HOW TO UPDATE YOUR MANUAL

This update package (Publication Number NPD-57-1) contains corrections and insertions to the Network Products Concepts and Facilities notebook. You **must** have the Network Products Concepts and Facilities notebook dated January 15, 1985 (Publication Number 57) to use these updates. You may order the notebook, along with the updates, through your TYMNET Marketing representative.

REPLACE Pages	WITH Pages
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Hardware/Engine page	TYMNET Communications Processor Family page
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2-5/2-6/2-7/2-8	2-5/2-6/2-7/2-8
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7-3/7-4	7-3/7-4
9-7/9-8/9-9/9-10/9-11/9-12	9-7/9-8/9-9/9-10/9-11/9-12
Reader Comment Form	Reader Comment Form

Insert the Preface between the title page and the Contents.

Insert pages 6-1 through 6-20 after the X.25 tab.

Insert pages 10-1 through 10-20 after the SDLC tab.

Insert pages GLOSSARY-1 through GLOSSARY-9 after the Glossary tab.

Network Products Concepts and Facilities

July 31, 1985

Publication Number 57

PREFACE

This notebook presents the concepts and facilities of each TYMNET network product and explains how each fits into a network system. It is intended for technicians and analysts in a private network environment. The notebook is divided into eighteen chapters.

Chapter One describes the TYMNET Communications Processor family of hardware products. It includes descriptions of the Engine processor, Mini-Engine, Micro-Engine, Asynchronous Terminal Concentrator, Port Switch Module, Multiple Extended Processor, External Processor Interface, and Super-Engine.

Chapter Two explains ISIS, the TYMNET Internally Switched Interface System for communications processing. Topics include the kernel, the dispatcher, and slots.

Chapter Three, describing the TYMNET Node Code product, will be incorporated into this notebook at a future date.

Chapter Four explains the Supervisor, the central controller of a TYMNET network. Topics include network resource monitoring, user access control, circuit routing, and Supervisor takeover procedures.

Chapter Five describes the TYMSAT, an asynchronous terminal interface to a TYMNET network. It includes descriptions of TYMSAT support capabilities in stand-alone and ISIS environments.

Chapter Six explains the X.25/X.75 Communications Interface. Topics include Packet Assembly/Disassembly (PAD), packet-switching interface protocol, user facilities, and interface capabilities.

Chapter Seven describes the ISIS TYMCOM, an asynchronous host interface to a TYMNET network. Topics are signal protocol, system generation, and the TYMCOM Operations Manager.

Chapter Eight explains the TYMNET 2780/3780/HASP Interface. It includes descriptions of 2780/3780 and HASP link level protocol, external support capabilities, virtual terminal mode, DOS/MLI, RSCS/VMB, and Transparent Bisynchronous Interface facilities.

Chapter Nine describes the three TYMNET 3270 bisynchronous interface products: the 3270 Host Interface, the 3270 Terminal Interface, and the Character Mode Translator. Topics include protocols and support capabilities.

Chapter Ten explains the SDLC Interface. It describes data link capabilities, the X.25 Qualified Logical Link Control feature, supported IBM software and hardware, transmission frames, and system monitor operations.

Chapter Eleven describes the TYMNET SNA Interface. Access between SNA-protocol terminals and hosts through a TYMNET network and a description of IBM's System Network Architecture are presented.

Chapter Twelve explains PROBE, an interactive network monitoring tool that operates in conjunction with the Supervisor. Topics include network status information and network control commands.

Chapter Thirteen describes TMCS, the Tymnet Monitoring and Control System. It includes descriptions of the interactive monitoring commands, the Alarm facility, and the Automatic Recovery and Reload facility.

Chapter Fourteen explains NETVAL, the Network Validations program. Topics include network access control, user validation data, update and verification processes, and user capabilities.

Chapter Fifteen describes RAM, the Raw Accounting Merger program. It includes descriptions of the accounting data collection process, session record contents, and RAM data used in capacity planning.

Chapter Sixteen explains ELF, the Engine Load Facility program. It describes transferring and loading code into TYMNET Engine processors and slots.

Chapter Seventeen, describing the Configuration Management Facility, will be incorporated into this notebook at a future date.

Chapter Eighteen, explaining the TYMNET OnTyme message switching system, will be incorporated into this notebook at a future date.

The main text is followed by a glossary.

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TYMNET Communications Processor Family

CHAPTER 2

ISIS–II

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OVERVIEW

ISIS-II is TYMNET's special purpose operating system for communications processing. It allows several communication interface programs to operate simultaneously under multiprogramming.

ISIS-II software consists of three major parts: the kernel (a control center), the dispatcher (a message carrier), and the slots (processes providing interface services).

ISIS-II functions like a miniature version of the network. Just as the Supervisor controls the whole network, ISIS-II controls the Engine and allocates the Engine's resources.

With ISIS-II, Engine memory is divided into slots that are logically separate partitions containing a collection of related processes. Up to 64 ISIS-II slots may be allocated when an Engine is configured. Each interface board may be used by several slots. Each slot is independent, but all are controlled by the kernel, and may be interconnected by the dispatcher. This arrangement allows different interfaces and applications to reside in adjacent slots.

If slots communicate to an external device, for example, to a host computer using an interface board, they are termed "interfaces"; if the slots are entirely self-contained, they are termed "applications". Collectively, slot activities are termed "processes".

Figure 2-1 shows the general layout for an ISIS-II node configuration with three slots. The hardware device driver module services internal and external input and output (I/O) interrupts. The kernel schedules all other processes and provides communications between the hardware drivers and the individual slot processes. Each slot may have three job processes: Dynamic Debugging Tool (DDT), Foreground and Background, all of which may be active concurrently.

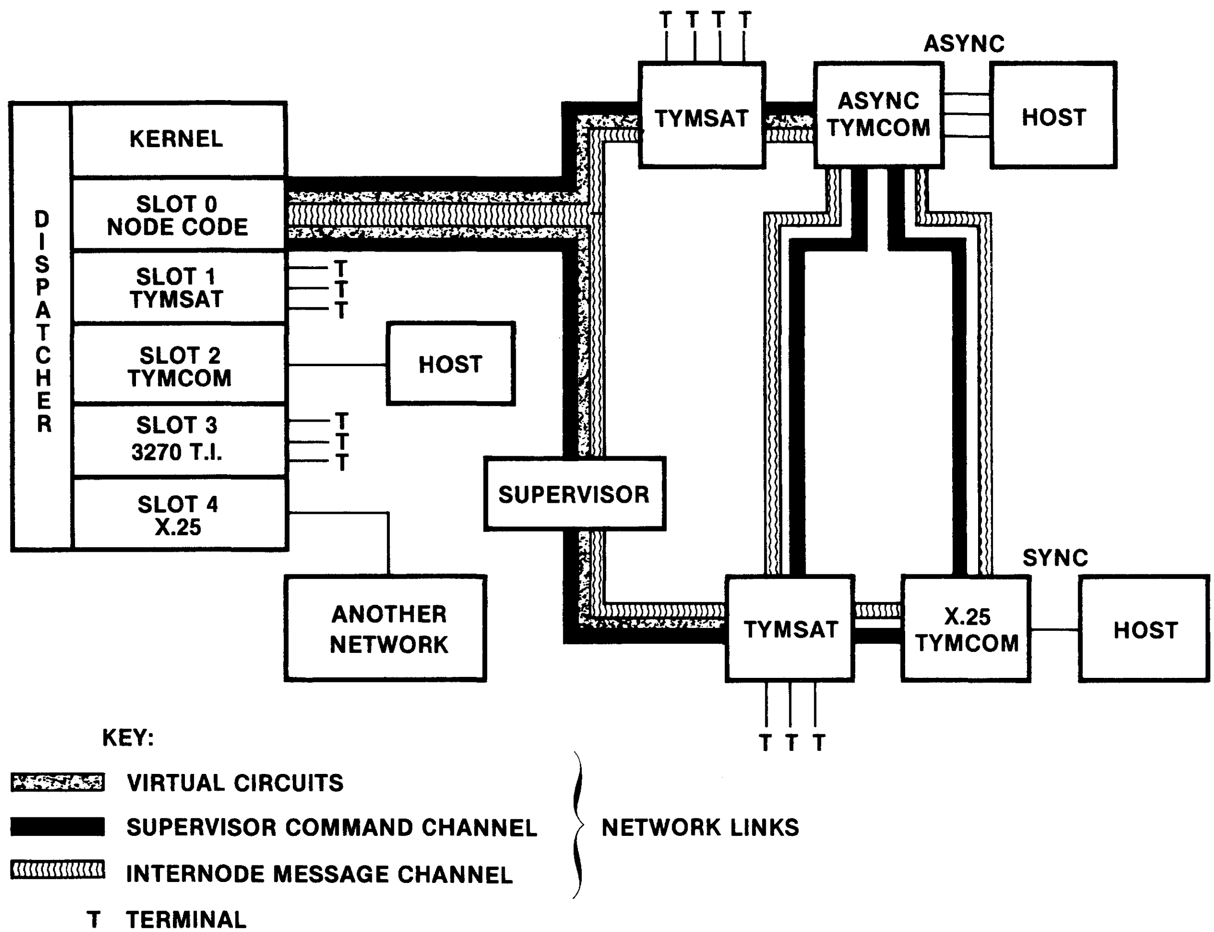

Figure 2-2. View of a Node in a TYMNET Network

The Kernel

The kernel is the control center of an Engine under ISIS-II and provides control over both Engine hardware and job scheduling. The kernel handles the following tasks.

- Manages slots (interface and application processes) created under ISIS-II. Each interface runs one or more processes and is allocated its own area of memory, supervised by the MAC. Whatever Engine memory is not used by the kernel and dispatcher is available for the slots. The same functional process may run in different slots.

- Schedules CPU time for all processes, which it divides into jobs. Jobs are independently scheduled according to relative urgency. Interrupts have the highest priority followed by foreground, intermediate (dispatcher), and background jobs (including DDT for code debugging). Background jobs conduct the major part of a slot's work, receiving long periods of CPU time at nonuniform intervals. The kernel processes an interrupt and returns the CPU to the original job when the interrupt has been handled.

- Controls the MAC board that assigns physical memory addresses to logical slot process addresses. The kernel also updates segment F, a common read-only data storage area containing information on all current job processes in the slots.

- Handles software and hardware I/O drivers. ISIS-II employs a set of general purpose drivers to handle communications between hosts, terminals and peripheral devices. Centralized drivers provide a high level of process security and make interface process software more flexible.

- Processes Supervisor Calls (SVCs) from the job slots requesting service for functions which slots do not have the license to do. The kernel validates a slot's requests, servicing only those that are legitimate, thereby controlling total machine resources and maintaining system integrity.

The Dispatcher

The dispatcher is the communications switching center of ISIS-II, and handles all data switching between slots. To the dispatcher, all slots are seen as equal, except that Node Code (slot 0) is able to perform data packet routing and network accounting chores for the network Supervisor. The dispatcher collects and forwards this accounting data to Node Code during and at the end of job slot processing sessions.

The dispatcher runs as an intermediate level job that handles the ISIS-II internal data bus, linking the slots with each other. The dispatcher operates each time a background job is run and sets up that background job for the next run. The dispatcher switches the output of a slot to the appropriate destination slot(s).

The slots must communicate with the dispatcher using a uniform format because all data from the interfaces in the slots must conform to a standard protocol. Each interface has a set of control tables used in communicating with the dispatcher and may also have a translator to convert messages to the standard message format. Each interface runs as one or more independent jobs under the kernel, sharing CPU time with other interfaces. The MAC prevents each slot from destroying the memory of its neighbor slots by overwriting them. The dispatcher checks the data flow to ensure that an interface in error damages only its own subset of circuits.

The Slots

A slot is both a logical division and a software process. Interface boards and slots have no fixed one-to-one relationship. Interface boards are physical hardware interfaces, typically supporting a number of peripheral devices, such as terminals or printers. Each independent device can be separately assigned to a slot.

A board can be assigned to one or more slots. An asynchronous board, for example, can support 32 asynchronous ports which are assigned to slots in groups of 16. Thus, two slots could use a single asynchronous board. A synchronous interface board has 16 synchronous ports which could be divided among as many as 16 slots.

Alternatively, one slot can have several interface boards assigned to it. A single slot can support groups of asynchronous lines as well as synchronous lines.

Under MAC, a slot can have up to 16 simultaneous memory segments, with hardware support for the segments provided by the MAC board. With ISIS-II, memory segment F is shared and readable by all processes. It contains system variables, such as clocks, which are of interest to all processes using CPU timeslices for job processing.

Segment E is a slot's Control Table Area (CTA) and is protected from inadvertent modification by the slot itself. The CTA contains descriptors of the slot's running configuration, such as pointers to variables, and memory size and layout. Each CTA is shared by the dispatcher and a slot using data structures to communicate with individual jobs and to record ongoing processes.

Dispatcher Internal Processes

ISIS-II internal communications are mainly between the dispatcher and the slots. When two interfaces talk to each other through the dispatcher, the sender and receiver do not have to be synchronous. What is necessary, however, is that the two data flows be independent of each other and that standard message format be used.

To accommodate bursts of data on the dispatcher bus, input and output ring buffers must be installed in all interface slots. Each ring buffer is allocated approximately a one second (maximum) data flow storage capacity.

Each interface, including slot 0, has a set of permuter tables that tell the dispatcher which port of one interface is connected to which port of another. Because slot processes are running concurrently, the dispatcher operates at an intermediate level of priority. This level is higher than background job priority, so background jobs get interrupted by the kernel's scheduler on behalf of the dispatcher.

The dispatcher normally attempts to move data from the source process to the destination process immediately. If the dispatcher cannot deliver at once, it buffers the data. To prevent source output ring buffer overloading, the dispatcher back-pressures the source port, not the source interface directly, as this would stop all source interface output, including output destined for other interfaces.

X.25/X.75

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OVERVIEW

The TYMNET X.25 and X.75 Interfaces provide standardized access to the packet-switching data transmission services of TYMNET. They are fully compatible with recognized international standards. The same interface implementation and procedures may be used to access both private and public networks that provide X.25 and/or X.75 access including networks based on TYMNET technology.

This document should be used with the International Telephone and Telegraph Consultative Committee (CCITT) Recommendation X.25 and International Standards Organization (ISO) standards 8208 and 7776.

Study Group VII of the CCITT produced and approved X.25 as an international recommendation in 1976, and X.75 as a provisional recommendation in 1978. Since then, these CCITT protocols have undergone several changes, the latest of which were approved in October, 1984. TYMNET recognizes that it is not possible for all computer vendors or TYMNET customers to accommodate themselves to the latest version of the recommendation. However, to meet all customer and vendor needs and requirements, TYMNET has provided several options that allow earlier versions of the recommendations to be used, therefore allowing each interface to be customized.

The X.25 and X.75 interfaces communicate in similar fashions. The X.25 interface connects Data Terminal Equipment (DTE) to a network based on TYMNET technology. The X.25 protocol connects customer equipment (terminals, hosts) to the network, and operates with the data processing systems of many major manufacturers. A complete list of supported vendors may be obtained from your TYMNET representative. The X.25 interface can also be used to connect a TYMNET custom network to a public network, or any other independent network with X.25 interfaces. No complete CCITT recommendation has been approved yet for this type of custom interface connection.

The X.75 interface is used to connect a TYMNET-based, packet-switched public network to another packet-switched public network, or an international packet-switched network. This involves the operation of an interchange signaling system for packet-switching data transmission services. The process involves transferring information between two signaling terminals, each within a packet mode network. The operation of the X.75 interface is the same as the X.25 interface except for the interchange signaling. The TYMNET X.75 Interface has been enhanced to produce compatible interfaces to the network services of all major public packet-switched networks. The X.75 interface is also widely used by the international record carriers.

STANDARD PACKET ASSEMBLY/ DISASSEMBLY

CCITT Recommendations X.3, X.28, and X.29 define the necessary elements to support asynchronous start-stop mode DTEs (see X.25 and Related Recommendations).

Figure 6-1 details the appropriate Packet Assembly/Disassembly (PAD) and X.25/X.75 standards used to communicate with different packet networks.

Terminal Packet Assembly/ Disassembly

The Terminal Packet Assembly/Disassembly (TPAD) is invoked when the interface is communicating with a TYMSAT interface. The TYMSAT is a nonpacket mode, asynchronous DTE that originates calls. A TYMSAT provides many of the features of a CCITT-defined PAD, as well as additional features. In this case, the X.25/X.75 interface builds an incoming call packet based on information entered by the TYMSAT user or by constant values determined at system generation time. After the call is established, the interface processes any X.29 packets received from the host DTE. The interface handles them locally or converts them to TYMNET protocol messages to control the TYMSAT. The X.25/X.75 interface also assembles the characters received from the TYMSAT into packets and forwards them, based on default data forwarding values, or on values set up by X.29 packets received from the host DTE. When reset, clear, or restart packets are received from or sent to the host DTE, a message is displayed to the user.

Host Packet Assembly/ Disassembly

The TYMNET HPAD mode is used when the X.25/X.75 interface is communicating with a TYMCOM. If the call to the TYMCOM host indicates that the call is from a PAD, the HPAD function is invoked (see Figure 6-2). The TYMNET protocol messages from the TYMCOM host are converted to X.25 messages.

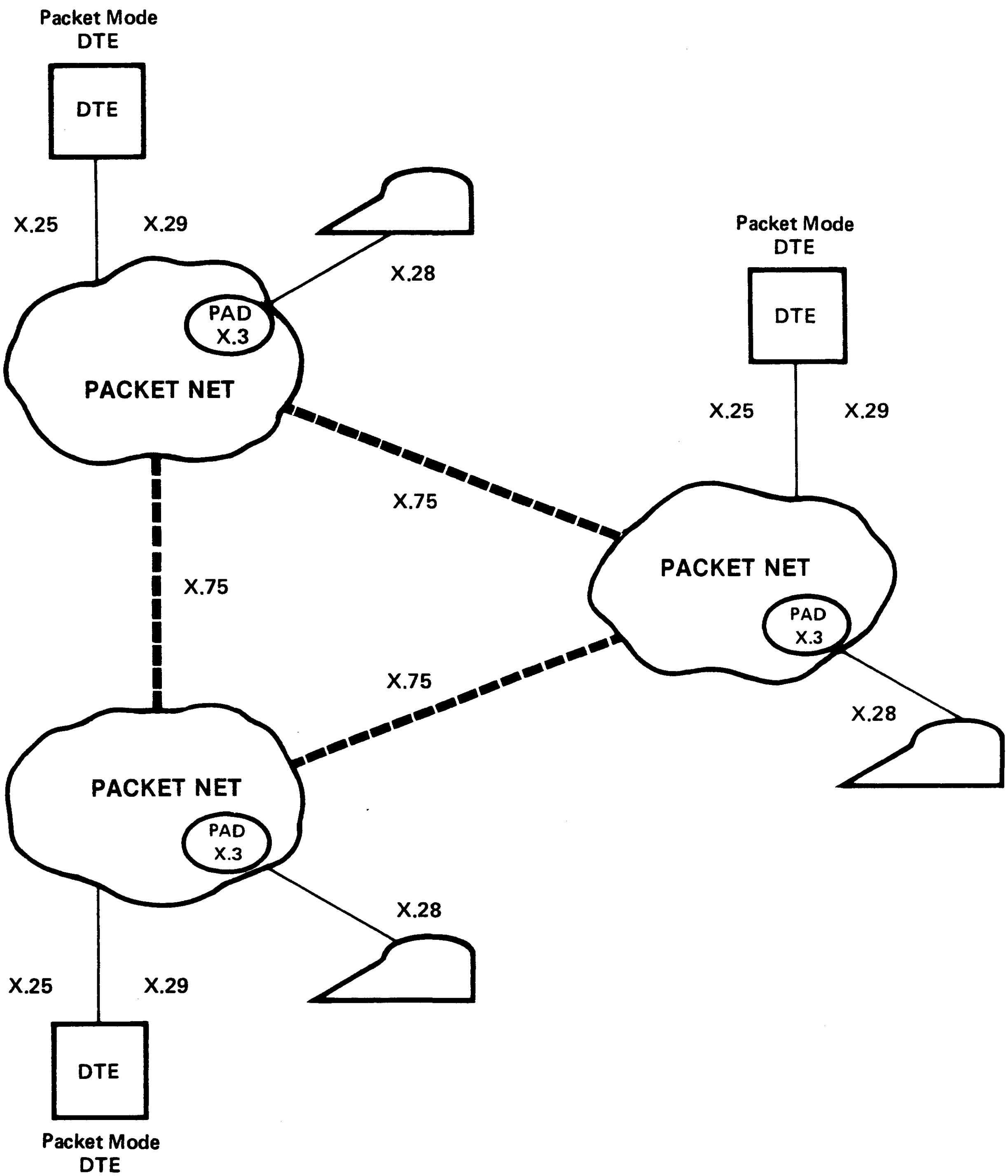

Figure 6-1. X.25/X.75 and PAD Standards

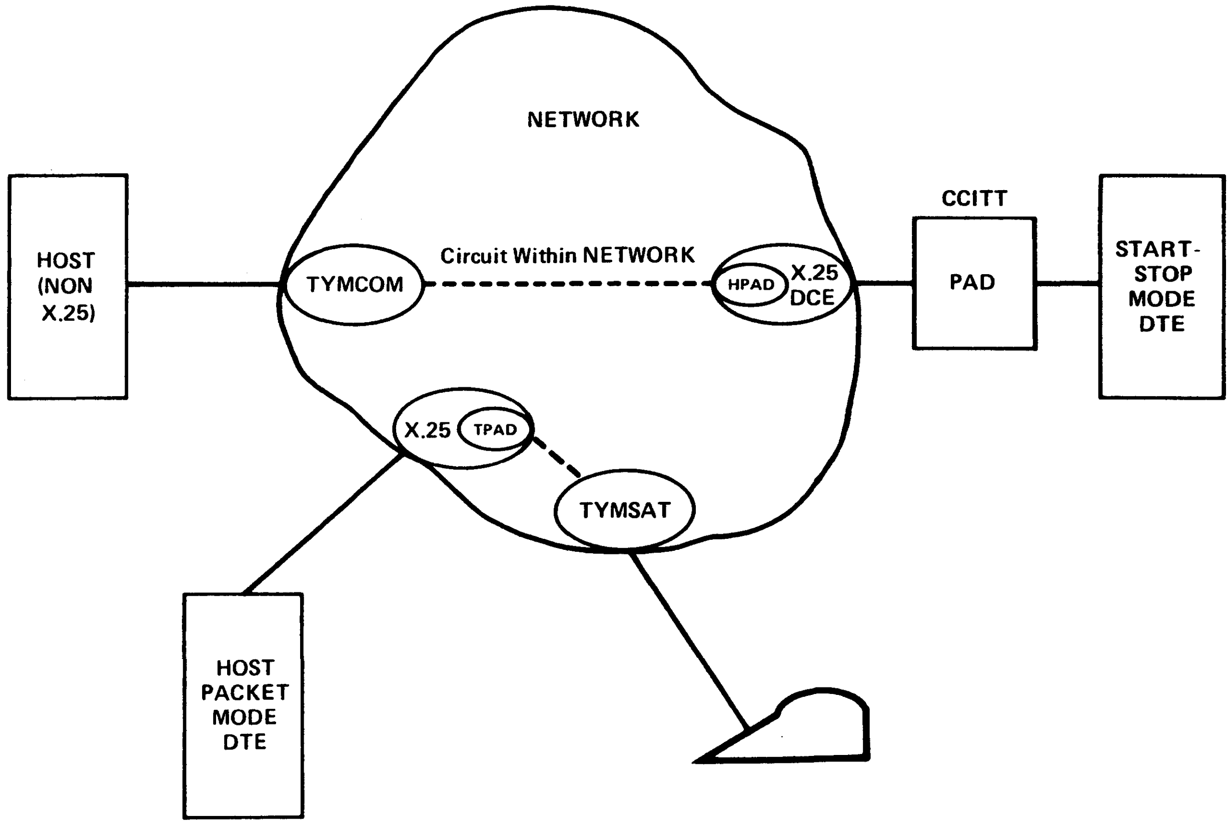

Figure 6-2. PAD Modes

X.25 PACKET-SWITCHING INTERFACE PROTOCOL

The X.25 packet-switching interface supports the physical, link, and packet-level procedures.

Physical Level

The physical level encompasses the mechanical, electrical, functional, and procedural characteristics to activate, maintain, and deactivate the physical link between the Data Circuit-terminating Equipment (DCE) and the DTE for X.25 or between the two Signaling Terminal Equipments (STEs) for X.75.

The physical level conforms to CCITT Recommendation V.24 (X.21-bis or RS-232-C) or to CCITT Recommendation V.35. The physical level supports both digital and private analog access lines. Support is not currently provided for the X.21 digital electrical interface.

A full-duplex, synchronous data link is required for connection to an X.25 interface or an X.75 gateway. Either a permanent, leased communication circuit, a switched circuit, or a dedicated hard-wired connection may be used.

Lines can have a maximum speed of 64 kilobits per second (kbps) using CCITT standard High-level Data Link Control (HDLC), and a maximum speed of 9600 bits per second (bps) using Binary Synchronous Communication (BSC). The BSC transmission format supports V.24 only. The effective data throughput capacity of the X.25 or X.75 interface may be less than the total hardware throughput supported. This supported throughput varies with the configuration and traffic load.

Link Level

The link-level access protocol controls data transmission across the physical access link. Both user information and control signals are transferred across the access link in transmission units called frames. The main function of the link-level protocol is to ensure that packet-level information, which is contained within link-level information fields, crosses the DTE/DCE interface with a very small undetected error rate.

Packet Level

The packet-level access protocol provides the interface procedures required to:

- set up and clear Switched Virtual Circuits (SVCs)
- maintain control of the transfer of data
- signal Permanent Virtual Circuit (PVC) status between DTEs

Both data and control information is transferred in transmission units called packets. Each packet transferred across the interface is contained within a single link-level information frame. Only one packet may be contained in a link-level information frame. The packet types, formats, and procedures used are those given in CCITT Recommendation X.25 for SVC and PVC services. The meanings of network-generated cause codes are the same as those specified in CCITT Recommendation X.96.

X.25 PACKET-SWITCHING INTERFACE PROTOCOL ATTRIBUTES

The TYMNET X.25 packet-switching Interface is a highly flexible interface providing data communication service among user interfaces. It supports all the intrinsic facilities of CCITT Recommendation X.25 except the D-bit of CCITT Recommendation X.25. In addition to supporting the physical, link, and packet-level procedures, it also supports the following:

- the standard default packet-level attributes specified by CCITT Recommendation X.25
- all essential facilities designated in CCITT Recommendation X.2 for Virtual Call service

Several additional capabilities are supported that are not included in the 1980 version of the CCITT Recommendation X.25, but are included in the 1984 version. The X.25/X.75 interface also complies with the 1980 version of CCITT Recommendations X.2, X.87/X.300, X.96, X.121 and X.180.

Figure 6-3A, 6-3B, 6-3C, 6-3D, and 6-3E depict the TYMNET X.25/X.75 Interface attributes at the physical, link, and packet levels.

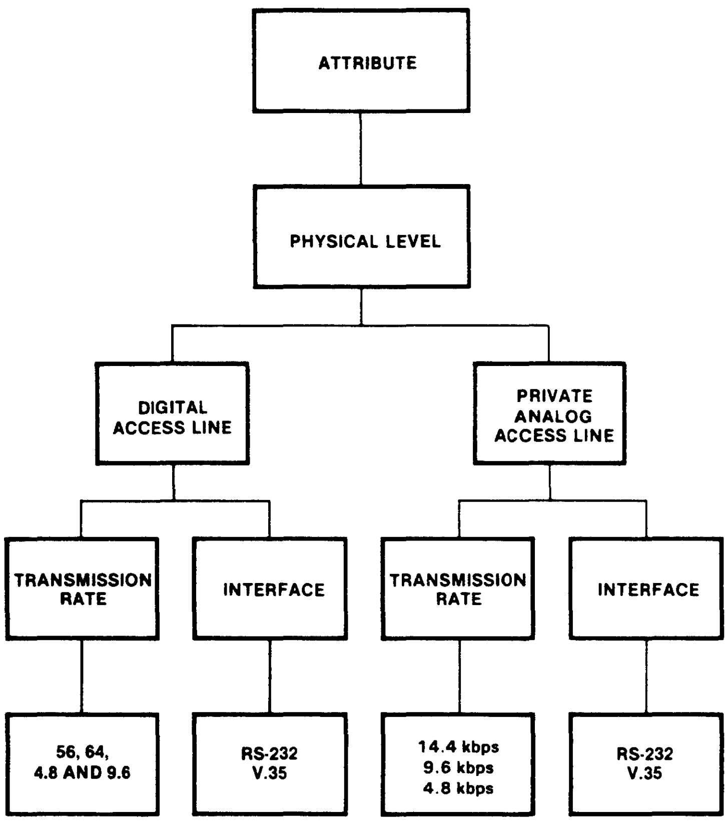

Figure 6-3A. TYMNET X.25/X.75 Attribute—Physical Level

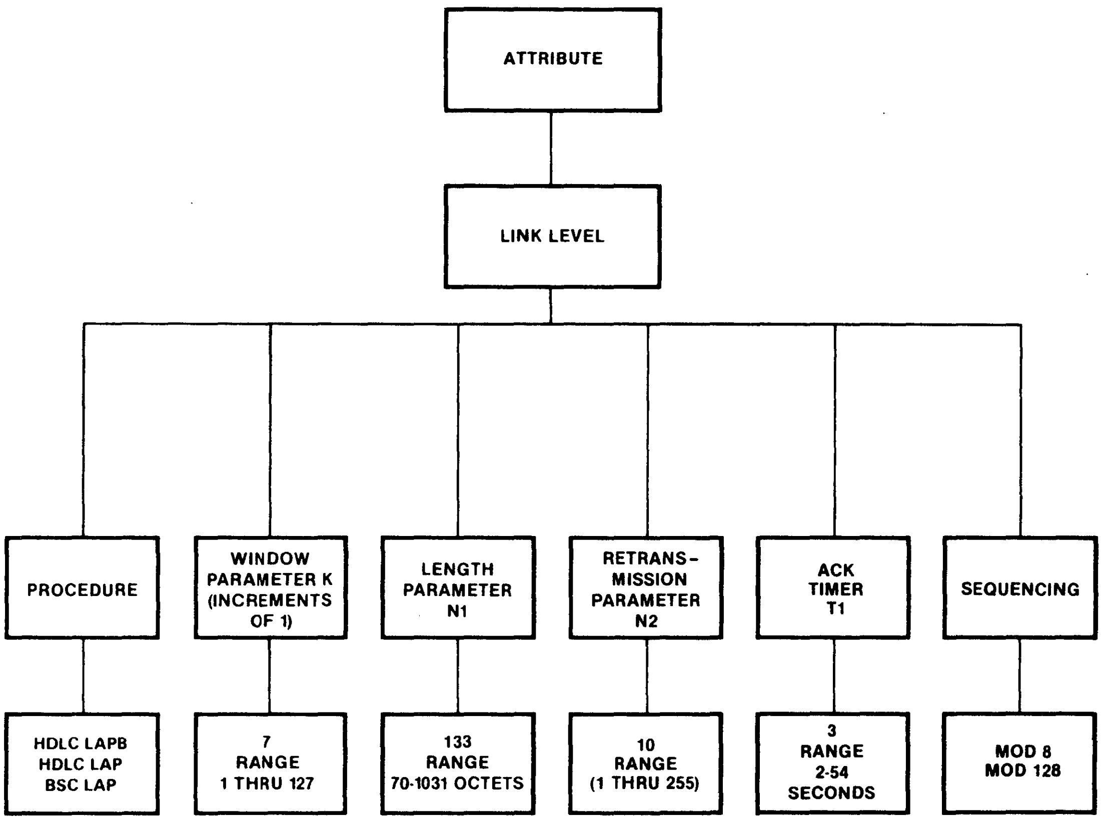

Figure 6-3B. TYMNET X.25/X.75 Attribute—Link Level

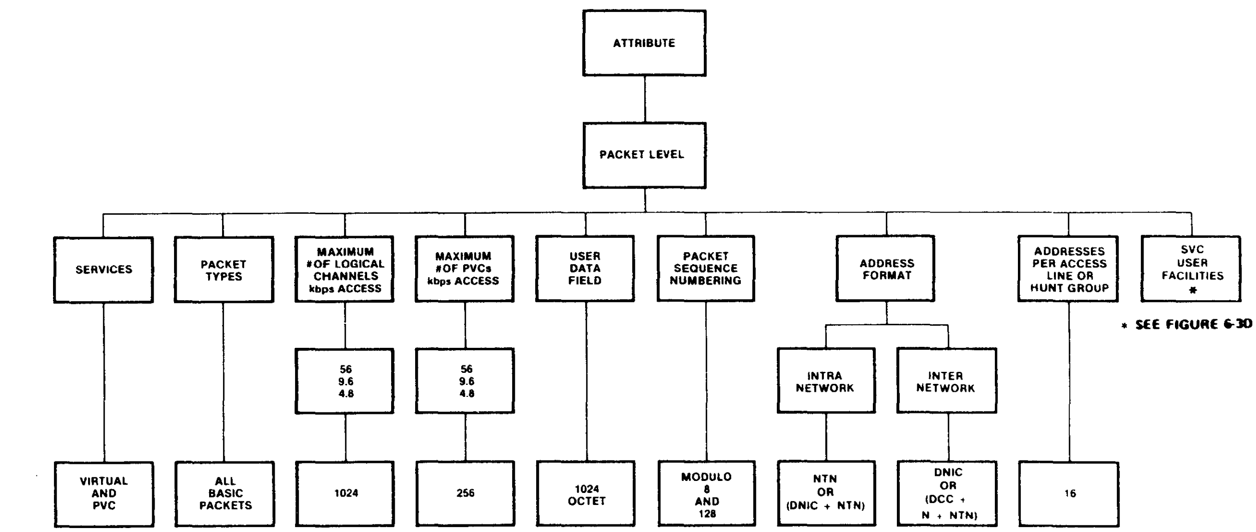

Figure 6-3C. TYMNET X.25/X.75 Attribute—Packet Level

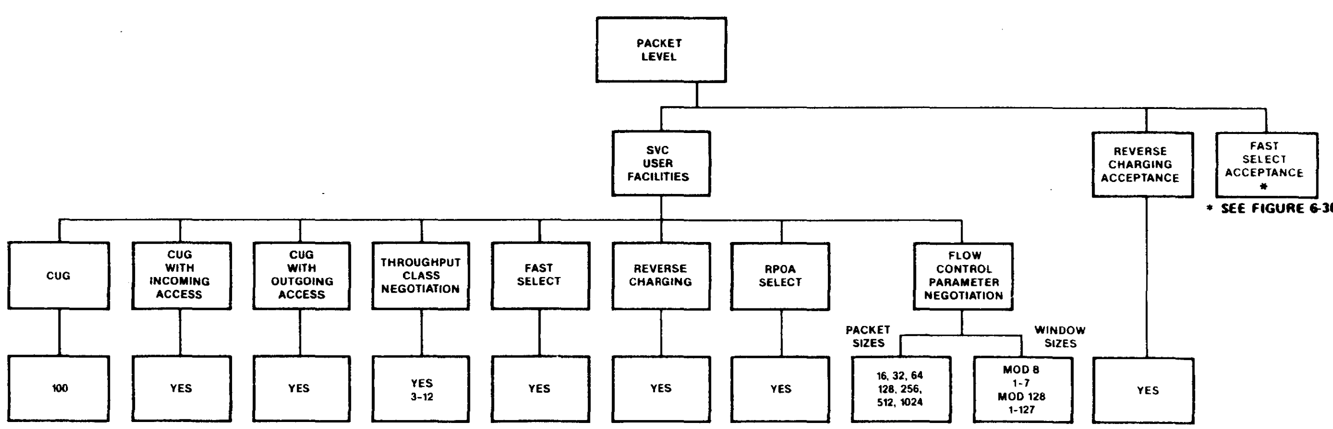

Figure 6-3D. TYMNET X.25/X.75 Attribute—Packet Level—Continued

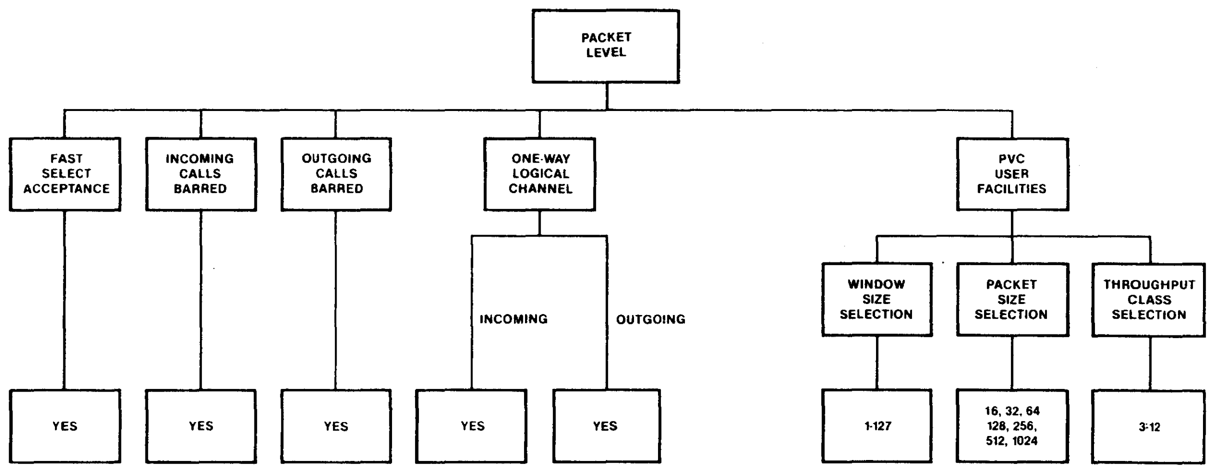

Figure 6-3E. TYMNET X.25/X.75 Attribute—Packet Level—Continued

X.25 USER FACILITIES

Tables 6-1A, 6-1B, 6-1C, and 6-1D list TYMNET X.25 user facilities. The tables also specify TYMNET compliance with 1984 CCITT recommendations. Additional user facilities being considered for future support are also included.

Table 6-1A. TYMNET X.25 User Facilities

1	OPTIONAL USER FACILITIES ASSIGNED FOR AN AGREED CONTRACTUAL PERIOD					
	FACILITY	BRIEF DESCRIPTION	CCITT		TYMNET	
			VC	PVC	VC	PVC
1.1	Extended packet sequence numbering (Modulo 128)	Provides sequence numbering of packets performed Modulo 128.	A	A	S	S
1.2	Nonstandard default window size	Allows the DTE to specify a default window size other than 2. TYMNET supports 1 through 127 in each direction.	A	A	S	S
1.3	Nonstandard default packet size	Allows the DTE to specify a default packet size other than 128. TYMNET provides for the selection of a packet size of 16, 32, 64, 256, 512, 1024 in one or both directions. Packet sizes 2048, 4096 are not supported.	A	A	S	S
1.4	Default throughput class assignment	Provides for the selection of throughput classes from the list of supported throughput classes.	A	A	S	S
1.5	Flow control parameter negotiation	Permits negotiation on a per call basis for packet and window sizes of the DTE/DCE interface for each direction of transmission.	A	—	S	—
1.6	Throughput class negotiation	Permits negotiation of the throughput classes, which are considered independently for each direction of transmission.	E	—	S	—
1.7	Packet retransmission	Allows a DTE to request retransmission of one or several consecutive DCE data packets from the DCE by transferring across the DTE/DCE interface a DTE reject packet.	A	A	N	N
1.8	Incoming calls barred	Prevents incoming virtual calls from being presented to the DTE.	E	—	S	—
1.9	Outgoing calls barred	Prevents the DCE from accepting outgoing virtual calls from the DTE.	E	—	S	—
1.10	One-way logical channel outgoing	Restricts one or more logical channels for outgoing virtual calls only, thus ensuring that either one or more logical channels will be available for originating outgoing virtual calls regardless of the number of incoming calls at the DTE/DCE interface.	E	—	S	—
1.11	One-way logical channel incoming	Restricts one or more logical channels for incoming virtual calls, thus ensuring that one or more logical channels will be available for incoming virtual calls, regardless of the number of outgoing calls at the DTE/DCE interface.	A	—	S	—
1.12	Closed User Group	Enables DTE to belong to a maximum of 100 CUGs on each access line. Creates and protects user virtual subnetwork.	E	—	S	—
1.13	CUG with outgoing access	Enables DTE to belong to a maximum of 100 CUGs on each access line. Authorizes DTE to originate virtual calls to other DTEs in the open network and to DTEs having the incoming access capability.	A	—	S	—

KEY

CCITT	TYMNET
E —Essential User facility	S—Supported
A —Additional User service	N—Not Available
FS—Further Study	F—Future Implementation

Table 6 - 1B. TYMNET X.25 User Facilities

	OPTIONAL USER FACILITIES ASSIGNED FOR AN AGREED CONTRACTUAL PERIOD					
	FACILITY	BRIEF DESCRIPTION	CCITT		TYMNET	
			VC	PVC	VC	PVC
1.14	CUG with incoming access	Enables DTE to be a member of one or more CUGs and receive incoming calls from DTEs in the open network and from DTEs with outgoing access capability.	A	—	S	—
1.15	Incoming calls barred within a closed user group	Permits the DTE to originate virtual calls to DTEs in this CUG, but precludes the reception of incoming calls from DTEs in this CUG.	A	—	S	—
1.16	Outgoing calls barred within a closed user group	Permits the DTE to receive virtual calls from DTEs in this CUG, but prevents the DTE from originating virtual calls to DTEs in this CUG.	A	—	S	—
1.17	Bilateral closed user group	Enables the DTE to be a member of one or more bilateral CUGs and permits a pair of DTEs that agrees bilaterally to communicate with each other but precludes communication with all other DTEs.	A	—	F	—
1.18	Bilateral closed user group with outgoing access	Enables the DTE to be a member of one or more bilateral CUGs and to originate virtual calls to DTEs in the open part of the network.	A	—	F	—
1.19	Reverse charging acceptance	Authorizes the DCE to transmit to the DTE incoming calls that request the reverse charging facility.	E	—	S	—
1.20	Fast select acceptance	Authorizes the network to transmit to the DTE incoming call packets with Fast Select.	A	—	S	—
1.21	Multilink procedures	Performs the functions of distributing Single Link Procedure (SLP) packets across the available DCE or DTE to be transmitted to the DTE or DCE. MLP also resequences packets received from the DTE/DCE for delivery to the DTE or DCE packet level respectively.	A	A	F	F
1.22	Charging information	Allows the DTE to receive charging information for an agreed period of time.	A	—	N	—
1.23	Direct call	This is a 1984 CCITT Further Study (FS) facility. TYMNET has no equivalent feature.	FS	—	N	—
1.24	Hunt group	Distributes incoming calls having an address associated with the hunt group across a designated grouping of DTE/DCE interfaces.	A	—	S	—
1.25	On-line facility registration	This is a 1984 CCITT facility. It is planned for future implementation.	A	—	F	—
1.26	D-bit modification	This facility is not available and there are no plans for implementation. TYMNET clears calls with the D-bit set.	A	A	N	N
1.27	Local charging prevention	Authorizes the DCE to prevent the establishment of virtual calls, which the suscriber must pay for. This facility is partially implemented by TYMNET.	A	—	F	—

KEY

CCITT

E —Essential User facility
A —Additional User service
FS—Further Study

TYMNET

S—Supported
N—Not Available
F—Future Implementation

Table 6-1C. TYMNET X.25 User Facilities

	OPTIONAL USER FACILITIES ASSIGNED FOR AN AGREED CONTRACTUAL PERIOD					
	FACILITY	BRIEF DESCRIPTION	CCITT		TYMNET	
			VC	PVC	VC	PVC
1.28	Call redirection	Redirects incoming calls destined to this DTE when DTE is out of order or the DTE is busy.	A	—	F	—
1.29	Network user identification	Enables the DTE to provide information to the network for billing, security, or network management.	A	—	F	—
1.30	Extended frame sequence numbering	Sets the frame options appropriate to the link. Mod 128 frame level numbering is supported.	A	A	S	S
1.31	RPOA selection	Allows a DTE initiating a call that must transit an international gateway to specify the RPOA transit networks through which the call is to be routed.	A	—	S	—

KEY

CCITT

E —Essential User facility
A —Additional User service
FS—Further Study

TYMNET

S—Supported
N—Not Available
F—Future Implementation

Table 6-1D. TYMNET X.25 User Facilities

2	OPTIONAL USER FACILITIES ON A PER CALL BASIS					
	FACILITY	BRIEF DESCRIPTION	CCITT		TYMNET	
			VC	PVC	VC	PVC
2.1	Closed user group selection	Permits the DTE to be a member of more than one group. The groups can communicate with each other. This facility precludes communication with all other DTEs.	E	—	S	—
2.2	Bilateral closed user group selection	This facility is not currently available.	A	—	F	—
2.3	Reverse charging	Allows the calling DTE to request that the call be charged to the called user.	A	—	S	—
2.4	RPOA selection	Provides for the user specification by the calling DTE of a RPOA transit network.	A	—	S*	—
2.5	Flow control parameter negotiation	Allows the DTE to negotiate packet and window size.	E	—	S	—
2.6	Fast select	Enables the calling DTE to send up to 128 octets of user data and receive up to 128 octets from the called DTE.	E	—	S	—
2.7	Throughput class negotiation	Enables the DTE to negotiate throughput class for each direction of data transmission.	E	—	S	—
2.8	Abbreviated address calling	This is a CCITT 1984 Further Study (FS) feature. TYMNET has an equivalent feature.	FS	—	PS	—
2.9	Charging information	Allows the DTE to receive charging information on a per call basis.	A	—	F	—
2.10	Transit delay selection and indication	Permits selection and indication of the transit delay applicable to that virtual call.	A	—	F	—
2.11	Call redirection notification	Allows the DCE to use this facility in the incoming call packet to inform the alternate DTE that the call has been redirected, why the call was redirected, and the address of the originally called DTE.	A	—	F	—
2.12	Called line address modified notification	Allows the DTE to use this facility in the call connected or clear indication packets to inform the calling DTE why the called address in the packets is different from that specified in the call request packet.	A	—	F	—
2.13	Network user identification	Enables the DTE to provide information to the network for billing, security, or network management.	A	—	F	—
2.14	Closed user group with outgoing access selection	Allows the DTE to make an outgoing call into the open part of the network and prevents preferential CUG selection.	A	—	S	—

KEY

CCITT	TYMNET
E —Essential User facility	S —Supported
A —Additional User service	N —Not Available
FS—Further Study	F —Future Implementation
	PS—Partially Supported

*1984 enhancement for multiple RPOA selection not yet implemented.

X.25 PACKET-SWITCHING INTERFACE CAPABILITIES

X.25 packet-switching interface capabilities are as follows:

- SVC service
- PVC service
- TYMNET addressing convention
- User self-testing capability

Switched Virtual Circuit Service

SVC service provides the following capabilities:

- Interface initialization
- Virtual call setup and clearing
- Flow control
- Sequenced data transfer

Permanent Virtual Circuit Service

The X.25 PVC service provides the same capabilities as SVC service except for the call setup and clearing procedures. Certain facility negotiations performed at call setup for SVCs are handled through installation parameters for PVCs. Error situations that result in call clearing in SVC mode will produce resets in PVC mode.

TYMNET Addressing Convention

The CCITT Recommendation X.121 standard ensures that a data terminal on a Public Data Network (PDN) can be accessed by the same address from anywhere in the world. The address consists of a Data Network Identification Code (DNIC) and a Network Terminal Number (NTN). The DNIC is a four-digit number used to uniquely identify a particular PDN. For instance, the TYMNET domestic PDN is assigned the DNIC 3106. Recommendation X.121 allows an NTN to have a maximum of ten digits. Otherwise, the NTN is not restricted, and the definition of its format is left to the individual networks.

User Self-Testing Capability

A DTE may place virtual calls to its own address. The network performs incoming call logical channel selection by the established procedures. Through the self-testing capability, users may perform tests on DTE packet-level procedures.

X.25 AND RELATED RECOMMENDATIONS

The following is a brief summary of the scope of each CCITT recommendation.

X.25

The X.25 Recommendation specifies the interface between the DTE (customer equipment) and the DCE (network node) for terminals operating in the packet mode on PDNs.

X.75

The X.75 Recommendation specifies procedures for connecting X.25 packet networks through a gateway interface. It uses the same three-level architecture and is similar to the X.25 procedures. There is only one added field at the packet level (network layer) for utility information between networks.

X.3

The X.3 Recommendation defines PAD services in a PDN and the functions that a packet-switched network has to provide to an interface with asynchronous DTEs.

X.28

The X.28 Recommendation describes procedures for connection and operation of simple asynchronous DTEs to a packet assembler and disassembler attached to an X.25 packet mode network. The PAD performs the function of converting and reconverting serial streams of information from the asynchronous DTE into X.25 packets for transit in the network.

X.29

The X.29 Recommendation specifies the procedures for the exchange of control information and user data between a PAD facility and a packet mode DTE or another PAD.

X.87/X.300

The X.87/X.300 Recommendation specifies the essential interaction between elements of customer interfaces, interexchange signaling systems, and other network functions that are specifically related to the provision and use of international user facilities and network utilities.

X.121

The X.121 Recommendation defines the universal subscriber addressing scheme, which enables unique identification of each subscriber that can be accessed by the international PDN services. The numbering plan uniquely identifies the world zone, country or geographical area, network, and the subscriber.

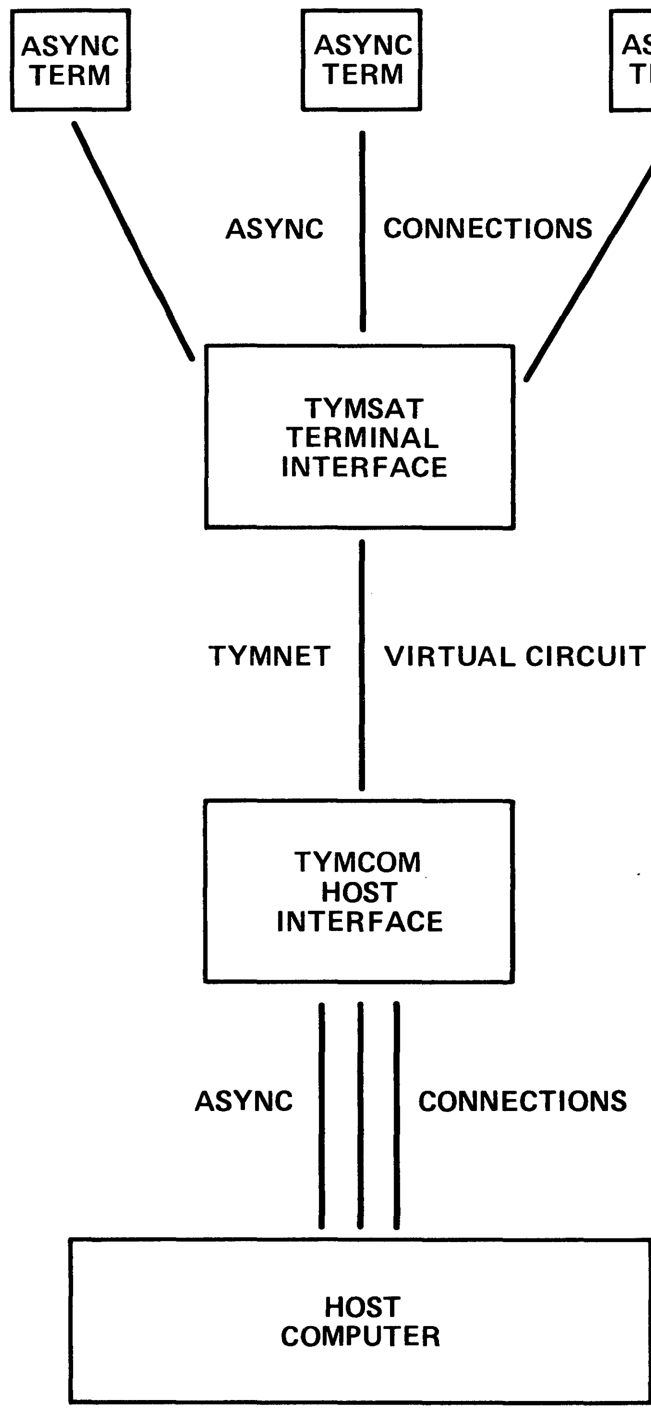

Figure 7-1. Asynchronous ISIS TYMCOM Interface

Signal Protocol

The ISIS TYMCOM supports the following host computer communication line speeds.

Table 7 - 1. Communication Line Speeds

Range	Line Type
75-4800 baud	asynchronous
75-9600 baud	SIO

Various cable pin configurations provide capabilities of SIO lines employing EIA RS-232C signal protocol subsets and X.20 subset signaling standards. Options provide other capabilities when generating TYMCOM software. On heavily loaded machines, the overall throughput capability of the slot may occasionally limit the character rate of individual ports to less than full capacity. Also, the origination (terminal) and network access may limit the overall throughput capability.

Software Signal Protocol

The ISIS TYMCOM has the ability to detect two control signals from the host. It can also manipulate two control signals toward the host for each port. The detected control signals are selected by the cable pin configuration on a port-by-port basis and are determined by the mode in which the TYMCOM operates. The TYMCOM is used as Data Communications Equipment (DCE) and appears to the host as a bank of modems. The TYMCOM can also be used as Data Terminal Equipment (DTE) and appears to the host as several hardwired terminals.

Hardware Signal Protocol

The signals that are actually presented to and received from the host can be varied by the selection of cable options. There are two standard pin configurations available. Special cables or cable adaptors may be ordered to suit customer requirements as long as software protocol is satisfied.

The first cable pin configuration is used for host ports that expect to communicate with a terminal using a modem. The TYMCOM appears to the host as a modem.

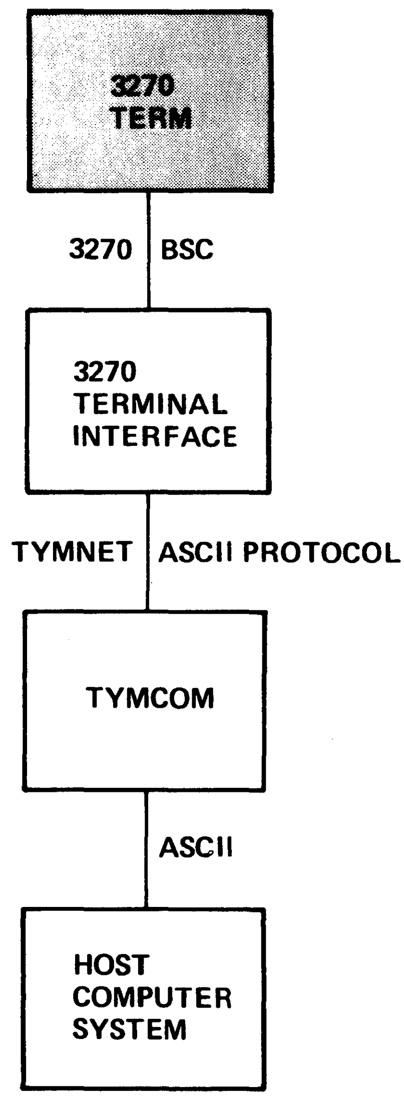

Figure 9-2. Virtual Terminal Mode

Virtual Host Mode

The virtual host mode makes it possible for certain ASCII block mode terminals to access 3270 protocol host computers through the TYMNET 3270 Host Interface. This mode increases the number of 3270 application users.

The host interface translates terminal input from ASCII to EBCDIC and formats the data into standard BSC messages. Output from the host computer is translated from EBCDIC to ASCII, and 3270 commands and orders are translated to screen and control sequences recognized by the terminal.

The translation process required is unique to each supported ASCII terminal model. Support is limited to the following terminals:

- IBM 3101
- Perkin-Elmer Owl 1200 series
- TYMSHARE 470

These terminals were selected for cursor control and field properties that minimize the amount of data for transfer through the network. Terminal selection was based on efficiency and response time.

The TYMNET 3270 Host Interface provides two methods of printer support in virtual host mode. The first method allows an ASCII printer to be logged in to a printer port on the 3270 host interface. In the second method, an ASCII printer is connected to the printer port on a Perkin-Elmer OWL terminal or a TYMSHARE 470 terminal. The second method requires that the host configuration associate the printer with the terminal. As a result, a terminal may be used to direct host output to the printer.

Figure 9-3 illustrates a virtual host mode connection.

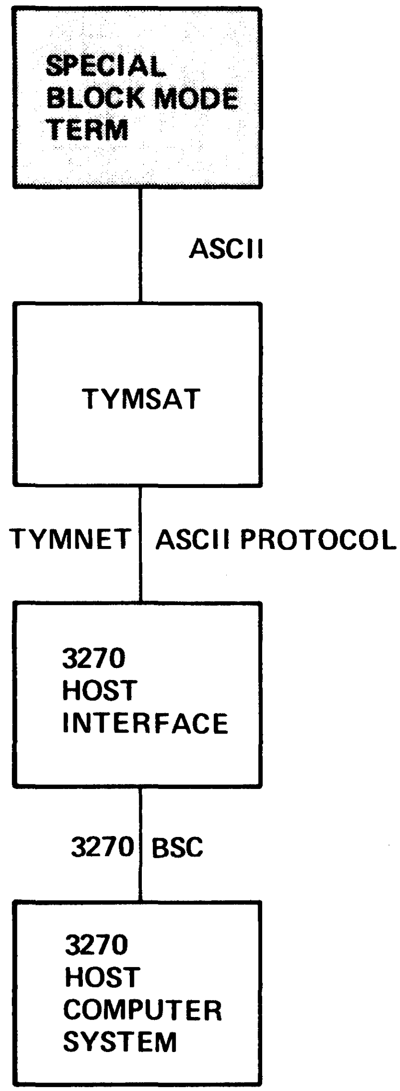

Figure 9-3. Virtual Host Mode

Native Mode with CMT/3270 Emulator

The CMT/3270 emulator supports terminals operating in ASCII character mode and allows less intelligent terminals to communicate with the TYMNET 3270 Host Interface operating in native mode. Because CMT/3270 uses DSP to communicate with the host interface, it is also possible to use the X.25 interface. The following are currently supported ASCII character mode terminals:

- ADDS Viewpoint® 60/90
- ADDS Viewpoint® 78
- ADM-3A®
- ADM-11/1178®
- Dasher™ D100/200
- Displayphone™
- Hazeltine 1500 series
- Scanset™
- Televideo® 920/925
- VT-100®

Since support for additional terminals is added regularly, a current list of supported terminals should be requested from a Tymnet representative.

The basic function of the CMT/3270 interface is to translate characteristics between a host with 3270 devices and certain ASCII terminals. The essential components of this function are an emulation of local 3270 keyboard functions and a translation of data formats. A secondary function is to reduce the character traffic to achieve the fastest response time and minimize network congestion.

Figure 9-4 illustrates the native mode connection options with the CMT/3270 emulator.

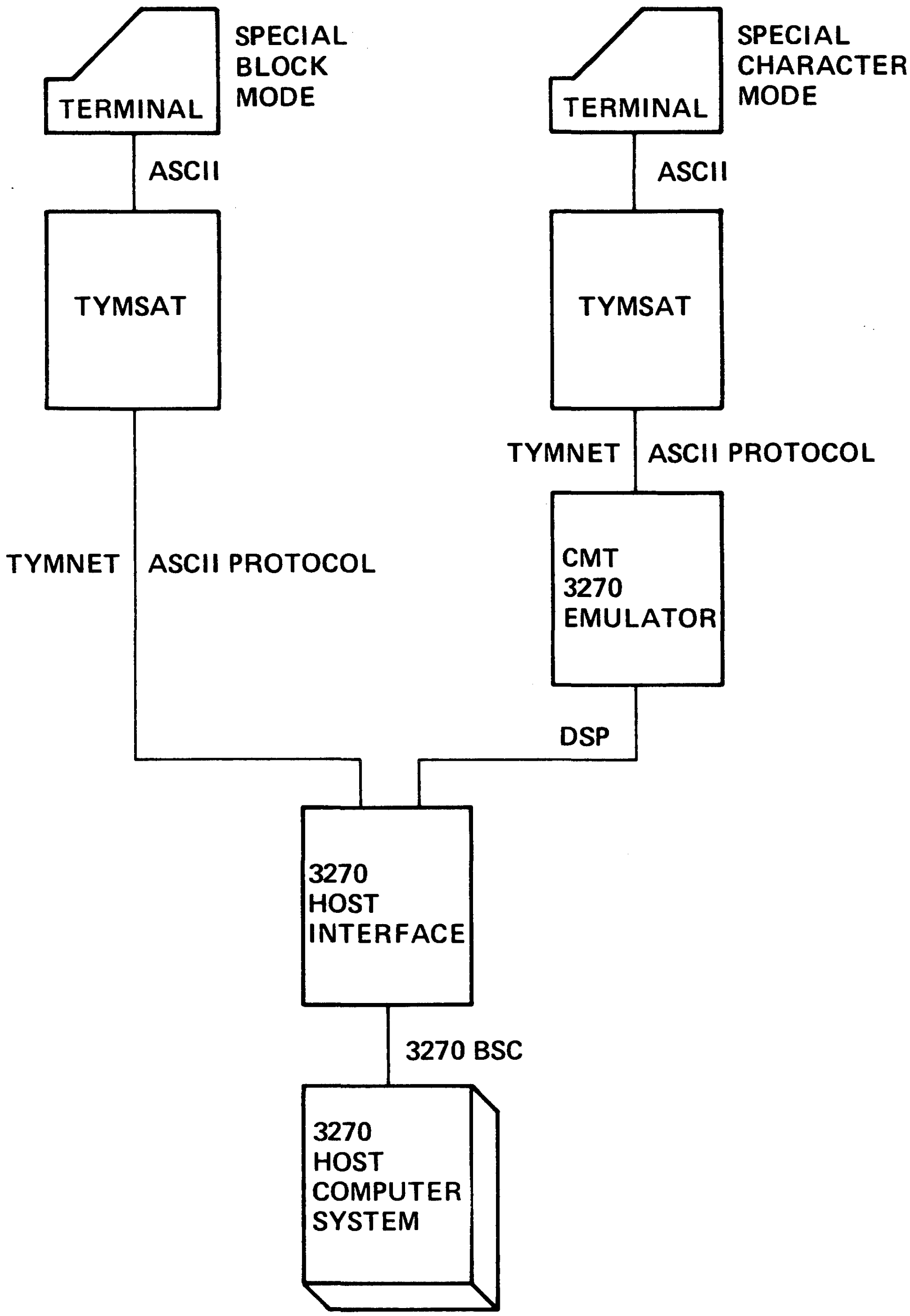

Figure 9-4. Native Mode with CMT/3270 Emulator

X.25 Interface

The 3270 DSP allows an X.25 network connection to provide access to 3270 applications. The 3270 DSP is a fourth layer of protocol above the three X.25 protocol layers and is used to transfer 3270 information.

A Packet Assembler/Disassembler (PAD) can substitute for the host or terminal interface. The PAD communicates with a device by a BSC line or by a more direct mechanism such as a host channel attachment.

Figure 9-5 illustrates the various X.25 connection options.

CHAPTER 10

SDLC INTERFACE

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10-7 Ports and Links
10-10 Transmission Frames
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10-19 Normal Response Mode
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OVERVIEW

This document provides an overview of the TYMNET SDLC Interface, its operation, and its support capabilities. This document assumes the reader is familiar with IBM SDLC concepts or has access to IBM product information.

Briefly, Synchronous Data Link Control (SDLC) is the link-level protocol for IBM's System Network Architecture (SNA). This synchronous-by-bit protocol incorporates data and control information within a frame structure that is sent along communication lines. SDLC synchronizes the receiver with the transmitter and provides error checking and recovery.

The TYMNET SDLC Interface is a software product that enables SDLC-protocol terminals and hosts to communicate with each other through the TYMNET network. In this relationship, the network replaces a dedicated leased-line connection between the terminals and hosts. The network can also provide a connection between two host front ends, thus connecting two SNA networks into one "multiple domain" network.

On both the host and terminal ends of the network, the SDLC interface translates between the SDLC and TYMNET communications protocols. In other words, this software product performs as a host interface at the host end and as a terminal interface at the terminal end of the network.

Figure 10-1 shows an example of the SDLC interface at both the host and terminal ends of the network.

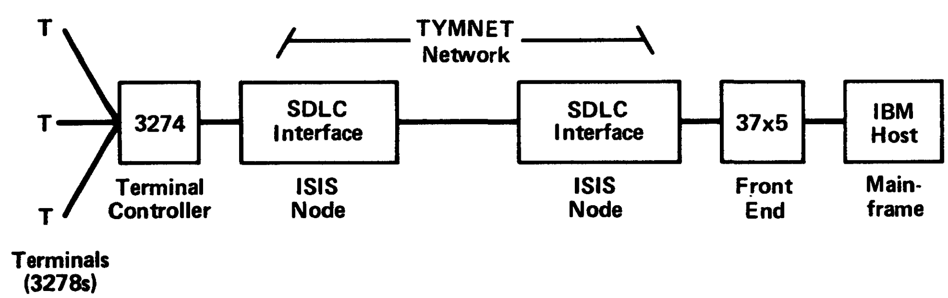

Figure 10-1. TYMNET SDLC Interface

Figure 10-2 illustrates the possible interconnections of SNA/SDLC hosts and terminals using TYMNET.

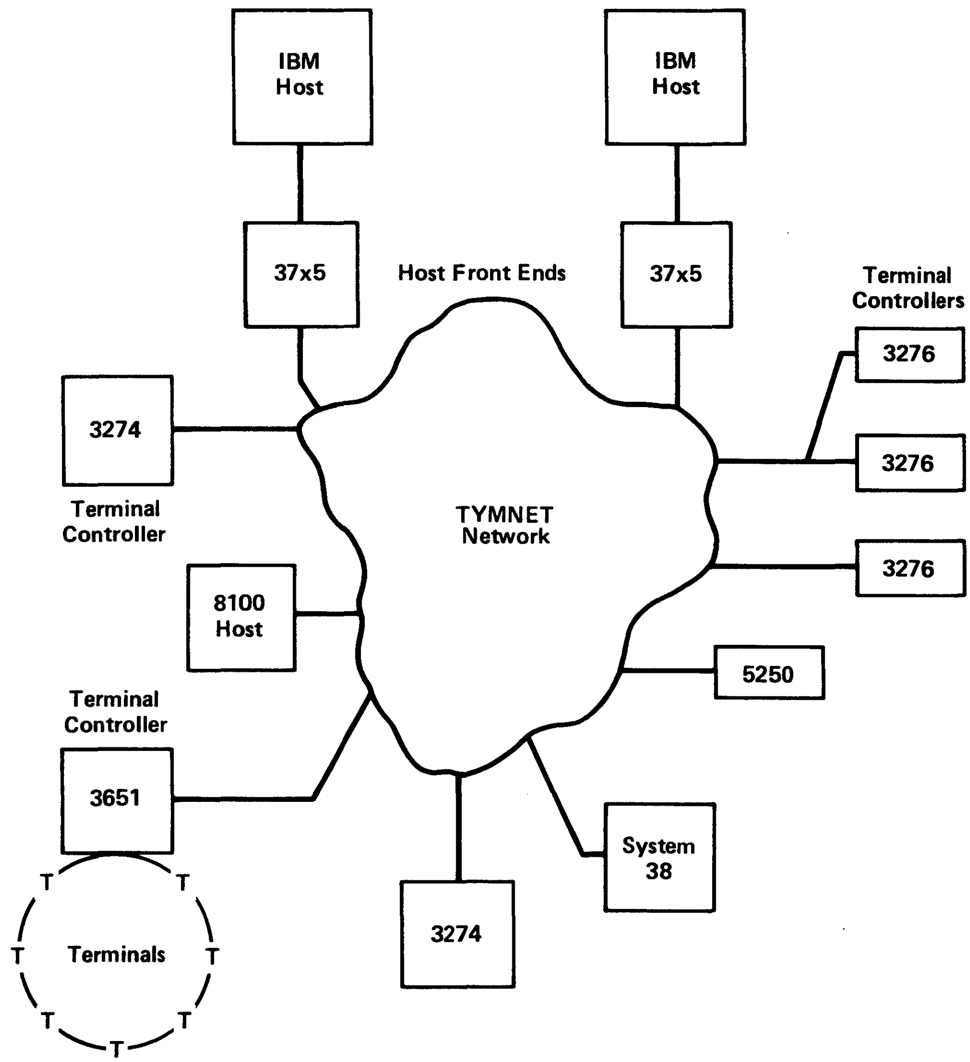

Figure 10-2. TYMNET/SDLC Network

The TYMNET SDLC Interface runs in a slot on an Internally Switched Interface System (ISIS) node. Other TYMNET programs can operate simultaneously in the same node.

The SDLC interface provides a leased-line type connection through the network in the form of a network virtual circuit. The virtual circuit is configured to always connect a particular terminal controller with the same host(s). No hardware or software changes are normally required at either the host or terminal ends because the SDLC interface provides a virtually transparent connection. This transparency is easier to explain if some terms are first defined.

In IBM terminology, SNA network nodes are defined by the following Physical Unit (PU) types:

1. Physical Unit type 1 (PU.T1) is a terminal.

2. Physical Unit type 2 (PU.T2) is a terminal controller.

3. Physical Unit type 4 (PU.T4) is a host front end or remote communication controller.

4. Physical Unit type 5 (PU.T5) is a mainframe host.

There are no PU.T3 nodes.

In the following discussion, the SDLC interface is called the host interface when it connects to a PU.T4 and the terminal interface when it connects to a PU.T2.

Also useful to this discussion is the concept of primary and secondary stations:

- A primary station controls the flow of data on a communication link. A primary station sends commands and receives responses. In this document, the term primary station usually refers to the host front end (PU.T4).

- A secondary station is in a slave relationship to the primary station. It receives commands and returns responses. In this document, the term secondary station usually refers to the terminal controller (PU.T2).

Each of these stations has a corresponding port on the SDLC interface. A port is defined as the hardware and software associated with one physical line. Primary and secondary ports help create the illusion of transparency through the network.

The SDLC interface achieves transparency by a type of mirroring (illustrated in Figure 10-3):

- To the terminal controller, the terminal interface appears as a host front end. Also, the terminal ports that connect to the interface are "primary ports" because they appear to the interface as host front-end ports.

- To the host front end, the host interface appears as a terminal controller. Also, the host port that connects to the interface is a "secondary port" because it appears to the interface as a terminal port.

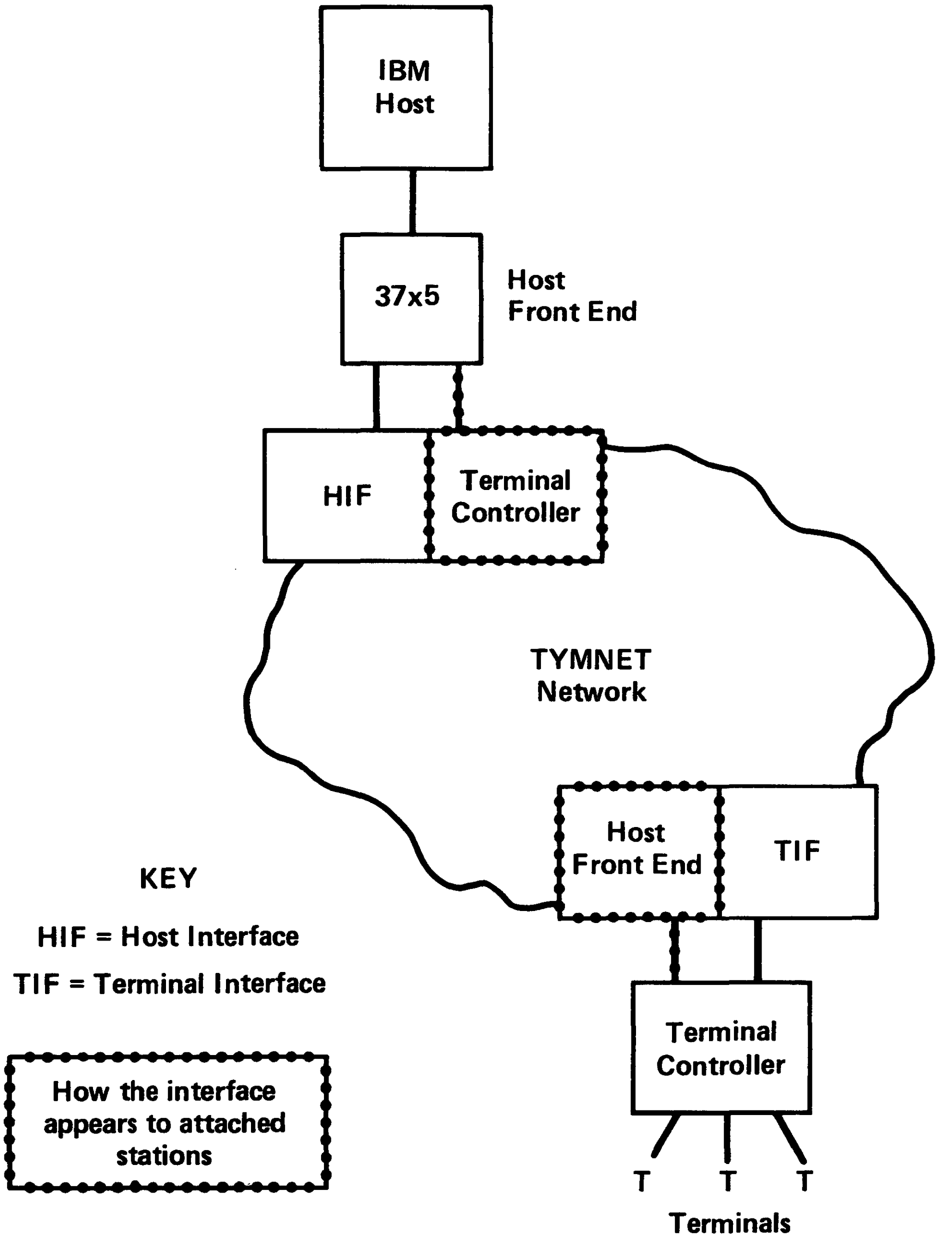

Figure 10-3. How the SDLC Interface Appears

SUPPORT CAPABILITIES

The SDLC interface supports a variety of data-link configurations and command frames and operates in both Normal Response Mode (NRM) and Normal Disconnect Mode (NDM). As a special feature, X.25 Qualified Logical Link Control (QLLC) support enables the TYMNET SDLC Interface to communicate with the TYMNET X.25 Interface. This support allows SDLC terminals and hosts to communicate with X.25 QLLC terminals and hosts through the network.

The following sections detail data-link capabilities, describe the X.25 QLLC feature, and summarize the IBM software and hardware supported by the SDLC interface.

Ports and Links

A single SDLC interface can support any mix of primary and secondary ports up to a maximum of 16 ports, and each of these ports can support up to 32 stations. The stations can be in either a point-to-point or a multipoint configuration.

The SDLC interface supports both switched and nonswitched (leased) circuits between terminals and hosts. (These circuits are described later in this document.)

Both half- and full-duplex modes of operation are supported.

The four nonswitched data-link configurations supported by the TYMNET SDLC Interface are summarized in the following list:

1. half-duplex point-to-point
2. full-duplex point-to-point
3. half-duplex multipoint
4. full-duplex multipoint

Figures 10-4 through 10-7 illustrate data-link support.

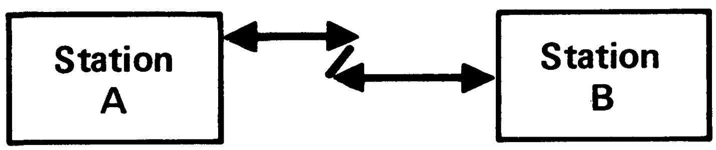

Figure 10-4. Half-Duplex Point-to-Point

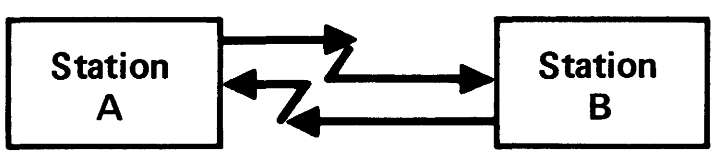

Figure 10-5. Full-Duplex Point-to-Point

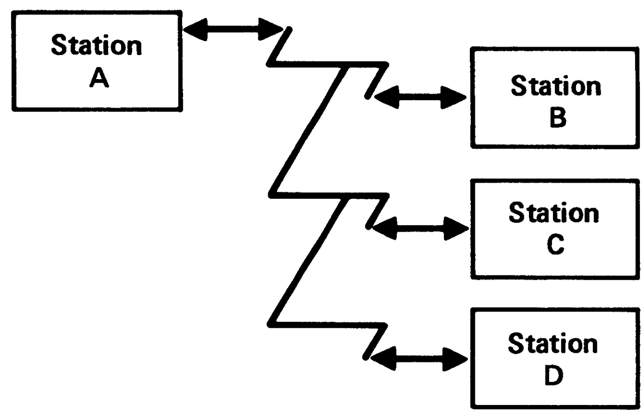

Figure 10-6. Half-Duplex Multipoint

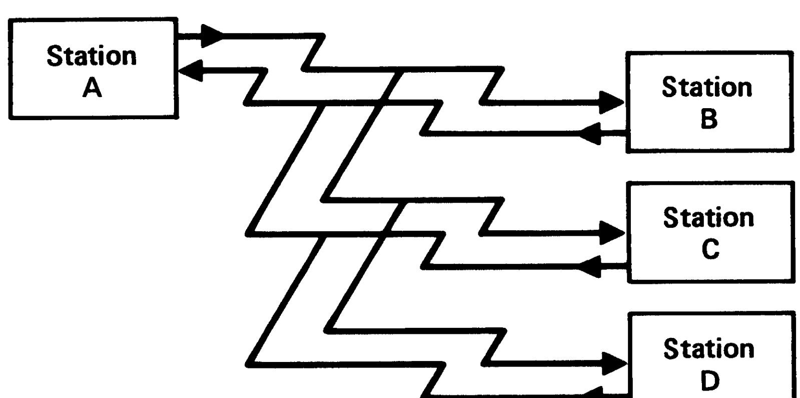

Figure 10-7. Full-Duplex Multipoint

Transmission Frames

The format SDLC uses for all data-link transmissions is called a frame. There are three types of SDLC frames:

- unnumbered
- supervisory
- information

Figure 10-8 shows the fields contained in all SDLC frames.

Flag	Address	Control	Information (Optional)	Frame Check Sequence	Flag

Figure 10-8. SDLC Frame Structure

Brief descriptions of each field follow:

- The first flag indicates the beginning of the frame.
- The address field identifies the secondary station on the link.
- The control field indicates the frame type, that is, whether it is an unnumbered, supervisory, or information frame. The control field also contains the send and receive counts, which some frames carry to ensure proper sequencing of data, and a Poll/Final (P/F) bit, which controls the start and finish of a transmission sequence.

  All of the commands and responses that control link level protocol are contained in the control field.
- The optional information field contains data.
- The frame check sequence is a series of bits called the Cyclic Redundancy Check (CRC). The receiving station uses the CRC to check for transmission errors within the frame.
- The last flag indicates the end of the frame.

Commands and Responses

Control-field commands and responses are differentiated as follows:

- A frame sent by a primary station and received by a secondary station is a command.
- A frame sent by a secondary station and received by a primary station is a response.

Each frame type (unnumbered, supervisory, or information) can transmit certain commands or responses within its control field. Table 10-1 shows the SDLC commands and responses supported by the TYMNET SDLC Interface. The frame type that can contain the commands and responses is on the left, followed by the command acronym and whether it is a command, response, or both. The last column shows the acronym definition.

The SDLC interface uses two kinds of procedures for handling an SDLC frame: local and end-to-end. Local procedures involve transmitting or receiving the frame to or from an attached station; the frame is not passed end-to-end. All supervisory frames are handled locally, as well as the send and receive counts and P/F bit contained in certain control fields.

End-to-end procedures involve transmitting and receiving frames to or from another interface through the network. SDLC unnumbered frames and information frames are handled end-to-end.

Table 10-1. Control Field Commands and Responses

Frame Type	Acronym	Command	Response	Definition
Unnumbered	DISC	X		Disconnect
	DM		X	Disconnect Mode
	FRMR		X	Frame Reject (invalid frame received)
	RD		X	Request Disconnect
	RIM		X	Request Initialization Mode
	SIM	X		Set Initialization Mode (mode setting)
	SNRM	X		Set Normal Response Mode (mode setting)
	TEST	X	X	Test pattern in information field
	UA		X	Unnumbered Acknowledgment
	UI	X	X	Unnumbered Information frame
	XID	X	X	Exchange Identification
Supervisory	REJ	X	X	Reject (request retransmission)
	RNR	X	X	Receive Not Ready
	RR	X	X	Receive Ready
Information	I	X	X	Information

X.25 Qualified Logical Link Control

As an enhancement to the SDLC interface, X.25 QLLC support enables the interface to communicate with X.25 QLLC Data Terminal Equipment (DTE) through a TYMNET network.

NOTE

> The SDLC interface without X.25 QLLC support is not compatible with X.25. The following material only applies to the X.25 QLLC-enhanced version.

Figure 10-9 illustrates how the X.25 QLLC capability enables the SDLC interface to support both SDLC and X.25 hosts and terminals. The X.25 QLLC DTE must be connected to a TYMNET X.25 Interface, and the SDLC DTE must be connected to a TYMNET SDLC Interface. Also, the X.25 interface at the host end of the network must be connected to an SDLC host front end running IBM Network Packet Switching Interface (NPSI) software. The NPSI program translates between X.25 QLLC packets and SDLC commands and responses.

The interface at the terminal end of the network handles the X.25 QLLC packet as follows:

1. The X.25 interface transparently passes the packet to an X.25 QLLC terminal controller.

2. The SDLC terminal interface strips the QLLC header from the packet and frames the data for transmission across an SDLC link to an SDLC terminal controller.

The SDLC interface uses mapping to support both SDLC and X.25 QLLC protocols. When the SDLC interface receives end-to-end commands and responses, it maps them to the appropriate format for transmission. Table 10-2 shows the interface mapping between QLLC packets and SDLC command/response frames.

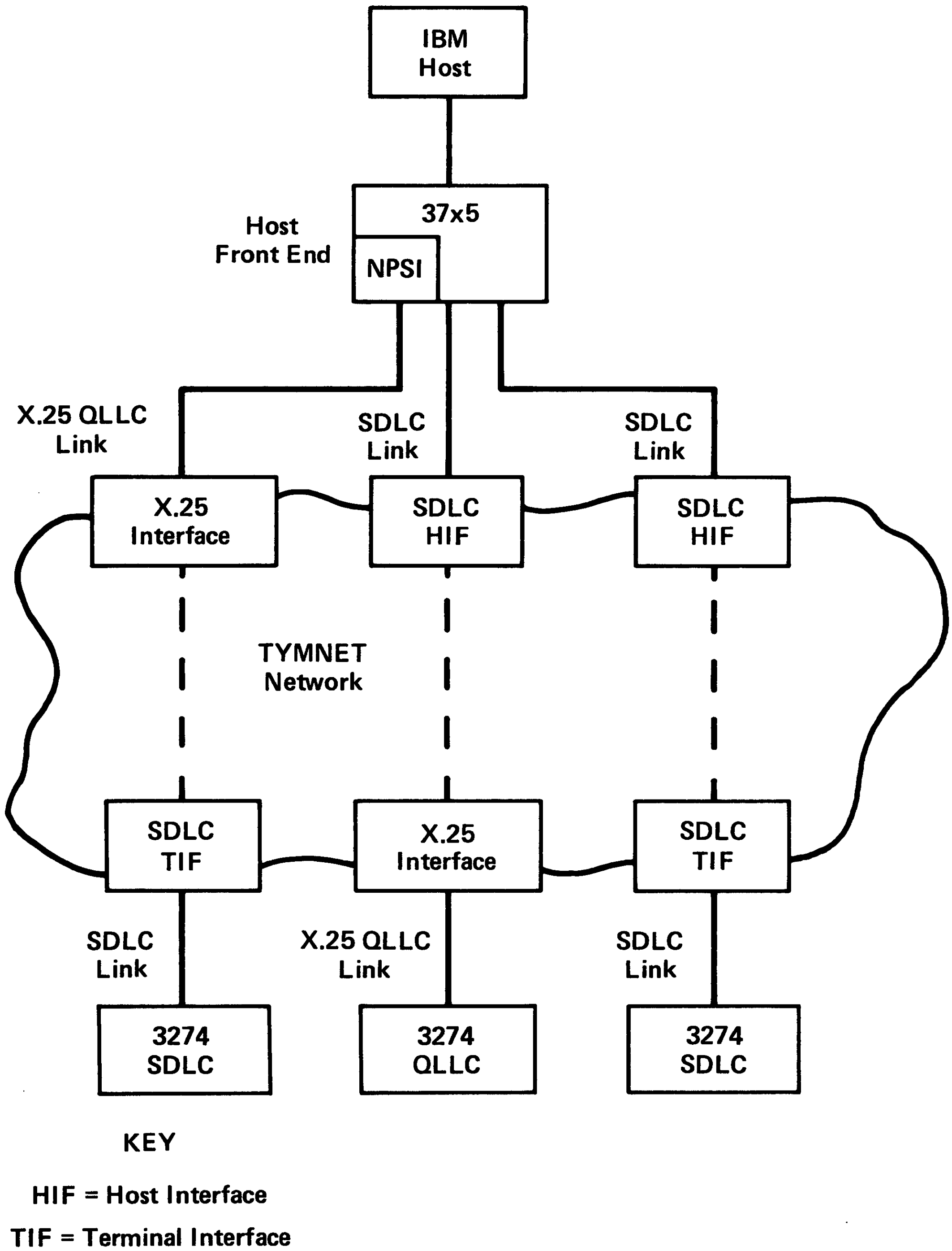

Figure 10-9. TYMNET SDLC/X.25 Network

Table 10-2. SDLC Frame/QLLC Packet Mapping

SDLC Frame	QLLC Packet	Control Field (Hex)	Informa-tion Field Allowed	Command	Response
DISC	QDISC	53	NO	X	
DM	QDM	1F	NO		X
FRMR	QFRMR	97	YES		X
RD	QRD	53	NO		X
SNRM	QSM	93	NO	X	
TEST	QTEST	F3	YES	X	X
UA	QUA	73	NO		X
XID	QXID	BF	YES	X	X

IBM Host Software

The following table summarizes IBM host software that is compatible with the TYMNET SDLC Interface.

Table 10-3. Supported IBM Host Software

System Control	Programs	Remote Job Entry (RJE) Subsystems	Program Products
DOS/VSE	NCP/VS VTAM	POWER/VSE	ACF/NCP/VS ACF/VTAM ACF/VTAME CICS/VS EXTM
MVS	NCP/VS TCAM VTAM	JES2 JES3	ACF/NCP/VS ACF/TCAM ACF/VTAM CICS/VS IMS/VS JES2/NJE JES3/NJP JES3/RJP TSO ACF/TCAM TSO ACF/VTAM
OS/VS1	NCP/VS TCAM VTAM	JES RES	ACF/NCP/VS ACF/TCAM ACF/VTAM CICS/VS IMS/VS

IBM Terminals

The TYMNET SDLC Interface is compatible with 3270 terminal equipment and 3770 communication terminals. Compatible devices are listed below.

Control Units:

3271-11, 12
3274-1C, 41C, 51C
3275-11, 12
3651

Control Unit Display Stations:

3276-1, 2, 3, 4
3276-11, 12, 13, 14

Application Terminals: 360x

Communication Terminals:

3771-1, 2, 3
3774-p1, p2
3775-p1
3776-1, 2, 3, 4
3777-1, 3

Control Unit Display: 8775

IBM Computer Systems

TYMNET SDLC Interface primary and secondary ports are compatible with a variety of IBM computer systems operating as either primary or secondary stations on a particular link. These systems are listed below:

- Series/1
- System/32
- System/34
- System/38
- 8100
- 3705
- 3725
- 5250

OPERATION

The following sections provide an overview of the SDLC interface system operation and include discussions of polling, circuit building, call procedures, operating modes, and the system monitor.

Polling

Because it offers faster response time than end-to-end polling, local polling is an important feature of the TYMNET SDLC Interface.

While reading the following description of local polling, the reader can refer back to Figure 10-3 to see how the interface appears to attached stations. Figure 10-3 helps clarify the local polling process, which consists of looking at a port to see what type of signal is going over a link.

On the host side of the network, polling is performed by the host front end, which sends a Receive Ready (RR) with a poll bit to a secondary port on the host interface. The host interface then responds on behalf of the terminal controller by sending either an RR with a final bit (indicating that it has nothing to transmit) or any information frames ready to be sent.

On the terminal side of the network, the terminal interface performs the same polling process as the host and sends an RR with a poll bit to a terminal address on the terminal controller.

Local polling is faster than end-to-end polling because both ends of the network poll independently of each other.

Virtual Circuit Management

The TYMNET SDLC Interface communicates across the network through network virtual circuits. These circuits are configured in the system generation file (Tymfile) and are established in one of two ways:

1. The interface builds a <u>switched circuit</u> when it receives Data Set Ready (DSR) from the attached DTE. The interface maintains the circuit until DSR stops.

2. The interface builds a <u>leased circuit</u> when the slot is loaded and maintains the circuit permanently, even if the DTE is disconnected from the leased port on the interface.

For both switched and leased circuits, the circuit destination and other login information are predefined in the Tymfile.

Call Procedures

After the SDLC interface has built a circuit, it sets up a call. Different versions of the interface use different call procedures.

The SDLC interface without X.25 QLLC support sends "call user data" to set up a call.

For compatibility with X.25 DTEs, the SDLC interface with X.25 QLLC support uses one of the following two call procedures:

1. A Switched Virtual Call (SVC) sends and receives call request packets that identify it as an SVC to the X.25 interface. This SVC has its destination predefined at system generation.

2. A Permanent Virtual Call (PVC), like an SVC, sends and receives specific signals that identify it to the X.25 interface. The PVC is simpler than an SVC and does not require call setup packets.

Which of the above calls is used depends on the X.25 host application requirements.

NOTE

In other TYMNET documents, PVC is an acronym for Permanent Virtual Circuit. In this document, PVC means an X.25 QLLC Permanent Virtual Call, and TYMNET Permanent Virtual Circuits are called network virtual circuits.

Normal Disconnect Mode

During the circuit building just described, both the terminal and host interfaces are in Normal Disconnect Mode (NDM). After the network virtual circuit has been built, NDM continues until the primary station changes it with a mode-setting command.

During NDM, the following unnumbered frames can be sent end-to-end (see Table 10-1 for acronym definitions):

DISC	SNRM
DM	TEST
FRMR	UA
SIM	XID

Normal Response Mode

During Normal Response Mode (NRM), the terminal and host interfaces can exchange both unnumbered and information frames end-to-end. To establish NRM, the primary station sends the Set Normal Response Mode (SNRM) command to the secondary station, and the secondary station returns an Unnumbered Acknowledgment (UA).

System Monitor

The TYMNET SDLC Interface incorporates a system monitor. This monitor has a unique host number. Network operators with appropriate network validation can log in to this host number, access the system monitor, and display system information. Operators can also use the system monitor to interactively change some system parameters.

The system monitor displays the following information:

1. status of all hosts on the interface
2. configuration of a line or lines
3. status, loading, and exception conditions of physical links
4. status of network logical links
5. interface software revision level
6. crash count and last crash code

A network operator can issue diagnostic commands through the system monitor to isolate data-link problems. The operator can also use the monitor to shut or activate lines and stations and to change virtual circuit login information, station polling addresses, destination line, and window frame size. The monitor also provides extended Dynamic Debugging Tool (DDT) commands, which are incorporated in most other TYMNET interfaces.

GLOSSARY

ASCII	American National Standard Code for Information Interchange. Consists of 7 bits for each character code plus a parity bit, giving a total of 128 unique characters.
Asynchronous Communication	Start/stop communication used for relatively low-speed applications (less than 19,200 baud). The time of occurrence of the start of each character, or block of characters, is arbitrary.
Background Job	ISIS slot context that conducts the major part of a slot's work, receiving longer periods of CPU time at nonuniform intervals.
Baud Rate	The number of signalling code elements transmitted per second.
Bisynchronous Communication	An IBM synchronous communications protocol that uses a standardized set of control characters and control character sequences for synchronous transmission of binary-coded data.
Bootstrap Program	A special program located in PROM on the Engine multifunction card; performs the functions of loading and dumping the Engine.
Channel	A single path for transmitting signals, usually in distinction from other, parallel paths.
CCITT	See International Telephone and Telegraph Consultative Committee.
Checksum	A calculated value used to check the validity of data.
Clock	A device that generates electronic timing signals.
Command File	A system generation file containing a series of commands used to create a NIB file.

Configuration File
A system generation parameter file containing statements that customize slot code for certain products, such as ELF and NETVAL.

Controlling User Directory
A database on disk that contains data used to control access to a TYMNET network. Maintained by NETVAL.

Control Table Area
An ISIS slot's memory segment 0E. Contains descriptors of a slot's running configuration.

Crossover Cable
EIA RS-232-C cable used to cross signals, for example, the transmit data signal on the originating end becomes the receive data signal on the terminating end. Also called a null-modem cable.

CTA
See Control Table Area.

CUD
See Controlling User Directory.

Data Communications Equipment
The equipment that provides the functions required to establish, maintain, and terminate a connection and the signal conversion and coding required for communication between data terminal equipment and data circuits.

Data Network Identification Code
Used to identify a particular public data network. Composed of a 3-digit country or geographic area code plus a 1-digit public network identification code.

Data Terminal Equipment
The equipment comprising a data source, a data sink, or both.

DCE
See Data Communications Equipment.

DDT
Dynamic Debugging Tool. A background ISIS job operating within a slot. Permits the user to log in to the kernel and load or examine the contents of a slot, change contents of memory locations, and perform various special diagnostic operations.

Dispatcher — That portion of the ISIS operating system responsible for all communications between slots and the kernel.

DNIC — See Data Network Identification Code.

Drowsiness Factor — A time factor added to the normal sleep time of a Supervisor. Used to alter the normal priority of Supervisor sleep times.

DTE — See Data Terminal Equipment.

EBCDIC — Extended Binary-Coded Decimal Interchange Code. An 8-bit character code used primarily in IBM equipment.

FEP — See Front End Processor.

Foreground Job — ISIS slot context that is used to communicate with interrupt-level processes like synchronous and asynchronous I/O.

Frame — In data link transmission, the sequence of contiguous bits bracketed by and including beginning and ending flag sequences.

Front End Processor — A subsidiary computer that performs the controls and conversion functions necessary for data transmission between host computers and a communications network.

Full Duplex — A system for transmission of communications signals in two directions simultaneously.

Gateway — A connection between two networks that allows circuits on one network to be continued into the other.

Half Duplex — A system for transmission of communications signals in two directions, but not at the same time.

Hardwired — The direct wiring of two devices involved in a communication system. A modem or telephone system is not involved in this type of connection.

HDLC See High Level Data Link Control.

Heartbeat A periodic signal sent from the ISRM slot to the PSM over a dedicated, synchronous line.

High Level Data Link Control A bit-oriented, synchronous, serial data protocol that has been modified from SDLC by the International Standards Organization. CCITT further modified HDLC for LAP and LAPB as part of the X.25 network interface standard.

Host A stand-alone computer connected to TYMNET or an application running in an ISIS slot. Identified by a unique address number.

Interface A shared boundary between two subsystems or two devices.

International Telephone and Telegraph Consultative Committee A specialized organization of the United Nations under the International Telecommunications Union, whose task it is to make technical recommendations about telephone, telegraph, and data communication interfaces.

ISIS Internally Switched Interface System. Operating system used in TYMNET Engines that allows multiple data communications functions to run on a single processor.

ISRM ISIS System Recovery Module. Provides the user interface and control of the PSM.

Kernel That portion of the ISIS operating system that manages job slots, allocates CPU time, controls all hardware interfaces, and handles interrupts.

LAN See Local Area Network.

Link A communications channel or a line, normally restricted in use to a point-to-point line. In TYMNET, a logical connection, which could consist of numerous lines, between two nodes.

Local Area Network — A network that typically connects terminals to computers within a single building complex.

Master User Directory — The database stored on the disk of each network Supervisor, which contains data that is used to control access to a TYMNET network. The MUD data is identical to CUD data maintained by the NETVAL program.

MERLIN — Merge and Link ISIS Nodes program. Binds together a combination of Node Code, the ISIS kernel, and one or more slot codes into a binary image file to be loaded into an Engine.

MUD — See Master User Directory.

Multiplex — To subdivide a transmission channel into two or more separate channels. A means of interleaving or concurrently transmitting more than one message on a single channel.

NAD — Node Assembler/Debugger program. The Engine assembler.

Needle — A special intranetwork message containing circuit path information.

Network Topology — The logical connection of nodes in a network.

NIB File — NAD Image Binary file. Contains ISIS, Node Code, or slot code.

Node — A branching or exchange point. In TYMNET, a communications processor running network software.

Node Code — The software that interfaces a node to the rest of the network.

Nonswitched Line — A leased or hardwired connection.

Optional User Facility — A service element not belonging to the set of elements forming a basic user service, but enhancing the service.

Packet A group of bits, including data and control elements, that is switched and transmitted as a composite whole. The data and control elements, and possibly error control information, are arranged in a specified format.

Packet Assembly/Disassembly A function of assembling/disassembling data into packets.

Packet Switching A type of data communications in which small, defined blocks of data, called packets, are independently transmitted from point to point between source and destination and reassembled into proper sequence at a destination.

PAD A device or software function that provides Packet Assembly/Disassembly for nonpacket mode terminals to exchange data in packet mode.

Password Identification code associated with a username. Entered by the user and validated by the Supervisor before network access is permitted.

PDN See Public Data Network.

Peripheral Devices Devices, such as printers, tapes, and disk drives, that are external to the system processor.

Permanent Virtual Circuit A circuit that exists between two DTEs that is identical to the data transfer phase of a virtual call. No call setup or clearing procedure is possible or necessary.

Permuter Table In each node, a table consisting of one entry for each line and channel on the node. Used to identify the path of a virtual circuit.

Polling A technique by which each terminal sharing a communications line is periodically interrogated by the multiplexer or control station to determine whether a terminal requires servicing.

Port — The physical and logical interface through which data passes.

Port Switch Module — A hardware device that switches ports from a failed processor to an operational one.

Processor — A single set of hardware modules that provides the computational capabilities for a node or ISIS system, for example, a TYMNET Engine.

Protocol — A predefined method of exchanging data messages between computers or other intelligent data terminal equipment.

PSM — See Port Switch Module.

Public Data Network — A network established and operated for providing data transmission services to the public.

PVC — See Permanent Virtual Circuit.

RS-232-C — The interface, standardized by the Electronic Industries Association, between data terminal equipment and data communication equipment employing serial binary data interchange.

Recognized Private Operating Agency — Private telecommunications carriers, such as TYMNET, AT&T, and TELENET.

RPOA — See Recognized Private Operating Agency.

SDLC — See Synchronous Data Link Control.

Serial Input/Output — Data transmission in which the bits composing a character are sent sequentially.

SIO — See Serial Input/Output.

SIO Board — The Direct Memory Access communications controller that handles up to eight dual-line interfaces.

Sleeping Pills — A series of commands sent to standby Supervisors by the active Supervisor; keeps standby Supervisors inactive.

Slots
Processes providing separate operating environments for different software products. Engine memory divided into logically separate partitions.

Super Clock
A hardware module installed in a Supervisor node that provides the date and time.

Switched Line
A communications link for which a physical path may vary with each usage, for example, the dial-up telephone network.

Synchronous Communication
Transmission in which the speed of operation is controlled by a clock or timing device.

Synchronous Data Link Control
A synchronous-by-bit, link-level protocol that incorporates data and control information within a frame structure that is sent along communications lines.

System Generation Files
Tymfiles, command, and configuration files used to assemble product source code into image files.

Throughput
The total amount of useful work performed by a system during a given period of time.

Tymfile
A file containing parameter statements that define software configuration.

TYMNET Engine Processor
A high-performance, microcode-driven, 32-bit minicomputer.

Username
User identification code entered by the user and validated by the Supervisor before network access is permitted.

Virtual Circuit
In TYMNET, a pathway through the network established by the Supervisor. Provides a connection between a user's terminal and a desired destination.

V.24
A CCITT data communications hardware interface standard for asynchronous communications at speeds of up to 19,200 bits per second.

V.35 A CCITT data communications hardware interface standard for communications at speeds of up to 56,000 bits per second.

Window Size The number of records a node sends before the lack of an acknowledgment necessitates record retransmission.

Zap To tear down or clear a circuit by sending a zapper along the circuit.

Zapper A control code that tears down a circuit.

READER COMMENT FORM

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TYMNET Network Technology Development/Documentation
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Cupertino, CA 95014

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