Burroughs

Operation and Reference Manual

B 20 Systems SNA/X.25 Network Gateway

(Relative to Release Level 1.1)

Distribution Code SA

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Printed in U.S.A.
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INTRODUCTION

This manual is both an operator's guide and a system programmer's reference manual. Because the manual must serve users with very different needs and levels of technical knowledge, there exists a clear division between each section.

This manual has four sections:

Section 1	Workstation Operator's Instructions
Section 2	Programmer's Guide to Installation
Section 3	Status Monitor
Section 4	Functional Description

The workstation operator can find the step-by-step procedures necessary to install the gateway in section 1, **Workstation Operator's Instructions.** Section 1 contains all the information most operators will need. The system programmer will find the remaining three sections helpful, especially section 2, **Programmer's Guide to Installation**, which supplies the information necessary to determine the appropriate installation parameters.

This manual contains a glossary and the following appendices:

Appendix A	BTOS Status Codes
Appendix B	Request Units
Appendix C	FID2 Path Information Unit
Appendix D	Sense Codes
Appendix E	Installation Forms
Appendix F	Related Documentation

SECTION 1

WORKSTATION OPERATOR'S INSTRUCTIONS

OVERVIEW

The SNA/X.25 Network Gateway is a set of programs that enables your B 20 or XE 520 to communicate with other workstations at local and remote locations. The special feature of this gateway is that, when used in conjunction with other Burroughs programs, it allows entry (hence the name "gateway") into two data communications networks--SNA (Systems Network Architecture) and X.25. Data communications networks are to computer data what airline routes are to airplanes and highways are to automobiles. And just as it is sometimes more economical and efficient to travel by airplane for a portion of a journey that begins and ends by automobile, so too is it more efficient for data to travel by way of an X.25 network for a portion of a journey that begins and ends in a SNA network.

You must use the SNA/X.25 Network Gateway with a B 20 systems BTOS master or standalone operating system of release level 4.0 or higher. If you use the gateway on an XE 520 system, the release level of its operating system must be MS2 2.00.05 or higher. In B 20 systems the level of your operating system is displayed in the Signon form or in the upper-right corner of the screen when you are in the Executive. If the terms Signon form and Executive are unfamiliar to you, consult the B 20 Systems Software Operation Guide (form 1162203). If you need information about the XE 520 system, consult the XE 520 BTOS User's Guide (form 1166295).

It is likely that you will be using the gateway together with one of these Burroughs programs:

1) B 20 Systems X.25 Network Gateway (release level 4.0 or higher)

and

2) Either B 20 Systems SNA Enhanced 3270 Emulator
   B 20 Systems SNA RJE
   or
   another machine/application oriented SNA software package

As a workstation operator, you may be responsible for installing these programs. They must be installed in a specific sequence:

1st X.25 Network Gateway.
2nd SNA/X.25 Network Gateway.
3rd SNA 3270 or SNA RJE.

To install the first and third items, consult the associated manuals:

B 20 Systems X.25 Network Gateway Reference Manual (form 1176104).
B 20 Systems SNA 3270 Emulator Reference Manual (form 1162989).
B 20 Systems SNA RJE Reference Manual (form 1180205).

LOADING AND INSTALLING

Loading is the process of copying the programs from the master diskette you purchased from Burroughs onto the hard disk of your master or standalone B 20 workstation or onto the hard disk of your XE 520. Installing is the actual execution of the programs that have been copied onto the hard disk. Loading should have to be done only once because the loading procedure permanently records (until a command to delete) the gateway programs on your hard disk. Installation must be done every time you reset or turn off your workstation because the installed gateway programs use Random Access Memory (RAM) which must continuously receive power in order to "remember" its contents.

Loading the Gateway

The SNA/X.25 Network Gateway programs can be loaded only onto B 20 systems with hard disks operating as master or standalone workstations and XE 520 systems. This does not mean, however, that systems without hard disks cannot use the SNA/X.25 Network Gateway. Systems without disks can operate as clustered workstations. Dual floppy systems can operate as standalone workstations by installing the gateway programs from floppy disk each time they are needed.

You must load five principal programs onto your hard disk:

Program	Function
snax25.run	Installs the SNA/X.25 Network Gateway.
snax25clear.run	Clears the call to the DTE. Address for SNA/X.25 Network Gateway.
snax25call.run	Establishes a call to the DTE address for the SNA/X.25 Network Gateway.
snax25stat.run	Invokes the SNA/X.25 status monitor.
snax25stat.form	Supplies the screen format for the status monitor.

Command Guidelines

A short series of commands makes loading the gateway programs a simple procedure. Depending on whether you have a master or standalone B 20 workstation or a XE 520, choose from the three loading procedures that follow.

Characters that you must type are shown in **boldface.**

The characters that you type can be upper or lowercase.

Special keys, such as RETURN and GO, are shown in uppercase.

Loading the Gateway on B 20 Standalone Hard Disk Systems

1. Turn on your standalone workstation and sign on.
2. Insert the SNA/X.25 Network Gateway diskette into drive [f0]. Do not press the RESET button.
3. Load the programs as follows:
   Command **Software Installation** GO
4. Press GO as directed by the screen message.
5. After loading is complete (a screen message informs you of this), remove the diskette and put it in a safe place.
6. To install the gateway, go to the section entitled Installing the Gateway.

Loading the Gateway on B 20 Master Hard Disk Systems

1. Turn on your system and sign on.
2. Insert the SNA/X.25 Network Gateway diskette into drive [f0]. Do not press the RESET button.
3. Load the programs as follows:
   Command **Software Installation** GO
4. Turn off all clustered workstations as directed by the screen message. Press GO.
5. After loading is complete (a screen message informs you of this), remove the diskette and put it in a safe place.
6. Resume cluster operations.
7. To install the gateway, go to the section entitled Installing the Gateway.

Loading the Gateway on an XE 520 System

1. Turn on the XE 520.

2. Turn on a clustered workstation that has a floppy disk unit attached and log on to XE 520 BTOS.

3. Use the Path command to select the volume [sys] and the directory <sys>.
   Command **Path** RETURN
   [Volume] **sys**
   [Directory] **sys**
   [Default file prefix
   [Password]
   [Node]

4. Press GO.

5. Insert the SNA/X.25 Network Gateway diskette into drive [f0] of the clustered workstation. Do not press the RESET button.

6. Load the programs by executing the following command at the workstation:
   Command **Software Installation** GO

7. Turn off all clustered workstations (except, of course, the workstation at which you are working) as directed by screen message. Press GO.

8. After loading is complete (a screen message will inform you of this), remove the diskette and put it in a safe place.

9. Resume cluster operations.

10. To install the gateway, go to the next section.

Installing the Gateway

Remember: Before installation of the SNA/X.25 Network Gateway, you must install the X.25 Network Gateway, release level 4.0 or higher.

Installing the Gateway on an XE 520 with Clustered B 20 Systems

In most cases a host system programmer or data processing manager has the responsibility of installing the gateway on XE 520 systems. Therefore, these procedures are in section 2, Programmer's Guide to Installation.

Installing the Gateway on a B 20 Master, Standalone or Clustered B 20 System

You can install the SNA/X.25 Network Gateway in standalone or master workstations, or in any clustered workstation other than a B21-1 (which has no RS-232 ports and so no means to connect physically to a network). When you install the gateway in a master workstation, any clustered workstation may use it.

Refer to section 2 for a discussion of installations of multiple gateways in a clustered system.

Installation of the SNA/X.25 Network Gateway means, in effect, installation of the SNA/X.25 Transport Service. Installation of the SNA Transport Service involves supplying technical information in response to a form that appears on the screen. Obtain this information from your system programmer or data processing manager. Appendix F reproduces this form. Fill it out for future reference.

The example below assumes that you have a system with a hard disk. If you have a dual-floppy system, remember to have the gateway disk inserted in the appropriate drive (usually [f0]).

SNA/X.25 Transport Service

Install the transport service first. If you attempt to install the other programs of the gateway--SNA/X.25 Call, SNA/X.25 Clear, or SNA/X.25 Status--you will receive one of these error messages: "The SNA Network Gateway is not installed" or "Subsystem error: Service not available (Error 33)."

Install the transport service as follows:

Command **Install SNA X.25 Transport Service** RETURN

The following form appears:

```
Install SNA/X.25 Transport Service

  [Max # of LUs (default = # of WS)]
  [Starting LU number (default = 1)]
  [Max PIU size (default = 265]
  [Switched ID (default = 0)]
  [ID Block (default = 018)]
  [Max X.25 Packet size (default = 128 bytes)]
  [Switched VC Outgoing CALL? (default = no)]
  [Target DTE Address (default = none)]
  [Switched VC Incoming CALL? (default = no)]
  [Low port number (default = 00)]
  [High port number (default = 99]
  [Permanent VC LCN (default = none)]
```

If you want to install the transport service using all of the default parameters shown in the form above, press GO.

If you want to choose your own values, fill them in on the selected (highlighted) line. You can step through the form by using RETURN. When you have finished, press GO.

SNA/X.25 Call

If you want to make a "call" to a workstation other than the one designated in "Target DTE Address" of the transport service, you need not reinstall the transport service. You can accomplish it by installing the SNA/X.25 Call program:

```
      Command       SNA X.25 Call RETURN
  [Target DTE Address (default = Install parm)]
  [Number of Retries (default = 0)]
```

When you have made your selections, press GO.

If you do not specify a DTE address, the program uses the address parameter (Install parm) supplied at the installation of the transport service.

SNA/X.25 Clear

When you want to change the address designated in the call program and return to the address given in installation of the transport service, give the following command:

```
      Command       SNA X.25 Clear GO
```

SNA/X.25 Status

The status monitor program allows you to monitor the activity of the gateway, giving you information about the type and amount of information your workstation has received and sent. Your system programmer may want you to relay this kind of information to him if, for example, he is troubleshooting a problem at a remote location. Refer to figure 3-1 for an illustration of what you will see on the screen. Install the status monitor as follows:

```
      Command       SNA X.25 Status GO
```

To exit the status monitor, press FINISH.

SECTION 2

PROGRAMMER'S GUIDE TO INSTALLATION

OVERVIEW

The B 20 SNA/X.25 Network Gateway is a software product that allows the B 20 and XE 520 families of Burroughs products to interface with data communications networks supporting IBM System Network Architecture (SNA) while taking advantage of the features of packet-switching X.25 Public Data Networks (PDN). This means in practical terms that SNA communications systems can use PDN facilities instead of leased or dial lines provided by a telephone company. The X.25 component in the program allows host access over PDNs by embedding the functions of a virtual circuit in an SNA gateway. The virtual circuit that is employed uses Logical Link Control (LLC-2) protocol. The virtual circuits serve similar functions in the system as other data transmission services and facilities (data links). SNA nodes interconnected by virtual circuit services remain logically adjacent, and the X.25 virtual circuit protocol, LLC-2, provides the mechanism to transfer information between these adjacent network nodes.

BURROUGHS SOFTWARE INTEGRATION

Burroughs SNA software presently consists of two high-level services--SNA 3270 and SNA RJE--and two gateway services--SNA Gateway and SNA/X.25 Network Gateway. Either (or both) of the high-level services can be combined with the SNA/X.25 Network Gateway or the SNA Gateway, with the important restriction that the two gateways **are not** installed in the same master workstation at same time. In cluster environments, a single gateway can serve all stations in the cluster. Up to 16 logical units of SNA RJE MLUs and/or SNA 3270 CRT/Printer subsystems per gateway can be served.

If you intend to run SNA RJE on some stations in a cluster and SNA 3270 on others, be aware of the conflict between having 1 ID Block number and multiple device types.

Figure 2-1 shows the software layering in a system using the SNA/X.25 Network Gateway.

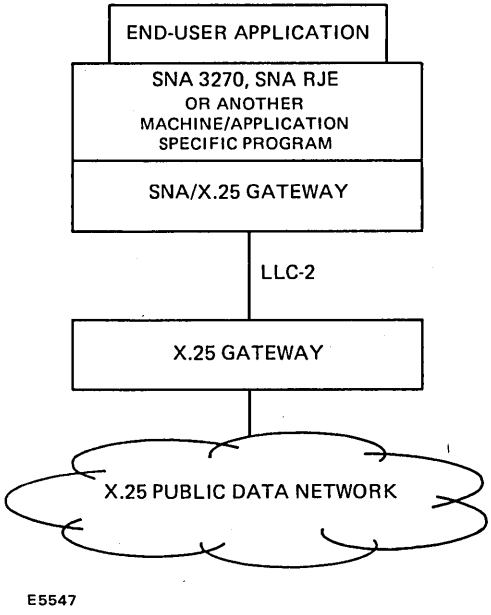

Figure 2-1: Software Integration

CLUSTER-HOST INTERFACING

The SNA/X.25 Network Gateway can be connected (by way of a packet network) to an IBM (or IBM compatible) host supporting an SNA/X.25 interface. The Burroughs workstation or cluster appears to the host as a PU.T2 device, with an IBM 5973 Network Interface Adapter. Both the Burroughs SNA 3270 and SNA RJE subsystems can utilize the SNA/X.25 gateway to access the host computer.

MULTIPLE SNA/X.25 NETWORK GATEWAYS

Multiple SNA/X.25 network gateways can be installed in a cluster environment. Typically the SNA/X.25 Network Gateway is installed on the master workstation. This configuration allows any workstation in the cluster to communicate with the host computer (host computer A) through a program functioning as a logical subsystem, for example, B 20 Systems SNA 3270 Emulator.

A cluster workstation can link to a host computer different from the one to which the master workstation is linked. This is done by separately installing the SNA/X.25 Network Gateway on a selected cluster workstation, thereby allowing that workstation access to a second host computer (host computer B).

The SNA/X.25 Network Gateway installed on the cluster workstation is called a local SNA/X.25 Network Gateway. It functions regardless of the fact that an SNA/X.25 Network Gateway to the first host computer (host computer A) has already been installed at the master workstation.

After the local SNA/X.25 Network Gateway is installed, all SNA/X.25 logical subsystem activity on that workstation is served by the local SNA/X.25 Network Gateway to host computer B. The link between the cluster workstation and host computer B has no affect on other workstations on the cluster; they will continue to use the SNA/X.25 Network Gateway installed on the master workstation which accesses host computer A.

To drop the local SNA/X.25 Network Gateway installation and attach the workstation to host computer A, the user of host computer B presses the RESET button on the back of his workstation.

When the local SNA/X.25 Network Gateway to host computer B is gone, the cluster workstation will immediately have access to the SNA/X.25 Network Gateway to host computer A on the master workstation.

COMPONENTS OF THE GATEWAY PACKAGE

Individual SNA/X.25 programs require execution of only some of the files on the release diskette. (Note that SNA/X.25 Network Gateway must be running in every situation.)

The required files for each subsystem are as follows:

SNA/X.25 Network Gateway
    snax25.run

SNA/X.25 Call
    snax25call.run

SNA/X.25 Clear
    snax25clear.run

SNA/X.25 Status Monitor
    snax25stat.run
    snax25stat.form

The SNA/X.25 Network Gateway is comprised of four programs:

1. SNA/X.25 Transport Service

The SNA/X.25 Transport Service is an installed system service that implements the SNA Transmission Subsystem for a Physical Unit, Type 2 (PU.T2-cluster controller). The system must be installed at the standalone workstation or master workstation in cluster configurations before using any of the other components of the SNA/X.25 Network Gateway. (The X.25 Network Gateway must be installed before the SNA/X.25 Network Gateway.)

2. SNA/X.25 Status Monitor

The SNA/X.25 Status Monitor allows the workstation user to display the status of SNA sessions on the video display of standalone and master workstations and of cluster workstations with the system service installed at their master workstation. The SNA/X.25 Status Monitor is an application subsystem.

3. SNA/X.25 Target DTE Call Out

The SNA/X.25 Target DTE Call Out is an an application subsystem facility that provides the user with the ability to dynamically establish an X.25 virtual circuit to a distant end DTE. The default number of attempts to establish a call is one. The user has the option of specifying a larger number of retries when this command is invoked. Also, if no entry is present in the DTE number field the call attempt is made to the number entered in the Install SNA/X.25 Transport Service DTE parameter.

4. SNA/X.25 Target DTE Clear Call

The SNA/X.25 Target DTE Clear Call is an application subsystem facility that provides the user with the ability to dynamically clear an established X.25 virtual circuit.

HARDWARE SUPPORT OF SNA/X.25 GATEWAY

Overview

A B 20 with the SNA/X.25 Network Gateway installed appears as an SNA PU.T2 device with a Network Interface Adaptor (NIA). You must use the SNA/X.25 Network Gateway in combination with the X.25 Network Gateway. The X.25 Network Gateway supports X.25 level functions 2 and 3, and it interfaces to public networks through an RS-232 interface. See figure 2-2.

The only hardware requirements for SNA/X.25 Network Gateway are those applicable for proper functioning of the X.25 Network Gateway.

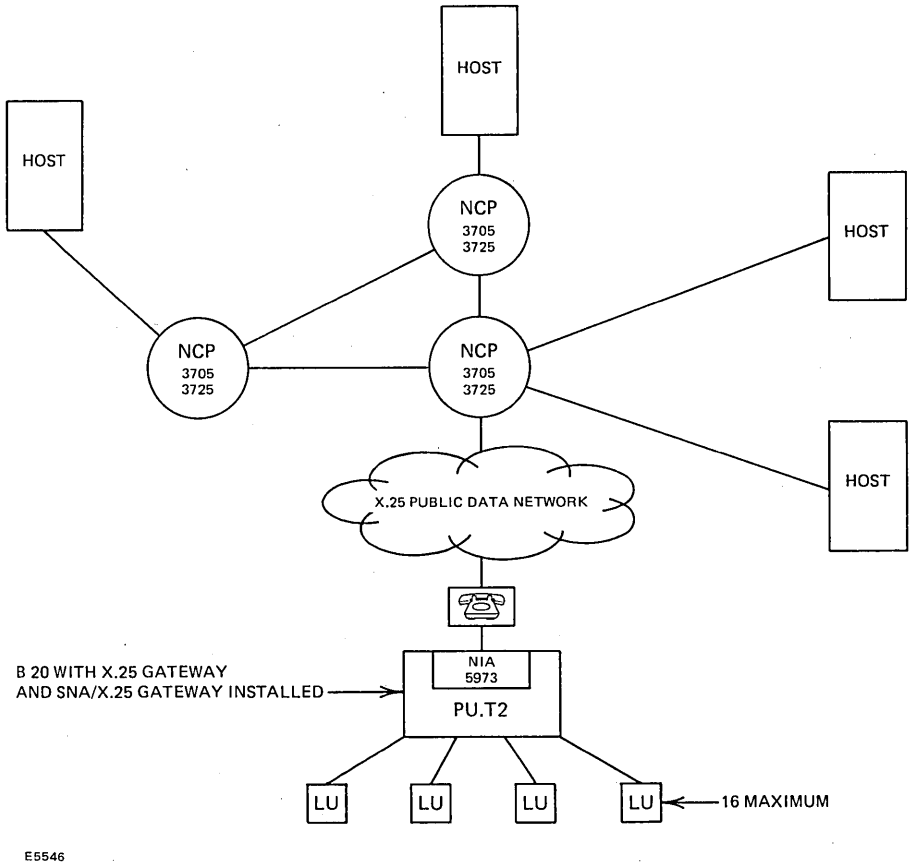

Figure 2-2: SNA/X.25 Network

Memory Requirements

The installed SNA/X.25 Network Gateway requires 33k fixed bytes and a variable amount of memory for buffers and control blocks at the workstation where it is installed.

The amount of memory required for buffers and control blocks is based on the installation parameters and is calculated as follows:

$$\#Bytes = 2 + (\lfloor \#LUs * Bufmultiple \rfloor * \lfloor Max\ PIU\ size + 7 \rfloor) + (\lfloor \#LUs * Bufmultiple \rfloor * 2)$$

The Bufmultiple parameter is calculated from the maximum size of the PIU. For a PIU size of 265, the bufmultiple value is 4.

Approximately 690 bytes of memory are required per logical unit; the default parameter of maximum PIU size is 265.

Buffers are also needed for X.25 packets, and the memory requirement for this buffer space is as follows:

$$\#Bytes = 2 + (40 * \lfloor Max\ X.25\ PacketSize + 7 \rfloor) + (40 * 2)$$

The maximum size of the memory used for buffers and control structures will not exceed 40K bytes.

The SNA/X.25 Status Monitor requires 35K bytes at the workstation where it is running.

The SNA/X.25 Call Subsystem requires 10K bytes at the workstation where it is running.

The SNA/X.25 Clear Subsystem requires 10k bytes at the workstation where it is running.

Modem Connection

The SNA/X.25 Network Gateway is intended for use with synchronous modems such as the Burroughs CP1000 series of modems or the Bell 201, 208, or 209 Data Sets (Data-Phone 2400, 4800, or 9600 Service).

In many systems, modem options are dictated by the conditions of the line to which the B 20 is connected. Burroughs recommends the following optional modem features:

- o internally timed transmitter
- o switched carrier
- o without new sync
- o four-wire operation

For synchronous operation with an internally timed modem, the B 22 system switches must be set for external clock. For the B 21 workstations, this is done automatically under program control.

The use of the terms external clock and internal clock can be confusing. Literature on a particular modem is usually written from the modem point of view; internal clock is usually interpreted to mean that clocking is internal to the modem. This manual, however, is written from the workstation point of view: external clock means that clocking is external to the workstation, which, of course, is internal to the modem.

If the modem is connected to communications Channel B of the B 22 workstation, the required switch settings on the I/O-Memory Board are shown in table 2-1 below.

Table 2-1. Switch Settings for Channel B on I/O Memory Board (Switch Box 1)

Switch	Setting
5	ON
6	ON
7	OFF
8	OFF

A double-male RS-232-C extension cable must be used to connect the workstation to the modem. It should be a straight-through terminal-to-modem cable rather than the crossover (null modem) type that is used to connect the workstation to another terminal.

RS-232-C signals used in synchronous operation are shown in table 2-2.

Table 2-2. RS-232-C Signals in Synchronous Operation.

Pin Number	Signal Name
1, 7	Ground
2	Transmit data
3	Receive data
4	Request to send
5	Clear to send
6	Data set ready
8	Data carrier detect
15	Transmit clock
17	Receive clock
20	Data terminal ready
22	Ring indicator

SOFTWARE SUPPORT OF THE SNA/X.25 GATEWAY

The SNA/X.25 Network Gateway supports an LLC-2. The Synchronous Data Link Control (SDLC) functional layer inside the SNA gateway has been taken out and the SNA gateway interacts with the X.25 gateway as a virtual circuit, either as a switched virtual circuit or a permanent virtual circuit. The SNA/X.25 Network Gateway can accept incoming calls only, outgoing calls only, or both incoming and outgoing. The SNA/X.25 Network Gateway includes the upper layers of the SNA gateway, which means that the interface between the upper layers of the SNA gateway (as represented by such software products as CRT and printer emulators and RJE stations) is the same as under the SNA/X.25 Network Gateway. Thus either the SNA or the SNA/X.25 gateway can be running; they cannot be running simultaneously. It is permissible to have one gateway on the master and the other on a cluster, providing that the clustered workstation has the appropriate gateway installed, and it has its own physical connection.

INSTALLING THE SNA/X.25 NETWORK GATEWAY

Installing the Gateway on an XE 520 with Clustered B 20 Systems

B 20 SNA Network Gateway support is provided by way of the onboard SIO channels of the Terminal Processor or Cluster Processor of the XE 520 system. Network access is accomplished on RS-232-C leased lines at speeds of 2400, 4800, 7200, and 9600 bps and on dial-up lines up to 4800 bps.

There are two procedures to install the SNA Network Gateway on the XE 520. The first procedure provides installation on the Cluster Processor (CP) or Terminal Processor (TP) of a XE 520 so that the gateway is available to B 20 workstations at bootup. The second provides installation from the Command Line Interpreter of B 20 workstations.

1. Installation at Bootup

This procedure modifies the files InitCPxx.jcl or InitTPxx.jcl (where xx is the CP or TP number). If all channels of the CP or TP are dedicated to asynchronous service, modification of the CPxx.cnf or TPxx.cnf file is also necessary to provide a synchronous line for the gateway. Step 1b describes this procedure.

A full discussion of the installation parameters is given in the section entitled Installation on a B 20 Master, Standalone or Clustered System.

1a. Edit InitCPxx.jcl or InitTPxx.jcl, whichever is appropriate, incorporating the following command line:

$Run [sys]<sys>snax.run, (supply installation parameters)

For example:

$Run [sys]<sys>snax.run,6,2, , , , , , , , ,75,

Where:

The maximum number of workstations is 6.
The starting LU number is 2.
The spaces separated by commas are the default parameters.
The high port number is 75.
The final parameter (undefined) is the default parameter.

NOTE

Because the XE 520 designates its communication channels by numbers instead of letters, use 1 in place of A, 2 in place of B, and so forth. Also, only channels 1 and 2 are available on CPs, whereas channels 1, 2, 3, and 4 are available on TPs.

1b. Edit CPxx.cnf or TPxx.cnf, whichever is appropriate, deleting the line of text that inappropriately defines your chosen channel as asynchronous.

2. Installation from the Command Line Interpreter

This procedure also modifies the InitCPxx.jcl or InitTPxx.jcl (where xx is the CP or TP number). However, it is done while in the Command Line Interpreter of a clustered workstation. If all channels of the CP or TP are dedicated to asynchronous service, modification of the CPxx.cnf or TPxx.cnf file is also necessary to provide a synchronous line for the gateway. Step 1b describes that procedure.

A full discussion of the installation parameters is given in the section, Installing the Gateway on a B 20 Master, Standalone, or Clustered System.

When a B 20 operates as an asynchronous terminal connected to the XE 520 BTOS a dollar sign ($) appears on the screen. In response to that prompt, type the following:

Run [sys]<sys>snax.run, (supply installation parameters)

For example:

Run [sys]<sys>snax.run,6,2, , , , , , , , ,75,

Where:

The maximum number of workstations is 6.
The starting LU number is 2.
The spaces separated by commas are the default parameters.
The high port number is 75
The final parameter (undefined) is the default parameter.

NOTE

Because the XE 520 designates its communication channels by numbers instead of letters, use 1 in place of A, 2 in place of B, and so forth. Also, only channels 1 and 2 are available on CPs, whereas channels 1, 2, 3, and 4 are available on TPs.

Installing the Gateway on a B 20 Master, Standalone, or Clustered System

B 20 SNA Network Gateway support is provided by way of the onboard Terminal Processor channels and Cluster Processor channels of the XE 520. Network access is accomplished on RS-232-C leased lines at speeds of 2400, 4800, 7200, and 9600 bps and on dial-up lines up to 4800 bps.

In order to use the SNA Network Gateway, the Transport Service must first be installed (in the master workstation if a cluster is being used). These parameters should be coordinated with the SNA host and front-end processor.

TRANSPORT SERVICE INSTALLATION

```
[Max # of LUs (default = # of WS)]
[Starting LU number (default = 1)]
[Max PIU size (default = 265]
[Switched ID (default = 0)]
[ID Block (default = 018)]
[Max X.25 Packet size (default = 128 bytes)]
[Switched VC Outgoing CALL? (default = no)]
[Target DTE Address (default = none)]
[Switched VC Incoming CALL? (default = no)]
[Low port number (default = 00)]
[High port number (default = 99]
[Permanent VC LCN (default = none)]
```

The following parameters, requiring a yes/no answer, will accept as yes any character sequence beginning with a y, and any character sequence beginning with n will be regarded as no.

[Max # of LUs (default = # of WS)]

This item defines the maximum number of LUs for this PU.T2 (Physical Unit, Type 2) device. The value should be greater than or equal to the number of LUs defined for this PU in the Network Control Program (NCP) "sysgen" (system generation). If the field is left blank, the value defaults to the number of workstation defined at system build for the cluster.

[Starting LU number (default = 1)]

This item sets the first LU address. For 3276 emulation, the LU addresses should start with 2.

[Max PIU size (default = 265]

This item defines the size of the Path Information Unit. It must fall in the range of 10 to 1024. A frame of 1024 is the largest that can be received in one segment from a 3705 NCP. This value should correspond to the value MAXDATA parameter on the PU macro in the NCP sysgen.

[Switched ID (default = 0)]

The allowable range for this value is hex 0 to FFFFF. This is the terminal ID specified for dial (switched) operation. The PSXID (an LLC command) response will contain the converted binary ID value.

[ID Block (default = 018)]

This is the 3-digit hex number designating device types. RJE and 3276 devices each have their own unique ID Block numbers. When mixing RJE and 3270 devices in a cluster system, then you must take account of the conflict between having 1 ID Block number and multiple devices types.

[Max X.25 Packet size (default = 128 bytes)]

This item sets the maximum X.25 packet size in bytes, and it can be one of the following: 16, 32, 64, 128, 256, 512, or 1024. This value must correspond to the value entered into the X.25 Network Gateway installation parameter "[Max packet size]."

[Switched VC Outgoing CALL? (default = no)]

This item allows the virtual circuit to perform outgoing calls. If yes is the response to this item and to "[Switched VC Incoming CALL?]" the gateway will accept both incoming and outgoing calls. For outgoing calls, the subsystem will use the address asked for in the next item.

[Target DTE Address (default = none)]

This is the address used by the outgoing call subsystem enabled by the prior parameter. It is used for the called address in the X.25 CALL REQUEST PACKET generated by the X.25 Network Gateway when call initiation is invoked by **SNA X.25 Call** command. This parameter can be overridden when you invoke **SNA X.25 Call** and enter another "Target DTE Address."

[Switched VC Incoming CALL? (default = no)]

This item allows the virtual circuit to accept incoming calls. If yes is the response to this item and to "[Switched VC Outgoing CALL?]," the gateway will accept both incoming and outgoing calls.

[Low port number (default = 00)]

This item sets the low boundary of the port numbers for which incoming calls will be accepted. This parameter is applicable to Switched Virtual Circuit (SVC) incoming-call-only mode or incoming/outgoing-call mode.

[High port number (default = 99]

This items contain the high boundary of the port numbers for which incoming calls will be accepted. This parameter is applicable to SVC (Switched Virtual Circuit) incoming-call-only mode or incoming/outgoing-call mode.

[Permanent VC LCN (default = none)]

This item will provide the LCN (Logical Channel Number) when the SNA/X.25 Network Gateway wants to establish a permanent virtual circuit. This LCN is defined also in the X.25 Network Gateway. It is the number given a subscriber of a packet network when connected to a remote IBM NCP.

SNA/X.25 Call Parameters

[Target DTE Address (default = Install parm)]

This is the address used by the switched virtual circuit outgoing call subsystem. It overrides the address given in the "Switched VC Incoming CALL?" parameter or the transport service. (See above.) It is used for the called address in the X.25 CALL REQUEST packet generated by the X.25 Network Gateway when call initiation is invoked by **SNA X.25 Call** command.

[Number of retries (default = 0)]
This items designates the number of times the call subsystem will attempt a call.

SNA/X.25 Clear

No parameters are necessary for this subsystem to execute. Simply invoke the command **SNA X.25 Clear** and press GO. This will clear the address defined in SNA/X.25 Call.

Notes to the System Programmer

1) When you install the SNA/X.25 Network Gateway to accept Incoming-Calls only, check the X.25 connection status on the X.25 Status Monitor to make sure the RESTART exchange sequence has been completed; otherwise the screen becomes locked. (It becomes unlocked after the INCOMING-CALL packet is received at the X.25 Network Gateway.)

2) When you attempt to install the SNA/X.25 Network Gateway more than once, the "old ones" stay in the memory of the workstation. Consequently, repeated attempts to install the gateway cause the system to crash. Reboot the system if it is necessary to install the SNA/X.25 Network Gateway more than once.

3) The B 20 is not capable of responding to the PSTEST command in this release level of the SNA/X.25 Network Gateway (1.1).

4) In this release level of the SNA/X.25 Network Gateway (1.1), the B 20 is not capable of generating a reliable INIT-SELF command when the user data field is empty. Avoid the use of empty data fields.

SECTION 3

SNA/X.25 STATUS MONITOR

The SNA/X.25 Network Gateway Status Monitor provides a full-screen display of PU, X.25, and LU statistics. In addition to the summary statistics, network configuration information is included. The SNA/X.25 Network Gateway Status Monitor can be used in conjunction with the X.25 Network Gateway Status Monitor to verify configuration and operational status, and it provides a tool in diagnosing error conditions.

The SNA/X.25 STATUS executive command invokes the SNA/X.25 Network Gateway Status Monitor. If the SNA/X.25 Network Gateway is not installed when **SNA X.25 Status** is executed, the status monitor is not invoked and the following is displayed on the user screen: "The SNA Network Gateway is not installed".

If the node (PU) is active, that is Activate Physical Unit (ACTPU) has been sent by the host computer and received by the B 20, the LU information in the Summary LU Status area is displayed in reverse video. Otherwise, it is not differentiated from the Summary Link Block and the PU Block. Figure 3-1 shows the appearance of the Summary LU Status area when the node is not active.

The Status Monitor screen is divided into three areas:

- o the Summary SNA Status area
- o the Summary X.25 Status area
- o the Summary LU Status area

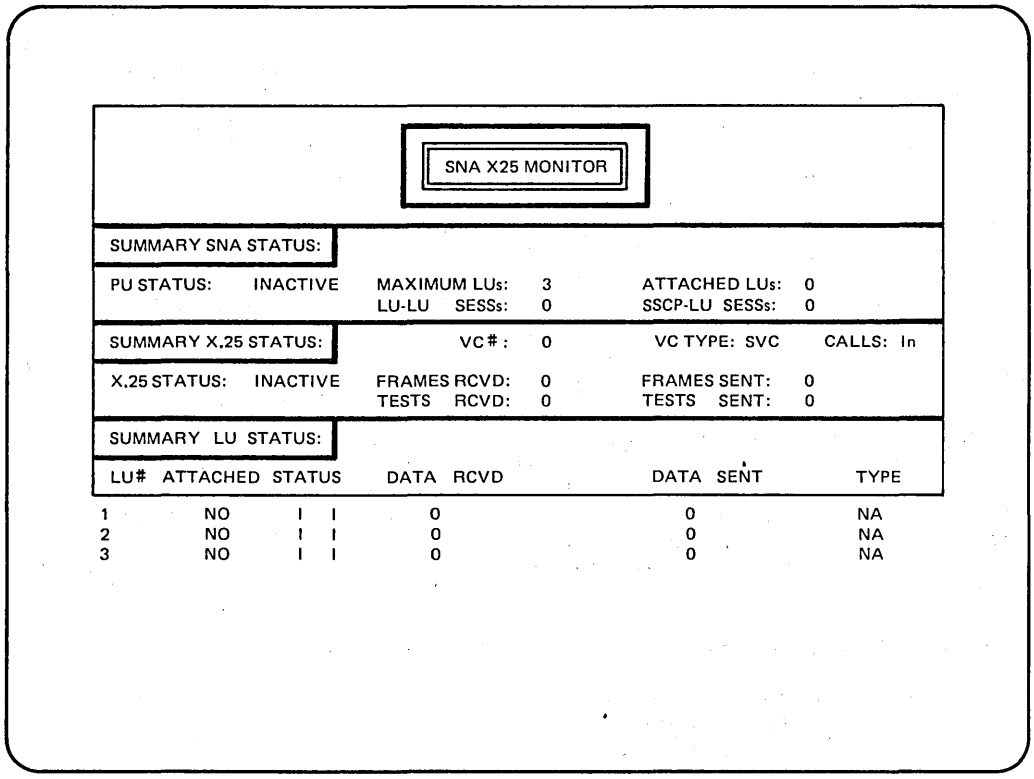

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Figure 3-1. SNA Network Gateway Status Monitor, PU Not Active.

SUMMARY SNA STATUS AREA

The Summary SNA Status area gives an overview of the SNA Network Gateway installed at this node and its attached LUs.

PU STATUS
shows whether or not this PU is active. If active, the SSCP in the host computer has issued an ACTPU to this data communications network node, thus allowing the SNA/X.25 Network Gateway to be installed.

MAXIMUM LUs
shows the maximum number of LUs that was specified at installation of the SNA Network Gateway.

ATTACHED LUs
shows the number of LUs currently attached.

LU-LU SESSs
shows the number of LU-LU current sessions, that is, the number of application programs currently in operation on this SNA Network Gateway.

SSCP-LU SESSs
shows the number of SSCP-LU sessions available though not necessarily in use. The value represents the number of LUs that have received Activate Logical Units (ACTLUs) from the host.

SUMMARY X.25 STATUS AREA

The Summary X.25 Status area summarizes the status of the X.25 Network Gateway. For a more detailed report of the activity of the X.25 Network Gateway use the status monitor that is available as a service of the X.25 Network Gateway.

X.25 Status
shows ACTIVE if the virtual circuit (VC) is connected, INACTIVE if not connected.

VC#
shows the virtual circuit number being used.

VC TYPE
shows SVC if the connection is through a switched virtual circuit, PVC if the connection is through a permanent virtual circuit.

CALLS
shows IN or OUT, depending on the type of virtual circuit installed as a parameter in installation of the transport service.

FRAMES RCVD
shows the number of Information frames (I frames) that this node has received from the host computer since the last installation or activation of the SNA Network Gateway. When the number reaches 65535, it is reset to 0.

FRAMES SENT
shows the number of I frames that this node has sent to the host computer since the last installation or activation of the SNA Network Gateway. When the number reaches 65535, it is reset to 0.

TESTS RCVD
shows the number of link level diagnostic test frames that this node has received from the host computer since the last installation or activation of the SNA Network Gateway. When the number reaches 65535, it is reset to 0.

TESTS SENT
shows the number of link level diagnostic test frames that this node has sent to the host computer since the last installation or activation of the SNA Network Gateway. When the number reaches 65535, it is reset to 0.

SUMMARY LU STATUS AREA

The Summary LU Status area shows in a list format the status of each LU installed with the SNA Network Gateway.

LU#
shows the numbers of the installed LUs. LU numbers are always sequential and always begin with 1. The maximum number of LUs equals the number specified when the SNA Network Gateway was installed.

ATTACHED
indicates whether or not a particular LU is being used by a user application program. The possible values are yes and no.

STATUS
shows the status of the SSCP-LU session and the LU-LU session for a particular LU. The possible values are active and inactive. The status code is comprised of two letters. The first of the two letters refers to the status of the SSCP-LU session, and the second refers to the LU-LU session.

DATA RCVD
shows the number of PIUs received from another LU by this LU during the current LU-LU session, that is, since the last activation of this LU.

DATA SENT
shows the number of PIUs sent by this LU to another LU during the current LU-LU session, that is, since the last activation of this LU.

TYPE
shows the type of B 20 SNA 3270 subsystem currently identified with a particular LU number.

The subsystem types are:

3270 (the SNA 3270 CRT subsystem)
3270P (the SNA 3270 printer subsystem)
RJE workstation
N/A (Not Attached)

KEYBOARD INPUT

The SNA/X.25 Network Gateway Status Monitor accepts keyboard input only in the Summary LU Status area.

The Summary LU Status area displays up to five LUs at once. To display more LUs (if they are configured), press SCROLL UP. The second LU becomes the top LU displayed in the Summary LU Status area, and a new LU is added at the bottom of the area.

LU information scrolls up as long as the key is pressed. Likewise, SCROLL DOWN can be pressed to view LUs that have scrolled off the top of the Summary LU Block.
Terminate the SNA status monitor by pressing FINISH. The B 20 returns to the control of the executive.

All keys other than FINISH, ACTION-FINISH, SCROLL UP, and SCROLL DOWN are ignored by the Status Monitor.

SECTION 4

FUNCTIONAL DESCRIPTION

OVERVIEW

This section presents an overview of the IBM Systems Network Architecture (SNA) and its special implementation as a gateway into an X.25 gateway. Be forewarned that in speaking about SNA, it is very easy to become mired in confusing acronyms and abbreviations. SNA is a formal definition of the functions of data communications network components. It defines formats for the exchange of data across network interfaces and protocols of allowable sequences of actions on the part of each component.

SNA is not a single product; it is composed of subsystems of several products. SNA is not a static entity but an evolving structure that will become further defined by time and use. The SNA/X.25 Network Gateway is itself an example of the dynamic nature of SNA. In a classical SNA network, the Data Link Control (DLC) function is performed by the Synchronous Data Link Control (SDLC), a bit-oriented protocol that allows serial-by-bit information transfer over a communications line. In the SNA/X.25 Network Gateway, the X.25 virtual circuit replaces the physical line established by the SDLC protocol. The interaction between the upper layers of the SNA network and X.25 virtual circuit is under the control of the Logical Link Control-2 (LLC-2) protocol. The LLC-2 protocol performs the linking between the 3705 Communications Controller and a B 20 (emulating a NIA 5973).

Four concepts are essential to an understanding of SNA:

Functional layers

Network-addressable units

Sessions

Peer protocols

FUNCTIONAL LAYERS

SNA comprises four main groups of data communications network functions:

The application layer

The function management layers

The transmission subsystem layers

The physical control layer

Each layer exists in each end-point of a data communications network, allowing symmetric functionality with well defined interfaces.

The SNA data communications network layers are shown in figure 4-1.

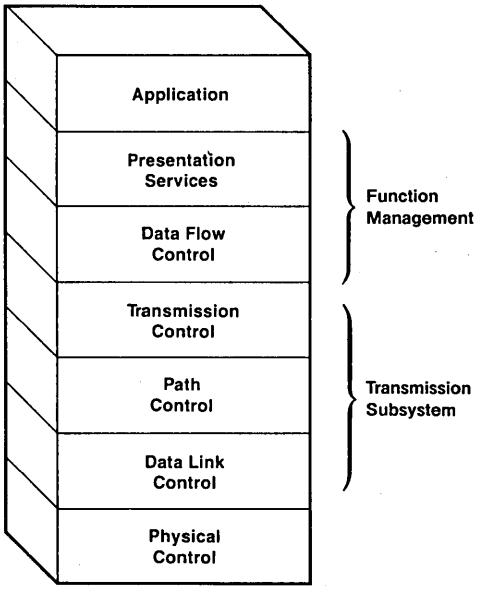


Figure 4-1. Layers of an SNA Network

Application

The application layer is concerned exclusively with user application program processing and bears no direct relationship to data transmission formats, protocols or procedures.

The function management layers as a group provide services associated with supporting specific hardware or software capabilities such as screen formatting. Function Management also includes services to combine the message data to be exchanged and to control the timing of the data transfer so that it does not outpace the receiving device.

The transmission subsystem layers as a group take responsibility for transmitting packets through the network, for reconfiguring the network, and for establishing logical connections between the end-points of the communications system.

The physical control layer is concerned with coordinating the functions of the physical components of an SNA data communications network.

Function Management

The function management layers are Presentation Services (PS) and Data Flow Control (DFC).

Presentation Services

Presentation Services (PS) provides device-specific transformations to be handled with applications independent of the lower layers.

Data Flow Control

Data Flow Control (DFC) does request/response sending/receiving, request/response correlation, and chaining to provide a means of sending or receiving a sequence of chains as one transaction.

Transmission Subsystem

The transmission subsystem includes Transmission Control (TC), Path Control (PC), and Data Link Control (DLC).

Transmission Control

The Transmission Control (TC) layer has three parts: the Connection Point Manager (CPM), Session Control (SC), and Network Control (NC).

Connection Point Manager

The Connection Point Manager (CPM) controls sequence number checking and assigning, pacing (session-level flow control), enciphering/deciphering of data, and internal routing.

Session Control

Session Control (SC) provides session-specific support for starting, clearing, and resynchronizing session-related data flows.

Network Control

Network Control (NC) provides for node outage notification and alternate routing capabilities. This support is provided on a per session basis, as is function managment layer support. Network Control is under the direction of a Network Control Program (NCP).

Path Control

Path Control (PC) contains the routing code necessary to support connections. Optionally, it provides for the segmentation of packets Path Information Units (PIUs) into smaller packets to meet the buffer requirements of the adjacent node or terminal. It also provides for the blocking of small packets into one larger packet in order to increase line use.

Data Link Control

Data Link Control (DLC) is responsible for point-to-point or multipoint communications between two network nodes or between a node and a terminal. As explained in the opening paragraph of this section, the SNA/X.25 Network Gateway DLC function is performed by LLC-2 protocol. It replaces the SDLC protocol of a classical SNA network.

Physical Control

The Physical Control Layer has the responsibility for coordination of the physical components of an SNA data communications network. The physical components of an SNA data communications network are called Physical Units (PUs). Each data communications network node is characterized by the PU type it contains. See figure 2-2.

Physical Unit Types 4 and 5

Physical Unit Type 4 is the front-end communications processor, which is responsible for maintaining information exchange with the other PU types on behalf of the host computer.

Physical Unit Type 5 is the host computer, which contains the System Services Control Point (SSCP) and also processes user application programs.

PU Type 4 and 5 nodes provide full network address routing and both local and global flow control capability. In addition, they provide certain boundary function support, consisting of services relating to IPLing (Initial Program Loading), dumping, session activation and resetting, and address translation.

PU Type 5 nodes differ from PU.T4 nodes in that PU.T5 nodes perform end-user application processing, and they contain a System Services Control Point (SSCP) in addition to the PU. PU.T4 nodes possess neither of these attributes.

Physical Unit Types 1 and 2

Physical Unit Type 1 is a terminal device (or other input/output device) that sends and receives data directly to or from the user.

Physical Unit Type 2 is the cluster controller responsible for maintaining information exchange with the other PU types on behalf of the user's terminal or another application program.

PU Type 1 and 2 nodes, that is, terminals and controllers respectively, have somewhat less network awareness than do Type 4 and 5 nodes. Type 1 and 2 nodes do not have network routing tables and are therefore free of the responsibility of network address translation, network routing, and global flow control.

The sensitivity of PU Type 1 and 2 nodes to changes in network address configuration is somewhat limited. This limitation enhances the advantages of dynamic network reconfiguration, since only nodes having network routing tables are affected by changes.

NETWORK ADDRESSABLE UNITS

Network Addressable Units (NAUs) in SNA include PUs and two other kinds of entities. They are the System Services Control Point (SSCP) and the Logical Unit (LU). PUs carry out commands from the SSCP and control network resources within their own nodes. The functions of the SSCP and the LU are described below.

System Service Control Point

The System Services Control Point (SSCP) resides in a PU.T5 and controls a network domain. The association of an SSCP and the PUs, LUs, links, and link stations that it activates and deactivates form a domain of control for domain bring-up and take-down, dynamic address assignment, problem determination, statistics gathering, and so on. SSCPs also control inter-host communications between LUs. There are as many domains in a given network as there are SSCPs.

Logical Unit

The Logical Unit is the conduit through which a user accesses the network. Each LU is associated with a network address and contains one or more half-sessions. (The connection of a half-session in one LU and a half-session in another LU is called a session.)

SESSIONS

A session is a temporary logical connection between NAUs for the exchange of messages. This exchange is conducted in accordance with ground rules that have been agreed to for that exchange. There are three types of sessions: SSCP-PU sessions, SSCP-LU sessions, and LU-LU sessions.

End users access the network through the use of LU-LU sessions. However, before a LU-LU session can be established, the SSCP must first establish sessions with the PU containing the Secondary LU (SLU), and then with the LUs themselves.

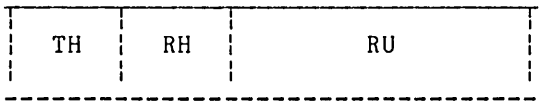
PEER PROTOCOLS

Be aware that the discussion of the protocols below is not intended to be a comprehensive presentation of all the protocols used in a SNA/X.25 network system. Use the documentation list at the end of this section as a guide to more in-depth reference material.

Functions in the same layer of different nodes are referred to as peer functions. Peer functions communicate with each other via a series of headers and trailers attached to the messages exchanged by the end users. These are called peer protocols; they need not be understood by lower layers and are stripped off before messages are given to upper layers.

The information to be passed between the end users is called the Request Unit (RU). When an RU is sent from one end user, a Request/Response Header (RH) is attached to the front of the RU by the Transmission Control layer. This is then called a Basic Information Unit (BIU). A Transmission Header (TH) is attached to the front of the message by the Path Control layer to form a Path Information Unit (PIU). (In a classical SNA network the SDLC protocol of the DFC adds a link header (LH) and link trailer (LT); these are not a part of the SNA/X.25 Network Gateway PIU.) When the message reaches the receiving node, each of the headers and trailers is examined and removed by the corresponding layer before the message is passed to the receiving end user.

PIU Frame



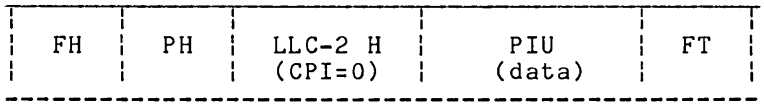
Transmission Subsystem Layers

Data Link Control (LLC-2)

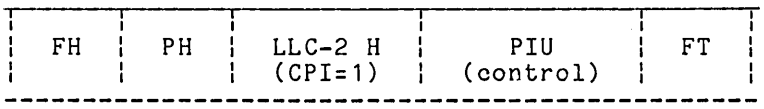
The following illustration shows the composition of the frame after the LLC-2 protocol adds its header (LLC-2 H) and the X.25 High-Level Data Link Control adds its Packet Header (PH), Frame Header (FH), and Frame Trailer (FT).

The Control Present Indicator (CPI) determines whether the packet contains data or control information.

The following illustration shows the LLC-2 data packet.



The following illustration shows the LLC-2 control packet.



A Path Information Unit (PIU) can be either segmented or not depending on its size. When it is segmented, the Packet Sequence Indicator (PSI) bit will be set in the whole series of LLC-2 packets with the exception of the last packet. The segmentation is different from the segmentation in the SNA Transmission Control layer that is identified in the Transmission Header.

When the Control Present Indicator (CPI) bit is on, byte 2 of the LLC-2 is a control identifier. In the case of PSXID or PSTEST commands, byte 3 and the remaining bytes are command modifiers that are defined in the same format as the SDLC XID or TEST command.

Following is an example of data flow between a host and a B 20.

HOST	X.25 NETWORK	B 20
CALL request	-->	
		--> INCOMING CALL
		<-- call accepted
call accepted	<--	
DTE DATA (PSTEST)	-->	
		<-- DTE DATA (PSTEST)
DTE DATA (PSXID)	-->	
		<-- DTE DATA (PSXID)
DTE DATA (PSCONT)	-->	
		<-- DTE DATA (PSCONT)
DTE DATA (ACTPU)	-->	
		<-- DTE DATA (RSP)
DTE DATA (ACTLU)	-->	
		<-- DTE DATA (RSP)
BIND	-->	
		<--DTE DATA (bind RSP)

```
SDT                          -->

                                          <-- DTE DATA (SDT RSP)

RU (segments, PSI=1)         -->

RU (last segment, PSI=0)     -->

                                          <-- DTE RSP (RSP)

Unbind                       -->

                                          <-- DTE RSP (unbind)

DACTLU                       <--

                                          <-- DTE RSP (DACTLU RSP)

DACTPU

                                          <-- DTE RSP (DACTPU RSP)

DTE DATA (PSDISC)            -->

                                          <-- DTE DATA (PSDISC)

CLear REQUEST                 ->

                                          <-- CLear CONFIRMation)
```

ACTLU--Activate Logical Unit
ACTPU--Activate Physical Unit
DACTLU--Deactivate Logical Unit
DACTPU--Deactivate Physical unit
PSCONT--Packet Sequence Contact
PSTEST--Packet Sequence Test
PSXID--Packet Sequence Exchange Station Identification
SDT--Start Data Traffic
RSP--Response

Path Control

The Path Control layer adds, uses, and removes the Transmission Header, which is six bytes long for all PU2s. These six bytes always follow the 2-byte SDLC header. The format of the TH is given in Appendix C.

Transmission Control

The Transmission Control layer adds, uses, and removes the Request/Response Header (RH), which is three bytes long. These three bytes always follow the Transmission Header. The format of the RH is given in Appendix C.

The remainder of this section is concerned with the contents of the Request Units (RUs).

Session Control

The following sessions must exist between the host system and the B 20 for an exchange of information:

SSCP-PU [host - Physical Unit (PU)]

SSCP-SLU [host - B 20 Secondary Logical Unit]

PLU-SLU [host application program - B 20 SLU] (referred to as LU-LU)

The SSCP-PU session must be established before establishing the SSCP-SLU or LU-LU sessions. When the host network operator activates the specific Physical Unit corresponding to the B 20, the host systems Communications Access Method (VTAM, TCAM, or EXTM) issues the Activate Physical Unit (ACTPU) command to the B 20. The SSCP-PU session is in effect when the B 20 responds positively to the ACTPU command.

The SSCP-PU session is terminated when the host network operator deactivates the Physical Unit corresponding to the B 20. When all SSCP-LU sessions for the B 20 have been terminated, the host issues the Deactivate Physical Unit (DACTPU) command. When the B 20 returns a positive response to the DACTPU command, the SSCP-PU session is terminated.

After the SSCP-PU session is established, an Activate Logical Unit (ACTLU) command may be issued by the Access Method to establish the SSCP-SLU session. The SSCP-SLU session must be established before establishing the LU-LU session. The SSCP-SLU session is in effect when the B 20 responds positively to the ACTLU command.

The SSCP-SLU session is terminated when the host sends a Deactivate Logical Unit (DACTLU) command to the specified SLU. When the B 20 returns a positive response to the DACTLU command, the SSCP-SLU session is terminated.

A LU-LU session is started by the host application program when it issues the Bind request. The B 20 LU examines the session parameters of the Bind and, if they are acceptable, allows the session to be established by sending a positive response to the Bind command. If the session parameters are not acceptable, the B 20 LU rejects the Bind command by returning a negative response, indicating that the session parameters are invalid (sense code X'0821').

After the Bind command has been accepted with a positive response, the host program can issue the Start Data Traffic (SDT) command to allow data traffic to flow for the session.

The PLU can terminate an LU-LU session by requesting that the SSCP close the session. The SSCP then sends the Unbind command to the secondary LU and the LU-LU session is terminated.

During a LU-LU session, the host program can issue a Clear command, which causes the B 20 to initialize all buffers. Once a Clear command has been received by the B 20, the host must send an SDT command or an Unbind command before the B 20 will react to any other commands.

APPENDIX A

STATUS CODES

Decimal Value	Hexa-decimal Value	Description
8800	2260	Interconnecting line failure or inactive line. One of the following conditions exists: (a) the line has not been properly activated, (b) the line has been deactivated, (c) a line failure has been detected. No incoming or outgoing data is allowed.
8801	2261	Internal Transport Service resources unavaliable. Retry the request.
8802	2262	All LUs currently in use.
8803	2263	LU currently attached. The user has specified an LU number to which another user is attached.
8804	2264	Read or write buffer size insufficient. The volume of data to be received or transmitted surpasses the size of the buffer. The data has been truncated to the buffer size requested.
8805	2265	Requested LU number not within the range configured on the installation menu. Recheck the number supplied and retry.
8806	2266	User-specified Timeout value exceeded. The request was not fulfilled.

Decimal Value	Hexa-decimal Value	Description
8807	2267	Invalid link address. Obtain a valid link address from local communications/operations personnel.
8808	2268	Transport Service has detected a fatal error or the same host has reactivated the node. Re-try the request or check with local operations personnel to determine cause.
8809	2269	The Transport Service has detected a fatal error or the host has reactivated the LU. Retry the request or check with local operations personnel to determine cause.
8810	226A	Request not executable. The SSCP-PU session is not active because the owning host has deactivated the node.
8811	226B	Request not executable. The SSCP-LU session is not active because the host has deactivated the LU.
8812	226C	Session reset by PLU.
8813	226D	Request received in non-functional state. Terminate the current session or detach the LU.
8814	226E	Request is from an LU that has not previously issued an AttachLU to the Transport Service.
8815	226F	No buffer resource available. A read or write-type operation was attempted with a buffer size = 0.

Decimal Value	Hexa-decimal Value	Description
8816	2270	Request not executable, LU-LU session not active. Probably caused by issuing a TerminateSNASession request with no LU-LU session active.
8817	2271	Too many requests have been sent to the Transport Service. Re-try the request.
8818	2272	Unable to queue request due to insufficient memory resources.
8819	2273	No inbound data can flow. The host has not yet activated the LU.
8820	2274	Process termination. All requests were (or shortly will be) cleared because the user's process has terminated.
8821	2275	InitiateSNASession request issued for an active LU.
8822	2276	Maximum number of allocatable LUs has been exceeded.
8823	2277	SDLC window-size maxout value is either less than one or greater than seven.
8824	2278	User has specified an LU number greater than 2 as the starting LU.
8825	2279	A DetachLU has been received. All subsequent requests are rejected except AttachLU.
8826	227A	PLU has terminated session. All outstanding user requests are terminated.

Decimal Value	Hexa-decimal Value	Description
8827	227B	A dial-up (switched) line or two-wire mode was chosen concurrently with FDX mode.
8828	227C	SNA Transport Service detected a segmentation error. Node is to be totally reset.
8829	227D	An InitiateSNASession request received a negative response from the host.
8830	227E	A TerminateSNASession request received a negative response from the host.
8831	227F	Invalid channel. An invalid communications channel has been specified.
8832	2280	Yes or No not specified. An installation parameter requiring either a yes (Y) or no (N) has received neither value.
8833	2281	Invalid dial ID. Only numeric values may be specified.
8834	2282	Invalid buffer size. A value either too small (<10) or too large (>1024) has been specified for the maxmum PIU size.
8850	2292	Invalid LU supplied. The Logical Unit number specified at installation is not in the range 2-17. Execute "SNA 3270 CRT" command with valid LU Number.
8851	2293	Invalid screen profile. The Screen Profile specified at installation is not in the range A-D, or a-d. Execute "SNA 3270 CRT" command with valid screen profile. (See Section 3 of the B 20 Systems SNA 3270 Emulator Reference Manual (form 1162989) for a discussion of screen profile types.)

Decimal Value	Hexa-decimal Value	Description
8852	2294	Invalid numeric lock parameter. The response to the Numeric Lock parameter specified at installation is not y or n. Execute "SNA 3270 CRT" with a valid numeric lock parameter.
8865	2301	No file name. A file name is a required parameter for installation of the 3270 Printer subsystem. Execute "Install SNA 3270 PRT" with a valid file name.
8866	2302	Invalid file name. Execute "Install SNA 3270 PRT" with a valid file name.
8867	2303	SNA Network Gateway not installed. The SNA Network Gateway must be installed before the 3270 Printer subsystem can be installed. Install the Network Gateway, then execute the "Install SNA 3270 PRT" command.
8868	2304	Invalid LU type. Execute "SNA 3270 CRT" or "Install SNA 3270 PRT" as appropriate with a valid LU type.
8880	2310	Timeout occurred. No data were received from the host computer during the time period specified in procedures with a Timeout parameter. This error can occur when there is a heavy load on the host computer.

Decimal Value	Hexa-decimal Value	Description
8881	2311	Minus function. This is equivalent to a minus function condition when typing on the keyboard.
8882	2312	Input inhibited. Some condition occurred which inhibits input to the screen image. Press the RESET key to clear the condition.
8883	2313	Input error. An error occurred while writing to the screen image; for example, an attempt to write to a write-protected field. Press the RESET key to clear the condition.
8884	2314	Invalid screen. An invalid screen size was specified in the OpenSNA3270Emulator procedure.
8885	2315	Invalid keyboard input. An invalid character was found in the keyboard stream. Press the RESET key to clear the condition.
8886	2316	Invalid ATTENTION key ID. An invalid ATTENTION key ID character was used in the ReturnSNA3270Screen. Press the RESET key to clear the condition.
8887	2317	Program error. The host computer has sent an error condition to the screen. Press the RESET key to clear the condition.
8888	2318	Invalid Printer. The PrinterId on OpenSNA3270Emulator was invalid, or the IDENT key specified an invalid printer. Press the RESET key to clear the condition.

APPENDIX B
REQUEST UNITS

Supported SNA request units:

	Send	Receive
Session Control		
ACTLU		X
ACTPU		X
BIND		X
CLEAR		X
DACTLU		X
DACTPU		X
UNBIND		X
FMD NS(MA)		
REQMS		X
RECFMS	X	
FMD NS(S)		
INIT-SELF		
TERM-SELF		
CHARACTER-CODED LOGON	X	
CHARACTER-CODED LOGOFF	X	

Format of supported SNA request units:

ACTLU

```
Byte 0    = X'0D'

     1    = X'01'

     2    bit 0-3 = FM profile (should be 3)
          bit 4-7 = TS profile (should be 3)
```

ACTPU

```
Byte 0    = X'11'

     1    = X'01'  cold
          = X'02'  error recovery procedure

     2    bit 0-3 = FM profile (should be 3)
          bit 4-7 = TS profile (should be 3)

     3-8    A six byte field that specified the
            ID of the SSCP issuing the ACTPU.
```

BIND

```
Byte 0    = X'31'

     1    = X'01'

     2    = X'03' (FM profile)

     3    = X'03' (TS profile)

     4    bit 0, chaining use:
                 0  The PLU can send only single-
                    element chains.
                 1  The PLU can send single- or
                    multiple-element chains.
          bit 1 = 0
          bit 2-3, chaining responses:
                 01  The PLU can only request
                     exception only responses.
                 10  The PLU can only request
                     definite responses.
                 11  The PLU can request definite
                     or exception-only responses.
          bit 4-5, reserved
          bit 6 = 0
          bit 7 = 1
```

Byte 5 bit 0, chaining use:
0 The B 20 can send only single-element chains.
1 The B 20 can send single- or multiple-element chains.
bit 1 = 0
bit 2-3, chaining responses:
01 The B 20 can only request exception-only responses.
10 The B 20 can only request definite responses.
11 The B 20 can request definite or exception-only responses.
bit 4-5, reserved
bit 6 = 0
bit 7 = 0

Byte 6 bit 0, reserved
bit 1 = 0
bit 2 = 1
bit 3 = 1
bit 4 = 0
bit 5-7, reserved

Byte 7 bit 0-1 = B'10'
bit 2 = 0
bit 3 = 0
bit 4-6, reserved
bit 7 = 0

Byte 8 bit 0-1, reserved
bit 2-7, Secondary-to-primary LU pacing count. If set to zeros, pacing is not used.

Byte 9 bit 0-1, reserved
bit 2-7, Primary-to-secondary LU pacing count. If set to zeros, pacing is not used.

Byte 10 Maximum RU size sent by the B 20. Some possible values are:
85=256 86=512 C6=768 87=1024
A7=1280 C7=1536 E7=1792 88=2048

Byte 11 Maximum RU size sent by the PLU. Values are the same as for byte 10.

Byte 12, 13 reserved

Byte 14 = X'02' Type 2 3270 data stream compatibility mode.
= X'03' Type 3 3270 print function using 3270 data stream.

Byte 15-19, reserved

Byte 20 = Default number of rows

Byte 21 = Default number of columns

Byte 22 = Alternate number of rows

Byte 23 = Alternate number of columns

Byte 24 = Session buffer size

Byte 25 and up, reserved

CLEAR

Byte 0 = X'A1'

DACTLU

Byte 0 = X'0E'

DACTPU

Byte 0 = X'12'

1 = X'01' physical connection may be broken
= X'02' physical connection not to be broken

UNBIND

Byte 0 = X'32'

1 = X'01' normal send of session

APPENDIX C
F1D2 PATH INFORMATION UNIT

Byte

0	1	2	3	4	5	6	7	8	9
THB0	THB1	DAF'		OAF'		SNF			RHB 2 RU

THB0, bit 0-3 B '0010'

bit 4,5 Middle segment = 00,
Last segment = 01,
First segment = 10,
Whole BIU = 11

bit 6 reserved

bit 7 Expedited flow = 1

THB1 = X'00' (reserved)

THDAF' = Destination Address Field

THOAF' = Origin Address Field

THSNF = Sequence Number Field

RHB0, bit 0Request = 0,
response = 1

bit 1,2 Presentation Services = 00,
Network Control = 01,
Data Flow Control = 10,
Session Control = 11

bit 3 reserved

bit 4 Field Formatted = 1,
No FM header = 0

bit 5 Sense Data Included = 1

bit 6 Begin Chain = 1

bit 7 End Chain = 1

RHB1,	bit 0,2-4	No rsp requested	= 000,
		Definite rsp requested	= 010, 100, 110,
		Exception rsp requested	= 011, 101, 111
	bit 6	Rsp bypasses queues	= 0,
		enqueue rsp	= 1
	bit 7	Pacing request	= 1,
		not pacing indicator	= 0
RHB 2,	bit 0	Begin Bracket	= 1
	bit 1	End Bracket	= 1
	bit 2	Change Direction	= 1
	bit 3	reserved	
	bit 4	Code 0	= 0,
		Code 1	= 1
	bit 5	RU enciphered	= 1
	bit 6	RU was padded before encipherment	= 1

APPENDIX D
SENSE CODES

The Transport Service (TS) supports the following SNA Sense Codes (Status Codes):

Modifier	Description
Path Error (Major Code = X'80')	
X'04'	Unrecognized DAF'.
X'05'	No session.
X'08'	PU not active.
X'09'	LU not active.
X'0F'	Invalid address combination.
RH Usage Error (Major Code = X'40')	
X'08'	Pacing not supported.
X'0A'	No response (not allowed).
State Error (Major Code = X'20')	
X'01'	Sequence number was not one greater than last received.
X'05'	Data traffic reset.
Request Error (Major Code = X'10'	
X'03'	Function not supported.
X'07'	Category not supported.
Request Reject (Major Code = X'08'	
X'01'	Resource not available.
X'05'	Session limit exceeded.
X'0A'	Permission rejected.
X'0C'	Procedure not supported.
X'15'	Function active.
X'1C'	Request not executable.
X'21'	Invalid session parameters.
X'31'	LU is disconnected.

APPENDIX E
INSTALLATION FORMS

SNA/X.25 Transport Service Form

[Max # of LUs (default = # of WS)] _____

[Starting LU number (default = 1)] _____

[Max PIU size (default = 265] _____

[Switched ID (default = 0)] _____

[ID Block (default = 018)] _____

[Max X.25 Packet size (default = 128 bytes)] _____

[Switched VC Outgoing CALL? (default = no)] _____

[Target DTE Address (default = none)] _____

[Switched VC Incoming CALL? (default = no)] _____

[Low port number (default = 00)] _____

[High port number (default = 99] _____

[Permanent VC LCN (default = none)] _____

SNA/X.25 Call Form

[Target DTE Address (default = Install parm)] _____
[Number of Retries (default = 0)] _____

APPENDIX F
RELATED DOCUMENTATION

These additional documents may be helpful in understanding SNA and X.25 networks:

Burroughs Manuals

B 20 Systems X.25 Network Gateway, form 1176104.

CMS SNA Adaptor User's Guide, form 1144458.

IBM Manuals

Systems Network Architecture: General Information, form GA27-3102.

IBM Synchronous Data Link Control: General Information, form GA27-3093.

Systems Network Architecture Format and Protocol Reference Manual: Architectural Logic, form SC30-3112.

Systems Network Architecture: Concepts and Products, form GC30-3072.

Systems Network Architecture: Sessions Between Logical Units, form GC20-1868.

Systems Network Architecture: Introduction to Sessions Between Logical Units, form GC20-1869.

Systems Network Architecture Handbook: General Systems Division, form S229-4522.

The X.25 Interface for Attaching IBM SNA nodes to Packet-Switched Data Networks, form GA27-3345.

Other Publications

Communications Architecture for Distributed Systems. R.J. Cypser (New York: Addison-Wesley Publishing Company, 1978).

Computer Network Architectures. Anton Meijer and Paul Peeters. (Rockville, Maryland: Computer Science Press, 1982).

CCITT, Data communication networks. Services and Facilities. Terminal equipment and interfaces. Recommendation X.1--X.29, Yellow Book, Vol VII-Facicle VIII.2, CCITT CIIth Plenary Assembly, Geneva, 10-21 Nov. 1980, ITU, Geneva, 1981.

GLOSSARY

Activate Logical Unit (ACTLU). A Session Control command that establishes an SSCP-LU session.

Activate Physical Unit (ACTPU). A Session Control command that establishes an SSCP-PU session.

Advanced Communication Function (ACF). A feature of Release 3 and beyond of SNA that provides multiple host networking support.

Application Programmer Interface (API). The procedural macro in the IBM data communications product Virtual Telecommunications Access Method (VTAM).

Basic Mapping Support (BMS). A feature that maps user data into 3270 formatted screens under CICS

Basic Transmission Unit (BTU). Comprises one or more blocked PIUs.

BIND. A Session Control command that establishes an LU-LU session.

Blocking. A technique for combining small units of data into a single block for transmission.

Boundary Function. An NCP (Network Control Program) component that provides SNA support for adjacent cluster controller and terminal nodes.

Brackets. An SNA protocol that delimit a logical conversation between two LUs.

CCITT. Comite Consultatif Internationale de Telegraphique et Telephonique (International Telegraph and Telephone Consultative Committee).

Chain. An SNA protocol that provides a means of grouping logically related units of data. Chaining in SNA is a distinct function from chaining in BTOS.

CLEAR. A Session Control command used to purge all requests and responses and inhibit normal data traffic flow.

Cluster Controller. An SNA node containing a Type 2 Physical Unit (PU.T2).

Communications Controller. An SNA node containing a Type 4 Physical Unit.

Connection Point Manager (CPM). The coordinator of all the flows for one half-session and the interface for the half-session to the common data communications network.

Data Flow Control (DFC). The SNA data communications network layer that controls whether the half-session can send, receive, or concurrently send and receive RUs. It also groups related RUs into RU chains and delimits transactions via the bracket protocol. In addition it correlates requests and responses and generates sequence numbers.

Data Link Control (DLC). The SNA layer that is responsible for transmission of data across physical connections.

Deactivate Logical Unit (DACTLU). A Session Control command that terminates an SSCP-LU session.

Deactivate Physical Unit (DACTPU). A Session Control command that terminates an SSCP-PU session.

Destination Address Field (DAF). A field in the Transmission Header that identifies the destination of the data.

Domain. That portion of an SNA network consisting of all resources controlled by one SSCP.

Format Identification (FID). An indicator in the Transmission Header that defines the format of the Transmission Header.

Frame. The unit of data transmitted over SDLC data links.

Frame Check Sequence (FCS). Comprises the 16 bits that precede the ending flag of an SDLC frame. They contain the result of a CRC calculation on the frame. The FCS is used for error checking.

High-Level Data Link Control (HDLC). A bit-synchronous, link access protocol. Variants of the HDLC protocol are used as the link level protocol in the X.25 Network Gateway and in the B 20 cluster.

Host. An SNA node containing a Type 5 Physical Unit (PU.T5).

Information Frame (I-frame). An SDLC frame containing user data.

Layer. A defined functional separation of SNA protocols.

Logical Link Control. A virtual protocol that handles the dialog between the upper layers of SNA and the X.25 network gateway.

Logical Unit (LU). A Network Addressable Unit (NAU) through which end users access an SNA network.

Logical Unit Status (LUSTAT). A Data Flow Control command that sends LU status information.

Logical Unit Type. Defines the SNA protocols and functions used to support a logical unit. The LU Types are LU.T0, LU.T1, LU.T2, LU.T3, and LU.T4.

Network Addressable Unit (NAU). An SNA component that is uniquely addressable.

Network Control (NC). Comprises a set of commands that handle special situations related to network control such as notification of a lost subarea.

Network Control Program (NCP). Software that runs in a 3705 Communications Controller.

Network Services (NS). Comprises a set of SNA commands that provide session, configuration, maintenance, measurement, and network operator services.

Network Services Header. A command that contains a field-formatted NS request.

Node. A grouping of SNA components characterized by the type of Physical Unit it contains.

No Response Protocol. A Data Flow Control protocol in which no response is expected.

Normal Flow. A separate data flow on which end user data and some Data Flow Control commands are sent.

Normal Flow Send-Receive Protocols. Data Flow Control protocols that define responses to be sent to requests.

Origin Address Field. A field in the Transmission Header that identfies the source of the data.

One-Way Virtual Circuits. Accepts either incoming or outgoing calls but not both. See also Permanent Virtual Circuit, Virtual Circuit, and Two-Way Virtual Circuit.

Pacing. A technique for controlling the rate of data flow between nodes.

Packet. The basic unit of data transfer over an X.25 communications network. A packet contains control information as well as data.

Packet Switching. A type of data transfer that occupies a network communications link only during the time of actual data transmission. The data is transmitted in small segments, called packets.

Path Control (PC). The layer of SNA used for end-to-end routing of data.

Path Information Unit (PIU). Comprises the Transmission Header followed by a PIU or PIU segment.

Permanent Virtual Circuit (PVC). Does not require call establishment and cannot be cleared. See also One-Way Virtual Circuit, Two-Way Virtual Circuit, and Virtual Circuit.

Physical Unit (PU). The entity that is responsible for controlling the resources of a node.

Presentation Services (PS). Comprises the protocols responsible for presenting data to end users in a form that is required by them.

Presentation Services Profile. Profile defines a subset of Presentation Services options.

Primary Logical Unit (PLU). Resides in the Host node and is the LU that is responsible for control of the LU to LU session.

Profile. Defines a subset of optional SNA protocols and functions.

Protocol. A set of procedures that govern the exchange of data over a communications link.

Public Data Network (PDN). A regulated provider of communications services.

Two-Way Virtual Circuit. Accepts both incoming and outgoing calls. See also One-Way Virtual Circuits, Permanent Virtual Circuit, and Virtual Circuit.

Record Formatted Maintenance Statistics (RECFMS). A Network Services command that sends maintenance statistics from the 3270.

Ready To Receive (RTR). A Data Flow Control command used to indicate the receiver is ready to receive a bracket.

Request. End-user data or an SNA command sent by an LU, PU, or SSCP.

Request/Response Header (RH). A portion of an SNA unit of data used for various control purposes.

Request Maintenance Statistics (REQMS). A Network Services comand used to obtain configuration and performance information from the 3270.

Request/Response Unit (RU). A unit that contains user data, acknowledgement of user data, network commands, or responses to commands.

Response. A unit of data sent as a result of a corresponding request.

Secondary Logical Unit (SLU). A 3270 logical unit not functioning in a control mode. It is the converse of a Primary Logical Unit (PLU).

Segmenting. A technique for splitting up a message into smaller units for transmission.

Sequence Number Field (SNF). A field in the Transmission Header containing the sequence number of the unit of data.

Session. A temporary logical connection between two Network Addressable Units.

Session Control (SC). Comprises a set of commands for establishing and terminating sessions.

Shutdown (SHUTD). A command from the host to notify the 3270 Cluster Controller to prepare for termination of the session.

Shutdown Complete (SHUTC). A command from the 3270 Cluster Controller that notifies the host that shutdown processing is complete and the session is terminated.

SIGNAL. A Data Flow Control command that sends expedited messages.

SNA Character String (SCS). A series of EBCDIC control codes that format and control the printing of data. The SNA character string is supported by the 3270 for printers operating as Type 1 Logical Units (LU.T1s).

Start Data Traffic (SDT). A Session Control command that indicates that user data may be sent to the host.

Subarea. A grouping of SNA nodes that are assigned a unique subarea address.

Synchronous Data Link Control (SDLC). A bit-oriented, full-duplex data communications protocol used for remote communication in SNA networks.

Systems Network Architecture (SNA). The formal definition of IBM's data communications networking philosophy.

Systems Services Control Point (SSCP). The common control point in a domain, responsible for controlling the resources of the domain.

Terminal Node. An SNA node that contains a Type 1 Physical Unit (PU.T1).

Transmission Control (TC). Comprises a set of protocols for data sequencing and data transmission rate.

Transmission Header (TH). An SNA data header that identifies the source and destination of the data, its sequence number, and type of flow.

Transmission Subsystem (TS). Comprises all the Data Link Control, Path Control, and Transmission Control elements in an SNA network.

Transmission Subsystem Profile. Defines the subset of optional Transmission Subsystem protocols.

UNBIND. A Session Control command that terminates an LU-LU session.

Virtual Circuit (VC). A communications link between data terminal equipment through a store-and-forward packet network. Although data packets are not necessarily kept in sequence during transmisssion, they are kept in sequence at the receiving end of the link. See also One-Way Virtual Circuits, Permanent Virtual Circuits, and Virtual Circuits.

Virtual Telecommunications Access Method (VTAM). The main data communications access method used in SNA networks.

X.25 Network. A packet-switching public data communications network.

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Documentation Evaluation Form

Title: B 20 Systems SNA/X.25 Network Gateway Operation and Reference Manual

Form No: 1180171

Date: June 1985

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