specify PACING=0) altogether. Pacing parameters may be specified in the SYSGEN but if non-zero parameters are present in the BIND (user specified in the LOGMODE table) then the BIND parameters will override the SYSGEN specifications. However, there may be some restriction on the PACING specification (e.g. 3274 SLU type 1 will not accept PACING=0) for certain devices. In such cases, he may want to increase the pacing group size (e.g. PACING=(5,1)) to compensate for the higher propagation delay introduced by the PSDN. When making such allowances, he should take into account that the virtual circuit is essentially a full duplex link in that the pacing response can overlap with output data packet delivery. The user is asked to first consult the device's component description manual.

The user may also want to be careful with the response type specification. For example, if the data to a device will always be sent as OIC (Only-in-Chain) RU's that are less than or equal to 245 bytes, it is redundant to specify both pacing and definite response. Throughput can be restrained by the unnecessary network traffic.

Another example is the MAXOUT specification. This parameter specifies the maximum number of PIU segments that a host can send before polling the SNA device. There are two places where this parameter can be specified: in the host PU definition and in an NIA microswitch setting. Both the Frontal and Remote NIA's have a limited amount of buffer space for staging input/output. The Frontal NIA has a terminal appearance to an SNA host in that it intercepts and responses to polling from the host. (In the case of the X.25 NPSI, there is a routine that does a similar function.) On the other hand, the Remote NIA has a host appearance to the SNA cluster in that it generates polls to the device. Under this scheme, polls will not be propagated through the network and thereby avoid unnecessary network usage charge. If an SNA cluster is used primarily for output oriented applications, the user may wish to specify a large MAXOUT value (e.g. MAXOUT=7) so as to reduce the number of non-productive polling. However, if there are several screens attached to the cluster, and/or used primarily for interactive processing, then a lower MAXOUT (e.g. MAXOUT=3) will be more appropriate. Note however that if there are more than two PVC's associated with a frontal NIA, MAXOUT cannot be specified larger than 3.

Higher Protocol

Some higher level protocol can also be used to enhance terminal output capabilities.

For example, if there are 328X printers attached to a cluster, they should be operating under SCS (SNA Character String) control rather than DSC (Data Stream Compatibility). The reason is that under DSC mode printing will not start at the terminal until a complete output chain has been received. Under SCS control printing will begin as soon as a PIU segment is received. This way, printing can overlap with data transmission and therefore can help reduce total output elapse time. Furthermore, the pacing parameter can be used more advantageous in this case.

User/Application Dialog

The user may also want to design his application such that any unnecessary dialogs between the end user and application can be minimized. An example

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may be to present a formatted screen to the end user so that all the required information can be input to the host in one data transfer.

Compression/Compaction

Compression and compaction should always be used whenever possible to reduce the amount of data that has to be transmitted, and hence transmission delay.

DTE Buffer Capacity

The user should understand the capability of the remote terminal to avoid over design. For example, the IBM 3776 has two buffers operating in flip-flop mode. Before a next buffer of data can be sent, a pacing response must first be received. In this case, it would be a waste of time to tune the network such that the host is capable of sending multiple buffers in one data transfer.

Another example is that if a terminal is only capable of printing 100 lines of output per minute, it is pointless to try to design for 300 lines per minute capability.

Host Link Congestion

Queueing theory also applies to X.25 connections. Therefore, it is important not to over-utilize the host link. As a rule of thumb, the user should design his network such that the aggregated data rate at peak time from all the virtual circuits sharing the host physical access line will not exceed 50-60% of its capacity. The reason is that once this usage rate is approached, the queueing delay and host (or NCP) buffer storage will increase exponentially. All users will then realize a significant degradation in service.

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APPENDIX A. NIA WORKSHEETS

This Appendix contains uncompleted examples of the NIA worksheets, the first three are for the frontal NIA and the last three for the remote NIA. These samples are purposely left blank that the user may make photocopies of them for further use.

IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
FRONTAL - LAP Protocol

SERIAL NUMBER		LOCATION					
PARAMETER	SPECIFY	OPTION	SWITCH				
			ON	A OFF	ON	B OFF	
5973-L02 Frontal	7042	NIA-F					
PPSN Link Access Procedure	7038	LAP		4			
PPSN Packet Length	7035	128 bytes		2	2		
	7036	256 bytes	2			2	
Terminal/Cluster(DTE) Signalling Rate BPS	7044	1200					Set Strap 1
	7045	2400					Set Strap 2
	7046	4800					Set Strap 3
	7047	9600					Set Strap 4
PPSN Circuit Type and Quantity of PVCs	7049	SVC			7		
	7058	1 or 2		7		7	
	7059	3 or 4	7			7	
Lower Virtual Circuit Address	7050	Address 0				3	
	7051	Address 1			3		
PPSN Packet Window Size	7052	2 Packets		5		4,5	
	7053	3 Packets		5	5	4	
	7054	4 Packets	5			4,5	
	7055	5 Packets	5		5	4	
	7056	6 Packets		5	4	5	
	7057	7 Packets		5	4,5		
PPSN Time Out Delay at LAP Level	7060	.5 second	6			6	BPS 9600
	7061	1 second		6	6		4800
	7062	2 seconds		6		6	1200/2400

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IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
FRONTAL - LAP-B Protocol

SERIAL NUMBER		LOCATION					
PARAMETER	SPECIFY	OPTION	SWITCH				
			A		B		
			ON	OFF	ON	OFF	
5973-L02 Frontal	7042	NIA-F					
PPSN Link Access Procedure	7158	LAP-B					
PPSN Packet Length	7035	128 bytes		2	2		
	7036	256 bytes	2			2	
Terminal/Cluster(DTE) Signalling Rate BPS	7044	1200					Set Strap 1
	7045	2400					Set Strap 2
	7046	4800					Set Strap 3
	7047	9600					Set Strap 4
PPSN Circuit Type	7049	SVC			7		
Quantity of PVC's	7053	1 or 2		7		7	
	7059	3 or 4	7			7	
Lower Virtual Circuit Address	7050	Address 0				3	
	7051	Address 1			3		
PPSN Packet Window Size	7052	2 Packets		5		4,5	
	7053	3 Packets		5	5	4	
	7054	4 Packets	5			4,5	
	7055	5 Packets	5		5	4	
	7056	6 Packets		5	4	5	
	7057	7 Packets		5	4,5		
PPSN Time Out Delay at LAP Level	7060	.5 second	6			6	BPS 9600
	7061	1 second		6	6		4800
	7062	2 seconds		6		6	1200/2400

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IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
 - FRONTAL *-----*

 | SERIAL NUMBER _____ | LOCATION _____ |

Network Interface Adapter Circuit Board A.

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IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
REMOTE - LAP Protocol

SERIAL NUMBER		LOCATION					
PARAMETER	SPECIFY	OPTION	SWITCH				
			ON	A OFF	ON	B OFF	
5973-L02 Remote	7043	NIA-R					
PPSN Link Access Procedure	7038	LAP		4			
DTE SDLC Window Size	7033	3 Frames		1			
	7037	7 Frames	1				
PPSN Packet Length	7035	128 bytes		2	2		
	7036	256 bytes	2			2	
Terminal/Cluster(DTE) Signalling Rate BPS	7044	1200					Set Strap 1
	7045	2400					Set Strap 2
	7046	4800					Set Strap 3
	7047	9600					Set Strap 4
PPSN Circuit Type	7049	SVC			7		
	7058	PVC		7		7	
Lower Virtual Circuit Address	7050	Address 0				3	
	7051	Address 1			3		
PPSN Packet Window Size	7052	2 Packets		5		4,5	
	7053	3 Packets		5	5	4	
	7054	4 Packets	5			4,5	
	7055	5 Packets	5		5	4	
	7056	6 Packets		5	4	5	
	7057	7 Packets		5	4,5		
PPSN Time Out Delay at LAP Level	7060	.5 second	6			6	BPS 9600
	7061	1 second		6	6		4800
	7062	2 seconds		6		6	1200/2400

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IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
REMOTE - LAP-B Protocol

SERIAL NUMBER		LOCATION					
PARAMETER	SPECIFY	OPTION	SWITCH				
5973-L02 Remote	7043	NIA-R					
PPSN Link Access Procedure	7158	LAP-B					
			ON	A OFF	ON	B OFF	
DTE SDLC Window Size	7033	3 Frames		1			
	7037	7 Frames	1				
PPSN Packet Length	7035	128 bytes		2	2		
	7036	256 bytes	2			2	
Terminal/Cluster(DTE) Signalling Rate BPS	7044	1200					Set Strap 1
	7045	2400					Set Strap 2
	7046	4800					Set Strap 3
	7047	9600					Set Strap 4
PPSN Circuit Type	7049	SVC			7		
	7058	PVC		7		7	
Lower Virtual Circuit Address	7050	Address 0				3	
	7051	Address 1			3		
PPSN Packet Window Size	7052	2 Packets		5		4,5	
	7053	3 Packets		5	5	4	
	7054	4 Packets	5			4,5	
	7055	5 Packets	5		5	4	
	7056	6 Packets		5	4	5	
	7057	7 Packets		5	4,5		
PPSN Time Out Delay at LAP Level	7060	.5 second	6			6	BPS 9600
	7061	1 second		6	6		4800
	7062	2 seconds		6		6	1200/2400

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IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
 - REMOTE *-----*

 | SERIAL NUMBER _____ | LOCATION _____ |

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APPENDIX B. NIA LED DISPLAYS

The following table reflects the most common LED displays and is not necessary complete.

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```

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
LED
LEFT RIGHT | NIA STATE
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
DURING PROGRAM LOADING FROM CASSETTE TAPE.
-----
'0' | | Normal.
-----
'0' | E | Diagnostic - no loading at all.
'0' | F | - incorrect loading.
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
DURING INITIAL TEST ROUTINES.
-----
3 | | Normal.
5 | |
6 | |
-----
5 | E | Diagnostic - No clocking received from modem.
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
DURING X.25 LINK LEVEL ESTABLISHMENT.
-----
A | | Normal.
-----
'A' | 0 | Diagnostic - DCE interface not active.
'A' | 4 | - No UA response from network.
'A' | 5 | - No SARM (LAP only) received from network.
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
WAITING FOR CALL ESTABLISHMENT (SVC only).
-----
B | | Normal.
-----
'B' | 1 | Diagnostic - No DTR on from host communication adapter.
'B' | E | - Call CLEAR by NIA or by network. (1)..
'B' | F | - Invalid keying error on call set up.
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
DURING XID AND CONTACT.
-----
E | | Normal.
-----
'E' | 1 | Diagnostic - No DTR on from host communication adapter.
'E' | E | - RESET by NIA or by network. (1)..
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

```

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```

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  LED
  LEFT RIGHT | NIA STATE
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  F           | DURING DATA EXCHANGE.
-----
  'F'        E | Normal.
-----
  'F'        E | Diagnostic. (1)..
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  NOTES
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  ' '        | Means flashing of the LED.
-----
  (1)..      | Complementary information is available by
  A          i | pressing the "ENTER" key on the NIA.
  X          X | Then the LED's display successively and
  Y          Y | cyclically.
  Z          Z |   i = Virtual Circuit Number (frontal NIA only).
  A          j |   XX = Command received or sent (FB for RESTART).
  X          X |   YY = Cause value.      (See remote NIA problem )
  Y          Y |   ZZ = Diagnostic value (determination for some )
  Z          Z |                   (examples of cause value)
  A          k |                   (and diagnostic value. )
  .. and so on.
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  
```


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APPENDIX C. NIA SPECIFY CODES FOR ORDERING

1. ATTACHED EQUIPMENT
 - 7042 FOR FRONT-END NIA, I.E. ATTACHED TO A HOST
 - 7043 FOR REMOTE NIA, I.E. ATTACHED TO A REMOTE TERMINAL
2. LANGUAGE
 - 2927 UK-ENGLISH PANEL, UK-ENGLISH SAFETY LABELS (UK)
 - 2928 FRENCH PANEL, FRENCH SAFETY LABELS
 - 2929 GERMAN PANEL, GERMAN SAFETY LABELS
 - 2932 ITALIAN PANEL, ITALIAN SAFETY LABELS
 - 2934 CANADIAN-ENGL. PANEL, BILINGUAL (ENGL-FRENCH) SAFETY LABELS
 - 2935 CANADIAN-FRENCH PANEL, BILINGUAL (FRENCH-ENGL) SAFETY LABEL
3. CABLE LENGTH TO PSDN DCE
 - 9695 1.8 METRES (6 FEET)
 - 9696 4 METRES (13 FEET, 4")
 - 9697 8 METRES (26 FEET, 8")
 - 9698 15 METRES (50 FEET)
4. POWER SUPPLY (SINGLE-PHASE ONLY)
 - 2813 FOR 220 V, 50 HZ (FRANCE, GERMANY, NETHERLANDS, UK, BELGIUM, LUXEMBURG, ITALY, SWITZERLAND, DENMARK)
 - 9901 FOR 115 V, 60 HZ (CANADA & USA)
5. LOWER VIRTUAL-CIRCUIT ADDRESS
 - 7050 ADDRESS IS 0 (ZERO)
 - 7051 ADDRESS IS 1
6. PSDN CIRCUIT TYPE AND NUMBER OF PVCS
 - 7049 SVC (SWITCHED)
 - 7058 1 OR 2 PVCS (WITH SVC BACK-UP CAPABILITY, IN CASE OF REMOTE NIA)
 - 7059 3 OR 4 PVCS (VALID ONLY FOR FRONT-END NIA-SC7042)
7. PSDN PACKET-LENGTH
 - 7035 128 BYTES
 - 7036 256 BYTES
8. PSDN PACKET WINDOW-SIZE (DEFINES THE DEFAULT VALUE WHENEVER "ADAPTATION OF WINDOW-SIZE AT CALL TIME" IS NOT USED).
 - 7052 2
 - 7053 3
 - 7054 4
 - 7055 5
 - 7056 6

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- 7057 7
9. PSDN LINE-ACCESS PROCEDURE
- 7038 LAP, CONVENIENT FOR EURONET DIRECT ACCESS, AND DATAPAC UNTIL END 1982.
 - 7158 CONVENIENT FOR OTHER NETWORKS (LAPB) INCLUDING USA NETWORKS, AND EURONET INDIRECT ACCESS. NOTE THAT ADDITIONAL FUNCTIONS LIKE SVC BACK-UP (ON REMOTE NIA) AND EVENT-LOG TOOL (ON FRONT-END NIA) ARE AVAILABLE ONLY IF THIS SC 7158 IS ORDERED
10. PSDN TIME-OUT DELAY AT LAP LEVEL
- 7060 0.5 SEC
 - 7061 1 SEC
 - 7062 2 SEC
- (RECOMMENDED DELAY DEPENDS UPON SUBSCRIBED SIGNALLING RATE: 2 SEC FOR 1200 OR 2400 BPS, 1 SEC FOR 4800 BPS, AND 0.5 SE FOR 9600 BPS)
11. TERMINAL SDLC-FRAME WINDOW-SIZE (ONLY FOR REMOTE NIA 7043)
- 7033 3
 - 7037 7
12. TERMINAL SIGNALLING RATE
- 7044 1200 BPS
 - 7045 2400 BPS
 - 7046 4800 BPS
 - 7047 9600 BPS

New Microcode

As from July 1982 new microcode was shipped for every newly built NIA. The new microcode consists of two versions for the Frontal NIA and two versions for the Remote NIA. A new specify code S/C 7158 is also being introduced for microcode that applies to the LAP-B protocol.

New functions are available with this microcode, are:-

- Switched Network backup,
- modified Wrap function, and
- an Event Log

which are explained in "New Microcode Function" on page 111.

The following table reflects the July 82 NIA microcode status,

- Frontal NIA:
 - S/C 7038 (LAP protocol) 'PN1' = P/N 4010865 E/C 873380
 - S/C 7158 (LAP-B protocol) 'PN2' = P/N 8684648 E/C 467516
- Remote NIA:
 - S/C 7038 (LAP protocol) 'PN1' = P/N 4010867 E/C 873381
 - S/C 7158 (LAP-B protocol) 'PN2' = P/N 8684649 E/C 467517

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in which PN1 is the current microcode and PN2 is the July 82 microcode. For each NIA as shown in the table there are two cassette part numbers (P/N) and engineering change levels (E/C).

The type PN2 cassettes are required for all LAP-B X.25 networks and should be ordered through the IBM marketing representative. Note that the NIA switch setting for LAP/LAP-B protocol has no affect with the PN2 microcode. This implies that a code migration from the PN1 cassette to a PN2 cassette may be performed without a change of this switch. On the other hand, in the case of the migration from the PN2 cassette to the PN1 cassette, it will be necessary to verify the NIA switch setting. For more information on the NIA switch settings see the section "NIA Worksheets" on page 52.

New Microcode Function

The new microcode functions are only available on the PN2 cassettes. They are:-

1. The Switched Network Backup function

When the remote NIA is in permanent (PVC) mode, the SNBU function allows the operator to use the remote NIA in switched (SVC) mode in the case of PVC failure in the PSDN. The SNBU function is only available on remote PN2 cassettes.

2. The Wrap Function

The modified Wrap function is available only on PN2 cassettes for both Frontal and Remote NIA's.

3. The Event Log function

This function is provided to assist with X.25 network problem determination by logging automatically and dynamically events in a memory log area. This function is only available on Frontal PN2 cassettes. The EVENT LOG function also provides sub-functions to access, display and erase the logged data. The logged events are classified by X.25 level, as shown below.

- X.25 level 1 - hardware link between NIA and PSDN.

The recorded events for this level, are:-

- DSR off
- CTS off
- DCD off

- X.25 level 2 - LAP level between NIA and PSDN.

The recorded events for this level, are:-

- SABM, DISC, REJ and CMDR received from network
- DISC, REJ, CMDR, BAD FCS, RNR and TIME OUT transmitted from NIA

- X.25 level 3 - PLP level between NIA and PSDN.

The recorded events for this level, are:-

- RESTART, RESET and CLEAR received from PSDN or transmitted from NIA

These new functions are fully described in new releases of the relevant NIA Product Description Manuals (Frontal GA11-8642 and Remote GA11-8643). Descriptions of these new functions are provided in "Appendix I. NIA New Microcode Function" on page 147 for use until the new versions of the manuals are available.

The objective of this appendix is to explain how PIU segmentation is performed within the NCP, and how the X.25 NPSI licensed program structures these segments into data packets for transmission to another SNA node. Users who do not have a 3705 installed may wish to skip this section.

SNA DATA FLOW

In SNA, every message entering or exiting a common transmission network is referred to as a request or a response. This unit of information is called a request/response unit (RU).

In order for the RU to travel in the transmission subsystem, it must include a number of headers to ensure proper routing and end-to-end coordination. The unit of data and control information passed between the transmission control and path control layers in SNA is called a Basic Information Unit (BIU). It consists of the RU and a request/response header (RH). The RH is used to manage the flow of all RU's, e.g. whether data is to be transmitted in a chain and the type of response expected.

The BIU (especially on data output) is usually too large for effective transmission over communications facilities. In order to have better response time and less retransmission in case of line failures, BIU's are sometimes segmented into smaller units for transmission.

When a BIU or a BIU segment is passed to the SNA path control layer, a Transmission Header (TH) is added which is used to control the physical routing of the message towards its destination. It also identifies the protocol format used and whether the unit of information has been segmented. This unit of information is called a Path Information Unit (PIU). Thus a PIU consists of either a TH and a BIU (TH+RH+RU - without segmenting) or a TH and a BIU (TH+RU - with segmentation) segment. Because of this segmentation, it is sometimes referred to as a PIU segment.

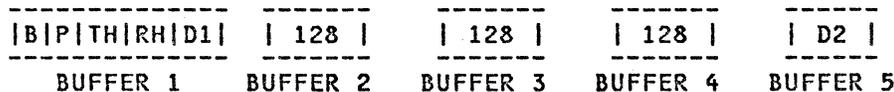
It is interesting to follow how the RU is segmented and packetized enroute from the host to the remote terminal via the NCP, X.25 NPSI and an X.25 PSDN.

PIU SEGMENTATION

The output segment size from an NCP is dependent on the actual RU size, the NCP buffer size (BFRS) and the PU MAXDATA specifications.

On data output, NCP will first compare the PIU size (RU + TH + RH) with the MAXDATA specification for the physical unit. If the PIU is smaller than or equal to MAXDATA, the user data will be sent out as a PIU with only 1 segment. If the PIU size is larger than MAXDATA, then it will be broken up into multiple PIU segments for transmission.

Suppose there are 512 bytes of user data to be transmitted and BFRS is defined as 128 and MAXDATA as 265. The user data will be stored in the NCP buffer as follows:



- where B = Buffer Control field - 18 bytes.
- P = Pad from TH conversion.
- TH = SNA Transmission Header.
- RH = SNA Request/Response Header.
- D1 = User data in 1st buffer.
- D2 = User data in last buffer.

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The Pad (P) bytes and TH requirements are dependent on the SNA PU type of the destination SNA node and the ACF/NCP/VS release level. In SNA terminology, a cluster controller such as a 3274, 3276, or 368X is classified as a PU type 2 and communicates in a FID2 (Format Identifier) format. Some terminals, e.g. 3767, are classified as a PU type 1 and use the FID3 format. An NCP is classified as a PU type 4 and communicates in a FID4 format. (Version 1 Release 2.1 uses the FID 1 format). The following table is a summary of the various FID and buffer pad bytes and TH/RH relationship:

	ACF/NCP/VS R2.1				ACF/NCP/VS R3				
	B	P	TH	RH	B	P	TH	RH	
FID 2	18	4	6	3	18	20	6	3	bytes
FID 3	18	8	2	3	18	24	2	3	bytes
FID 4	18	-	-	-	18	0	26	3	bytes

Assuming that the remote SNA node is a PU type 2 supported by ACF/NCP/VS R2.1, after allowance has been made for the buffer control, pad bytes and TH/RH, the first buffer will contain 97 (D1 = 128 - 18 - 4 - 6 - 3) bytes of user data. The second, third and fourth buffers will contain 128 bytes of user data. The remaining 31 bytes (D2 = 512 - 97 - 128 - 128 - 128) of user data will be placed in the fifth buffer.

Before data transmission, NCP will divide MAXDATA by BFRS to determine the number of NCP buffers to send in one data transfer. In this example, then, up to 2 buffers (265/128=2.07 rounded down to 2) of data will be selected as a BIU segment. As the each BIU segment is passed to the NCP path control layer for eventually transmission, a TH is added to each BIU to form a PIU segment.

The PIU segments will appear as follows:

----- TH RH 225 ----- PIU #1	----- TH 256 ----- PIU #2	----- TH 31 ----- PIU #3	TH = 6 bytes, RH = 3 bytes
---	--------------------------------------	-------------------------------------	----------------------------

Packetization

If the other end of the virtual circuit connection is an SNA peripheral node attached to a remote NIA (that is, a type 2 virtual circuit is used), before each PIU segment is transmitted, the X.25 NPSI will check to see if the segment can be fitted into a data packet. Suppose the maximum data packet size is 256 bytes (as specified as the VCCINDX operand for the virtual circuit which points to a VCCPT connection table entry with MAXPKTL as 256). If a PIU segment is less than or equal to 254 bytes, then it can be sent out as one data packet even after a two byte PSH header has been added. If a PIU segment is greater than 254 bytes, then the first 254 bytes along with a two byte PSH header will be put in the first data packet. Another two bytes of PSH header will be added to the remaining of the PIU segment to be sent out as a second packet.

Thus, in the above example, 4 data packets are required to sent the PIU segments:

----- PIU #1	----- PIU #2	----- PIU #3
PSH TH RH 225	PSH TH 248	PSH 8
-----	-----	-----
PACKET #1	PACKET #2	PKT #3
		PACKET #4

Suppose that BFRS=124 is specified instead, while all other parameters remain unchanged. Then following the same logic as discussed above, the PIU segments will be:

----- TH RH 217 ----- PIU #1	----- TH 248 ----- PIU #2	----- TH 47 ----- PIU #3
---	--------------------------------------	-------------------------------------

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On output from the X.25 NPSI, these will be sent in three data packets:

----- PSH TH RH 217 -----	----- PSH TH 248 -----	----- PSH TH 47 -----
PACKET #1	PACKET #2	PACKET #3

It can therefore be seen that although BFRS=128 is an optimal specification for SDLC link utilization when the NCP is used predominantly for SDLC 3270 connections, it does not necessarily provide good data packet usage. This is especially true when an RU consists of multiple PIU segments where each middle segment has to be broken into a full packet and a small trailer packet. If the NCP is to be used mainly for X.25 connections, then the user may want to trade SDLC link utilisation for less data packet requirement and better network performance.

Note that even though the buffer padding requirement is different in ACF/NCP/VS Release 3 (20 bytes as opposed to 4 bytes in ACF/NCP/VS R2.1), this only means that there will be 16 bytes (=20-4) of user data shifted from the first buffer to the last buffer. BFRS=124 is still an optimal specification. It will not affect packet sizes for the middle PIU segments.

Using the same logic, optimal BFRS specifications can also be deduced for various maximum data packet sizes:

Maximum Packet Size	BFRS Specification
64 bytes	56
128	120
256	124
512	124
1024	124

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APPENDIX E. SYSTEM/34 DEFINITIONS FOR X.25 CONNECTION

This section provides sample System/34 configuration screens for defining a link to a frontal NIA for connection to a PSDN. The remote end of the network can only be an IBM 5250 Information Display System with integrated X.25 attachment feature or through a remote IBM 5973-L02 NIA. This section also mentions the hardware settings required to the communications adapter for frontal NIA attachment.

SAMPLE SYSTEM/34 CONFIGURATION DISPLAYS

The following are a sample of the IBM System/34 Configuration Display Screens as might be configured by a user for a remote line to a frontal NIA. For more information refer to the IBM System/34 Installation and Modification Reference Manual - SC21-7689.

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1. The first display below is for the System Configuration Menu. In our example the user entered selection 16 to review configuration parameters.

```
          ** 1.0  SYSTEM CONFIGURATION MENU **

1 FULL SYSTEM CONFIGURATION          9 CREATE/EDIT WORK STATION PARAMETERS
2 ALTER WORK STATION ENVIRONMENT     10
3 ALTER SYSTEM PARAMETERS            11
4 ALTER WORK STATION CONFIGURATION   12
5 ALTER SNA/SDLC PARAMETERS          13
6 ALTER P/P AND COMMUNICATION SUPPORT 14 BASIC CONFIGURATION WITH DEFAULTS
7                                     15 RELEASE UPDATE
8                                     16 REVIEW CONFIGURATION PARAMETERS

      ENTER SELECTION - 16          CMD KEY 9 - END
```

Figure 5. System/34 System Configuration Menu Display Screen

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2. This next screen is a display of the Remote Work Station Line Configuration. In this case line 3 was chosen for the X.25 link. The link is defined as switched (SVC) with manual call.

** 2.2 REMOTE WORK STATION LINE CONFIGURATION **

SPECIFY:		LINE #:	1	2	3	4
1. REMOTE LINE USE:	(0-NO 1-YES)		1	1	1	1
2. REMOTE LINE SWITCHED:	(0-NO 1-YES)		0	0	1	1
3. SWITCH TYPE:	(0-NONE 1-MANUAL CALL 2-AUTO ANSWER 3-MANUAL ANSWER)		0	0	1	1
4. SLOW POLLING:	(0-NO 1-YES)		0	0	1	1

CMD KEY 5 - VERIFY

ENTER - CONTINUE

CMD KEY 19 - CANCEL

Figure 6. System/34 Display 2.2 Remote Work Station Line Configuration Screen

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3. This display screen shows the remote work station configuration, which consisted of 2 displays and 1 printer. The only information pertinent to the link is the station address which is 'C1' which is a frontal NIA requirement for a SVC.

2A REMOTE WORK STATION CONFIGURATION	LINE #	3	CONTROLLER LOGICAL ID STATION ADDRESS ALTERNATIVE LINE #	C01 C1 4
1. LOGICAL ID:		R1 R2	PR	
2. DEVICE TYPE:		D D	P	
3. UNIT ADDRESS:		00 02	04	
4. ATTRIBUTE:		E	C	
5. DEFAULT PRINTER:		PR	PR	

CMD KEY 4/ENTER - CHANGE SETS CMD KEY 5 - VERIFY ROLL KEYS - PAGING
CMD KEY 9 - END CMD KEY 19 - CANCEL HELP - DEFINITIONS

Figure 7. System/34 Display 2.A Remote Work Station Configuration Screen

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4. The last sample display screen is the SDLC Line 3 Configuration which is obtained by the command 'D C' and then scroll passed the 4 BSC line displays and the first 2 SDLC lines.

NOTE: The station address C3 as shown on this display only applies when the System/34 is on the secondary end of a link to a host system.

SDLC LINE 3 CONFIGURATION

RATE.....	FULL	SWITCH TYPE.....	MANUAL CALL
MODEM.....	NON-IBM	STATION ADDRESS.....	C3
TONE.....	N	EXCHANGE ID.....	AAAAA
CLOCK.....	MODEM	LINE.....	NORMAL
LINE TYPE...	SWITCHED	RECEIVE BUFFERS.....	007
		TRANSMIT BUFFERS.....	007

ENTER F-FORWARD, I-INPUT, R-RESTART, U-UPDATE, OR E-END..... F

Figure 8. System/34 SDLC Line 3 Configuration Display Screen

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SYSTEM/34 HARDWARE SETTINGS.

The IBM Customer Engineer is required to make the changes to the communications adapters for X.25 operation. The switch settings depend on the type of adapter physically installed on the System/34, and can be one of two types.

1. The Multiline Communications Adapter.

SWITCH 1 has to be OFF for X.25 link operation which is only half-duplex. The Request to Send lead is brought up by the System/34 when required to transmit data.

SWITCH 4 to be set to NOT NRZI CODING, which is the ON position.

2. The Standard Communications Adapter.

SWITCH 1 has also to be set in the OFF position for half-duplex line operation.

For this adapter SWITCH 3 has to be ON for the NOT NRZI CODING. X.25 only supports the NRZ option.

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APPENDIX F. X.25 NETWORK DEFINITION SAMPLE

```

*****
* X25 NPSI R 2 STAGE 1 INPUT *- UNIQUE GENERATION NUMBER = 3 -----*
*****
* 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 WITH THE USE OF A SERIES/1 AS A *
* PSDN.                                                                *
* 4 TESTS CAN BE DONE, IE CPU TO CPU PCNE LLC TYPE 0 (2 MCH),      *
* CPU TO 327X LLC TYPE 2 PVC AND SVC (1 MCH) WITH REMOTE NIA,      *
* CPU TO 327X LLC TYPE 2 PVC WITH FRONTAL AND REMOTE NIA,         *
* CPU TO 327X LLC TYPE 2 SVC WITH FRONTAL AND REMOTE NIA,         *
* (NOTE: THE LAST 2 TESTS ARE NOT DEFINED TO X.25 NPSI).           *
*****
*           * ----- TEST 1 ----- *
*----- CPU TO CPU PCNE TYPE 0 VIRTUAL CIRCUIT -----*
*-----MCH CHARACTERISTICS-----*
*-----*
*           DTE 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*** AS PSDN *****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-----*
*-----*
*           DTE 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*** AS PSDN *****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-- |
* --2---SVC---128-----3-- | | --1---SVC---128-----3-- |
*
*****
*           * ----- TEST 3 ----- *
*----- CPU TO 327X PSH TYPE 2 VIRTUAL CIRCUIT -----*
*-----MCH CHARACTERISTICS-----*
*-----*
*           DTE END                                     DTE END
* FRONTAL NIA                                         REMOTE NIA

```

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```

* LINE NAME      = L040A6
* PU NAME       = P040A6A
* M/WINDOW      = 7
SERIES/1        M/WINDOW      = 7
****VIRTUAL CIRCUIT DATA**** AS PSDN ****VIRTUAL CIRCUIT DATA****
* VC/NO TYPE PKT/SZ V/WNDW
* --1---SVC---256-----3---|=====|-----|--1---SVC---256-----3---
*
*
* *****
* * ----- TEST 4 ----- *
* ----- CPU TO 327X PSH TYPE 2 VIRTUAL CIRCUIT -----
* -----MCH CHARACTERISTICS-----
*
* DTE END DTE END
* FRONTAL NIA REMOTE NIA
* LINE NAME = L040A7
* PU NAME = P040A7A/C
* LU NAME = T040A7A1/C1
* M/WINDOW = 7
SERIES/1        M/WINDOW      = 7
****VIRTUAL CIRCUIT DATA**** AS PSDN ****VIRTUAL CIRCUIT DATA****
* VC/NO TYPE PKT/SZ V/WNDW
* --1---PVC---128-----3---|=====|-----|--1---PVC---128-----3---
*
*
* *****
* X25BUILD - THIS MACRO DESCRIBES THE GENERATION PROCESS.
*
* *****
WTCX252 X25BUILD IDNUMH=01, ID FOR NON-SNA SWITCHED SUPPORT C
JOB CARD=YES, USE OS JOB CARD FROM 'MODS.GEN3705' C
MACLIB=STAGE2, WORK DATA SET FOR NPSI STAGE 2 OUTPUT C
MCHCNT=3, 3 MCH LINKS DEFINED C
QUALIFY=NCP715, USE NPSI R2 AND NCP R2.1 DATA SETS C
SNAP=NO, SNAP FACILITY NOT ALLOWED. C
SRCHI=X25BLK3, STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
SRCLO=X25TBL3, STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
SRCPRFX=X25, STAGE 2 OUTPUT TABLES & BLOCKS PREFIX C
TYP SYS=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
INSLW=(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
INSLW=(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
INSLW=(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
INSLW=(25,0), FREE BUFFER PERCENTAGE C

```

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```

**          VWINDOW=7          PACKET TRANSMIT/RECEIVE WINDOW SIZE
**
** X25VCCPT INDEX=5,          TABLE ENTRY NUMBER          C
**          MAXPKTL=64,       MAXIMUM PACKET LENGTH EXCL PACKET HDR C
**          INSLW=(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
**          INSLW=(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
**          INSLW=(25,0),     FREE BUFFER PERCENTAGE      C
**          VWINDOW=2        PACKET TRANSMIT/RECEIVE WINDOW SIZE
**
**
** *****
** *          X250UFTT - SVC USER FACILITIES AND CALL USER DATA TABLE.          *
** *          X250UFTT INDEX=1          TABLE ENTRY NUMBER          *
** *          X25MCH - DESCRIBE THE PHYSICAL MULTICHANNEL LINK.          *
** *          - DTE 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
** *          LCH0=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
** *          PKTMODL=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=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
**
** *****
** *          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

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```

**          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,        NOT USED FOR SWITCHED              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,        NOT USED FOR SVC                  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,        OPERAND NOT USED FOR SVC            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.      *
*   - DTE END 0A2/0A3                                     *
*
*****
XM040A2 X25MCH ADDRESS=(0A2,0A3), 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
      MNWINDOW=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
      PKTMODL=8,      MODULO 8 PACKET NUMBERING              C
      PROTCOL=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
**
*****
*

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```

*      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,     OPERAND NOT USED FOR SVC             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,     OPERAND NOT USED FOR SVC             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,     OPERAND NOT USED FOR SVC             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.
*      - DTE 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(2),  LOGICAL CHAN GRP 0, UP TO CHAN #2    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=(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
        PKTMDL=8,     MODULO 8 PACKET NUMBERING            C
        PROTCOL=LAPB, LINK ACCESS BALANCED PROTOCOL       C
        PUNAME=XP040A4, MCH PU NAME (SEE NAMING STANDARDS) C
        SPEED=2400,   SPEED OF PHYSICAL CIRCUIT.           C

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```

STATION=DTE,          NO CONNECTION TO A NETWORK NODE      C
DTIMER=1,            TIME (SECS) BETWEEN ND RETRANSMISSIONS
TPTIMER=1.0          X25 T1 TIMER IN SECS
**
*****
*
*   X25LCG - DESCRIBE THE LOGICAL CHANNEL GROUP.
*
*
*****
X25LCG LCGN=0          LOGICAL CHANNEL GROUP NUMBER
**
*****
*
*   X25LINE - DESCRIBE THE VIRTUAL CIRCUIT.
*
*
*****
L040A4A 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
**
P040A4A X25PU  PUTYPE=2,          ATTACH TO AN SNA 3276 VIA REMOTE NIA  C
                    ADDR=C1,        STATION ADDRESS IS ALWAYS 'C1' FOR NIAC
                    MAXDATA=137,    DEPENDANT ON PU CONSTRAINTS          C
                    PASSLIM=7,      MAXIMUM PIU SEGMENTS IN TRANSMISSION  C
                    MAXOUT=7,       MAXIMUM SDLC FRAMES BEFORE LINK RESP  C
                    ISTATUS=ACTIVE,  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
**
*****
*
*   X25LINE - DESCRIBE THE VIRTUAL CIRCUIT.
*
*
*****
L040A4B X25LINE LCN=2,          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,        THIS OPERAND IGNORED FOR SVC          C
                    VCCINDX=1,       INDEX IN CONNECTION PARAMETER TABLE  C
                    CALL=INOUT       BOTH ENDS MAY ESTABLISH CALLS
**
P040A4B X25PU  PUTYPE=(1,2),     ALLOW BOTH PU TYPES 1 AND 2          C
                    MAXLU=1         1 LOGICAL UNIT
**
                    USUALLY MAXLU SHOULD BE GT 1.
**
*****
*
*   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=X25NCP3, 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=X25HI3,  STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
                    INCINIT=X25INI3,  STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
                    INCL2LO=X25LOI3,  STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
                    ORDINIT=X25INO3,  STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
                    ORDL2HI=X25HI03,  STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
                    ORDL2LO=X25LO3,   STAGE 2 OUTPUT MEMBER NAME (2 = GENNO)C
                    SCANCTL=(2,2)     SCANNER 2 & 3 SCAN LIMITS & ADDR SUBS
**
END

```

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APPENDIX G. NCP DEFINITION SAMPLE

```

*****
* NCP STAGE 1 INPUT *- UNIQUE GENERATION NUMBER = 3 -----*
*****
* THE UNIQUE GENERATION NUMBER (ALSO REFERRED TO AS 'GENNO') IS *
* USED IN THE FOLLOWING PLACES IN THIS INPUT SOURCES CODE:- *
* 1 - AS THE LAST DIGIT IN 'NEWNAME' BELOW. *
* 2 - 'NEWNAME' AND 'OBJQUAL' IN THE 'NCPBUILD' MACRO. *
* 3 - IN THE COMMENTS PRECEEDING 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 = N043FX3 * 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 DTE 1D *
* * * * *
* A2/A3 X25 , FDX, NO NO NO STATION DTE 1D *
* * * * *
* A4/A5 X25 , FDX NO NO NO STATION DTE 1D *
* * * * *
* A6 SDLC, HDX, NO NO NO FRONTAL NIA 1D *
* * * * *
* A7 SDLC, HDX, NO NO NO FRONTAL NIA 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 *

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```

*****
VTAMV2R1 PCCU CUADDR=0FB,          3705 CONTROL UNIT ADDRESS      X
                AUTODMP=NO,         AUTODMP IF NCP FAILS          X
                AUTOIPL=NO,         AUTOIPL AND RESTART          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
    
```

```

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

```

NCPBUILD BUILD ABEND=YES,          X
                ASMXREF=NO,         NO ASSEMBLER CROSS-REFERENCE X
                BFRS=128,          NCP BUFFER SIZE              X
                CA=(TYPE1),        CHANNEL ADAPTER TYPES        X
                CHANTYP=TYPE1,     X                             X
                CSMHDR=27F5C711C3F0405C40C8C4D9405C, 3270 CRITSIT HEADERX
                CSMHDRC=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
                ENABLTO=6.5,       IBM 386X REQUIRE 6.5 AS MINIMUM X
                JOBCARD=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=N043FX3,   NAME OF THIS LOAD MODULE (3 = GENNO)X
                OBJLIB=OBJWORK,    LIBRARY FOR ASSEMBLER OUTPUTS X
                OBJQUAL=X3,        X = X25, 3 = 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
                PRNGEN=(NOGEN,NOGEN), GENERATED STATEMENTS NOT PRINTED X
                REMLOAD=YES,       RPL INSTALLED              X
                RESOEXT=40,        ALLOW 40 NAUS TO BE RE-USED X
                SLODOWN=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
                TYPYS=OS,        OS USED FOR STAGE 2      X
                UNIT=SYSDA        DATA SET FOR ASSEMBLY AND LINK EDIT
    
```

```

*****
* SYSCNTRL MACRO SPECIFICATIONS *
*****
    
```

```

NCPSSYC 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,      MINIMISE ASYNCH CHANNEL INTERRUPTS X
                TIMEOUT=120,     AUTO SHUT DOWN IF NO RESP IN 2 MIN X
                UNITSZ=152        VTAM IO BUFFER SIZE (IOBUF)
    
```

```

*
*****
* CSB MACRO SPECIFICATIONS *
*****
    
```

```

NCPCSB0 CSB SPEED=(150,600,1200),  BUS MACH CLOCKS          X
                MOD=0,           SCANNER ADDRESS 020 TO 03F X
                TYPE=TYPE3,      TYPE 3 COMM SCANNER
NCPCSB1 CSB SPEED=(134,300,600,1200), BUS MACH CLOCKS          X
                MOD=1,           SCANNER ADDRESS 0A0 TO 0CF X
    
```

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```

TYPE=TYPE2                TYPE 2 COMM SCANNER
*****
* SWITCHED LINE LU POOL *
*****
SWPOOLU  LUDRPOOL NUMTYP1=10,NUMTYP2=10
**
*****
* 327X DEFINITION FOR FRONTAL TO REMOTE NIA MCH SVC *
*****
G04NIAS  GROUP  LNCTL=SDLC,          ALL LINES IN THIS GROUP ARE SDLC      C
                CLOCKNG=EXT,        USE EXTERNAL CLOCKING FOR ALL LINES  C
                DIAL=YES,           ALL DIAL LINES                        C
                NEWSYNC=NO,         NO USE FOR NEWSYNC FEATURE          C
                NRZI=NO,           NIA CAN ONLY WORK IN NRZ MODE       C
                POLLED=YES,        THIS IS THE PRIMARY END OF THE LINK  C
                REPLYTO=1.0,       1 SECOND STATION TIMEOUT INTERVAL  C
                RETRIES=NONE,     LET THE PPSN HANDLE THE RETRIES    C
                TYPE=NCP          ALL RESOURCES ARE NCP
**
L040A6   LINE  ADDRESS=(0A6),        3705 LINE ADAPTER ADDRESS           C
                CALL=INOUT,        ALLOW INCOMING AND OUTGOING CALLS   C
                DATRATE=HIGH,     USE THE HIGHER MODEM DATA RATE     C
                DUPLEX=FULL,      PHYSICAL FACILITY IS FULL DUPLEX    C
                ISTATUS=INACTIVE,  INITIALIZATION WILL NOT ACTIVATE   C
                MAXPU=1,          MAXIMUM PU'S ON THIS LINE          C
                PAUSE=4.0,        NIA POLL TIMEOUT                   C
                SPEED=2400        LINE SPEED
**
P040A6A  PU    PUTYPE=2,            ONLY PU TYPE 2'S CAN USE THIS LINE  C
                MAXLU=3          MAXIMUM NO OF LU'S
**
*****
* 327X DEFINITION FOR FRONTAL TO REMOTE NIA MCH PVC *
*****
G04NIAP  GROUP  LNCTL=SDLC,          ALL LINES IN THIS GROUP ARE SDLC      C
                CLOCKNG=EXT,        USE EXTERNAL CLOCKING FOR ALL LINES  C
                DIAL=NO,           NO DIAL LINES                        C
                NEWSYNC=NO,         NO USE FOR NEWSYNC FEATURE          C
                NRZI=NO,           NIA CAN ONLY WORK IN NRZ MODE       C
                POLLED=YES,        THIS IS THE PRIMARY END OF THE LINK  C
                REPLYTO=1.0,       1 SECOND STATION TIMEOUT INTERVAL  C
                RETRIES=NONE,     LET THE PPSN HANDLE THE RETRIES    C
                TYPE=NCP          ALL RESOURCES ARE NCP
**
L040A7   LINE  ADDRESS=(0A7),        3705 LINE ADAPTER ADDRESS           C
                DATRATE=HIGH,     USE THE HIGHER MODEM DATA RATE     C
                DUPLEX=FULL,      PHYSICAL FACILITY IS FULL DUPLEX    C
                ISTATUS=INACTIVE,  INITIALIZATION WILL NOT ACTIVATE   C
                MAXPU=3,          MAXIMUM PU'S ON THIS LINE          C
                PAUSE=4.0,        NIA POLL TIMEOUT                   C
                SPEED=2400        LINE SPEED
**
                SERVICE ORDER=(P040A7A,P040A7B,P040A7C)
**
P040A7A  PU    ADDR=C1,            NIA REQUIRES FOR SVC                C
                MAXDATA=265,     MAXIMUM DATA INCLUDES OVERHEADS   C
                PUTYPE=2,        ONLY PU TYPE 2'S CAN USE THIS LINE  C
                MAXOUT=3,        NIA ALLOW IN MULTIPOINT CONFIG     C
                PASSLIM=7,       MAXIMUM PIU'S IN TRANSMISSION      C
                ISTATUS=INACTIVE,  ACTIVATE WHEN REQUIRED              C
                SSCPFM=USSSCS,    VTAM LOGON FORMATTING              C
                USSTAB=US3276,    USS TABLE REFERENCE FOR VTAM     C
                MODETAB=MT32763  MODE TABLE REFERENCE FOR VTAM
**
T040A7A1 LU    LOCADDR=2,          ADDRESS OF LU                        C
                ISTATUS=ACTIVE    ACTIVATE WITH PU
**
P040A7B  PU    ADDR=C2,            NIA REQUIRES FOR SVC                C
                MAXDATA=265,     MAXIMUM DATA INCLUDES OVERHEADS   C
                PUTYPE=2,        ONLY PU TYPE 2'S CAN USE THIS LINE  C
                MAXOUT=3,        NIA ALLOW IN MULTIPOINT CONFIG     C
                PASSLIM=7,       MAXIMUM PIU'S IN TRANSMISSION      C
                ISTATUS=INACTIVE,  ACTIVATE WHEN REQUIRED              C
                SSCPFM=USSSCS,    VTAM LOGON FORMATTING              C
                USSTAB=US3276,    USS TABLE REFERENCE FOR VTAM     C

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```

MODETAB=MT32763          MODE TABLE REFERENCE FOR VTAM
**
T040A7B1  LU  LOCADDR=2,          ADDRESS OF LU          C
                ISTATUS=ACTIVE      ACTIVATE WITH PU
**
P040A7C  PU  ADDR=C3,              NIA REQUIRES FOR SVC  C
                MAXDATA=265,         MAXIMUM DATA INCLUDES OVERHEADS C
                PUTYPE=2,             ONLY PU TYPE 2'S CAN USE THIS LINE C
                MAXOUT=3,             NIA ALLOW IN MULTIPOINT CONFIG C
                PASSLIM=7,           MAXIMUM PIU'S IN TRANSMISSION C
                ISTATUS=INACTIVE,    ACTIVATE WHEN REQUIRED C
                SSCPFM=USSSCS,       VTAM LOGON FORMATTING C
                USSTAB=US3276,       USS TABLE REFERENCE FOR VTAM C
                MODETAB=MT32763     MODE TABLE REFERENCE FOR VTAM
**
T040A7C1  LU  LOCADDR=2,          ADDRESS OF LU          C
                ISTATUS=ACTIVE      ACTIVATE WITH PU
**
*****
* X25 DEFINITION - FROM X25 STAGE2 OUTPUT *
*****
* PLACE GENERATED X25NCP3 (3 = 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=(X25A0A0CX,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=2400
XC0A4    SERVICE ORDER=XP040A4
XP040A4  PU  ADDR=01,MAXDATA=261,ANS=STOP,PUTYPE=1
XU040A4  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
XC0A0003 SERVICE ORDER=XP0A0003
XP0A0003 PU  PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)
XU0A0003 LU  LOCADDR=0
XLOA0004 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
XLOA2001 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
XLOA2002 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
XLOA2003 LINE ADDRESS=NONE,UACB=XA0A2003
XC0A2003 SERVICE ORDER=XP0A2003
XP0A2003 PU  PUTYPE=1,ADDR=01,MAXDATA=261,VPACING=(2,1),PACING=(1,1)

```

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```

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

L040A4A LINE ADDRESS=NONE,UACB=XA0A4001
XC0A4001 SERVICE ORDER=P040A4A
P040A4A PU ADDR=C1,MAXDATA=137,MAXOUT=7,PASSLIM=7,MODETAB=MT32763,S*
SCPFM=USSSCS,USSTAB=US3276,ISTATUS=ACTIVE,PUTYPE=2

T040A4A1 LU LOCADDR=2,ISTATUS=ACTIVE
X25SCA4B 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

L040A4B LINE CALL=INOUT,ADDRESS=NONE,AUTO=YES,UACB=XA0A4002
P040A4B PU MAXLU=1,PUTYPE=(1,2)
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=BALINIMD,SRCHI=X2*
5BLK3,SRCL0=X25TBL3,INCL2LO=X25LOI3,ORDL2LO=X25L3,INCL2H*
I=X25HII3,ORDL2HI=X25HIO3,INCINIT=X25IHI3,ORDINIT=X25INO*
3,TMRTICK=BALTICK

```

**

END

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APPENDIX H. NIA SWITCH SETTINGS AND STRAPPING EXAMPLES

This Appendix contains sample NIA switch settings and strapping as used in the X.25 tests at the Raleigh Systems Centre. The worksheets as described in "NIA Worksheets" on page 52 are used to describe the settings. The === is used to indicate the NIA Specify Code selected on the worksheets in this Appendix.

The sample worksheets are cross-referenced by the TEST number in the LOCATION field. For example the first two worksheets are examples of the remote NIA settings used for TEST 3/2, which references GENERATION number 3 TEST number 2. Appendix G "Appendix F. X.25 Network Definition Sample" on page 123 describes this test in the comments section at the beginning of the listing.

Note: All the NIA testing was conducted with the July 82 microcode, and as all the tests were LAP-B protocol 'PN2" cassettes were used.

IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
REMOTE - LAP-B Protocol

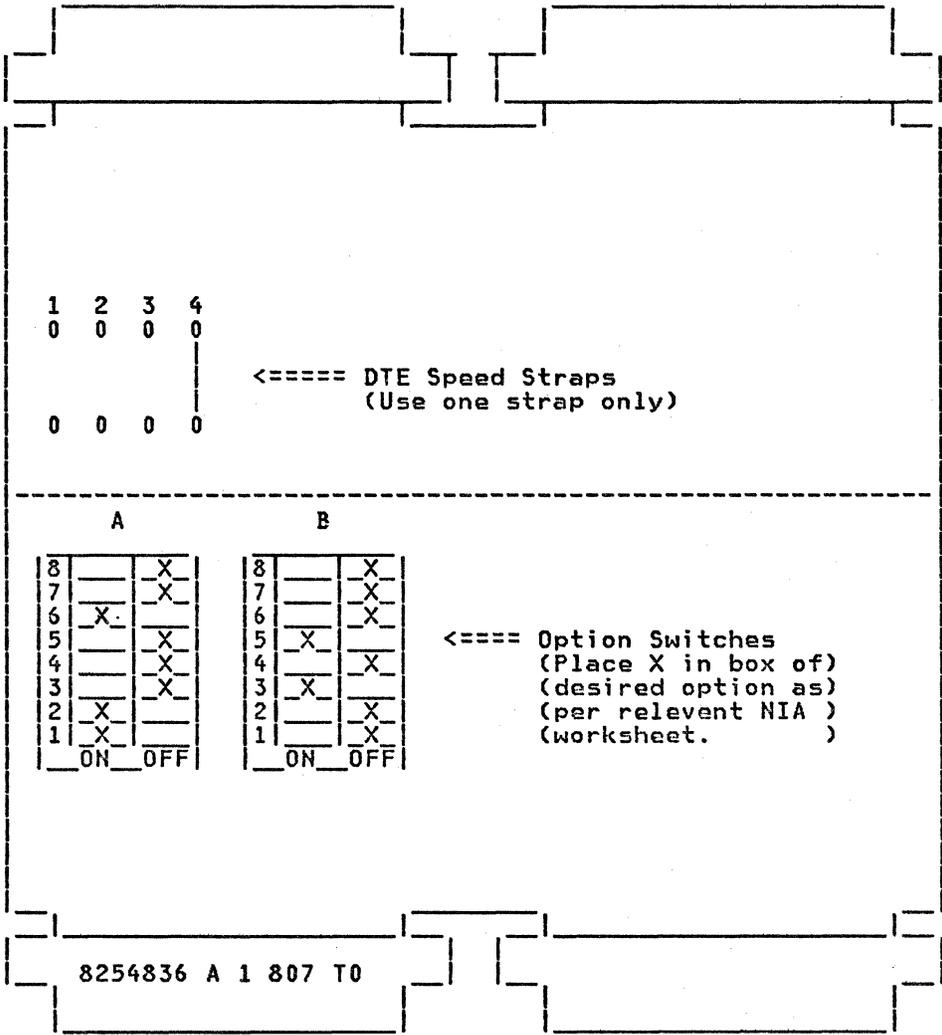
SERIAL NUMBER_5101708_ LOCATION_Raleigh_Systems_Centre_Test_3/2_PVC_								
PARAMETER	SPECIFY	OPTION	SWITCH					
5973-L02 Remote	7043	NIA-R						
PPSN Link Access Procedure	7158	LAP-B	ON	A	OFF	ON	B	OFF
DTE SDLC Window Size	7033	3 Frames			1			
	=====	7037	=====	7 Frames	=====	1	=====	=====
PPSN Packet Length	7035	128 bytes			2	2		
	=====	7036	=====	256 bytes	=====	2	=====	=====
Terminal/Cluster(DTE) Signalling Rate BPS	7044	1200						Set Strap 1
	7045	2400						Set Strap 2
	7046	4800						Set Strap 3
	=====	7047	=====	9600	=====			Set Strap 4
PPSN Circuit Type	7049	SVC				7		
	=====	7058	=====	PVC	=====	7	=====	7
Lower Virtual Circuit Address	7050	Address 0					3	
	=====	7051	=====	Address 1	=====		3	=====
PPSN Packet Window Size	7052	2 Packets			5		4,5	
	=====	7053	=====	3 Packets	=====	5	5	4
	7054	4 Packets	5				4,5	
	7055	5 Packets	5			5	4	
	7056	6 Packets			5	4	5	
	7057	7 Packets			5	4,5		
PPSN Time Out Delay at LAP Level	7060	.5 second	6				6	BPS 9600
	7061	1 second			6	6		4800
	7062	2 seconds			6		6	1200/2400

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IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
 - REMOTE *-----*

 | SERIAL NUMBER_5101708_| LOCATION_R_S_C_Test_3/2_PVC_|

Network Interface Adapter Circuit Board A.



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IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
 REMOTE - LAP-B Protocol

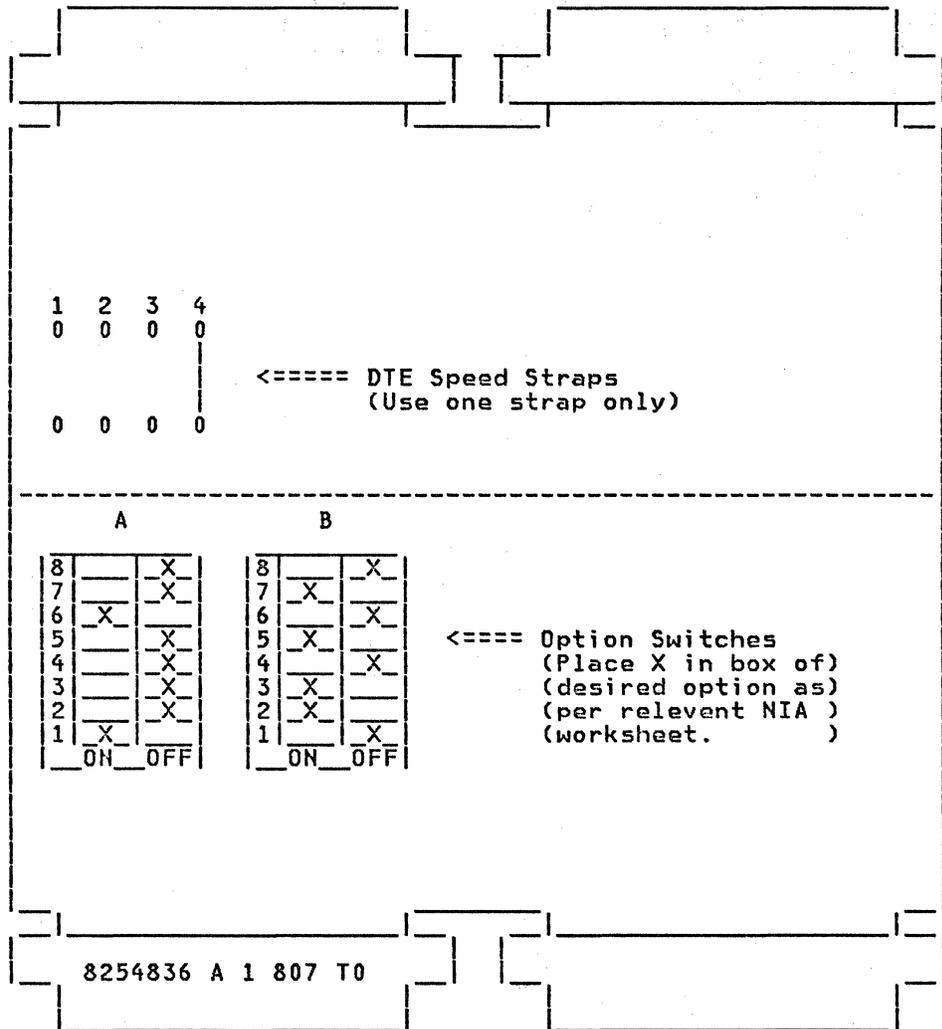
SERIAL NUMBER_5101708_ LOCATION_Raleigh_Systems_Centre_Test_3/2_SVC_									
PARAMETER	SPECIFY	OPTION	SWITCH						
			ON	A	OFF	ON	B	OFF	
5973-L02 Remote	7043	NIA-R							
PPSN Link Access Procedure	7158	LAP-B							
DTE SDLC Window Size	7033	3 Frames			1				
	7037	=7 Frames			1				
PPSN Packet Length	7035	=128 bytes			2		2		
	7036	256 bytes	2					2	
Terminal/Cluster(DTE) Signalling Rate BPS	7044	1200						Set Strap 1	
	7045	2400						Set Strap 2	
	7046	4800						Set Strap 3	
	7047	= 9600						Set Strap 4	
PPSN Circuit Type	7049	= SVC					7		
	7058	PVC			7			7	
Lower Virtual Circuit Address	7050	Address 0						3	
	7051	=Address 1						3	
PPSN Packet Window Size	7052	2 Packets			5			4,5	
	7053	=3 Packets			5		5	4	
	7054	4 Packets	5					4,5	
	7055	5 Packets	5			5		4	
	7056	6 Packets			5	4		5	
	7057	7 Packets			5	4,5			
PPSN Time Out Delay at LAP Level	7060	=.5 second	6					6	BPS 9600
	7061	1 second			6	6			4800
	7062	2 seconds			6			6	1200/2400

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IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
 - REMOTE *-----*

 | SERIAL NUMBER_5101708_| LOCATION_R_S_C_Test_3/2_SVC_|

Network Interface Adapter Circuit Board A.



1	2	3	4
0	0	0	0
0	0	0	0

<===== DTE Speed Straps
 (Use one strap only)

A		B	
8	<input type="checkbox"/>	8	<input checked="" type="checkbox"/>
7	<input type="checkbox"/>	7	<input checked="" type="checkbox"/>
6	<input checked="" type="checkbox"/>	6	<input checked="" type="checkbox"/>
5	<input type="checkbox"/>	5	<input checked="" type="checkbox"/>
4	<input type="checkbox"/>	4	<input checked="" type="checkbox"/>
3	<input type="checkbox"/>	3	<input checked="" type="checkbox"/>
2	<input type="checkbox"/>	2	<input checked="" type="checkbox"/>
1	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ON	OFF	ON	OFF

<===== Option Switches
 (Place X in box of)
 (desired option as)
 (per relevent NIA)
 (worksheet.)

8254836 A 1 807 T0

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IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
FRONTAL - LAP-B Protocol

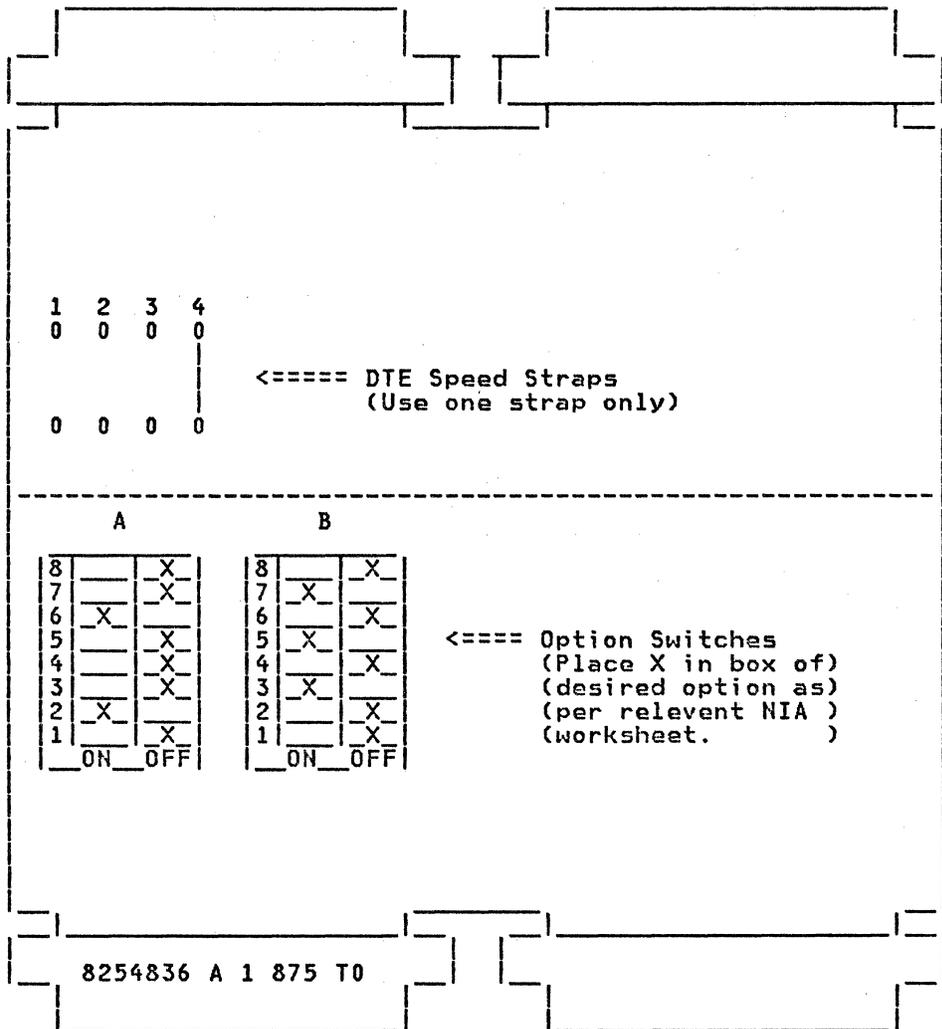
* SERIAL NUMBER_5101787_ LOCATION_Raleigh_Systems_Centre_Test_3/3 *							
PARAMETER	SPECIFY	OPTION	SWITCH				
5973-L02 Frontal	7042	NIA-F					
PPSN Link Access Procedure	7158	LAP-B					
			ON	A OFF	ON	B OFF	
PPSN Packet Length	7035	128 bytes		2	2		
	7036	256 bytes	2		2		
Terminal/Cluster(DTE) Signalling Rate BPS	7044	1200					Set Strap 1
	7045	2400					Set Strap 2
	7046	4800					Set Strap 3
	7047	9600					Set Strap 4
PPSN Circuit Type	7049	SVC			7		
Quantity of PVC's	7058	1 or 2		7		7	
	7059	3 or 4	7			7	
Lower Virtual Circuit Address	7050	Address 0				3	
	7051	Address 1				3	
PPSN Packet Window Size	7052	2 Packets		5		4,5	
	7053	3 Packets		5	5	4	
	7054	4 Packets	5			4,5	
	7055	5 Packets	5		5	4	
	7056	6 Packets		5	4	5	
	7057	7 Packets		5	4,5		
PPSN Time Out Delay at LAP Level	7060	.5 second	6			6	BPS 9600
	7061	1 second		6	6		4800
	7062	2 seconds		6		6	1200/2400

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IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
 - FRONTAL *-----*

 |SERIAL NUMBER_5101787_|LOCATION_R_S_C_Test_3/3_____|

Network Interface Adapter Circuit Board A.



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IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
REMOTE - LAP-B Protocol

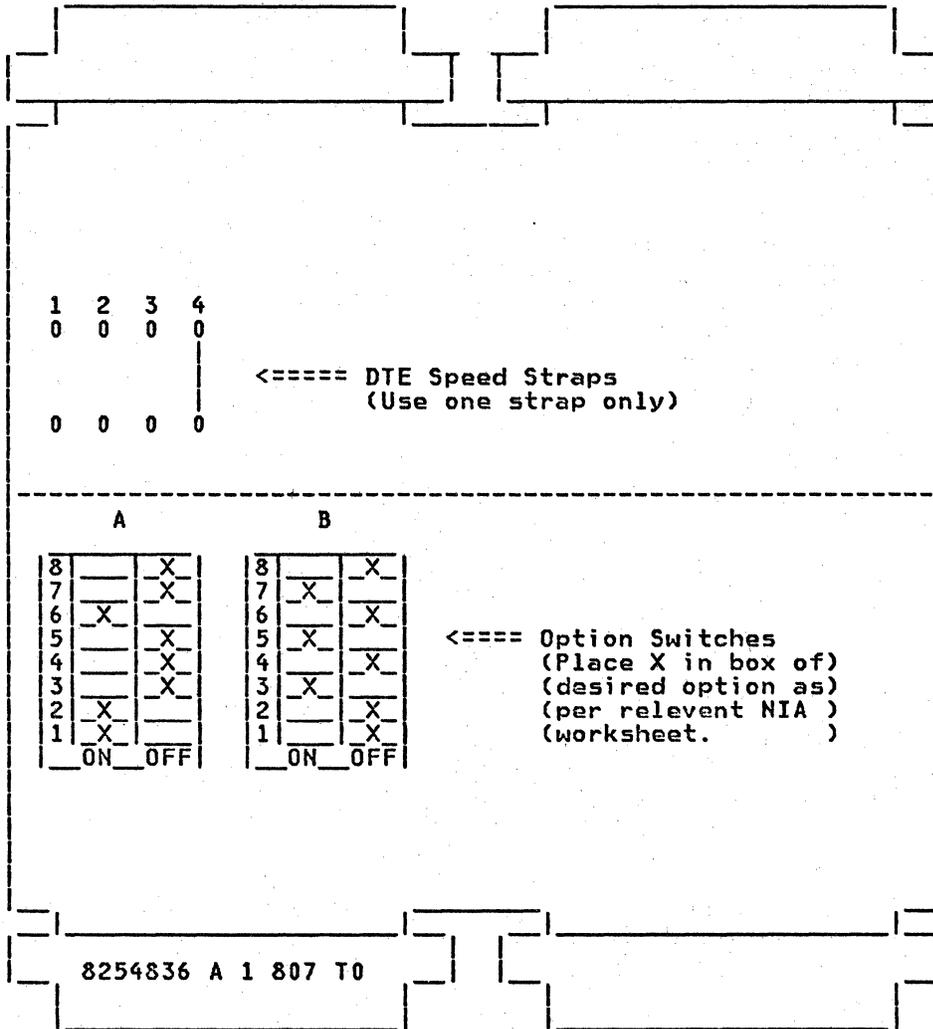
----- SERIAL NUMBER_5101708_ LOCATION_Raleigh_Systems_Centre_Test_3/3							
PARAMETER	SPECIFY	OPTION	SWITCH				
			ON	A OFF	ON	B OFF	
5973-L02 Remote	7043	NIA-R					
PPSN Link Access Procedure	7158	LAP-B					
DTE SDLC Window Size	7033	3 Frames		1			
	7037	7 Frames	1				
PPSN Packet Length	7035	128 bytes		2	2		
	7036	256 bytes	2			2	
Terminal/Cluster(DTE) Signalling Rate BPS	7044	1200					Set Strap 1
	7045	2400					Set Strap 2
	7046	4800					Set Strap 3
	7047	9600					Set Strap 4
PPSN Circuit Type	7049	SVC			7		
	7058	PVC		7		7	
	Lower Virtual Circuit Address	7050	Address 0				3
7051		Address 1			3		
PPSN Packet Window Size	7052	2 Packets		5		4,5	
	7053	3 Packets		5	5	4	
	7054	4 Packets	5			4,5	
	7055	5 Packets	5		5	4	
	7056	6 Packets		5	4	5	
	7057	7 Packets		5	4,5		
PPSN Time Out Delay at LAP Level	7060	.5 second	6			6	BPS 9600
	7061	1 second		6	6		4800
	7062	2 seconds		6		6	1200/2400

Raleigh International Systems Centre

IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
 - REMOTE *-----*

 | SERIAL NUMBER_5101708_| LOCATION_R_S_C_Test_3/3_|

Network Interface Adapter Circuit Board A.



Raleigh International Systems Centre

IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
FRONTAL - LAP-B Protocol

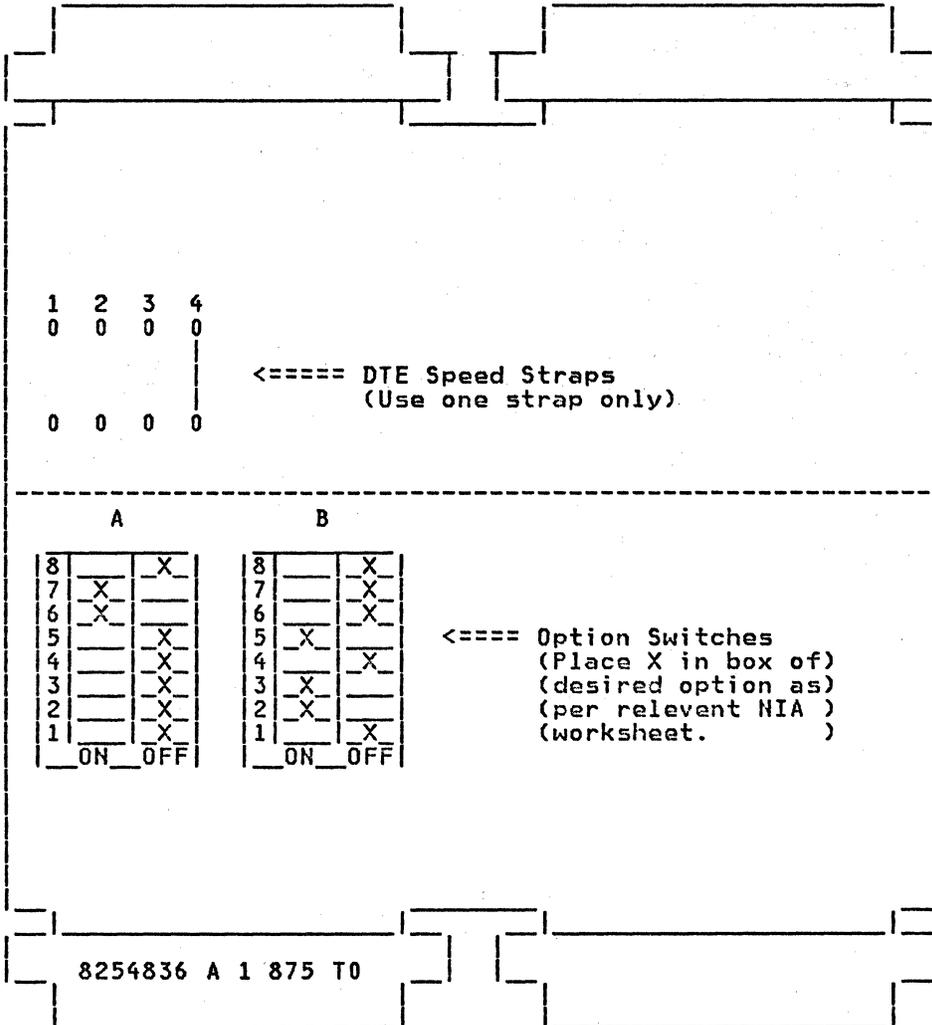
* SERIAL NUMBER_5101787_ LOCATION_Raleigh_Systems_Centre_Test_3/4 *							
PARAMETER	SPECIFY	OPTION	SWITCH				
5973-L02 Frontal	7042	NIA-F					
PPSN Link Access Procedure	7158	LAP-B	ON	A OFF	ON	B OFF	
PPSN Packet Length	7035	128 bytes		2	2		
	7036	256 bytes	2			2	
Terminal/Cluster(DTE) Signalling Rate BPS	7044	1200					Set Strap 1
	7045	2400					Set Strap 2
	7046	4800					Set Strap 3
	7047	9600					Set Strap 4
PPSN Circuit Type	7049	SVC			7		
Quantity of PVC's	7058	1 or 2		7		7	
	7059	3 or 4	7			7	
Lower Virtual Circuit Address	7050	Address 0				3	
	7051	Address 1				3	
PPSN Packet Window Size	7052	2 Packets		5		4,5	
	7053	3 Packets		5	5	4	
	7054	4 Packets	5			4,5	
	7055	5 Packets	5		5	4	
	7056	6 Packets		5	4	5	
PPSN Time Out Delay at LAP Level	7057	7 Packets		5	4,5		
	7060	.5 second	6			6	BPS 9600
	7061	1 second		6	6		4800
	7062	2 seconds		6		6	1200/2400

Raleigh International Systems Centre

IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
 - FRONTAL *-----*

 |SERIAL NUMBER_5101787_|LOCATION_R_S_C_Test_3/4_|

Network Interface Adapter Circuit Board A.



Raleigh International Systems Centre

IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
 REMOTE - LAP-B Protocol

----- SERIAL NUMBER_5101708 LOCATION_Raleigh_Systems_Centre_Test_3/4 -----*							
PARAMETER	SPECIFY	OPTION	SWITCH				
			ON	A OFF	ON	B OFF	
5973-L02 Remote	7043	NIA-R					
PPSN Link Access Procedure	7158	LAP-B					
DTE SDLC Window Size	7033	3 Frames		1			
	7037	7 Frames	1				
PPSN Packet Length	7035	128 bytes		2	2		
	7036	256 bytes	2			2	
Terminal/Cluster(DTE) Signalling Rate BPS	7044	1200					Set Strap 1
	7045	2400					Set Strap 2
	7046	4800					Set Strap 3
	7047	9600					Set Strap 4
PPSN Circuit Type	7049	SVC			7		
	7058	PVC		7		7	
Lower Virtual Circuit Address	7050	Address 0				3	
	7051	Address 1			3		
PPSN Packet Window Size	7052	2 Packets		5		4,5	
	7053	3 Packets		5	5	4	
	7054	4 Packets	5			4,5	
	7055	5 Packets	5		5	4	
	7056	6 Packets		5	4	5	
	7057	7 Packets		5	4,5		
PPSN Time Out Delay at LAP Level	7060	.5 second	6			6	BPS 9600
	7061	1 second		6	6		4800
	7062	2 seconds		6		6	1200/2400

Raleigh International Systems Centre

IBM 5973-L02 - NETWORK INTERFACE ADAPTER - WORKSHEET
 - REMOTE *-----*

 |SERIAL NUMBER_5101708_|LOCATION_R_S_C_Test_3/4_|

Network Interface Adapter Circuit Board A.

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The two new functions described in this appendix are available for LAPB networks only as from the new microcode release which is described in "New Microcode" on page 110.

EVENT LOG FUNCTION

NOTE: Frontal NIA only.

General Description:

This function, only available on the Frontal NIA operating with LAPB, is provided as a tool to supplement the normal LED display for problem diagnosis in error situations.

This function automatically and dynamically logs X.25 events which may impact the NIA operations into a part of the memory called the LOG AREA. The operator may use the keyboard to display the stored information.

The EVENT LOG function is composed of the following sub-functions:

- The recording of events (automatic and internal)
- Three special key functions:
 - Special erase key function
 - Special access key function
 - Special end-of-display key function
- Fourteen specific key functions for the display:
 - Four quantitative display functions
 - Ten qualitative display functions

The meaning of these sub-functions will be explained later on.

The Log Area display is allowed at any time, whatever the NIA state -- NIA left led previously showing A, B, C, D, E, or F -- and does not impact NIA normal operations in any way.

After entering a mode called special access key function, the operator can request for various stored information to be displayed. These will be shown cyclically on the two LEDs, data byte after data byte which are encoded according to conversion tables provided later on. The display may be presented in one of two speeds: a high speed for scanning and a low speed for detail analysis.

The operator can exit from the special access key function and return to normal operation or request for another special key function at any time.

At each IML time (or whenever internal self-tests routines are performed) the Log Area is cleared and the internal log function is automatically ready to work without operator intervention. Additionally, a special function, called the special erase key function, is provided to allow the operator to reinitialize the Log Area.

Note: When entering a LOG SUB-FUNCTION, if a wrong digit has been keyed, the normal erase key function can always be used to erase this wrong digit.

After entering the special access key, if an invalid subfunction is requested, the display will show a '1' on the left LED and an 'F' on the

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right. If this is the case, the operator just need to press the "ENTER" key and then the correct log sub-function.

Type of Possible Events to be recorded in the Log Area:

The events which may be recorded, are classified below by

X25 type level:

Type 1: X25 level 1 (hardware link between NIA and PPSN)
Type 2: X25 level 2 (lap level between NIA and PPSN)
Type 3: X25 level 3 (PLP level between NIA and PPSN)

The following events may be recorded according to this classification:

X25 level 1:

DSR OFF
CTS OFF
DCD OFF

X25 level 2:

SABM	sent by the	DISC	events sent
DISC	PPSN	REJ	by the NIA-F
REJ	to the	CMDR	to the PPSN
CMDR	NIA-F	RNR	
BAD FCS	set by the NIA-F on frames		
TIMEOUT	received from the PPSN		

X25 level 3:

RESTART	coming either
RESET	from the
CLEAR	NIA-F or the PPSN

Log Area Key Functions:

It is assumed that the NIA is displaying A, B, C, D, E, or F on its left led whatever the display is on the right led (normal operations).

The special access key function (1+ENTER):

NIA being in normal operations, you may gain access to the display functions (called specific keys functions) by entering the special access key function at the keyboard:

(1+ENTER)

After entering this special key function, the NIA is displaying 1 on its left LED and its right LED is blank. When in this state, the NIA is waiting for the operator to enter any specific key function, the special erase key function, or the special end-of-display key function.

The special erase key function (E+4+ENTER):

This function may be run at any time after entering the the special access key function (and/or any specific key function).

The EVENT LOG function being automatically initialized at every power-on time or during internal test routines, you may also re-initialize it by keying the special erase key function:

(4+ENTER)

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When the LOG AREA is cleared, the two LEDs display 0. Then, the EVENT LOG function begins to log again the events which may occur and is waiting for a specific key function or the special end of display function.

The special end of display key function (A+ENTER):

This function is available after having entered the special access key function and/or any special or specific functions. This function is provided to return to the normal display mode and cancel the special access key function and by the way any other specific display function.

Specific key functions (quantitative display functions):

These specific key functions are available after performing the special access key function.

Four functions correspond to counters for each type of event (level1, level2, level3) and to a counter for all these levels. The recording is done cyclically and the display of this recording is done on the two LEDs (00 to FF, that is, 000 to 255): See the conversion table. The required counter is displayed until a new command is requested: This new command may be another specific key function (qualitative or quantitative), the special erase key function, or the special end of display key function. Should a new event occur while a quantitative display function is running, the corresponding counters would be updated but not the current display. These quantitative display functions are:

E+0+ENTER	: number of all type 1, 2, or 3 events
E+1+ENTER	: number of all type 1 events
E+2+ENTER	: number of all type 2 events
E+3+ENTER	: number of all type 3 events

Note that these counters (modulo 256) correspond to all events which have been recorded from the last power-on action (or running of internal test routines) or the last special erase key function.

The table below shows the conversion from hexadecimal to decimal numbers:

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HEX	DEC								
00	000	34	052	68	104	9C	156	D0	208
01	001	35	053	69	105	9D	157	D1	209
02	002	36	054	6A	106	9E	158	D2	210
03	003	37	055	6B	107	9F	159	D3	211
04	004	38	056	6C	108	A0	160	D4	212
05	005	39	057	6D	109	A1	161	D5	213
06	006	3A	058	6E	110	A2	162	D6	214
07	007	3B	059	6F	111	A3	163	D7	215
08	008	3C	060	70	112	A4	164	D8	216
09	009	3D	061	71	113	A5	165	D9	217
0A	010	3E	062	72	114	A6	166	DA	218
0B	011	3F	063	73	115	A7	167	DB	219
0C	012	40	064	74	116	A8	168	DC	220
0D	013	41	065	75	117	A9	169	DD	221
0E	014	42	066	76	118	AA	170	DE	222
0F	015	43	067	77	119	AB	171	DF	223
10	016	44	068	78	120	AC	172	E0	224
11	017	45	069	79	121	AD	173	E1	225
12	018	46	070	7A	122	AE	174	E2	226
13	019	47	071	7B	123	AF	175	E3	227
14	020	48	072	7C	124	B0	176	E4	228
15	021	49	073	7D	125	B1	177	E5	229
16	022	4A	074	7E	126	B2	178	E6	230
17	023	4B	075	7F	127	B3	179	E7	231
18	024	4C	076	80	128	B4	180	E8	232
19	025	4D	077	81	129	B5	181	E9	233
1A	026	4E	078	82	130	B6	182	EA	234
1B	027	4F	079	83	131	B7	183	EB	235
1C	028	50	080	84	132	B8	184	EC	236
1D	029	51	081	85	133	B9	185	ED	237
1E	030	52	082	86	134	BA	186	EE	238
1F	031	53	083	87	135	BB	187	EF	239
20	032	54	084	88	136	BC	188	E0	240
21	033	55	085	89	137	BD	189	E1	241
22	034	56	086	8A	138	BE	190	E2	242
23	035	57	087	8B	139	BF	191	F3	243
24	036	58	088	8C	140	C0	192	F4	244
25	037	59	089	8D	141	C1	193	F5	245
26	038	5A	090	8E	142	C2	194	F6	246
27	039	5B	091	8F	143	C3	195	F7	247
28	040	5C	092	90	144	C4	196	F8	248
29	041	5D	093	91	145	C5	197	F9	249
2A	042	5E	094	92	146	C6	198	FA	250
2B	043	5F	095	93	147	C7	199	FB	251
2C	044	60	096	94	148	C8	200	FC	252
2D	045	61	097	95	149	C9	201	FD	253
2E	046	62	098	96	150	CA	202	FE	254
2F	047	63	099	97	151	CB	203	FF	255
30	048	64	100	98	152	CC	204		
31	049	65	101	99	153	CD	205		
32	050	66	102	9A	154	CE	206		
33	051	67	103	9B	155	CF	207		

Specific Key Function (Qualitative Display Functions):

These specific key functions are available after performing the special access key function.

Ten qualitative display functions correspond to the display of the last events recorded. The number of events which may be logged is from 00 to 64 (the recording is done cyclically by the NIA). Each event is encoded in three bytes. Using one of the qualitative display functions will show for each event a display on four bytes (type of event (T), cause byte if any (C), diagnostic byte if any (D)), plus one byte of blanks to separate one event from another):

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TT CC DD TT CC DD ...

Note that if there is no cause (C) or diagnostic byte (D) for level 1 or 2 events, they will be replaced by 00. The decoding is done below.

The display (and the recording) is done cyclically and will run until a new command is requested. This new command may be another specific key function (qualitative or quantitative), the special erase key function or the special end of display key function. Furthermore, the display is done at low speed: At any time during this display you may obtain a high speed display by pushing the ENTER key. Pushing the ENTER key again will slow the display back down. This operation may be performed as many times as you want.

It is important to note that every new event which would occur while a qualitative function is running, will be automatically added to the Log Area and to the display. The different qualitative function are:

0+1+ENTER	: Display the last 8 events recorded
0+2+ENTER	: Display the last 16 events recorded
0+3+ENTER	: Display the last 24 events recorded
0+4+ENTER	: Display the last 32 events recorded
0+5+ENTER	: Display the last 40 events recorded
0+6+ENTER	: Display the last 48 events recorded
0+7+ENTER	: Display the last 56 events recorded
0+8+ENTER	: Display the last 64 events recorded (display of the whole Log Area)
E+5+ENTER	: Display all the type 2 events recorded
E+6+ENTER	: Display all the type 3 events recorded

Note that when keying the last three functions, the display corresponds to the events contained at this very moment in the log area: Should more than 64 events occur since the last power-on action (running of internal test routines), or since the last special erase key function was performed, the number of events displayed might be different from the number displayed by the quantitative functions (in this case, the number displayed corresponds to all events which have occurred since the last power-on action, or since the running of internal test routines, or since the last special erase key function was performed).

The decoding of the display during one of these function is indicated below:

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levels	description of the event	T	C	D	explanations
X25 level 1	DSR off	11	00	00	Note that the integration for every level 1 event is about 6 seconds.
	CTS off	12	00	00	
	DSR and CTS off	13	00	00	
	DCD off	14	00	00	
	DCD and DSR off	15	00	00	
	DCD and CTS off	16	00	00	
X25 level 2	SABM	21	00	00	
	DISC	22	00	00	
	send by PPSN				
	FRMR	23	CC	DD	.for meaning of CC,DD see Note 1
	REJ	24	00	00	
X25 level 2	TIMEOUT	28	00	xx	.xx is the no. of retries
	REJ	29	00	00	.for meaning of CC,DD see Note 1 .during data exchange except keyboard D+ENTER function .in no response to SABM retries except keyboard D+ENTER function .set by NIA on received frames
	RNR	2A	00	00	
	FRMR	2B	CC	DD	
	DISC	2C	00	00	
	DISC	2D	00	00	
BAD FCS	2E	00	00		
X25 level 3	RESTART	30	cause	diag.	.except initial restart
	RESET on VC=0 or 4	34	cause	diag.	see Note 2
	RESET on VC=1	35	cause	diag.	
	RESET on VC=2	36	cause	diag.	
	RESET on VC=3	37	cause	diag.	
	CLEAR on VC=0	38	cause	diag.	
CLEAR on VC=1	39	cause	diag.		
X25 level 3	RESTART	40	00	diag.	see Note 2
	RESET on VC=0 or 4	44	00	diag.	
	RESET on VC=1	45	00	diag.	
	RESET on VC=2	46	00	diag.	
	RESET on VC=3	47	00	diag.	
	CLEAR on VC=0	48	00	diag.	
CLEAR on VC=1	49	00	diag.		

Note 1: For FRMR, the cause byte refers to bits 1, 2, 3, 4, 5, 6, 7, 8, and the diagnostic byte refers to bits 17, 18, 19, 20, 21, 22, 23, 24 of the X25 CCITT Recommendation (Geneva, 1980) FRMR description (table 4/X25).

Note 2: For RESTART, RESET, and CLEAR:

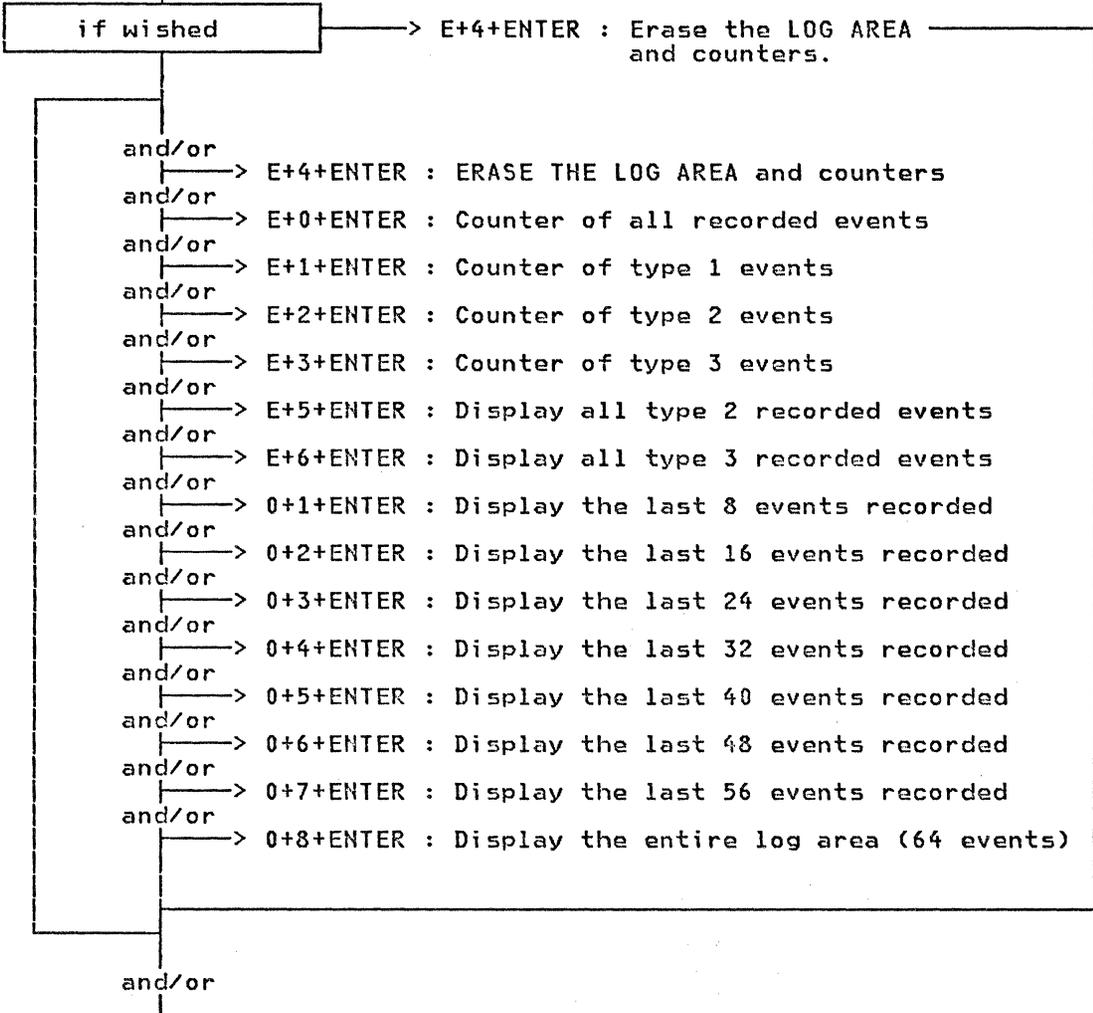
1. If the RESTART, RESET, or CLEAR has been sent by the frontal NIA (event type 40 to 49) the cause byte of the display (00) is the one sent over the PPSN. Note that this byte is generally displayed as (FF) during the normal problem determination display. For diagnostic meaning, refer to the Product Description Manual (GA11-8642).
2. For events number 34 to 39, the cause byte is 00 if the RESET or CLEAR has been sent by the IBM remote side, for instance using a remote NIA. Refer to the Product Description Manual (GA11-8642). Should the cause byte be different from 00, refer to the diagnostics delivered by the network itself.

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Key function summary for event log function:

NIA normal running
display: A, B, C, D, E, F

Gain access to the log area
display function by
entering at the keyboard
(1+ENTER)
display 1 on the left LED.



Exit from the LOG ACCESS PROCEDURE by performing the special end-of-display key function (A+ENTER). The NIA will now display its current state at this very moment (A, B, C, D, E, or F on its left LED).

SWITCHED NETWORK BACKUP (SNBU) FUNCTION.

This function is only available for the Remote NIA operating with LAPB.

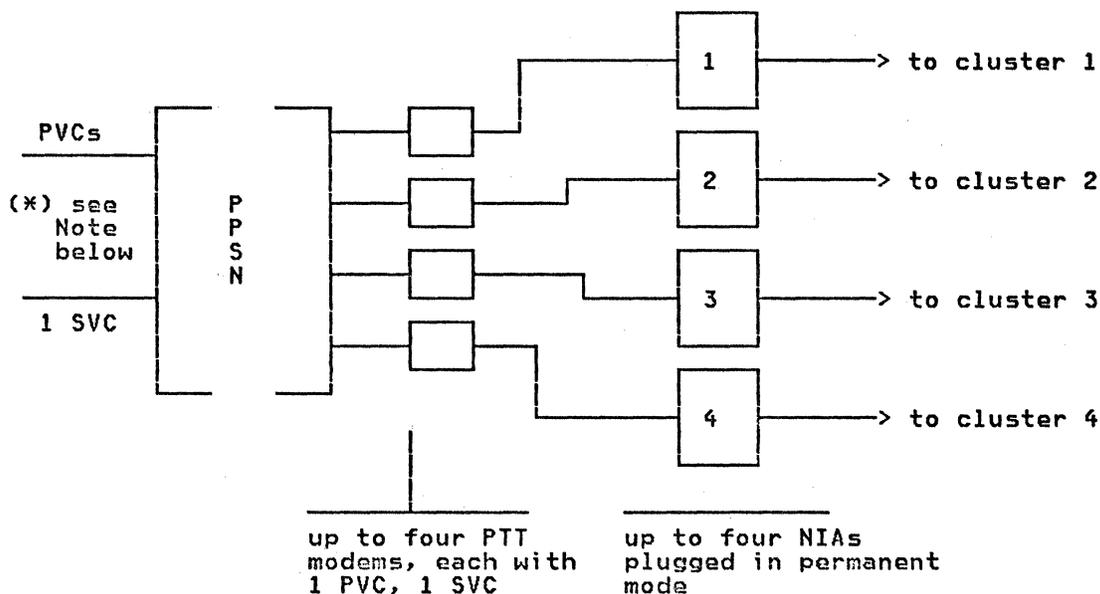
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The Switched Network Backup Configuration

This function (SNBU) is available on the remote cassette, Part Number 8684649 (this number is written on the cassette itself). With the SNBU function, the operator can disable the permanent logical channel and switch operations to a switched logical channel for backup or alternate host access provided that the following conditions are met:

1. The cassette tape is PN 8684649,
2. A permanent and a switched logical channel have been subscribed in the access line with the following assignments:
 - For PPSN allowing lower VC number 0 (for example TRANSPAC): PVC = 0 ; SVC = 1
 - For PPSN allowing lower VC number 1 (for example DATEX-P): PVC = 1 ; SVC = 2
3. The host side has the possibility to work in switched mode: IBM 3705 with the X.25 NPSI program product or a Frontal NIA. Note that the Frontal NIA must be using the PN 8684648 cassette tape (this number is written on the cassette).

Note that the SNBU function is particularly interesting when a permanent virtual circuit on the network failed (whatever is the cluster SDLC address).



Note: For the host side, refer to the NCP Packet Switching Program Product and Operation Manual, Program Product 5668-981, SC30-3078, or to the IBM 5973 L02 SC 7042 Product Description Manual, GA11-8642.

Using the SNBU Function

The configuration must be as described in the SNBU environment paragraph.

This function may be enabled any time when a 'E' (flashing or not) is displayed on the left LED of the NIA by pressing the "B" and ENTER keys. The remote NIA is in SNBU mode when the left LED displays a 'B'. To perform a call refer to the section "NIA Switched Virtual Circuit Call Establishment" on page 69.

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The Remote NIA can be returned to operate with the PVC connection at any time by pressing the "A" and ENTER keys whenever that it displays an 'A' or 'B' (flashing or not) on its left LED. An automatic link setup will be performed and a 'E' displayed to indicate that the NIA is now working with the permanent mode.

If link level procedure cannot be successfully established, an 'A' will appear on the left LED together with a diagnostic on the right.

Note that, when in SNBU mode, a "power off" and "on" action will cause the NIA to return to the permanent mode.

When using the SNBU function, the following displays are available:

B	6
E	6
F	6

frame received with wrong VC number

- . VC number 0 in SNBU mode on PPSN allowing lower VC number 0.
- . VC number 1 in SNBU mode on PPSN allowing lower VC number 1.
- . VC number 1 in permanent mode on PPSN allowing lower VC number 0.
- . VC number 2 in permanent mode on PPSN allowing lower VC number 1.

The NIA will send a CLEAR or a RESET on this wrong VC number and will display B6, E6, F6, according to whether the previous display was B, E, or F.

The SWITCHED NETWORK BACKUP Function Using a Frontal NIA:

This function (SNBU) is a remote NIA function available with a remote PN 8684649 cassette (this number is written on the remote cassette). The remote NIA must be plugged in permanent mode.

The configuration is supposed to be basically a permanent virtual circuit configuration using an IBM 3705 + X.25 NPSI PROGRAM PRODUCT or a frontal NIA plugged in permanent mode PLUS a frontal NIA plugged in switched mode for backup purposes. This last NIA must use a frontal PN 8684648 cassette (this number is written on the frontal cassette).

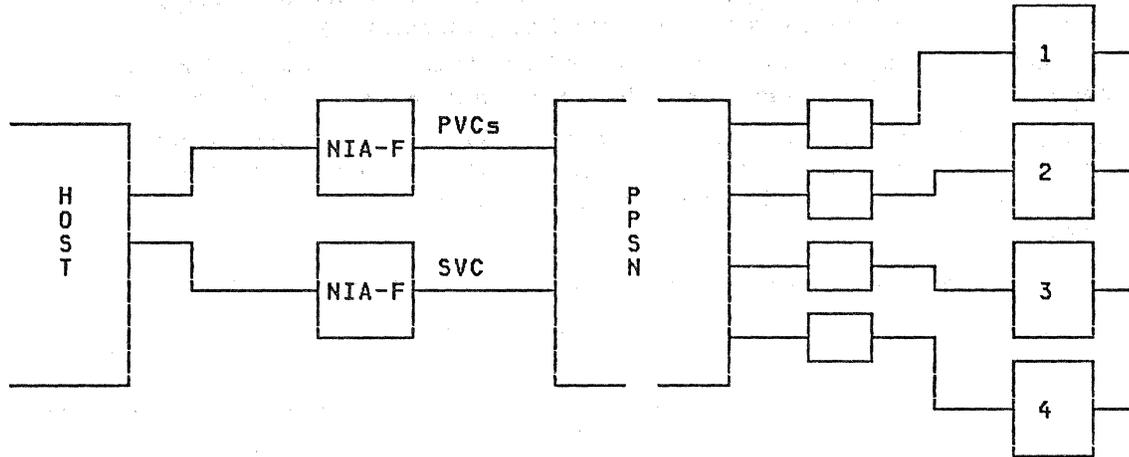
This implies that there are two PTT subscriptions on the host side (two modems):

- One X25 leased line for the permanent configuration.
- One X25 switched line with one switched virtual circuit for the frontal NIA plugged in switched mode for backup purposes.

Note that the SNBU function is particularly interesting when a permanent virtual circuit of the network has failed.

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SDLC leased line, multipoint half-duplex Up to four permanent virtual circuits



SDLC switched line, point-to-point, HDX

NIA-F for backup purposes

up to four PTT modems, each with 1 PVC, 1 SVC

up to four NIAs plugged in permanent mode

Figure 9. Typical Configuration to use SNBU with two frontal NIAs.

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