
**Information technology —
Telecommunications and information
exchange between systems — Use of X.25
to provide the OSI Connection-mode
Network Service**

*Technologies de l'information — Télécommunications et échange
d'informations entre systèmes — Utilisation du protocole X.25 pour
fournir le service de réseau OSI en mode connexion*



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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 8878 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

This second edition cancels and replaces the first edition (ISO 8878:1987), which has been technically revised. It consolidates Technical Corrigenda 1, 2 and 3, Addenda 1 and 2 and Amendment 1 as well as Technical Corrigendum 1 to Addendum 2.

NOTE — ISO/IEC DIS 8878-2 as well as defect reports 8878-012, 013, 014 and 015 have also been included in this second edition.

Annexes A, B, C and D form an integral part of this International Standard. Annexes E, F, G, H and I are for information only.

Introduction

This International Standard defines methods for providing the OSI Connection-Mode Network Service (CONS) through the use of the virtual circuit services of the X.25 Packet Layer Protocol (X.25 PLP). The method presented in the main body of this International Standard specifies a mapping between elements of the 1984 or later versions of the X.25/PLP (referred to as X.25/PLP-1984) using X.25 Virtual Call (VC) services and elements of the OSI CONS. Features associated with versions of X.25 later than 1984 are identified as to which version they relate. This International Standard is similar to CCITT Recommendation X.223; however, the two are currently published as separate documents.

Clause 13 contains the requirements for systems claiming conformance to this International Standard.

Other methods using other virtual circuit services and/or other versions of X.25 are also defined. In particular, a second method for VCs, which is presented in Annex A, defines a Subnetwork Dependent Convergence Protocol (SNDCP) that shall be used to provide the OSI CONS over subnetworks or with equipment using the 1980 or earlier versions of the X.25/PLP (referred to as X.25/PLP-1980). This SNDCP should only be used if the elements of the X.25/PLP-1984, as defined in 5.1 herein, are not available to support the OSI CONS. Annex B contains a classification of systems according to whether they implement the procedures defined in the main body of this International Standard, the procedures defined in Annex A, or both. In addition, it describes the possibilities and the rules for interworking between the classes of equipment identified.

Annexes A and B are integral parts of this International Standard. They are intended to provide a migration strategy towards the use of the 1984 version of X.25 in both subnetworks and DTEs. Because of the evolution of technology, the status of Annexes A and B will be reviewed in the future.

Annex C defines another method for providing the OSI CONS, in this case in conjunction with the PVC service of X.25.

Annex D provides the Protocol Implementation Conformance Statement (PICS) Proforma for this International Standard.

Annexes C and D are integral parts of this International Standard.

Annex E provides additional considerations on the relationship between the X.25 protocol procedures and the CONS primitives.

Annex F illustrates the use of X.25 Network Protocol Address Information (NPAI), i.e., the Address Field and the Address Extension Facilities.

Annex G illustrates the use of the X.25 transit delay facilities.

Annex H illustrates the use of the X.25 Priority Facility.

Annex I lists the differences between CCITT Rec. X.223 and ISO/IEC 8878.

Annexes E through I are not integral parts of this International Standard.

The relationship between the X.25/PLP-1984 and the OSI CONS is shown in Figure 1. This relationship is described only in terms of the Network Layer entities that provide the CONS. No discussion is given here to describe the actions of a Network Layer entity that only provides a relay function for a given network connection.

The OSI Network Service is defined in terms of

- a) the primitive actions and events of the Service;
- b) the parameters associated with each primitive action and event, and the form which they take;
- c) the interrelationship between, and the valid sequences of, these actions and events.

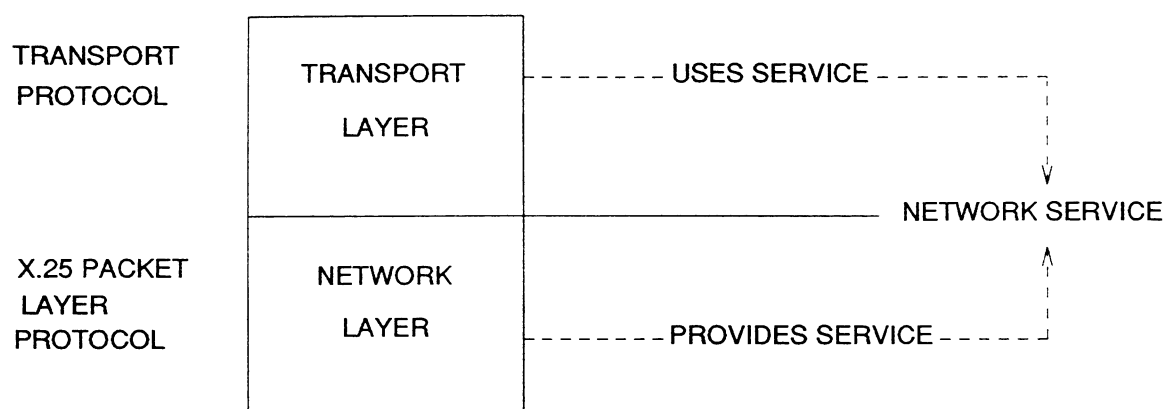


Figure 1 — Relationship of the X.25 Packet Layer Protocol to the OSI Connection-Mode Network Service

The OSI Network Service does not specify individual implementations or products nor does it constrain the implementation of entities and interfaces within a computer system.

The X.25/PLP-1984 is defined in terms of

- a) procedures for Virtual Calls and Permanent Virtual Circuits;
- b) formats of packets associated with these procedures;
- c) procedures and formats for optional user facilities and CCITT-Specified DTE facilities.

The use of the word "Network" to name the "Network" Layer of the OSI Reference Model should be distinguished from the use of the word "network" to denote a communications network as conventionally understood. To facilitate this distinction, the term "subnetwork" is used for a collection of physical equipment, commonly called a "network" (reference CCITT Rec. X.200 | ISO 7498). Subnetworks may be either public or private networks. In the case of public networks, their properties may be determined by separate CCITT Recommendations such as CCITT Rec. X.21 for a circuit-switched network or CCITT Rec. X.25 for a packet-switched network.

Throughout the set of OSI-related Recommendations | International Standards, the term "Service" refers to the abstract capability provided by one layer of the OSI Reference Model to the layer above it. Thus, the Network Service is a conceptual architectural Service, independent of administrative divisions.

NOTE — It is important to distinguish the specialized use of the term "Service" within the set of OSI-related Recommendations | International Standards from its use elsewhere to describe the provision of a service by an organization (such as the provision of a service, as defined in CCITT Recommendations, by an Administration).

Information technology — Telecommunications and information exchange between systems — Use of X.25 to provide the OSI Connection-mode Network Service

1. Scope

The OSI Connection-mode Network Service (CONS) is defined in terms of a set of primitive actions and events and associated parameters. For a protocol to support this service, there must be a mapping between the abstract primitives and parameters of the CONS and the real elements of the protocol. For the X.25 Packet Layer Protocol (PLP), the main body of this International Standard provides such a mapping for the X.25/PLP-1984 using Virtual Calls.

This International Standard also provides a mapping of the CONS primitives and parameters to the X.25/PLP-1980 plus an SNDCP (Annex A). These mappings apply to the X.25 VC service. In addition, the method of selecting the appropriate mapping, if any, for different combinations of end systems and Network Layer relay systems implementing one or more of the mappings is defined (Annex B).

For the PVC service for both the X.25/PLP-1984 and the X.25/PLP-1980, a mapping of CONS primitives and parameters to the X.25/PLP is given in Annex C.

This International Standard specifies two sets of procedures from which three classes of implementation are described. The requirements of these procedures are applicable both to end system operation and to half the operation of a Network Layer relay. Where relay operation is concerned, the two halves of the relay may be the same or different classes of implementation.

This International Standard specifies the requirements to be met by a **System-1984** implementation. Implementations in this class are designed to operate directly and efficiently with other System-1984 implementations, including cases of operation across an X.25(1984) subnetwork.

This International Standard also specifies the procedures to be operated by a **System-1980** implementation. Implementations in this class are designed to operate directly with other System-1980 implementations, including cases of operation across any form of X.25 subnetwork, but will operate less efficiently than System-1984 implementations.

This International Standard also specifies the requirements to be met by a **Compatible** implementation. Implementations in this class are designed to operate directly with all other implementation classes, including cases of operation across any type of X.25 subnetwork. They make efficient use of X.25(1984) when placed in this environment.

The X.25/PLP is usually regarded as operating between an end system (i.e., a "Data Terminal Equipment" in X.25 terminology) and a packet-switched public data subnetwork. However, the X.25/PLP can also be used in other

environments to provide the OSI CONS. Examples of such other uses include

- a) an end system connected to an X.25 packet-switched private data subnetwork;
- b) an end system connected to a local area network;
- c) direct connection or circuit-switched connection (including connection across a circuit-switched data subnetwork) of two end systems without an intervening packet-switched public data subnetwork;
- d) an end system connected to an Integrated Services Digital Network.

2. Normative references

The following CCITT Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The CCITT Secretariat maintains a list of currently valid CCITT Recommendations.

2.1 Identical Recommendations | International Standards

- CCITT Recommendation X.213 (1992) | ISO/IEC 8348:1992, *Information Technology — Network Service Definition for Open Systems Interconnection*.

2.2 Paired Recommendations | International Standards equivalent in technical content

- CCITT Recommendation X.25 (1988), *Interface Between Data Terminal Equipment (DTE) and Data Circuit Terminating Equipment (DCE) for terminals operating in the packet-mode and connected to Public Data Networks by dedicated circuit*.

NOTE — This Recommendation is referred solely with respect to its Packet Layer Protocol description. However, this Recommendation fully specifies the behaviour of the DCE while specifying only a minimum set of requirements for the DTE. Additional guidance for the design of DTEs is available in ISO/IEC 8208.

ISO/IEC 8208:1990, *Information technology — Data communications — X.25 Packet Layer Protocol for Data Terminal Equipment*.

- CCITT Recommendation X.200 (1988), *Reference model of Open Systems Interconnection for CCITT applications*.

ISO 7498:1984, *Information processing systems — Open Systems Interconnection — Basic Reference Model*.

- CCITT Recommendation X.210 (1988), *Open Systems Interconnection layer service definition conventions*.

ISO/TR 8509:1987, *Information processing systems — Open Systems Interconnection — Service conventions*.

2.3 Additional references

- CCITT Recommendation X.96 (1988), *Call progress signals in Public Data Networks*.

3. Definitions

For the purpose of this International Standard, the following definitions apply.

3.1 Reference Model definitions

The following terms, developed and defined in the OSI Reference Model (CCITT Rec. X.200 | ISO 7498), are used:

- a) Network connection
- b) Network Layer
- c) Network Service
- d) Network Service Access Point
- e) Network Service Access Point address
- f) Subnetwork

3.2 Service Conventions definitions

The following terms, as they apply to the Network Layer and as defined in the OSI Service Conventions (CCITT Rec. X.210 | ISO/TR 8509), are used:

- a) Network Service user
- b) Network Service provider
- c) primitive
- d) request
- e) indication
- f) response
- g) confirm

3.3 Network Service definitions

The following terms, as defined in the Network Service (CCITT Rec. X.213 | ISO/IEC 8348), are used:

- a) Calling Network Service user
- b) Called Network Service user
- c) Subnetwork Point of Attachment address
- d) Network Protocol Address Information
- e) Initial Domain Part
- f) Authority and Format Identifier
- g) Initial Domain Identifier
- h) Domain Specific Part

3.4 X.25 definitions

The following terms, as developed in the X.25 Packet Layer Protocol (CCITT Rec. X.25 | ISO/IEC 8208), are used:

- a) virtual circuit
- b) Virtual Call
- c) logical channel
- d) Packet Layer
- e) Data Terminal Equipment
- f) Data Circuit-terminating Equipment
- g) DXE (either a DTE or a DCE)

3.5 X.96 definitions

The following terms, as defined in CCITT Rec. X.96, are used:

- a) Category C call progress signal
- b) Category D call progress signal

4. Abbreviations

4.1 Network Service abbreviations

AFI	Authority and Format Identifier
CONS	Connection-Mode Network Service
DSP	Domain Specific Part
IDI	Initial Domain Identifier
IDP	Initial Domain Part
N	Network
NC	Network-connection
NL	Network Layer
NPAI	Network Protocol Address Information
NS	Network Service
NSAP	Network Service Access Point

OSI	Open Systems Interconnection
QOS	Quality of Service
SNPA	Subnetwork Point of Attachment

4.2 X.25 abbreviations

AEF	Address Extension Facility
AF	Address Field
B-MTCN	Basic Minimum Throughput Class Negotiation (Facility)
B-TCN	Basic Throughput Class Negotiation (Facility)
D-bit	Delivery Confirmation bit
DCE	Data Circuit-terminating Equipment
DTE	Data Terminal Equipment
EDN	Expedited Data Negotiation (Facility)
EETDN	End-to-End Transit Delay Negotiation (Facility)
FPF	Facility Parameter Field
GFI	General Format Identifier
LC	Logical Channel
M-bit	More Data bit
MBS	M-bit Sequence
PLP	Packet Layer Protocol
P(R)	Packet receive sequence number
P(S)	Packet send sequence number
PVC	Permanent Virtual Circuit
Q-bit	Qualifier bit
TDSAI	Transit Delay Selection And Indication (Facility)
VC	Virtual Call

5. Overview

The Network Service (NS) provides for the transparent transfer of data between NS users. It makes invisible to these NS users the way in which supporting communications resources are utilized to achieve this transfer.

5.1 Elements of the X.25/PLP-1984 used to support the OSI CONS

The X.25/PLP-1984, as defined by CCITT Rec. X.25 | ISO/IEC 8208, provides a specific realization for the transparent transfer of data between NS users of the CONS. The elements of this protocol to be considered are

- a) the virtual-circuit types;
- b) the packet types and fields to be mapped to the primitives and parameters of the OSI CONS;
- c) the optional user facilities and CCITT-Specified DTE facilities.

Of the two types of virtual circuits defined in CCITT Rec. X.25 | ISO/IEC 8208, the use of Virtual Calls (VCs) is mapped to the network connection (NC) establishment and release phases of the OSI CONS in clauses 6 and 7 and to the data transfer phase in clauses 8-11. (The corresponding mapping for PVCs is given in Annex C.)

Table 1 lists the X.25/PLP-1984 packets and associated fields that shall be used when supporting the OSI CONS.

In addition, the following optional user facilities and CCITT-Specified DTE facilities shall be used and/or agreed to:

- a) optional user facilities:
 - 1) Fast Select (facility used; when operating in a DTE-to-DTE environment without an intervening packet-switched network, the use of the Fast Select Facility shall also be agreed to by the two DTEs);
 - 2) Fast Select Acceptance (facility agreed to if operating in a packet-switched network environment);
 - 3) Basic Throughput Class Negotiation (facility agreed to and used);
 - 4) Transit Delay Selection And Indication (facility used).
- b) CCITT-Specified DTE facilities:

Table 1 — Packets and fields of the X.25/PLP-1984 used to support the OSI CONS

Packet Types¹⁾	Fields²⁾
CALL REQUEST INCOMING CALL CALL ACCEPTED CALL CONNECTED	General Format Identifier ³⁾ , Address Field, Facility Field, Call and Called User Data Field ⁴⁾
CLEAR REQUEST CLEAR INDICATION	Clearing Cause Field, Diagnostic Code Field, Address Field, Facility Field, Clear User Data Field ⁴⁾
DATA	D-bit, M-bit, P(S) ⁵⁾ , P(R) ⁵⁾ , User Data Field ⁴⁾
INTERRUPT	Interrupt User Data Field ⁴⁾
RECEIVE READY ⁶⁾ RECEIVE NOT READY ⁶⁾ REJECT ⁶⁾ (if agreed to)	P(R) ⁵⁾
RESET REQUEST RESET INDICATION	Resetting Cause Field, Diagnostic Code Field
RESTART INDICATION	Restarting Cause Field, Diagnostic Code Field

Notes to Table 1:

1 — The packets shown in the table are used in support of the primitives of the OSI CONS. Other packets not shown in the table (i.e., CLEAR CONFIRMATION, INTERRUPT CONFIRMATION, RESET CONFIRMATION, and RESTART CONFIRMATION packets) are essential to the use of the packets shown. Yet other packets (i.e., RESTART REQUEST, DIAGNOSTIC, REGISTRATION REQUEST, and REGISTRATION CONFIRMATION packets) have no relationship to the provision of the OSI CONS.

2 — The information in the fields shown in the table have a direct relationship to the parameters associated with the primitives of the OSI CONS. Other fields not shown in the table (e.g., the Logical Channel Identifier, the Packet Type Identifier, the Q-bit, the Address Length Fields, and the Facility Length Field) are essential to the use of the appropriate packets.

3 — Bit 7 of octet 1 of the General Format Identifier (GFI) in these packets is used to negotiate the overall availability of the Delivery Confirmation bit (D-bit) in support of the Receipt Confirmation Service. As such, this bit has no specific field-name as defined in the X.25/PLP-1984.

4 — All user data fields are octet aligned.

5 — The P(S) and P(R) fields are essential to the operation of the X.25/PLP-1984 in providing the Receipt Confirmation Service.

6 — The action implied by these packets has no relationship to the primitives of the OSI CONS. However, the P(R) field is essential to the operation of the X.25/PLP-1984 in providing the Receipt Confirmation Service.

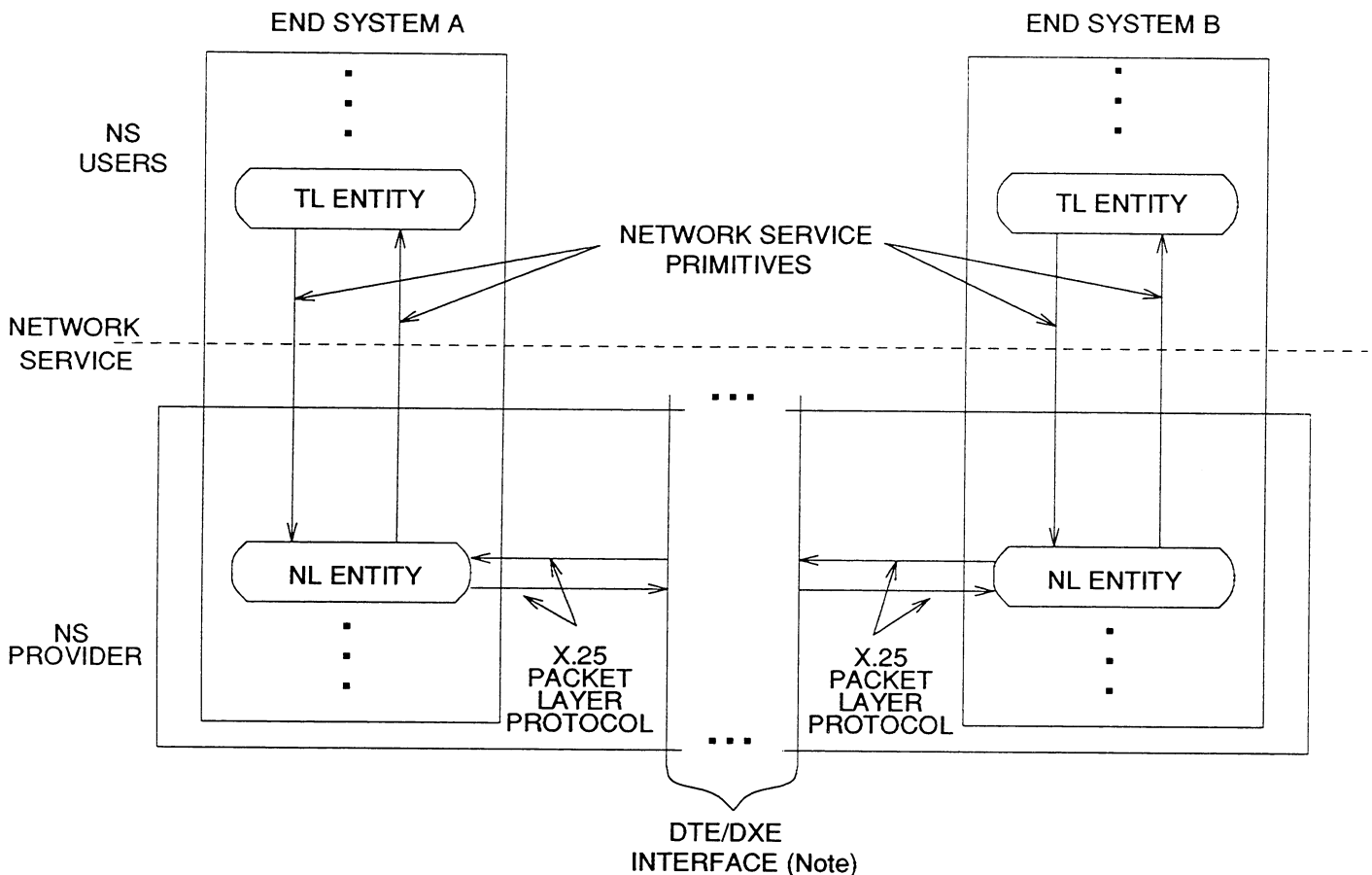
- 1) Called Address Extension (facility used);
- 2) Calling Address Extension (facility used);
- 3) End-to-End Transit Delay Negotiation (facility used);
- 4) Expedited Data Negotiation (facility used);
- 5) Basic Minimum Throughput Class Negotiation (facility used);
- 6) Priority (facility used with 1988 or later versions of the X.25/PLP).

5.2 General operation of the X.25/PLP-1984 for supporting the OSI CONS

The X.25/PLP-1984 can be used to provide the OSI CONS in an end system connected to a public or private X.25 packet-switched subnetwork. It can also be used in environments where the end system is connected to a Local Area Network or where end systems are connected by a dedicated path or by a circuit-switched connection.

As shown in Figure 2, the NS provider (more particularly, the Network Layer (NL) entity in an end system) must provide a translation between

- a) the primitives and parameters of the OSI CONS;
- b) the packets and associated fields of the X.25/PLP-1984.



NOTE — This interface consists of zero or more Network Layer entities providing a Network Layer relay function.

Figure 2 — Operation of OSI Connection-Mode Network Service and X.25 Packet Layer Protocol (1984)

Request and response primitives are translated into packets to be transmitted across the DTE/DXE interface by the NL entity. Received packets, where appropriate, are translated by the NL entity into indication and confirm primitives.

Annex E provides additional considerations on the relationship between the X.25 protocol procedures and the CONS primitives.

NOTE — The Network Service Definition specifies valid sequences of primitives at an NC endpoint and valid parameter responses at the called NC endpoint to Receipt Confirmation negotiation, Expedited Data negotiation, and Quality of Service (QOS) parameter negotiation. The necessity for the NL entity to monitor compliance and the actions to be taken on non-compliance are a local matter, and not subject to standardization.

There is also a relationship between some local mechanism used to identify a particular NC and a Logical Channel (LC) number used to identify a particular virtual circuit. This relationship is a local matter and is not discussed here.

6. Network connection establishment phase

6.1 Primitive/Parameter and packet/field relationships

Table 2 shows the relationships between the primitives/parameters used during the NC establishment phase and the packets/fields associated with the call setup procedures.

Table 2 — CONS:X.25/PLP-1984 mapping for the NC establishment phase

CONS	X.25/PLP-1984
PRIMITIVES: N-CONNECT request N-CONNECT indication N-CONNECT response N-CONNECT confirm	PACKETS: CALL REQUEST INCOMING CALL CALL ACCEPTED CALL CONNECTED
PARAMETERS: Called Address Calling Address Responding Address Receipt Confirmation Selection Expedited Data Selection QOS-Parameter Set NS-User-Data	FIELDS (INCLUDING FACILITIES): Called DTE Address Field Called Address Extension Facility Calling DTE Address Field Calling Address Extension Facility Called DTE Address Field Called Address Extension Facility General Format Identifier ¹⁾ Expedited Data Negotiation Facility Basic Throughput Class Negotiation Facility ²⁾ Basic Minimum Throughput Class Negotiation Facility Transit Delay Selection And Indication Facility End-to-End Transit Delay Negotiation Facility Priority Facility Call and Called User Data Field Fast Select Facility ³⁾

Notes to Table 2:

1 — Bit 7 of octet 1 of the GFI in call setup packets is used to negotiate the overall availability of the D-bit in support of the Receipt Confirmation Service. As such, this bit has no specific field-name as defined in the X.25/PLP-1984.

2 — For proper operation, this optional user facility shall also be agreed to for use on the interface.

3 — For proper operation, the Fast Select Acceptance Facility shall also be agreed to on the interface when accessing a packet-switched network.

6.2 Procedures

6.2.1 Primitive/Packet mapping

When an NL entity receives an N-CONNECT request or an N-CONNECT response primitive from an NS user, it transmits a CALL REQUEST or a CALL ACCEPTED packet, respectively, across the DTE/DXE interface.

When an NL entity receives an INCOMING CALL or a CALL CONNECTED packet, it signals an N-CONNECT indication or an N-CONNECT confirm primitive, respectively, to the NS user.

6.2.2 Network addresses

Local operation determines the contents of the Network Protocol Address Information (NPAI) and whether Network Addresses, where explicitly supplied, are mapped to and from the Address Field (AF) or the Address Extension Facilities (AEF) of X.25/PLP-1984 call setup packets. Annex F describes guidelines for the methods by which the required AF contents may be derived from the Network Address. The permitted techniques for the placement of Network Addresses in either the AF or AEF are given in this clause. The encoding techniques to be employed are those specified in CCITT Rec. X.25 | ISO/IEC 8208 for the AF and AEF. The content of these fields shall be in the preferred binary encoding defined in CCITT Rec. X.213 | ISO/IEC 8348. Examples of encoding Network Addresses in the NPAI of the X.25/PLP-1984 are also given in Annex F.

6.2.2.1 Encoding of Network addresses

6.2.2.1.1 Use of the Address Field (AF)

Under certain conditions, the Network Address, as defined in CCITT Rec. X.213 | ISO/IEC 8348, may be conveyed entirely in the AF. These conditions are

- a) the Network Address consists solely of the Initial Domain Part (IDP) (i.e., the Domain Specific Part (DSP) is null);
- b) the Authority and Format Identifier (AFI) can be deduced from the contents of the AF (e.g., with knowledge of the subnetwork to which the DTE is attached);
- c) the Initial Domain Identifier (IDI) is the same as the Subnetwork Point of Attachment (SNPA) Address.

When all of the above conditions are satisfied, the AF may be used to convey the semantics of the entire Network Address (the AFI is implied and the contents of the AF are equivalent to the IDI). In these cases, the AEF may also be used (see 6.2.2.1.2).

NOTE — The use of the preferred binary encoding results in binary-coded decimal digits in the AF, as required by CCITT Rec. X.25 | ISO/IEC 8208.

6.2.2.1.2 Use of the AEF

If any of the conditions in 6.2.2.1.1 are not satisfied, the AEF shall be used. The Network Address, complete with AFI, is placed in the AEF (bits 8 and 7 of the first octet of the Facility Parameter Field (FPF) of the AEF are both set to zero). In this case, the contents of the AF are not defined by this International Standard. Guidelines for their derivation are given in Annex F.

6.2.2.2 Decoding of Network addresses

If, after decoding the Network address as specified in the subclauses below, the Network address does not exist, then the NL entity clears the call by transmitting a CLEAR REQUEST packet across the DTE/DXE interface with a clearing cause code of "DTE Originated." It is recommended that the diagnostic code value be set to 232 (or 224), "Connection Rejection — NSAP Unreachable (Permanent Condition)." The NL entity shall not signal any primitive to the NS User.

6.2.2.2.1 Absent AEF case

If the AEF is not present, then local knowledge is required by the receiving NL entity to determine whether a Network Address is to be deduced from the content of the AF. If this local knowledge indicates that a Network Address is present, its abstract syntax is as follows:

- a) the AFI is deduced from knowledge of the subnetwork from which the packet was received;
- b) the IDI is the same as the contents of the AF;
- c) the DSP is absent.

If insufficient local knowledge exists to derive a Network Address from a received AF-only Called Address in an INCOMING CALL packet, then the call is rejected by transmission of a CLEAR REQUEST packet across the DTE/DXE interface with a clearing cause code of "DTE Originated." The diagnostic code value is recommended to be set to 232 "Connection Rejection — NSAP Unreachable (Permanent Condition)".

6.2.2.2.2 AEF case

If the AEF is present and bits 8 and 7 of the leading octet of the FPF are both set to zero, then the Network Address is contained entirely within the AEF. The abstract syntax is as follows:

- a) the AFI is contained within the first two digits of the AEF;
- b) the IDI is the remainder of the IDP after any leading and trailing padding digits are discarded;
- c) the DSP, if present, constitutes the remainder of the AEF content after any trailing padding digits are discarded.

If a Network Address cannot be derived from the Called AEF in an INCOMING CALL packet, then the call is rejected by transmission of a CLEAR REQUEST packet across the DTE/DXE interface with a clearing cause code of "DTE Originated." It is recommended that the diagnostic code value be set to 232 (or 224) "Connection Rejection — NSAP Unreachable (Permanent Condition)."

6.2.3 Receipt Confirmation selection

Bit 7 of octet 1 in the GFI of X.25/PLP-1984 call setup packets is mapped to/from the Receipt Confirmation Selection parameter of N-CONNECT primitives.

If the Receipt Confirmation Selection parameter of the N-CONNECT request primitive indicates "use of Receipt Confirmation," then the NL entity, if it can support the D-bit procedure as defined in 8.2.3 and 9.2.1, sets bit 7 of the GFI to 1 to indicate use of receipt confirmation during the data transfer phase. If "no use of Receipt Confirmation" is indicated or the NL entity cannot support the D-bit procedure, then bit 7 is set to 0.

When an NL entity receives an INCOMING CALL packet with bit 7 of the GFI set to 1 but it cannot support the D-bit procedure, it indicates "no use of Receipt Confirmation" in the Receipt Confirmation Selection parameter of the N-CONNECT indication primitive signaled to the Called NS user. Otherwise, if bit 7 of the GFI is set to 1 (respectively, 0), then the NL entity indicates "use (respectively, no use) of Receipt Confirmation" in the Receipt Confirmation Selection parameter of the N-CONNECT indication primitive signaled to the Called NS user.

When an NL entity receives an N-CONNECT response primitive with the Receipt Confirmation Selection parameter indicating "use (respectively, no use) of Receipt Confirmation," it sets bit 7 of the GFI in the CALL ACCEPTED packet to 1 (respectively, 0).

When an NL entity receives a CALL CONNECTED packet with bit 7 of the GFI set to 1 (respectively, 0), it indicates "use (respectively, no use) of Receipt Confirmation" in the Receipt Confirmation Selection parameter of the N-CONNECT confirm primitive signaled to the Calling NS user.

6.2.4 Expedited Data selection

The Expedited Data Negotiation (EDN) Facility of the X.25/PLP-1984 is mapped to/from the Expedited Data Selection parameter of N-CONNECT primitives.

If the Expedited Data Selection parameter of the N-CONNECT request primitive indicates "use of Expedited Data," then the NL entity, if it can support the Interrupt procedure using 32-octet INTERRUPT packets, encodes the EDN Facility in the CALL REQUEST packet to indicate use of expedited data during the data transfer phase. If "no use of Expedited Data" is indicated or the NL entity cannot support 32-octet INTERRUPT packets, then the EDN Facility shall be either encoded to indicate no use of expedited data or omitted.

When an NL entity receives an INCOMING CALL packet with no EDN Facility or with the EDN Facility indicating use of expedited data but it cannot support 32-octet INTERRUPT packets, it indicates "no use of Expedited Data" in the Expedited Data Selection parameter of the N-CONNECT indication primitive signaled to the Called NS user. Otherwise, if the EDN Facility indicates use (respectively, no use) of expedited data, then the NL entity indicates "use (respectively, no use) of Expedited Data" in the Expedited Data Selection parameter of the N-CONNECT indication primitive signaled to the Called NS user.

When an NL entity receives an N-CONNECT response primitive with the Expedited Data Selection parameter indicating "use of Expedited Data," it encodes the EDN Facility in the CALL ACCEPTED packet to indicate use of expedited data. If the Expedited Data Selection parameter indicates "no use of Expedited Data," then the EDN Facility shall be either encoded to indicate no use of expedited data or omitted.

When an NL entity receives a CALL CONNECTED packet with the EDN Facility indicating use (respectively, no use) of expedited data, it indicates "use (respectively, no use) of Expedited Data" in the Expedited Data Selection

parameter of the N-CONNECT confirm primitive signaled to the Calling NS user. If the CALL CONNECTED packet has no EDN Facility, then the NL entity indicates "no use of Expedited Data" to the Calling NS user.

6.2.5 QOS parameter set

The set of QOS parameters that are conveyed during the NC establishment phase consists of the following parameters:

- the throughput for the direction of data transfer from the Calling NS user to the Called NS user;
- the throughput for the direction of data transfer from the Called NS user to the Calling NS user;
- the transit delay that applies to both directions of data transfer;
- the priority of the data transferred on the NC (with respect to data transferred on other NCs);
- the priority of gaining an NC;
- the priority of keeping this NC.

For each of these parameters, a set of "subparameters" is defined as follows:

- a "Target" value, which is the QOS value desired by the Calling NS user;
- a "Lowest Quality Acceptable" value, which is the lowest QOS value agreeable to the Calling NS user;
- an "Available" value, which is the QOS value the NS provider is willing to provide;
- a "Selected" value, which is the QOS value to which the Called NS user agrees.

The set of values that can be specified for each subparameter is defined in every Network Service. This set includes the value "unspecified." It may also include a value defined to be a "default value" that is mutually understood by the NS provider and an NS user as applying in the absence of particular values.

6.2.5.1 Throughput QOS parameters

The Basic Throughput Class Negotiation (B-TCN) Facility and the Basic Minimum Throughput Class Negotiation (B-MTCN) Facility of the X.25/PLP-1984 are mapped to/from both Throughput QOS parameters of N-CONNECT primitives. The specific mapping of these X.25/PLP-1984 facilities to/from both sets of Throughput subparameters is given in Table 3.

Table 3 — Mapping of Throughput QOS subparameters to X.25/PLP-1984 Facilities

Subparameter	CONS Primitive	X.25/PLP-1984	
		Facility	Packet
Target	N-CONNECT request	B-TCN	CALL REQUEST
Lowest Quality Acceptable	N-CONNECT request	B-MTCN	CALL REQUEST
Available	N-CONNECT indication	B-TCN	INCOMING CALL
Lowest Quality Acceptable	N-CONNECT indication	B-MTCN	INCOMING CALL
Selected	N-CONNECT response	B-TCN	CALL ACCEPTED
Selected	N-CONNECT confirm	B-TCN	CALL CONNECTED

The set of values that can be specified for each Throughput subparameter ranges from 75 bits per second through 19 200¹⁾ bits per second, inclusive. This set consists of the following discrete values: 75, 150, 300, 600, 1 200, 2 400, 4 800, 9 600, 19 200, 48 000, 64 000, 128 000, and 192 000 bits per second. An NL entity supports either all of these values or a contiguous subset of them. The value "unspecified" is also allowed.

1) For the 1984 X.25/PLP, only throughputs up to 48 000 bits per second are available. For the 1988 X.25/PLP, this set is extended to 64 000 bits per second. For the 1992 X.25/PLP, this set is extended to 192 000 bits per second.

6.2.5.1.1 Processing an N-CONNECT request primitive

If an NL entity, when receiving an N-CONNECT request primitive, cannot support the Lowest Quality Acceptable throughput (i.e., the minimum throughput) when specified for either direction of data transfer, then it rejects the request. In this case, the NL entity does not transmit any X.25/PLP-1984 packet but it does signal an N-DISCONNECT indication primitive to the Calling NS user. The Originator parameter is "NS Provider." The Reason parameter is "Connection Rejection — QOS Not Available/Transient Condition," or "Connection Rejection — QOS Not Available/Permanent Condition" if the NL entity could never support the Lowest Quality Acceptable for either direction of data transfer.

If an NL entity, when receiving an N-CONNECT request primitive, can support the Lowest Quality Acceptable throughput when specified, for both directions of transfer, then for each direction of transfer it

- a) encodes the Lowest Quality Acceptable value in the B-MTCN facility;
- b) encodes the lesser of the Target value and the highest value that the NL entity is prepared to support in the B-TCN facility (as shown in Table 3).

If the Target subparameter (of either or both of the Throughput QOS parameters) is "unspecified," then the NL entity encodes the B-TCN Facility for the corresponding direction(s) of data transfer as the highest throughput rate supported by the NL entity. If the Lowest Quality Acceptable subparameter (of either or both of the Throughput QOS parameters) is "unspecified," then the NL entity encodes the B-MTCN Facility for the corresponding direction(s) of data transfer as 75 bits per second. The B-TCN and B-MTCN Facilities are transmitted across the DTE/DXE interface in a CALL REQUEST packet.

6.2.5.1.2 Processing an INCOMING CALL packet

When receiving an INCOMING CALL packet with a B-MTCN Facility, an NL entity compares the minimum throughput value specified in the B-MTCN Facility for each direction of data transfer to the available throughput value specified in the B-TCN Facility. If, for either direction, the available throughput value is less than the minimum throughput value or if the NL entity cannot support the minimum throughput value, then the NL entity clears the call (i.e., transmits a CLEAR REQUEST packet). The cause is "DTE Originated" and the diagnostic is "Connection Rejection — QOS Not Available/Transient Condition," or "Connection Rejection — QOS Not Available/Permanent Condition" if the NL entity could never support the lowest throughput value (these diagnostics have values 229 and 230, respectively). Otherwise, the NL entity indicates, for both directions of data transfer, the Available and Lowest Quality Acceptable throughput values in the Throughput QOS parameters of the N-CONNECT indication primitive signaled to the Called NS user. The Available and Lowest Quality Acceptable subparameters are mapped from the B-TCN and B-MTCN Facilities, respectively, as shown in Table 3.

If an NL entity receives an INCOMING CALL packet without the B-MTCN Facility, then the NL entity indicates the value "unspecified" for the Lowest Quality Acceptable subparameters of both the Throughput QOS parameters of the N-CONNECT indication primitive signaled to the Called NS user. The Available subparameters of both the Throughput QOS parameters are mapped from the B-TCN Facility.

NOTE — From a practical standpoint, the value "unspecified" can be taken to be 75 bits per second due to restrictions concerning the discrete values that can be signaled in the CALL ACCEPTED packet, as listed in 6.2.5.1.

6.2.5.1.3 Processing an N-CONNECT response primitive

When an NL entity receives an N-CONNECT response primitive, it encodes the Selected throughput values for both directions of data transfer, as given in the Throughput QOS parameters, in the B-TCN Facility returned in the CALL ACCEPTED packet.

6.2.5.1.4 Processing a CALL CONNECTED packet

When an NL entity receives a CALL CONNECTED packet, it indicates the Selected throughput values for both directions of data transfer, as given in the B-TCN Facility, in the Throughput QOS parameters of the N-CONNECT confirm primitive signaled to the Calling NS user.

6.2.5.2 Transit Delay QOS parameter

The Transit Delay Selection And Indication (TDSAI) Facility and the End-to-End Transit Delay Negotiation (EETDN) Facility of the X.25/PLP-1984 are mapped to/from the Transit Delay QOS parameter of N-CONNECT primitives.

The set of values that can be specified for each Transit Delay subparameter ranges from 1 ms through 65 534 ms, inclusive, in increments of 1 ms. An NL entity supports either all of these values or a contiguous subset of them. The value "unspecified" is also allowed.

An NL entity in an end system shall be able to determine the cumulative transit delay attributable to the NS provider in that end system. This is the transit delay of the NL entity itself, all lower-layer entities, and the effects of the access line transmission rate.

Annex G illustrates the use of the X.25 TDSAI and EETDN Facilities in support of the end-to-end negotiation of the Transit Delay QOS parameter.

6.2.5.2.1 Processing an N-CONNECT request primitive

If an NL entity, when receiving an N-CONNECT request primitive, cannot support the Lowest Quality Acceptable transit delay (i.e., the maximum transit delay) when specified, then it rejects the request. In this case, the NL entity does not transmit any X.25/PLP-1984 packet but it does signal an N-DISCONNECT indication primitive to the Calling NS user. The Originator parameter is "NS Provider." The Reason parameter is "Connection Rejection — QOS Not Available/Transient Condition," or "Connection Rejection — QOS Not Available/Permanent Condition" if the NL entity could never support the Lowest Quality Acceptable transit delay.

If an NL entity, when receiving an N-CONNECT request primitive, can support the Lowest Quality Acceptable transit delay (i.e., the maximum transit delay) when specified, or when the Target transit delay is specified and the Lowest Quality Acceptable transit delay is unspecified, then

- a) the NL entity encodes the cumulative transit delay attributable to the NS provider in the calling end system in the "cumulative-transit-delay subfield" (i.e., octets 1 and 2) of the EETDN Facility;
- b) if a Target transit delay is specified, then the NL entity encodes this value in the "target-transit-delay subfield" (i.e., octets 3 and 4) of the EETDN Facility (otherwise, this subfield is not used);

NOTE 1 — According to CCITT Rec. X.213 | ISO/IEC 8348, the case where the Target transit delay is unspecified and the Lowest Quality Acceptable transit delay has a value other than unspecified is not permitted; logically, this case can be represented by the permitted assignment where an identical value is specified for both the Target and Lowest Quality Acceptable transit delays.

- c) if a Lowest Quality Acceptable transit delay is specified, then the NL entity encodes this value in the "maximum-acceptable-transit-delay subfield" (i.e., octets 5 and 6) of the EETDN Facility (otherwise, this subfield is not used);
- d) if the Target transit delay is specified, then the NL entity encodes the value of the TDSAI Facility as being less than the Target transit delay minus the cumulative transit delay for the calling end system; otherwise, the TDSAI Facility is encoded with any value (i.e., it is not constrained by this International Standard).

NOTE 2 — Given a "routing management information base," the NL entity can refine the value encoded in the TDSAI Facility. For example, the value of the TDSAI Facility could take into account whether networks other than packet-switched networks are traversed in reaching the called end system or whether the called end system is reachable directly in a point-to-point configuration.

If both the Target and Lowest Quality Acceptable transit delays are unspecified, then the NL entity shall omit the TDSAI Facility (if applicable) and encode the EETDN Facility as given in (a) above. The TDSAI (if present) and EETDN Facilities are transmitted across the DTE/DXE interface in a CALL REQUEST packet.

NOTE 3 — The value of the TDSAI Facility in a CALL REQUEST packet in a DTE/DCE environment provides a guideline to the DCE for allocating resources. The final transit-delay value applicable to the Virtual Call may be less than, equal to, or greater than the value in the CALL REQUEST packet.

6.2.5.2.2 Processing an INCOMING CALL packet

When receiving an INCOMING CALL packet, an NL entity determines whether the TDSAI Facility and the "cumulative-transit-delay subfield" (i.e., octets 1 and 2) of the EETDN Facility are present. If either is absent, then the NL entity shall derive a value to use for the missing value from its local "routing management information base." It then computes the total NC transit delay as given below.

The total NC transit delay is determined by summing the values of

- a) the TDSAI Facility;

- b) the "cumulative-transit-delay subfield" (i.e., octets 1 and 2) of the EETDN Facility;
- c) the transit delay attributable to the NS provider in the called end system.

NOTE — The procedure suggested here for computing the value of the total NC transit delay is the best an NL entity can do in the absence of any "external information." However, given a "routing management information base," the NL entity can refine this value. For example, the transit delay attributable to the effects of the access line transmission rate is not included when the called end system is connected to the calling end system in a point-to-point configuration (these effects have been accounted for by the calling end system).

If the "maximum-acceptable-transit-delay subfield" (i.e., octets 5 and 6) of the EETDN Facility is present, then the NL entity compares the value in this "subfield" to the total NC transit delay computed above. If the total NC transit delay is greater than the maximum-acceptable transit delay, then the NL entity clears the call (i.e., transmits a CLEAR REQUEST packet). The cause is "DTE Originated" and the diagnostic is "Connection Rejection — QOS Not Available/Transient Condition," or "Connection Rejection — QOS Not Available/Permanent Condition" if the NL entity could never support the maximum-acceptable transit delay (these diagnostics have values 229 and 230, respectively). Otherwise, if either

- a) the total NC transit delay is less than or equal to the maximum-acceptable transit delay, or
- b) the "maximum-acceptable-transit-delay subfield" of the EETDN Facility is not present,

then the NL entity indicates the Available transit-delay value (as given by the total NC transit delay computed above) in the Transit Delay QOS parameter of the N-CONNECT indication primitive signaled to the Called NS user.

6.2.5.2.3 Processing an N-CONNECT response primitive

When an NL entity receives an N-CONNECT response primitive, it encodes the total NC transit-delay value (as computed above) in the "cumulative-transit-delay subfield" (octets 1 and 2) of the EETDN Facility returned in the CALL ACCEPTED packet.

NOTES

- 1 There is no Transit Delay QOS Parameter in an N-CONNECT response primitive.
- 2 The EETDN Facility returned in a CALL ACCEPTED packet only contains the "cumulative-transit-delay subfield."

6.2.5.2.4 Processing a CALL CONNECTED packet

When an NL entity receives a CALL CONNECTED packet, it indicates the Selected transit-delay value, as given by the "cumulative-transit-delay subfield" of the EETDN Facility, in the Transit Delay QOS parameter of the N-CONNECT confirm primitive signaled to the Calling NS user.

6.2.5.3 Priority QOS parameters

The Priority Facility of the X.25/PLP is mapped to/from the three Priority QOS parameters of N-CONNECT primitives.

The set of values that can be specified for each Priority subparameter ranges from 0 (lowest priority) to 14 (highest priority). An NL entity supports all of these values. The value "unspecified" is also allowed (encoded as 255 in the X.25/PLP).

Annex H illustrates the use of the X.25 Priority Facility in support of the end-to-end negotiation of the Priority QOS parameter.

6.2.5.3.1 Processing an N-CONNECT request primitive

An NL entity that supports a choice of priority levels shall proceed as specified in 6.2.5.3.1.1. An NL entity that does not support a choice of levels shall proceed as specified in 6.2.5.3.1.2.

6.2.5.3.1.1 Processing with choice of levels supported

If an NL entity, when receiving an N-CONNECT request primitive, cannot support the Lowest Quality Acceptable priority for any of the three Priority QOS parameters, when specified, then it rejects the request. In this case, the NL entity does not transmit any X.25/PLP packet but it does signal an N-DISCONNECT indication primitive to the Calling NS user. The Originator parameter is "NS Provider." The Reason parameter is "Connection Rejection —

QOS Not Available/Transient Condition," or "Connection Rejection — QOS Not Available/Permanent Condition" if the NL entity could never support the Lowest Quality Acceptable priority for one or more of the Priority QOS parameters.

If an NL entity, when receiving an N-CONNECT request primitive, can support the Lowest Quality Acceptable priority for all three Priority QOS parameters, when specified, or any of the Lowest Quality Acceptable Priority QOS parameters is unspecified, then the NL entity encodes the Priority Facility as follows:

- a) if the Lowest Quality Acceptable of a Priority QOS parameter is specified, its value is encoded in the subfield of the X.25/PLP Priority Facility designated to contain this subparameter; otherwise, this subfield of the facility is encoded as 255 (unspecified);
- b) if the Target of a Priority QOS parameter is specified, its value is encoded in the subfield of the X.25/PLP Priority Facility designated to contain this subparameter; otherwise, this subfield of the facility is encoded as 255 (unspecified).

If either the Target or the Lowest Quality Acceptable priority is specified for any of the Priority QOS parameters, then the resulting Priority Facility is transmitted across the DTE/DXE interface in a CALL REQUEST packet. Any subfield of the Priority Facility that contains the "unspecified" value (i.e., 255) may be omitted if, and only if, it is not followed by a subfield containing a value other than "unspecified." If both the Target and Lowest Quality Acceptable priority are unspecified for all Priority QOS parameters, then no Priority Facility is transmitted.

6.2.5.3.1.2 Processing with choice of levels not supported

When an NL entity receives an N-CONNECT request primitive, it shall encode the Lowest Quality Acceptable and Target priority level for each Priority QOS parameter in the X.25/PLP Priority Facility for transmission across the DTE/DXE interface in a CALL REQUEST packet, unless both values of all parameters are unspecified, in which case it shall not transmit a Priority Facility.

6.2.5.3.2 Processing an INCOMING CALL packet

An NL entity that supports a choice of priority levels shall proceed as specified in 6.2.5.3.2.1. An NL entity that does not support a choice of levels shall proceed as specified in 6.2.5.3.2.2.

6.2.5.3.2.1 Processing with choice of levels supported

When receiving an INCOMING CALL packet, an NL entity determines the Available and Lowest Quality Acceptable subparameters to be used in the N-CONNECT indication primitive for each Priority QOS parameter as follows:

- a) if the packet contains no Priority Facility, then both subparameters for each Priority QOS parameter are unspecified;
- b) if the subfield of the Priority Facility designated to contain the Available subparameter for a Priority QOS parameter is present, then the value of this subparameter is as given in the subfield; otherwise, the value is unspecified;
- c) if the subfield of the Priority Facility designated to contain the Lowest Quality Acceptable subparameter for a Priority QOS parameter is present, then the value of this subparameter is as given in the subfield; otherwise, the value is unspecified.

If, for any of the three Priority QOS parameters, the NL entity cannot support the Lowest Quality Acceptable priority, then the NL entity clears the call (i.e., transmits a CLEAR REQUEST packet). The cause is "DTE Originated" and the diagnostic is "Connection Rejection — QOS Not Available/Transient Condition," or "Connection Rejection — QOS Not Available/Permanent Condition" if the NL entity could never support the Lowest Quality Acceptable priority (these diagnostics have values 229 and 230, respectively). Otherwise, the NL entity indicates, for each Priority QOS parameter, the Available and Lowest Quality Acceptable priority values in the Priority QOS parameters of the N-CONNECT indication primitive signaled to the Called NS user.

6.2.5.3.2.2 Processing with choice of levels not supported

When an NL entity receives an INCOMING CALL packet, the values of the Available and Lowest Quality Acceptable priority-level subparameters for use in the N-CONNECT indication primitive for each Priority QOS parameter shall be the values signified by the Priority Facility in the packet (if present). The absence of a subfield in the Priority Facility corresponds to the value "unspecified." If the Priority Facility is not present in the INCOMING

CALL packet, then the values of both subparameters of each Priority QOS parameter shall be "unspecified."

6.2.5.3.3 Processing an N-CONNECT response primitive

When an NL entity receives an N-CONNECT response primitive, it encodes the Selected priority value, if specified, as given for each Priority QOS parameter, in the Priority Facility returned in the CALL ACCEPTED packet. Any subfield of the Priority Facility that contains the "unspecified" value (i.e., 255) may be omitted if, and only if, it is not followed by a subfield containing a value other than "unspecified." If the Selected priority value is unspecified for all Priority QOS parameters, then no Priority Facility is returned in the CALL ACCEPTED packet.

6.2.5.3.4 Processing a CALL CONNECTED packet

When an NL entity receives a CALL CONNECTED packet, it indicates the Selected priority value, as given in the Priority Facility (if present), for each Priority QOS parameter of the N-CONNECT confirm primitive signaled to the Calling NS user. The absence of a subfield in the Priority Facility corresponds to the value "unspecified." If the Priority Facility is not present in the CALL CONNECTED packet, then the Selected value of each Priority QOS parameter shall be "unspecified."

6.2.6 NS-User-Data

The Call User Data Field of X.25/PLP-1984 CALL REQUEST and INCOMING CALL packets is used to transfer the NS-user-data of N-CONNECT request and indication primitives, respectively. The Called User Data Field of X.25/PLP-1984 CALL ACCEPTED and CALL CONNECTED packets is used to transfer the NS-user-data of N-CONNECT response and confirm primitives, respectively. In addition, the Fast Select Facility shall be indicated in the CALL REQUEST packet sent by the Calling NL entity.

7. Network connection release phase

7.1 Primitive/Parameter and packet/field relationships

Table 4 shows the relationships between the primitives/parameters used during the NC release phase and the packets/fields associated with the call clearing procedures.

Table 4 — CONS:X.25/PLP-1984 mapping for the NC release phase

CONS	X.25/PLP-1984
PRIMITIVES N-DISCONNECT request N-DISCONNECT indication	PACKETS: CLEAR REQUEST CLEAR INDICATION, RESTART INDICATION ¹⁾ , CLEAR REQUEST ²⁾
PARAMETERS: Originator and Reason NS-User-Data Responding Address	FIELDS (INCLUDING FACILITIES): Cause and Diagnostic Code Fields ³⁾ Clear User Data Called DTE Address Field Called Address Extension Facility

Notes to Table 4:

1 — Receipt of a RESTART INDICATION packet should be treated as receipt of a CLEAR INDICATION packet for every logical channel and then mapped to an N-DISCONNECT indication primitive for every active NC associated with the Packet Layer Protocol being restarted. The Restarting Cause and Diagnostic Code Fields are then treated in the same manner as the Clearing Cause and Diagnostic Code Fields.

2 — See 7.2.1, Paragraph 2.

3 — The combination of Cause and Diagnostic Code Fields is mapped to/from the combination of Originator and Reason parameters.

7.2 Procedures

7.2.1 Primitive/Package mapping

When an NL entity receives an N-DISCONNECT request primitive from an NS user, it transmits a CLEAR REQUEST packet across the DTE/DXE interface. If, however, the NL entity had previously transmitted a CLEAR REQUEST packet and signaled an N-DISCONNECT indication primitive to the NS user (because of a protocol error; see below), then it does not transmit another CLEAR REQUEST packet.

If an NL entity detects an error in the operation of the X.25/PLP-1984 for which its action is to clear the VC (e.g., a format error in an INCOMING CALL packet or a timeout condition), then it transmits a CLEAR REQUEST packet across the DTE/DXE interface. If the virtual circuit is associated with an NC, then it also signals an N-DISCONNECT indication primitive to the NS user.

If an NL entity, upon receipt of an INCOMING CALL packet, is to deflect the call, then it should include, in its CLEAR REQUEST packet, any necessary CCITT-Specified DTE facilities and user data that are to be present in the INCOMING CALL packet transmitted to the alternate DTE. It shall also include the Call Deflection Selection Facility.

When an NL entity receives a CLEAR INDICATION packet (or a RESTART INDICATION packet), it signals an N-DISCONNECT indication primitive to the NS user. It also transmits a CLEAR CONFIRMATION packet (or a RESTART CONFIRMATION packet) across the DTE/DXE interface. If, however, the NL entity had previously transmitted a CLEAR REQUEST packet for the NC (i.e., a clear collision), then it does not signal an N-DISCONNECT indication primitive to the NS user nor transmit a CLEAR CONFIRMATION packet.

NOTE — If the received CLEAR INDICATION packet is in response to a previously-transmitted CALL REQUEST packet, the NL entity may retry the call if the Network Connection Establishment Delay has not been exceeded rather than immediately signaling an N-DISCONNECT indication primitive to its NS user. The NL entity may also use the clearing cause code (see 7.2.2) in the CLEAR INDICATION packet to determine whether to retry the call. That is, the reattempt may be successful if the clearing cause code is classified as Category C (see CCITT Rec. X.96); on the other hand, a Category D code indicates a problem of a more permanent nature. The time interval between and number of reattempted calls is a local matter. If multiple attempts at establishing the NC are all unsuccessful, then the Originator-parameter and Reason-parameter values finally signaled in the N-DISCONNECT indication primitive are a local matter.

If either NL entity wishes to disconnect an NC, it signals an N-DISCONNECT indication primitive to its NS user and transmits a CLEAR REQUEST packet across the DTE/DXE interface. If, however, the NL entity in the calling DTE cannot, for example, support the QOS parameters specified in an N-CONNECT request primitive or does not have an LC available to set up a VC, then it signals an N-DISCONNECT indication primitive to the Calling NS user but does not transmit a CLEAR REQUEST packet across the DTE/DXE interface.

7.2.2 Originator/Reason

The combination of Originator and Reason parameters of the N-DISCONNECT primitives is mapped to/from the combination of Clearing Cause (or Restarting Cause) and Diagnostic Code Fields.

The combination of the cause code "DTE Originated" (coded as all zeros) with a diagnostic in the set 241, 242, and 244-248 corresponds to an Originator-parameter value of "NS User." In this case, there is a one-to-one relationship between the values of the Reason parameter and these diagnostic codes.

The cause code "DTE Originated" (coded as all zeros) used in combination with diagnostic codes other than those listed above corresponds to an Originator-parameter value of "NS Provider." There is a one-to-one relationship between the values of the Reason parameter and diagnostic codes 225-232 and 235.

In other cases, the Originator-parameter and Reason-parameter values depend on

- a) the cause and/or diagnostic codes;
- b) whether the NC is in the NC establishment phase or in the data transfer phase.

The values of the Originator and Reason parameters are derived as given below.

- a) The Originator-parameter value is "NS Provider" and the Reason-parameter value is "Disconnection — Permanent Condition" when the NC is in the data transfer phase and any of the following applies:

- 1) cause codes "Out Of Order," "Local Procedure Error," "Remote Procedure Error," or "RPOA Out Of Order;"
- 2) diagnostic code 122.
- b) The Originator-parameter value is "NS Provider" and the Reason-parameter value is "Disconnection — Transient Condition" when the NC is in the data transfer phase and any of the following applies:
 - 1) cause code "Network Congestion;"
 - 2) diagnostic codes 113 or 115;
 - 3) cause code "DTE Originated" (coded as all zeros) with diagnostic codes 162 or 163.
- c) The Originator-parameter value is "NS Provider" and the Reason-parameter value is "Connection Rejection — NSAP Address Unknown (Permanent Condition)" when the NC is in the NC establishment phase and any of the following applies:
 - 1) cause codes "Not Obtainable" or "Ship Absent."
- d) The Originator-parameter value is "NS Provider" and the Reason-parameter value is "Connection Rejection — Reason Unspecified/Permanent Condition" when the NC is in the NC establishment phase and any of the following applies:
 - 1) cause codes "Access Barred," "Fast Select Acceptance Not Subscribed," "Incompatible Destination," "Invalid Facility Request," "Out Of Order," "Local Procedure Error," "Remote Procedure Error," "Reverse Charging Acceptance Not Subscribed," or "RPOA Out Of Order;"
 - 2) diagnostic codes 121 or 122;
 - 3) cause code "DTE Originated" (coded as all zeros) with diagnostic code 164.
- e) The Originator-parameter value is "NS Provider" and the Reason-parameter value is "Connection Rejection — Reason Unspecified/Transient Condition" when the NC is in the NC establishment phase and any of the following applies:
 - 1) cause codes "Network Congestion" or "Number Busy;"
 - 2) diagnostic codes 112-120;
 - 3) cause code "DTE Originated" (coded as all zeros) with a diagnostic code other than 162-164, 225-232, 235, 241, 242, and 244-248.
- f) The Originator-parameter and Reason-parameter values are both "Undefined" for any other combination of cause and diagnostic codes.

7.2.3 NS-User-Data

The Clear User Data Field of X.25/PLP-1984 CLEAR REQUEST and CLEAR INDICATION packets is used to transfer the NS-user-data between NS users.

7.2.4 Responding address

Local operation determines the contents of the Called Address Field and whether the responding Network Address, where explicitly supplied, is mapped to/from the AF or the AEF in X.25/PLP-1984 call clearing packets. Rules for encoding and decoding the responding Network Address are given in 6.2.2.

8. Data transfer phase — Data transfer service

8.1 Primitive/Parameter and packet/field relationships

Table 5 shows the relationships between the primitives/parameters used for the data transfer service and the packets/fields associated with the data transfer procedures.

8.2 Procedures

8.2.1 Primitive/Package mapping

When an NL entity receives an N-DATA request primitive from an NS user, it transmits a sequence of one or more DATA packets, known as an M-bit Sequence (MBS), across the DTE/DXE interface. The number of DATA

Table 5 — CONS:X.25/PLP-1984 mapping for the data transfer service

CONS	X.25/PLP-1984
PRIMITIVES: N-DATA request N-DATA indication	PACKETS: DATA DATA
PARAMETERS: NS-User-Data Confirmation Request	FIELDS: User Data, M-bit D-bit, P(S)

packets needed in an MBS depends on the amount of NS-user-data and on the maximum "packet size" (i.e., the maximum User Data Field Length of DATA packets) permitted on the DTE/DXE interface. All DATA packets but the last one of an MBS contain the maximum number of octets, have their M-bit set to 1, and have their D-bit set to 0. The last DATA packet has its M-bit set to 0. The D-bit setting of the last DATA packet is dependent on the Confirmation Request parameter (see 8.2.3 below). All DATA packets shall have the Q-bit set to zero.

When an NL entity receives an MBS with the Q-bit set to zero in each DATA packet, it signals an N-DATA indication primitive to the NS user.

8.2.2 NS-User-Data

The User Data Fields of X.25/PLP-1984 DATA packets are used to transfer NS-user-data between NS users.

8.2.3 Confirmation Request

The D-bit of the last DATA packet in an MBS is mapped to/from the Confirmation Request parameter.

If an N-DATA request primitive indicates in the Confirmation Request parameter that confirmation of receipt is requested (respectively, not requested), then the D-bit of the last DATA packet in an MBS is set to 1 (respectively, 0). In the case of confirmation of receipt being requested, the NL entity shall use a locally-defined mechanism to associate the P(S) of the last DATA packet in the MBS with the N-DATA request primitive. (This mechanism shall also provide for an association of an N-DATA request primitive with an N-DATA ACKNOWLEDGE indication primitive; see 9.2.1.)

When an NL entity signals an N-DATA indication primitive to the NS user, it indicates in the Confirmation Request parameter that confirmation of receipt is requested (respectively, not requested) if the D-bit of the last DATA packet in an MBS is set to 1 (respectively, 0). When the last DATA packet in an MBS has its D-bit set to 1, the NL entity shall not transmit a P(R) corresponding to that DATA packet across the DTE/DXE interface until it receives an N-DATA ACKNOWLEDGE request primitive from its NS user (see clause 9). In the case of the D-bit of the last DATA packet in an MBS being set to 1, the NL entity shall use a locally-defined mechanism to associate the P(S) of this packet with the N-DATA indication primitive. (This mechanism shall also provide for an association of an N-DATA indication primitive with an N-DATA ACKNOWLEDGE request primitive; see 9.2.1.)

9. Data transfer phase — Receipt confirmation service

9.1 Primitive and packet/field relationships

There is no distinct X.25/PLP-1984 packet associated with the N-DATA ACKNOWLEDGE request and N-DATA ACKNOWLEDGE indication primitives. The P(R) field of DATA, RECEIVE READY, RECEIVE NOT READY, and REJECT (if agreed to) packets is used to support the Receipt Confirmation Service.

9.2 Procedures

9.2.1 Primitive/Package mapping

When an NL entity receives an N-DATA ACKNOWLEDGE request primitive from an NS user, it uses its locally-defined mechanism mentioned in 8.2.3 for associating an N-DATA ACKNOWLEDGE request primitive with a previously-issued N-DATA indication primitive (and, hence, a P(S)) to determine a P(R) to be transferred in the appropriate packet across the DTE/DXE interface. (Note that such acknowledgements shall be issued in the same order that the corresponding N-DATA indications were issued.)

When an NL entity receives a P(R), it shall determine whether this P(R) is inclusive of a P(S) associated with a previously-received N-DATA request primitive that requested confirmation of receipt. If such an association is made, then the NL entity signals an N-DATA ACKNOWLEDGE indication primitive to the NS user. This N-DATA ACKNOWLEDGE indication primitive is associated, by the locally-defined mechanism mentioned in 8.2.3, to the previously-received N-DATA request primitive that had requested confirmation of receipt.

9.2.2 Parameters

There are no parameters associated with the Receipt Confirmation Service.

10. Data transfer phase — Expedited data transfer service

10.1 Primitive/Parameter and packet/field relationships

Table 6 shows the relationships between the primitives/parameters used for the Expedited Data Transfer Service and the packets/fields associated with the interrupt transfer procedures.

Table 6 — CONS:X.25/PLP-1984 mapping for the Expedited Data Transfer Service

CONS	X.25/PLP-1984
PRIMITIVES: N-EXPEDITED DATA request N-EXPEDITED DATA indication	PACKETS: INTERRUPT INTERRUPT
PARAMETERS: NS-User-Data	FIELDS: Interrupt User Data

10.2 Procedures

10.2.1 Primitive/Package mapping

When an NL entity receives an N-EXPEDITED DATA request primitive from an NS user, it transmits an INTERRUPT packet across the DTE/DXE interface. An NL entity shall not transmit a second INTERRUPT packet before an outstanding INTERRUPT packet has been confirmed by an INTERRUPT CONFIRMATION packet.

When an NL entity receives an INTERRUPT packet, it signals an N-EXPEDITED DATA indication primitive to the NS user. It also transmits an INTERRUPT CONFIRMATION packet across the DTE/DXE interface.

10.2.2 NS-User-Data

The Interrupt User Data Field of X.25/PLP-1984 INTERRUPT packets is used to transfer expedited NS-user-data between NS users.

11. Data transfer phase — Reset service

11.1 Primitive/Parameter and packet/field relationships

Table 7 shows the relationships between the primitives/parameters used for the Reset Service and the packets/fields associated with the reset procedures.

11.2 Procedures

11.2.1 Primitive/Package mapping

When an NL entity receives an N-RESET request primitive from an NS user, it transmits a RESET REQUEST packet across the DTE/DXE interface. When the NL entity is ready to accept subsequent data, expedited data, and confirmations of receipt from the NS user, it signals an N-RESET confirm primitive. The issuing of this primitive may or may not be related to the completion of the X.25/PLP-1984 reset procedure. Any data or expedited data received from the NS user following the N-RESET confirm primitive is transmitted after completion of the X.25/PLP-1984 reset procedure.

If an NL entity detects an error in the operation of the X.25/PLP-1984 for which its action is to reset the virtual circuit (e.g., a sequence error or a timeout condition), then it transmits a RESET REQUEST packet across the

Table 7 — CONS:X.25/PLP-1984 mapping for the Reset Service

CONS	X.25/PLP-1984
PRIMITIVES: N-RESET request N-RESET indication N-RESET response N-RESET confirm	PACKETS: RESET REQUEST RESET INDICATION, RESET REQUEST ¹⁾ none none
PARAMETERS: Originator and Reason	FIELDS: Cause and Diagnostic Code Fields ²⁾

Notes to Table 7:

1 — See 11.2.1, Paragraph 2.

2 — The combination of Cause and Diagnostic Code Fields is mapped to/from the combination of Originator and Reason parameters.

DTE/DXE interface. When the NL entity is ready to accept subsequent data, expedited data, and confirmations of receipt from the NS user, it signals an N-RESET indication primitive. The issuing of this primitive may or may not be related to the completion of the X.25/PLP-1984 reset procedure. Any data or expedited data received from the NS user following the N-RESET response primitive is transmitted after completion of the X.25/PLP-1984 reset procedure.

When an NL entity receives a RESET INDICATION packet, it signals an N-RESET indication primitive to the NS user (except if this results in a reset collision; see below).

When an N-RESET response primitive is received from the NS user, the NL entity shall be willing to accept subsequent data, expedited data, and confirmations of receipt received from the NS user for transmission upon completion of the X.25/PLP-1984 reset procedure.

During the reset process, the following actions are taken by the NL entity with respect to the operation of the X.25/PLP-1984:

- a) For DATA packets
 - 1) those awaiting transmission may either be transmitted prior to transmitting a reset packet or flushed from the queue of DATA packets awaiting transmission,
 - 2) those remaining in the transmit window when the reset procedure is completed are flushed, and
 - 3) those that have been received prior to receiving a reset packet but which do not constitute an entire MBS are flushed from the "MBS reassembly area."
- b) The lower window edge for each direction of data transmission is set to 0 and subsequently transmitted DATA packets are numbered starting from 0.
- c) Any busy condition that had existed prior to the reset is considered not to exist any longer.
- d) Any outstanding INTERRUPT packet remains unconfirmed.
- e) All timer and retransmission parameters relating to data and interrupt transfer are set back to their initial values.

No action is required with respect to the provision of the Network Service by an NL entity when it receives a RESET CONFIRMATION packet or a RESET INDICATION packet in response to a RESET REQUEST packet (i.e., a reset collision). However, it shall then be capable of receiving subsequent DATA and INTERRUPT packets and P(R) information.

11.2.2 Originator/Reason

The combination of Originator and Reason parameters of the N-RESET primitives is mapped to/from the combination of Resetting Cause and Diagnostic Code Fields.

The combination of the cause code "DTE Originated" (coded as all zeros) with the diagnostic "Reset — User Resynchronization" (diagnostic code 250) corresponds to an Originator-parameter value of "NS User" and a Reason-parameter value identical to the diagnostic.

All other combinations of cause codes except "DTE Originated" coded as "10000000" and diagnostic codes specified in CCITT Rec. X.25 | ISO/IEC 8208 correspond to an Originator-parameter value of "NS Provider." The value of the Reason parameter is derived as given below.

- a) The Reason-parameter value is "Congestion" if any of the following applies:
 - 1) cause code "Network Congestion;"
 - 2) cause code "DTE Originated" (coded as all zeros) and diagnostic 234.
- b) The Reason-parameter value is "Reason Unspecified" for any other combination of cause and diagnostic codes.

The cause code "DTE Originated" coded as "10000000" with any diagnostic code, as well as cause codes not specified in CCITT Rec. X.25 | ISO/IEC 8208 with any diagnostic code, corresponds to values of both the Originator parameter and the Reason parameter of "Undefined."

12. Response to protocol violations

An NL entity may receive a packet that is valid according to CCITT Rec. X.25 | ISO/IEC 8208 but is not valid when considered as part of the mapping specified in clauses 6 to 11. In such cases, it follows the actions given below.

- a) Error Conditions:
 - 1) INCOMING CALL packet without a B-TCN Facility;
 - 2) INCOMING CALL packet without a Fast Select Facility;
 - 3) CALL CONNECTED packet without an EETDN Facility;
 - 4) CALL CONNECTED packet with a Selected QOS value, when present, that is not valid with respect to the CALL REQUEST packet (e.g., the Selected value is less than the Lowest Quality Acceptable value).

Actions:

The NL entity shall transmit a CLEAR REQUEST packet across the DTE/DXE interface with a clearing cause code of "DTE Originated." It is recommended that the diagnostic code be set to 228 (or 224). For conditions (1) and (2), the NL entity shall not signal any primitive to the NS User; for conditions (3) and (4), the NL entity shall signal an N-DISCONNECT indication primitive to the NS User.

- b) Error Conditions:
 - 1) DATA packet with its Q-bit set to 1;
 - 2) DATA packet with its D-bit set to 1 when "no use of Receipt Confirmation" has been negotiated during NC establishment;
 - 3) INTERRUPT packet when "no use of Expedited Data" has been negotiated during NC establishment.

Actions:

The NL entity is strongly recommended to transmit either of the packets given below across the DTE/DXE interface with a cause code of "DTE Originated." The Originator parameter of the resulting primitive signaled to the NS User, in either case, shall be "NS Provider."

Packet to Transmit	Recommended Diagnostic Code	Primitive Signaled to NS User	Reason Parameter
CLEAR REQUEST	226 (or 224)	N-DISCONNECT indication	disconnection — reason unspecified (permanent condition)
RESET REQUEST	233 (or 224)	N-RESET indication	reset — reason unspecified

- c) Error Conditions:
 - 1) zero-length MBS.

Actions:

The NL entity transmits either of the packets in (b) or shall otherwise ignore the zero-length MBS.

13. Conformance

13.1 Conformance requirements

A system claiming to implement the procedures specified in this International Standard shall

- a) satisfy the conformance requirements of ISO/IEC 8208;
- b) support all the packets and associated fields/facilities specified in Table 1 (excluding interrupt packets), Table 2 (excluding Expedited Data Negotiation), and Tables 4, 5 and 7, except that a system may support call setup packets relating to incoming calls only or to outgoing calls only;
- c) support all the optional user facilities and CCITT-specified DTE facilities specified in 5.1 except the EDN Facility;
- d) support the mapping of Network Service primitives to CCITT Rec. X.25 | ISO/IEC 8208 packets in clauses 6 to 11;
- e) support the negotiation mechanism in 6.2.3 for the Receipt Confirmation Service;
- f) if it supports the optional Receipt Confirmation Service, support:
 - 1) the procedures specified in clause 9;
- g) support the negotiation mechanism in 6.2.4, including the case when the EDN Facility is absent, for the Expedited Data Transfer Service;
- h) if it supports the optional Expedited Data Transfer Service, support:
 - 1) INTERRUPT packets with 32-octet User Data Fields and the procedures and mappings defined in clause 10;
 - 2) the EDN Facility;
- i) support the conveyance of the Network Address in the X.25/PLP-1984 Called/Calling Address Extension Facilities;
- j) if it supports the conditions defined in 6.2.2.1.1:
 - 1) recognize the Network Address when it is received in the X.25/PLP-1984 Called/Calling Address Field and the conditions of 6.2.2.1.1 are satisfied.

13.2 Optional features

Clauses 6 to 11 allow certain options for implementations. Claims of conformance shall state

- a) whether Expedited Data Transfer is supported;
- b) whether Receipt Confirmation is supported;
- c) whether the method of conveying the Network Address in the X.25/PLP-1984 Called/Calling Address Field is supported for transmitted packets;
- d) whether the conditions defined in 6.2.2.1.1 are ever supported for receipt of Network Addresses conveyed in the X.25/PLP-1984 Called/Calling Address Fields;
- e) whether conformance to Annex A is also claimed;
- f) whether the procedures for use with the X.25 PVC service (Annex C) are supported.

Annex A

(normative)

X.25 (1980) Subnetwork Dependent Convergence Protocol

The Subnetwork Dependent Convergence Protocol (SNDCP) defined in this annex should only be used if the elements of X.25/PLP-1984, as defined in 5.1, are not available to support provision of the OSI CONS.

A.1 Introduction

The 1984 or later versions of CCITT Recommendation X.25 contains adequate mechanisms to enable the provision of the OSI CONS over X.25 subnetworks. Until such time as all public and private packet-switched X.25 data subnetworks conform to at least the 1984 version and all existing X.25 DTEs are upgraded, there is a need for a method of providing the CONS over the X.25 (1980) subnetwork access protocol.

This annex specifies a procedure that supplies the OSI CONS, principally by the use of SNDCP parameters conveyed within X.25 User Data Fields. The parameter encodings have been aligned to the facility codes of X.25 (1984).

This procedure is intended to form part of a migration strategy towards the use of X.25 (1984) in both subnetworks and DTEs.

A.2 Scope

A.2.1 Scope of this annex

This annex specifies an SNDCP to offer the OSI CONS over an X.25 subnetwork service. The SNDCP is applicable in the following cases:

- a) when the X.25 service does not support the full CONS (that is, when the X.25 service conforms to the 1980 CCITT Recommendation or earlier);
- b) when the resulting service for a concatenation of X.25 subnetworks only conforms to the 1980 CCITT Recommendations, even when one or more of the subnetworks conform to later X.25 CCITT Recommendations;
- c) when the X.25 subnetwork conforms to a CCITT Recommendation later than 1980, but when the calling or called DTE only implements the 1980 CCITT Recommendation.

There are two major elements of this specification: firstly, additional parameters carried as data within existing X.25 packets to provide mechanisms needed for provision of the OSI CONS; secondly, procedures specifying the use of the X.25 packets, as well as the existing and new parameters, to provide the OSI CONS.

A.2.2 Scope of the underlying X.25 subnetwork

The underlying subnetwork supports the 1980 CCITT X.25 Recommendation (the "Yellow Book") subnetwork access protocol.

Over older subnetworks not conforming to the 1980 CCITT X.25 Recommendation, the full CONS may not be achieved. In particular, delivery confirmation may not be supported.

The majority of the CONS requirements are directly supported by the X.25 protocol; the use of the SNDCP in other cases is minimal.

The X.25 (1980) datagram packets are not used. The X.25 Fast Select Facility is used if available, but it is not essential.

The use of this protocol is indicated by using a reserved ISO value for the protocol identification subfield of the Call User Data Field in a CALL REQUEST packet. This subfield is only used to identify the X.25 (1980) SNDCP and, thus, cannot be used simultaneously for other purposes (e.g., to identify a higher layer protocol).

NOTE — The solution described here is recognized as having some quality of service, cost, and feature penalties, but is seen as the best that can be achieved due to the disparity between the CONS and the X.25 (1980) protocol. In particular, there is no reasonable way to provide the optional Network expedited data service. Furthermore, NC establishment may involve extra delays in some cases if the X.25 data-transfer phase has to be used to convey parameters that cannot fit into the Call User Data

Field. Similarly, additional delay may be introduced during the NC release phase if disconnect user data has to be conveyed. Only a portion of the QOS parameters can be mapped into the elements of the X.25 protocol.

A.3 Abbreviations

The abbreviations given in the main body of this International Standard apply, with the additions listed below.

AE	Address Extension (parameter)
ID	Identifier
LI	Length Indicator
MTC	Minimum Throughput Class (parameter)
N-CC	Network Connection confirm
N-CR	Network Connection request
N-DR	Network Disconnect request
NPDU	Network Protocol Data Unit
NSDU	Network Service Data Unit
PT	Parameter Type
PV	Parameter Value
Q-bit	Qualifier Bit
SNDCP	Subnetwork Dependent Convergence Protocol

A.4 Overview of the protocol

A.4.1 Service provided by the Network Layer

The X.25 (1980) SNDCP provides the mechanism for entities in the Network Layer to interact and provide the CONS, as defined in CCITT Rec. X.213 | ISO/IEC 8348.

A.4.2 Service assumed from the X.25 subnetwork

The X.25 (1980) SNDCP assumes that the underlying X.25 subnetwork provides adequate error performance and flow control. No additional mechanisms are provided in the protocol to enhance the QOS.

A.4.2.1 Required features

The X.25 (1980) SNDCP depends on the availability of all of the following X.25 features (parenthesized references are to CCITT Recommendation X.25 (1980)):

- a) procedures for Virtual Call service (4.1);
- b) procedures for data transfer (4.3), except:
 - 1) user data field length need only be the standard length (4.3.2); however, other lengths may be supported;
 - 2) the D-bit is not mandatory; if it is not available, then the Receipt Confirmation Service shall not be available (4.3.3);
 - 3) the Interrupt procedure is not required (4.3.7);
- c) procedures for flow control (4.4);
- d) call setup and clearing packets (6.2);
- e) DTE and DCE DATA packets (6.3.1);
- f) flow control packets and reset packets (6.5);
- g) coding of X.25-subnetwork-generated diagnostics in clear, reset, and restart packets (Annex E).

A.4.2.2 Features that will be used if available

It is desirable that the DTE uses and/or subscribes to the following protocol elements:

- a) D-bit (4.3.3);
- b) Fast Select and Fast Select Acceptance Facilities (6.8.2, 7.2.4, and 7.2.5);
- c) Flow Control Parameter Negotiation Facility (7.2.2);
- d) Throughput Class Negotiation Facility (7.2.3).