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Information technology — Telecommunications and information exchange between systems — Provision of the connection-mode Network internal layer service by intermediate systems using ISO/IEC 8208, the X.25 Packet Layer Protocol

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Fourniture du service de la couche interne de réseau en mode connexion par des systèmes intermédiaires utilisant l'ISO/CEI 8208, protocole X.25 de couche paquet

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ISO/IEC 10177:1993(E)

Contents

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 10177 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Sub-Committee SC 6, *Telecommunications and information exchange between systems*.

Annexes A and B form an integral part of this International Standard. Annex C is for information only.

Introduction

This International Standard is one of the set of standards associated with the Network layer of ISO 7498's Reference Model for Open Systems Interconnection (OSI), aimed collectively at provision and support of the OSI Network service defined in ISO 8348. It has been developed within the general framework provided by ISO 8648, Internal Organization of the Network Layer, and in accordance with the more detailed model of intermediate-system functions defined in ISO/IEC 10028.

ISO/IEC 10028 defines the relaying functions of a Network-layer intermediate system, in terms of the Network internal layer service (NILS): the NILS models the information flow within the Network layer in support of instances of Network-layer communication, at a level of abstraction that is independent of particular protocols and subnetwork technologies. This International Standard specifies the mapping between the NILS and the X.25 packet layer protocol (specified in ISO/IEC 8208) for those cases where a real interworking unit — modelled by an abstract intermediate system — operates the X.25 packet layer protocol at its point of attachment to a real subnetwork, in support of the OSI connection-mode Network service.

The use of the X.25 packet layer protocol specified in this International Standard for interworking units is compatible with that specified in ISO 8878:1987 for real end systems; indeed, in certain scenarios, the same packet exchanges between an interworking unit and an end system are described by ISO 8878 when viewed from the end system, and by this International Standard when viewed from the interworking unit.

This International Standard applies to each environment in which ISO/IEC 8208 is used in support of the connection-mode Network service, including among others:

- a Packet Switched Public Data Network
- a Packet Switched Private Data Network
- a Local Area Network
- use of switched access to a packet switched (public or private) data network, eg, by ISDN, CSDN or PSTN
- other subnetworks where the DTE/DTE mode of the X.25 Packet Layer Protocol is used in support of the connection-mode Network service.

Information technology — Telecommunications and information exchange between systems — Provision of the connection-mode Network internal layer service by intermediate systems using ISO/IEC 8208, the X.25 Packet Layer Protocol

1 Scope

This International Standard specifies the method by which a Network-layer interworking unit (IWU) uses the X.25 packet layer protocol specified in ISO/IEC 8208 to support the OSI connection-mode Network service. The specification is expressed in terms of a mapping between the Network internal layer service defined in ISO/IEC 10028 and the Virtual Call (VC) and Permanent Virtual Circuit (PVC) services of the X.25 packet layer protocol.

An IWU to which this International Standard applies interconnects, for any individual Network connection, two real subnetworks, at least one of which is accessed using the X.25 packet layer protocol. When both subnetworks are accessed using the X.25 packet layer protocol, the specification applies independently to the IWU's operation on each subnetwork.

In addition, this International Standard uses ISO/IEC 10028's definition of the relaying functions of an intermediate system to extend its application beyond a single subnetwork point of attachment, to specify the requirements to be met by an IWU as a whole in supporting the OSI connection-mode Network service.

This International Standard covers operation of the X.25 packet layer protocol that is compatible with the 1984 and later versions of CCITT Recommendation X.25, and that is compatible with the 1980 version of X.25 when the Permanent Virtual Circuit service is used; compatibility with the 1980 version of X.25 for Virtual Calls is outside the scope of this International Standard.

To enable use of the PVC service, this International Standard defines a set of subnetwork dependent convergence protocol (SNDCP) procedures. These allow a given PVC to to support one Network connection at a time, but to support different Network connections, with the same or different values for address and quality of service parameters, etc, at different times. The procedures also allow for the possibility of using a PVC in support of other protocols, but not simultaneously with these procedures (apart from transient collision cases, which do not fail unnecessarily).

To evaluate conformance of a particular implementation, it is necessary to have a statement of which capabilities and options have been implemented. Such a statement is called a Protocol Implementation Conformance Statement (PICS), as defined in ISO/IEC 9646-1. This International Standard provides the PICS proforma in compliance with the relevant requirements, and in accordance with the relevant guidance, given in ISO/IEC 9646-2.

This International Standard does not specify any requirements relating to the exchange of routing information or layer-management information between an IWU and other systems.

2 Normative references

The following 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 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 editions of the standards listed below.

Members of IEC and ISO maintain registers of currently valid International Standards.

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

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

ISO/IEC 8208:1990/Amd.3:1991, *Information technology – Data communications – X.25 Packet Layer Protocol for Data Terminal Equipment, Amendment 3: Conformance requirements*

ISO 8648:1988, *Information processing systems – Open Systems Interconnection – Internal organization of the Network Layer*

ISO/IEC 9646-1:1991, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 1: General concepts*

ISO/IEC 9646-2:1991, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 2: Abstract test suite specification*

ISO/IEC 10028:1993, *Information technology – Telecommunications and information exchange between systems – Definition of the relaying functions of a Network layer intermediate system*

CCITT Recommendation X.213 (1992) | ISO/IEC 8348:1993, *Information technology – Network service definition for Open Systems Interconnection*

3 Definitions

3.1 Reference model definitions

This International Standard uses the following terms defined in ISO 7498:

a) Network layer
b) Network service
c) Network connection

3.2 Network layer architecture definitions

This International Standard uses the following terms defined in ISO 8648:

a) real subnetwork
b) interworking unit
c) intermediate system
d) subnetwork dependent convergence protocol

3.3 Network layer relaying definitions

This International Standard uses the following terms defined in ISO/IEC 10028:

a) Network internal layer service
b) Network internal service access point
c) Network hop end point

3.4 Addressing definitions

This International Standard uses the following terms defined in ISO/IEC 8348:

a) authority and format identifier
b) domain specific part
c) initial domain part
d) initial domain identifier
e) subnetwork point of attachment
f) subnetwork point of attachment address

3.5 X.25 packet layer protocol definitions

This International Standard uses the following terms defined in ISO/IEC 8208:

a) DTE/DXE interface
b) logical channel
c) M-bit sequence

d) packet layer entity
e) packet receive sequence number
f) packet send sequence number
g) Permanent Virtual Circuit
h) Qualifier bit
j) upper window edge
k) Virtual Call
l) window

4 Abbreviations

AF	Address field
AFI	authority and format identifier
bit/s	bits per second
CONS	connection-mode Network service
D-bit	Delivery Confirmation bit
ED	expedited data
EETDN	End to End Transit Delay Negotiation
GFI	General Format Identifier
IDI	initial domain identifier
IWU	interworking unit
LQA	lowest quality acceptable
M-bit	More Data mark
MTCN	Minimum Throughput Class Negotiation
N	Network
NC	Network connection
NHEP	Network hop endpoint
NILS	Network internal layer service
NISAP	Network internal service access point
NSDU	Network service data unit
P(R)	packet receive sequence number
P(S)	packet send sequence number
PICS	protocol implementation conformance statement
PLP	packet layer protocol
PVC	Permanent Virtual Circuit
Q-bit	Qualifier bit
QOS	quality of service
RC	receipt confirmation
SNPA	subnetwork point of attachment
TDSAI	Transit Delay Selection And Indication
VC	Virtual Circuit

5 Overview and principles of the protocol mapping

5.1 Structure of the specification

Clauses 7 to 9 define a mapping of the NILS primitives and parameters to and from (a subset of) the packets, procedures and facilities of the X.25 PLP. That mapping applies to one side of an IWU — e.g., item (4-A) in figure 1. Clause 6 specifies the requirements on an IWU supporting the CONS over X.25 PLP, in terms of that mapping and of the full NILS definition in ISO/IEC 10028. Clause 10 specifies the SNDCP procedures for use with PVCs. Annex A (normative) contains the PICS proforma, and annex B (normative) lists the requirements applying to the related ISO/IEC 8208 PICS.

NOTE — Apart from specification for the treatment of some mapping-protocol violations, in 8.7 and 9.1.1, all the direct normative provisions of this International Standard are contained in clause 6, and in clause 10 for PVCs. However, the statements of those provisions in clause 6 rely upon, and can only be interpreted by reference to, the extended definitions in clauses 7 to 9 and in ISO/IEC 10028.

5.2 NILS features to be supported

The features of the Network internal layer service for connection-mode operation are (see ISO/IEC 10028, clause 6):

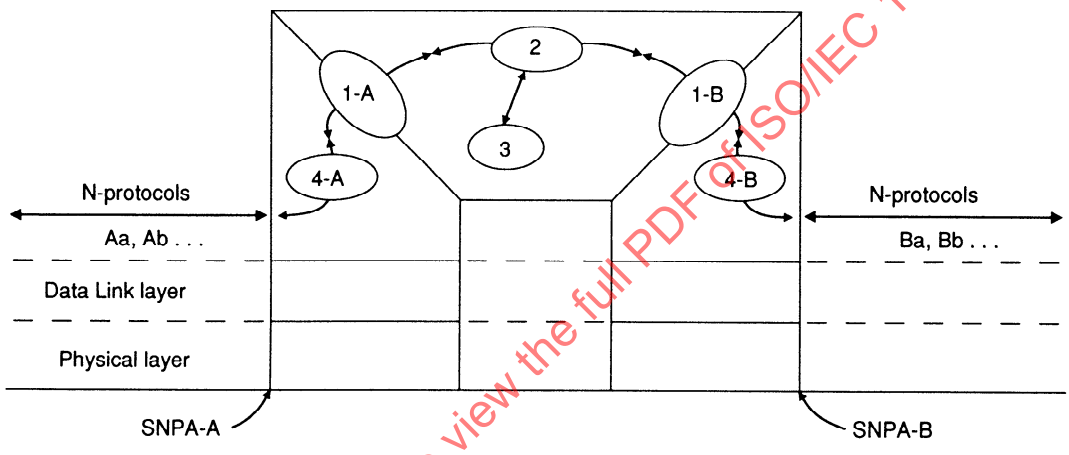
a) NC establishment
b) QOS negotiation
c) normal data transfer
d) flow control
e) expedited data transfer
f) receipt confirmation
g) NC reset

h) NC release
j) connection control
k) error diagnostics

5.3 General characteristics of the mapping between X.25 PLP and NILS

The SNPA at which an IWU operates the X.25 PLP is identified with the DTE/DXE interface across which packets are transferred, as specified in ISO/IEC 8208. In normal relaying, packets received by the IWU are mapped, where appropriate, to indication and confirm primitives of the NILS; request and response primitives are mapped to packets transmitted by the IWU. Certain error conditions at the IWU can result in indication primitives which map either to transmitted packets or to no packets at all. Also, certain flow control conditions result in a mapping between indication primitives and transmitted packets, or between request primitives and received packets.

Figure 1, adapted from ISO/IEC 10028, illustrates the model used by ISO/IEC 10028 in defining the abstract relaying functions of an intermediate system: ISO/IEC 10028 itself covers items (1) to (3) of the model. The protocol mapping is considered to occur between packets at an SNPA where the X.25 PLP is used to access a real subnetwork, and NILS primitives exchanged at the immediately related Network internal service access point (NISAP) — e.g., between SNPA-A and the NILS primitives at item (1-A) in figure 1, as shown by item (4-A). However, because of the abstract nature of the NILS and of an NISAP, and because there may be no access possible to the realizations of either in a particular IWU, conformance to this International Standard is defined in terms of observable behaviour at any suitable point in the path of the Network connection in question.



Where : -A and -B label the two sides of the intermediate system
(1) = Network internal layer service (NILS) primitives
(3) = N-routing and N-layer management support for relaying
SNPA = subnetwork point of attachment
(2) = NILS relaying function
(4) = mapping between NILS and N-protocols

Figure 1 — Intermediate-system model

The protocol mapping is such that each NILS primitive is to be considered as a direct abstraction of the corresponding packet(s); similarly, the primitive's parameters are in general direct abstractions from information contained in fields of the packet(s), supplemented in a few cases by local knowledge.

NOTES

1 The mapping function has, therefore, no state of its own, and no buffering capability: details of the mapping can, of course, depend upon the state of the DTE/DXE interface specified in ISO/IEC 8208.

2 NILS primitives are not to be viewed as modelling or otherwise representing anything like a programming interface to a protocol implementation, with the implied consequence that the implementation could intervene, below the NISAP, in the flow of Network-service-level information represented by the NILS. When a protocol implementation does intervene in the information flow, any effects of such intervention that are observable outside the IWU are ascribed by the ISO/IEC 10028 model to the relaying function, item 2 in Figure 1.

For example, consider the case where an INCOMING CALL packet contains the Expedited Data Negotiation facility encoding use of expedited data, and the IWU forwards a CALL REQUEST packet containing the EDN facility encoding no use of expedited data. The INCOMING CALL packet maps to an NI-CONNECT indication primitive having an Expedited Data Selection parameter with the value "use of Expedited Data", and the CALL REQUEST packet maps to an NI-CONNECT request primitive having an Expedited Data Selection parameter with the value "no use of Expedited Data": this corresponds to ISO/IEC 10028's REQ elementary sequence of NILS primitives, with parameter relationship **P2** (b).

3 NILS primitives that do not require forwarding of parameter information through the IWU might in practice be handled entirely within an implementation of the packet layer entity: for example, flow control (see 9.1.3 to 9.1.6) or response to NC resets (9.3.2, 9.3.3).

6 Conformance

6.1 Static conformance requirements

An implementation for which conformance to this International Standard is claimed shall support each feature of the NILS marked as Mandatory in column 3 of table 1, using the elements of the protocol mapping referred to in column 2. The features marked as Optional in column 3 may be supported or omitted by the implementation; when such features are supported by an implementation they shall be available to any NC, except in so far as their use may be subject to local management controls.

Table 1 — Static conformance requirements

1. Feature	2. Defining clauses	3. Status
Use of VC service	6.2.1	O)) M (see
Use of PVC service	6.2.2, 10	O) Note)
Network connections	7	M
NC establishment, outgoing	8.1, 8.7 - 8.16	O)) M (see
NC establishment, incoming	8.1, 8.7 - 8.16	O) Note)
QOS negotiation	8.12 - 8.14	M
normal data transfer	9.1.1, 9.1.2	M
flow control	9.1.3 - 9.1.6	M
expedited data transfer	9.2.1 - 9.2.3	O
receipt confirmation	9.1.2, 9.1.7	O
NC reset	9.3.1 - 9.3.7	M
NC release	8.2 - 8.5, 8.8, 8.9, 8.15, 8.17, 8.18	M
NC release on mapping-protocol violation	8.6	O
NC reset on mapping-protocol violation	9.3.2 (c)	O
no action on ignorable mapping-protocol violaton	9.1.1	O
connection control	8.16	O
error diagnostics	8.17, 8.18, 9.3.6, 9.3.7	M

Where : M = Mandatory O = Optional

NOTE — For each of these bracketed pairs of features, the features are individually optional, but it is mandatory to support at least one from each pair.

6.2 Requirements of the X.25 PLP implementation

6.2.1 Requirements when using Virtual Calls

The procedures, packets and facilities relating to the following X.25 PLP features are required for the NILS protocol mapping to Virtual Calls.

a) Virtual Calls
b) Virtual Call setup
c) aborting of outgoing Virtual Call setup
d) rejection of incoming Virtual Call setup
e) Virtual Call clearing
f) normal data transfer
g) More Data mark (M-bit)
h) flow control and window rotation
j) reset
k) D-bit negotiation at call setup
l) Fast Select, if outgoing NC establishment is supported
m) Throughput Class Negotiation facility
n) Transit Delay Selection And Indication facility
p) all CCITT-specified DTE facilities

In addition, the procedures and packets for each of the following features are required if the corresponding NS-provider option is supported.

q) Interrupt data transfer (for NILS expedited data transfer)
r) Delivery Confirmation (for NILS receipt confirmation)

In a DTE/DCE environment, subscription to the following facilities is required.

s) Fast Select Acceptance, if incoming NC establishment is supported
t) Throughput Class Negotiation

In a DTE/DTE environment, the two DTEs shall agree the use of Fast Select.

6.2.2 Requirements when using Permanent Virtual Circuits

The procedures, packets and facilities relating to the following X.25 PLP features are required for the NILS protocol mapping to PVCs.

a) normal data transfer
b) More Data mark (M-bit)
c) flow control and window rotation
d) reset

In addition, the procedures and packets for each of the following features are required if the corresponding NS-provider option is supported.

e) Interrupt data transfer (for NILS expedited data transfer)
f) Delivery Confirmation (for NILS receipt confirmation)

6.3 Dynamic conformance

6.3.1 Conformance at an SNPA

For an IWU to conform to this International Standard at an SNPA, any sequence of ISO/IEC 8208 packets sent and received on logical channels used to support Network connections, together with any RESTART packets:

a) shall conform to ISO/IEC 8208; and
b) when interpreted according to the mapping defined in clauses 7 to 9, shall correspond to sequences of NILS primitives, defined in ISO/IEC 10028.

NOTE — It is an implementation choice — see table 1 — whether or not mapping-protocol violations result in release or resetting of the affected NC as described in 8.6 and 9.3.4 below. If neither NC release nor NC reset is used when such a violation occurs, interpretation as in (b) above fails, but in that case the use of the logical channel cannot be interpreted as being in support of a Network connection.

6.3.2 Conformance as an interworking unit

For an IWU to conform to this International Standard as an interworking unit, it shall conform at the SNPA, as specified in 6.3.1. In addition, any observed behaviour of an NC on the remote side of the IWU shall correspond to possible sequences of NILS primitives which are related, as defined in ISO/IEC 10028 for sequences of primitives across hops and relays, (a) to those derived according to clauses 7 to 9 from the packets transferred at the SNPA; and (b) to any additional NILS primitives corresponding to failures of the lower-layer support for the packet layer at the SNPA or to protocol violations, as defined in 8.5 and 8.6 respectively.

6.4 Protocol implementation conformance statement

The supplier of an interworking unit which is claimed to conform to this International Standard shall complete a copy of the PICS proforma provided in Annex A.

In addition, a PICS proforma shall be completed for the X.25 PLP implementation, in accordance with the requirements of ISO/IEC 8208; entries shall be made in accordance with the modified requirements in annex B, which reflect the requirements of 6.2 above.

7 General considerations in mapping Network connections

Throughout the clauses defining the NILS protocol mapping, the mapping is considered to occur between one given SNPA, identified with the DTE/DXE interface of one packet layer entity, and one NISAP associated with that SNPA.

For connection-mode operation, ISO/IEC 10028 defines the instances of NILS primitives that belong to a given NC at a NISAP as occurring at a unique Network hop end point (NHEP), distinct from the NHEP of any other NC at that NISAP. NILS primitives are associated with the appropriate NHEP by a mechanism local to the intermediate system and not further defined by ISO/IEC 10028.

At any given instant, NHEPs at the NISAP map one-to-one to logical channels used in support of the CONS at the SNPA, and each Network connection maps to exactly one Virtual Call or Permanent Virtual Circuit. Logical channel identifiers in packets sent and received are the realization in protocol of the NILS NHEP identification mechanism. Throughout the duration of a Virtual Call, all packets belonging to the Virtual Call (i.e., having the same logical channel identifier) map to the same NC. Similarly when a PVC is used in suport of a Network connection, throughout the duration of the association between the PVC and the NC (see clause 10 below) all packets belonging to the PVC map to the same NC.

NOTE — An NHEP can map to two or more different logical channels in succession, when an NC request is aborted or rejected but is then re-attempted. Once an NC has been established, the mapping of NHEP and NC to logical channel and VC or PVC remains fixed.

8 Protocol mapping for NC establishment and release

The mapping between NILS and the X.25 PLP for NC establishment and NC release is defined in table 2 and the subclauses referenced from its entries.

There is no mapping in X.25 PLP for NI-CONNECT-PROCEEDING primitives. There is also no mapping defined for the Protection QoS and NI Accounting parameters.

Throughout this clause, except where specific mention of packet-images is made, references to packets for call setup and clearing are to be interpreted to mean the corresponding packet-images when applied to the mapping to Permanent Virtual Circuits; see clause 10.

8.1 NI-CONNECT

NI-CONNECT request and indication primitives correspond to CALL REQUEST and INCOMING CALL packets respectively, with the Fast Select facility present in each case. NI-CONNECT response and confirm primitives correspond to CALL ACCEPTED and CALL CONNECTED packets respectively.

8.2 NI-DISCONNECT request

NI-DISCONNECT request primitives correspond to CLEAR REQUEST packets.

8.3 NI-DISCONNECT indication: normal case

NI-DISCONNECT indication primitives correspond in the simplest cases to CLEAR INDICATION packets.

8.4 NI-DISCONNECT indication: packet-layer errors

An NI-DISCONNECT indication primitive also corresponds to a CLEAR REQUEST packet, when that is generated by the packet layer entity or by the SNDCP procedures for use with a PVC — for example, in response to an error in a received packet; and to a RESTART REQUEST or RESTART INDICATION packet that occurs while the logical channel is in use for an NC (in these cases, a single RESTART packet corresponds to multiple NI-DISCONNECT indications, one for each NC).

8.5 NI-DISCONNECT indication: lower-layer failures

An NI-DISCONNECT indication primitive also corresponds to an out-of-order condition at the Physical and Data Link layers, as specified in ISO/IEC 8208: this applies to each NC with a corresponding Virtual Call or PVC in use when the out-of-order condition occurs.

Table 2 — Protocol mapping for NILS NC establishment and release primitives and parameters

NILS primitive or parameter	ISO/IEC 8208 packet / field / facility	Subclauses
NI-CONNECT request NI-CONNECT indication	CALL REQUEST packet, Fast Select INCOMING CALL packet, Fast Select	8.1 8.1
Called Address	Called Address Extension or Called-DTE address in Address field	8.8 8.9
Calling Address	Calling Address Extension or Calling-DTE address in Address field	8.8 8.9
RC Selection	GFI field: bit 7 of octet 1	8.10
ED Selection	Expedited Data Negotiation	8.11
QOS Parameter Set:		
– Throughput, current	Throughput Class Negotiation	8.12
– Throughput, LQA	Minimum Throughput Class Negotiation	8.12
– Transit Delay, current and target	Transit Delay Selection and Indication; End to End Transit Delay Negotiation, cumulative and target	8.13.1, 8.13.2
– Transit Delay, LQA	End to End Transit Delay Negotiation, maximum acceptable	8.13.3
– Priority, current	Priority, target / available	8.14
– Priority, LQA	Priority, lowest-acceptable	8.14
NS-User-Data	Call User Data field	8.15
NI Connection Control	NUI Selection, Closed User Group Selection, Closed User Group With Outgoing Access Selection, Bilateral Closed User Group Selection, RPOA Selection, Reverse Charging	8.16
NI-CONNECT response NI-CONNECT confirm	CALL ACCEPTED packet CALL CONNECTED packet	8.1 8.1
Responding Address	Called Address Extension or Called-DTE address in Address field	8.8 8.9
RC Selection	GFI field: bit 7 of octet 1	8.10
ED Selection	Expedited Data Negotiation	8.11
QOS Parameter Set:		
– Throughput, selected	Throughput Class Negotiation	8.12
– Transit Delay, selected	End to End Transit Delay Negotiation, cumulative	8.13.4
– Priority, selected	Priority, selected	8.14
NS-User-Data	Called User Data field	8.15
NI Connection Control	NUI Selection	8.16

Table 2 (concluded)

NILS primitive or parameter	ISO/IEC 8208 packet / field / facility	Subclauses
NI-DISCONNECT request	CLEAR REQUEST packet	8.2
Originator Reason	) Clearing Cause field and) Diagnostic Code field	8.17
NS-User-Data	Clear User Data field	8.15
Responding Address	Called Address Extension or Called-DTE address in Address field	8.8 8.9
NI Diagnostic NI Location	Clearing Cause field and Diagnostic Code field Null value	8.18
NI-DISCONNECT indication	CLEAR INDICATION packet CLEAR REQUEST packet RESTART REQUEST packet RESTART INDICATION packet none	8.3 8.4, 8.6 8.4 8.4 8.5
Originator Reason	) Clearing / Restarting Cause field and) Diagnostic Code field	8.17
NS-User-Data	Clear User Data field	8.15
Responding Address	Called Address Extension or Called-DTE address in Address field	8.8 8.9
NI Diagnostic NI Location	Clearing / Restarting Cause field and Diagnostic Code field Null value	8.18
No NILS primitive	INCOMING CALL packet or CALL CONNECTED packet with invalid value(s) or combination of values in Address field and/or Facility Parameter field(s).	8.7, 8.8, 8.9

8.6 NI-DISCONNECT indication: mapping-protocol violations

Finally, an NI-DISCONNECT indication primitive corresponds to a CLEAR REQUEST packet generated in response to receipt of a packet which, although valid in terms of ISO/IEC 8208, is not valid as part of the mapping defined in the rest of clauses 8 and 9 of this International Standard.

The possibilities for such erroneous packets are:

a) INTERRUPT packet received when non-use of expedited data has been negotiated;
b) DATA packet received with D-bit set to one when non-use of receipt confirmation has been negotiated;
c) DATA packet received with Q-bit set to one;
d) M-bit sequence received with zero-length data;
e) CALL CONNECTED packet received with one or more of the errors specified in 8.7.2 below.

NOTE — Occurrence of one of the errors (a) to (d) above implies that the system originating the erroneous packet does not implement either ISO/IEC 10177 or ISO 8878. As a result, full support of the NILS, and through it end-to-end support of the Network service, is not possible when these errors occur. However, when call clearing is used in response to these errors, as described in this subclause, the NILS can be preserved at the receiving IWU and on the side of the NC remote from the source of the error. See also 9.3.2 for cases (a) - (d) and 9.1.1 for case (d).

8.7 Mapping-protocol violations in received call setup packets

8.7.1 INCOMING CALL packets

If an INCOMING CALL packet is received that is valid in terms of ISO/IEC 8208 but does not contain Address field and Facilities field values that can be mapped to parameters of an NI-CONNECT indication primitive, then either

a) the packet falls outside the scope of this International Standard; or
b) the packet is an erroneous packet that constitutes a mapping-protocol violation.

Case (a) occurs when:

i) the Called Address Extension facility is absent and the IWU is not able to deduce the AFI and, hence, the complete N-address according to the encoding of 8.9 below, or the facility is present but with the first octet of the Facility Parameter field set to indicate that the facility carries an address other than an N-address assigned according to ISO/IEC 8348; or
ii) the Calling Address Extension facility is absent and the IWU is not able to deduce the AFI and, hence, the complete N-address according to the encoding of 8.9 below, or the facility is present but with the first octet of the Facility Parameter field set to indicate that the facility carries an address other than an N-address assigned according to ISO/IEC 8348; and
iii) if either (i) or (ii) applies, the receiving DTE supports the X.25 PLP for uses other than in support of the OSI Network service in accordance with this International Standard or with ISO 8878.

Case (b) occurs when:

1) either (i) or (ii) above applies but not (iii); or
2) the Fast Select facility or Throughput Class Negotiation facility is absent from the INCOMING CALL packet received; or
3) the MTCN, TDSAI or EETDN facility is absent from an INCOMING CALL packet-image received on a PVC; or
4) there is an inconsistency in the QOS subparameter values — eg, a Current or Target value is worse than the corresponding LQA value (see 8.12, 8.13, 8.14 below).

In case (b) the DTE shall transmit a CLEAR REQUEST packet, with Cause "DTE Originated", in response to the erroneous received packet. It is recommended that the value of the Diagnostic Code field be set to 232 "connection rejection — NSAP unreachable / permanent condition" if (i) applies, and otherwise to 245 "connection rejection — reason unspecified / permanent condition". Neither the INCOMING CALL nor CLEAR REQUEST packet maps to a NILS primitive.

8.7.2 CALL CONNECTED packets

If a CALL CONNECTED packet is received that is valid in terms of ISO/IEC 8208 but does not contain Address field and Facilities field values that can be mapped to parameters of an NI-CONNECT confirm primitive, then the packet is an erroneous packet that constitutes a mapping-protocol violation. The possible errors are:

a) the Called Address Extension facility has the first octet of the Facility Parameter field set to indicate that the facility carries an address other than an N-address assigned according to ISO/IEC 8348;
b) the Called Address Extension facility is absent, and the DTE is unable to deduce the AFI and, hence, the complete N-address value for the Responding Address as at 8.9 below;
c) the End-to-End Transit Delay Negotiation facility is absent;
d) a facility encodes a Selected QOS Parameter value that is not valid with respect to the QOS negotiation rules applied to the corresponding CALL REQUEST packet (eg, the Selected value indicates lower QOS than the LQA value).

The DTE shall transmit a CLEAR REQUEST packet, with Cause "DTE Originated", in response to the erroneous received packet. It is recommended that the value of the Diagnostic Code field be set to 245 "connection rejection — reason unspecified / permanent condition". No NILS primitive corresponds to the CALL CONNECTED packet; 8.6 defines the mapping for the CLEAR REQUEST packet.

8.8 Address parameters: normal cases

Except possibly under the conditions defined in 8.9 below, a Called Address, Calling Address or Responding Address parameter is encoded in the corresponding Address Extension facility as specified in ISO/IEC 8208, including the setting of the first octet of the Facility Parameter field to indicate that the facility carries an address assigned according to ISO/IEC 8348.

8.9 Address parameters: exceptional cases

If all of the following restrictive conditions hold, an N-address parameter of a NILS primitive can be encoded entirely in the appropriate part of the Address field of the corresponding packet (but even when the conditions hold the normal encoding of 8.8 can be used instead). The Address field digits encode the IDI of the N-address.

a) The N-address consists solely of the initial domain part (i.e., the domain specific part is null);
b) the receiving DTE can deduce the AFI from the contents of the Address field (e.g., using knowledge of the subnetwork to which the DTE is attached);
c) the IDI is the same as the SNPA address conveyed as the contents of the Address field; and
d) the sending DTE has knowledge that the receiving DTE can deduce the AFI from the contents of the Address field.

NOTES

1 Detailed applicability of conditions (b) and (d) depends upon whether the IWU is the sending or receiving DTE for the packet in question.

2 It is possible for an IWU operating ISO/IEC 8208 on both sides to use this address encoding on one side and the normal encoding of 8.8 on the other, e.g., when the above conditions apply only on one side.

8.10 RC Selection parameters

The RC Selection parameter values "use of Receipt Confirmation" and "no use of Receipt Confirmation" correspond respectively to the values 1 and 0 for bit 7 of the first octet of a call setup packet.

8.11 ED Selection parameters

The value "use of Expedited Data" for the ED Selection parameter corresponds to presence of the Expedited Data Negotiation facility with the Facility Parameter field set to indicate use of expedited data as specified in ISO/IEC 8208. The value "no use of Expedited Data" for ED Selection corresponds either to the equivalent setting of the Expedited Data Negotiation facility's Facility Parameter field as specified in ISO/IEC 8208, or to absence of the facility from the packet in question.

8.12 QOS Parameter Set: Throughput parameters

The Current or Selected subparameters of Throughput are encoded in accordance with ISO/IEC 8208 in the Facility Parameter field of the Throughput Class Negotiation facility. The LQA subparameters of Throughput are encoded in accordance with ISO/IEC 8208 in the Facility Parameter field of the Minimum Throughput Class Negotiation facility. For operation over a PVC, each value encoded is less than or equal to that for the throughput of the PVC, for each direction of data transfer.

If an INCOMING CALL packet does not contain the Minimum Throughput Class Negotiation facility, the LQA subparameter of the NI-CONNECT indication primitive takes the value "unspecified".

NOTES

1 INCOMING CALL packets with missing MTCN facility occur in interworking with implementations of CCITT Recommendation X.223, which do not conform to the requirements of ISO 8878 and of this International Standard for QOS parameters in transmitted packets.

2 The subparameters in NI-CONNECT primitives can only take values 75 bit/s, 150 bit/s, 300 bit/s, etc, as specified in ISO/IEC 8208, since only those values can be encoded in Facility Parameter fields. If an IWU interconnects the X.25 PLP with a subnetwork protocol that uses a different set of values, the QOS negotiation rules of ISO/IEC 10028 govern any adjustment needed in matching the values on the two sides of the IWU.

8.13 QOS Parameter Set: Transit Delay parameters

8.13.1 Current subparameters

The Current subparameter of an NI-CONNECT request primitive's Transit Delay parameter is encoded in accordance with ISO/IEC 8208 as the cumulative transit delay in the Facility Parameter field of the EETDN facility. The value is that of the transit delay on the NC through the IWU to the SNPA.

The Current subparameter of an NI-CONNECT indication primitive's Transit Delay parameter is the sum of the cumulative transit delay value in the Facility Parameter field of the EETDN facility and the transit delay value in the TDSAI facility, when both values are present in the INCOMING CALL packet. (Thus the transit delay is again measured to the SNPA, but in this case excluding any component attributable to the IWU.)

If an INCOMING CALL packet does not contain both the TDSAI and EETDN facilities, the Current subparameter of the NI-CONNECT indication primitive takes a value derived by the N-entity using local information about the missing value(s).

NOTE — The need to use locally derived transit delay values in this way arises only in interworking with implementations of CCITT Recommendation X.223, which do not conform to the requirements of ISO 8878 and of this International Standard for QOS parameters in transmitted packets.

8.13.2 Target subparameters

The Target subparameter of a Transit Delay parameter is encoded in accordance with ISO/IEC 8208 as the target transit delay in the Facility Parameter field of the EETDN facility; absence of the octets that encode target transit delay corresponds to the value "unspecified" for the Target subparameter.

If the Target subparameter value is not "unspecified", the transit delay value in the TDSAI facility of a CALL REQUEST packet is less than the Target value minus the Cumulative subparameter value.

8.13.3 Lowest Quality Acceptable subparameters

The LQA subparameter of a Transit Delay parameter is encoded in accordance with ISO/IEC 8208 as the maximum acceptable transit delay in the Facility Parameter field of the EETDN facility; absence of the octets that encode maximum acceptable transit delay corresponds to the value "unspecified" for the LQA subparameter.

8.13.4 Selected subparameters

The Selected subparameter of a Transit Delay parameter is encoded in accordance with ISO/IEC 8208 as the cumulative transit delay in the Facility Parameter field of the EETDN facility.

8.14 QOS Parameter Set: Priority parameters

Absence of the Priority facility corresponds to values of "unspecified" for both the Current and LQA subparameters, or for the Selected subparameter, as appropriate, of each Priority QOS parameter (priority of data, priority to gain a connection, and priority to keep a connection). Otherwise, Priority subparameter values (in the range 0 to 14, or "unspecified") correspond directly to the values in the Priority facility in accordance with the specification in ISO/IEC 8208; values omitted from the Priority facility correspond to "unspecified" subparameter values.

8.15 NS-User-Data parameters

The sequence of octets (of length in the range 0 to 128) that is the value of an NS-User-Data parameter corresponds to the octets of the Call User Data, Called User Data, or Clear User Data field, as appropriate, of the same length, taken in order from the first octet of the field.

8.16 NI Connection Control parameters

Subparameters of NI Connection Control map either to null, or to X.25 PLP facilities as follows:

a) user authentication:
   NUI Selection,
   Closed User Group Selection
   Closed User Group With Outgoing Access Selection
   Bilateral Closed User Group Selection

b) routing control:
   RPOA Selection
   Called Line Address Modified Notification
   Call Redirection or Deflection Notification

c) cost determinants:
   Reverse Charging
   NUI Selection

Details of subparameter mappings are domain dependent, in the sense described in ISO/IEC 10028. (An annex of ISO/IEC 8208 contains information related to the extension, for some of these purposes, of the public-network X.25 domain across attached packet-switched private networks.)

8.17 Originator and Reason parameters

Originator and Reason parameters correspond to values of the Cause field and Diagnostic Code field as specified in tables 3 to 5; combinations of Cause and Diagnostic Code values not covered in those tables correspond to the value "undefined" for both Originator and Reason parameters. When NC release occurs because of lower-layer failure (see 8.5), the Originator and Reason parameters are those for cause "Out of Order".

NOTE — Although the mappings in tables 4 and 5, and that to "undefined" values, are one-way, they can apply to both sent and received packets: see the Note to 8.18 below.

8.18 NI Diagnostic and NI Location parameters

Non-null NI Diagnostic parameters correspond to values of the Cause field and Diagnostic Code field other than those in table 3. Details of the parameter mapping are domain dependent, as described in ISO/IEC 10028; however, for ISO/IEC 8208 Cause field values and standard diagnostic code values, the domain is that of all ISO/IEC 8208 implementations.

NOTE — NI Diagnostic information can be relayed between two subnetworks accessed via X.25 PLP, by forwarding of the corresponding Cause and Diagnostic Code fields.

Only the Null value of the NI Location parameter is mapped (but note that partial location information is conveyed by some values of the Cause and Diagnostic Code fields).

Table 3 — Mapping between Cause/Diagnostic Code and Originator/Reason (Mapping independent of NC phase)

Cause	Diagnostic	Originator	Reason
DTE Originated, standard diagnostic codes	241 242 244 245 246 247 248	NS User	disconnection — normal condition disconnection — abnormal condition connection rejection — transient condition connection rejection — permanent condition connection rejection — QOS not available / transient condition connection rejection — QOS not available / permanent condition connection rejection — incompatible information in NS-user-data
DTE Originated, standard diagnostic codes	225 226 227 228 229 230 231 232 235	NS Provider	disconnection — transient condition disconnection — permanent condition connection rejection — reason unspecified / transient condition connection rejection — reason unspecified / permanent condition connection rejection — QOS not available / transient condition connection rejection — QOS not available / permanent condition connection rejection — NSAP unreachable / transient condition connection rejection — NSAP unreachable / permanent condition connection rejection — NSAP address unknown / permanent condition

Table 4 — Mapping from Cause/Diagnostic Code to Originator/Reason (NC establishment phase)

Cause	Diagnostic	Originator	Reason
Not Obtainable,	any	NS Provider	connection rejection — NSAP address unknown / permanent condition
Access Barred, Fast Select Acceptance Not Subscribed, Incompatible Destination, Invalid Facility Request, Local Procedure Error, Out of Order, Remote Procedure Error, Reverse Charging Acceptance Not Subscribed, RPOA Out of Order any DTE Originated, standard diagnostic codes	any 121, 122 164	NS Provider	connection rejection — reason unspecified / permanent condition
DTE Originated, standard diagnostic codes Number Busy, Network Congestion, Network Operational any	any except 121, 122, 164 and table 3 values any 112 - 120	NS Provider	connection rejection — reason unspecified / transient condition

Table 5 — Mapping from Cause/Diagnostic Code to Originator/Reason (Data transfer phase)

Cause	Diagnostic	Originator	Reason
Network Congestion	any	NS Provider	disconnection — transient condition
any	113, 115		
DTE Originated, standard diagnostic codes	any except 225, 226, 241, 242		
Local Procedure Error, Out of Order, Remote Procedure Error, RPOA Out of Order	any	NS Provider	disconnection — permanent condition
any	122		

9 Protocol mapping for data transfer phase

The mapping between the NILS and the X.25 PLP for the data transfer phase of an NC is defined in table 6 and the subclauses referenced from its entries.

9.1 Data transfer, flow control and receipt confirmation

9.1.1 NI-DATA request and indication, and NS-User-Data-Octet parameters

The sequence of NI-DATA primitives corresponding to a single NSDU, as defined in ISO/IEC 10028, corresponds in the protocol mapping to an ISO/IEC 8208 M-bit sequence of DATA packets, each packet having the Qualifier bit set to zero. The NS-User-Data-Octet parameter values, taken in sequence, correspond to the octets of the User Data fields in the DATA packets of the M-bit sequence, in order of transmission from the first octet of the first packet.

A received M-bit sequence of zero length does not correspond to any NI-DATA primitive (since an NSDU cannot contain less than one octet). Receipt of such an M-bit sequence may be treated as a mapping-protocol violation (see 8.6 and 9.3.4), or the occurrence of the M-bit sequence may be ignored.

9.1.2 NSDU Qualifier parameters

The value of the NSDU Qualifier parameter in the last NI-DATA primitive of the sequence for an NSDU maps to the D-bit value of the last DATA packet in the corresponding M-bit sequence: D-bit values 0 and 1 correspond respectively to "Last" and "Last with Confirmation Request". All other DATA packets have the D-bit set to zero, corresponding to NSDU-Qualifier value "Normal" for each NI-DATA primitive mapped to the packet.

9.1.3 NI-PAUSE request

An NI-PAUSE request primitive corresponds either to a RECEIVE NOT READY packet sent when the logical channel is in the DTE RECEIVE READY state, or to the receipt of a DATA packet with P(S) value equal to the upper window edge for the receive direction.

9.1.4 NI-PAUSE indication

An NI-PAUSE indication primitive corresponds either to a RECEIVE NOT READY packet received when the logical channel is in the DXE RECEIVE READY state, or to the sending of a DATA packet with P(S) value equal to the upper window edge for the send direction.

9.1.5 NI-CONTINUE request

An NI-CONTINUE request primitive corresponds to (a) sending a RECEIVE READY or REJECT packet when the logical channel is in the DTE RECEIVE NOT READY state, provided that the packet's P(R) value sets an upper window edge greater than the P(S) value in the most recently accepted DATA packet; or (b) sending a DATA, RECEIVE READY or REJECT packet with a P(R) value that sets an upper window edge greater than the most recently received P(S) value when that P(S) value equalled the old upper window edge.

9.1.6 NI-CONTINUE indication

An NI-CONTINUE indication primitive corresponds to (a) receiving a RECEIVE READY or REJECT packet when the logical channel is in the DXE RECEIVE NOT READY state, provided that the packet's P(R) value sets an upper window edge greater than the most recently sent

P(S) value; or (b) receiving a DATA, RECEIVE READY or REJECT packet with a P(R) value that sets a new upper window edge when the most recently sent P(S) value equalled the old upper window edge.

9.1.7 NI-DATA-ACKNOWLEDGE request and indication

An NI-DATA-ACKNOWLEDGE primitive corresponds to sending or receiving a P(R) value greater than the P(S) value received or sent, respectively, in a DATA packet with the D-bit set to 1, when no such P(R) value has previously been sent or received. If a single P(R) transmission acknowledges two or more P(S) values in this way, there correspond the same number of distinct NI-DATA-ACKNOWLEDGE primitives.

NOTE — This definition precludes sending of such an acknowledging P(R) value except in association with an explicit NI-DATA-ACKNOWLEDGE request primitive.

Table 6 — Protocol mapping for NILS primitives and parameters in NC data transfer phase

NILS primitive / parameter	ISO/IEC 8208 packet / field	Subclauses
NI-DATA request NI-DATA indication	DATA packet transmitted DATA packet received	9.1.1 9.1.1
NS-User-Data-Octet	User Data field	9.1.1
NSDU Qualifier	M-bit, D-bit, P(S) fields	9.1.1, 9.1.2
NI-PAUSE request NI-PAUSE indication	) RECEIVE NOT READY packet, ( ) P(S) field in DATA packet (	9.1.3 9.1.4
NI-CONTINUE request NI-CONTINUE indication	) P(R) field in DATA, RECEIVE READY ( ) or REJECT packet (	9.1.5 9.1.6
NI-DATA-ACKNOWLEDGE request NI-DATA-ACKNOWLEDGE indication	) P(R) field in DATA, RECEIVE READY,) RECEIVE NOT READY, or REJECT packet	9.1.7
NI-EXPEDITED-DATA request NI-EXPEDITED-DATA indication	INTERRUPT packet transmitted INTERRUPT packet received	9.2.1 9.2.1
NS-User-Data	Interrupt User Data field	9.2.3
NI-EXPEDITED-DATA response NI-EXPEDITED-DATA confirm	INTERRUPT CONFIRMATION packet transmitted INTERRUPT CONFIRMATION packet received	9.2.2 9.2.2
NI-RESET request NI-RESET indication	RESET REQUEST packet RESET INDICATION packet or RESET REQUEST packet	9.3.1 9.3.2
Originator, Reason	) Resetting Cause field and Diagnostic Code field)	9.3.6
NI Diagnostic	Resetting Cause field and Diagnostic Code field	9.3.7
NI Location	–	9.3.7
NI-RESET response NI-RESET confirm	RESET CONFIRMATION packet transmitted RESET CONFIRMATION packet, RESET INDICATION packet	9.3.3 9.3.4

9.2 Expedited data transfer

9.2.1 NI-EXPEDITED-DATA request and indication

NI-EXPEDITED-DATA request and indication primitives correspond to sent and received INTERRUPT packets respectively.

9.2.2 NI-EXPEDITED-DATA response and confirm

NI-EXPEDITED-DATA response and confirm primitives correspond to sent and received INTERRUPT CONFIRMATION packets respectively.

9.2.3 NS-User-Data parameters

The sequence of octets (of length in the range 1 to 32) that is the value of an NS-User-Data parameter corresponds to the octets of the Interrupt User Data field, of the same length, taken in order from the first octet.

9.3 NC reset

9.3.1 NI-RESET request

NI-RESET request primitives correspond to RESET REQUEST packets.

9.3.2 NI-RESET indication

An NI-RESET indication primitive corresponds to:

a) a RESET INDICATION packet received when the logical channel is in FLOW CONTROL READY state; or
b) a RESET REQUEST packet that is generated by the packet layer entity for a logical channel in FLOW CONTROL READY state — e.g., on receiving an erroneous packet; or
c) a RESET REQUEST packet transmittted in response to receipt of a packet which, although valid in terms of ISO/IEC 8208, is not valid as part of the mapping defined for data transfer phase, in the rest of this clause.

The possibilities for erroneous packets giving rise to (c) are:

i) INTERRUPT packet received when non-use of expedited data has been negotiated;
ii) DATA packet received with D-bit set to one when non-use of receipt confirmation has been negotiated;
iii) DATA packet received with Q-bit set to one;
iv) M-bit sequence received with zero-length User Data.

NOTE — Occurrence of one of the above errors implies that the system originating the erroneous packet does not implement either ISO/IEC 10177 or ISO 8878. As a result, full support of the NILS, and through it end-to-end support of the Network service, is not possible when these errors occur. However, when resetting is used in response to these errors, as described in this subclause, the NILS can be preserved at the receiving IWU and on the side of the NC remote from the source of the error. See also 8.6 for cases (i) - (iv) and 9.1.1 for case (iv).

9.3.3 NI-RESET response

An NI-RESET response primitive corresponds to:

a) a RESET CONFIRMATION packet sent by the DTE following NI-RESET indication mapped as at 9.3.2 (a); or
b) a RESET CONFIRMATION packet received following NI-RESET indication mapped as at 9.3.2 (b) or (c); or
c) a RESET INDICATION packet received (as a reset collision) following NI-RESET indication mapped as at 9.3.2 (b) or (c).

9.3.4 NI-RESET confirm

An NI-RESET confirm primitive corresponds to:

a) a RESET CONFIRMATION packet received at the DTE; or
b) a RESET INDICATION packet received when a packet-layer reset collision occurs.

9.3.5 Sequencing of RESET packets and NI-RESET primitives

The correspondence between the primitives and packets as in 9.3.2 to 9.3.4 relates only to their positions in the respective sequences of primitives of the NC and packets on the logical channel. For any given instance of one of these primitive / packet pairs, the primitive can occur before or after transfer of the corresponding packet across the DTE/DXE interface.

9.3.6 Originator and Reason parameters

Originator and Reason parameters correspond to values of the Cause field and Diagnostic Code field as specified in table 7; combinations of Cause and Diagnostic Code values not covered in the table correspond to the value NS Provider for Originator and "reason unspecified" for Reason.

NOTE — The mapping for values not covered by table 7 can apply to both sent and received packets: see the Note to 9.3.10 below.

9.3.7 NI Diagnostic and NI Location parameters

Non-null NI Diagnostic parameters correspond to values of the Cause field and Diagnostic Code field other than those in table 7. Details of the parameter mapping are domain dependent, as described in ISO/IEC 10028; however, for ISO/IEC 8208 Cause field values and standard diagnostic code values, the domain is that of all ISO/IEC 8208 implementations.

NOTE — NI Diagnostic information can be relayed between two subnetworks accessed via X.25 PLP, by forwarding of the corresponding Cause and Diagnostic Code fields.

Only the Null value of the NI Location parameter is mapped (but note that partial location information is conveyed by some values of the Cause and Diagnostic Code fields).

Table 7 — Mapping between Cause/Diagnostic Code and Originator/Reason (NC reset)

Cause	Diagnostic	Originator	Reason
DTE Originated, standard diagnostic codes	250	NS User	user resynchronization
DTE Originated, standard diagnostic codes Network Congestion, Gateway Congestion	234) any)	NS Provider	congestion

10 SNDCP for use of Permanent Virtual Circuits

When a PVC is used in support of a Network connection, the call setup and clearing packets of the X.25 PLP, and associated procedures, are not available. In order to provide functions equivalent to Virtual Call setup and clearing in support of NC establishment and release, this clause specifies a set of SNDCP procedures in terms of:

— packet-images, defined in 10.1;
— two timers and one retransmission count, defined in 10.2;
— state-images and associated procedures, 10.3;
— the ability to support the data transfer phase of an NC, 10.4;
— additional procedures for dealing with unexpected packets received, 10.5.

10.1 Packet-images

A transmitted packet-image is a sequence of octets having the format of a CALL REQUEST, CALL ACCEPTED, CLEAR REQUEST or CLEAR CONFIRMATION packet as specified in ISO/IEC 8208, subject to the constraints that:

a) the GFI field of the packet-image encodes modulo 8 sequence numbering;

b) the logical channel identifier field of the packet-image encodes logical channel 1;

c) the Address Length fields in call setup packet-images, and in call clearing packet-images when present, are always zero (so that no DTE Address field is ever present in a packet-image).

A packet-image is transferred across a PVC as the User Data in an M-bit sequence of one or more DATA packets with Q-bit set to 1. Any such received M-bit sequence is considered to be a packet-image.

A received packet-image is defined to be identifiable if it is a sequence of at least three octets, the first three octets having the format of the packet header for an INCOMING CALL, CALL CONNECTED, CLEAR INDICATION or CLEAR CONFIRMATION packet as specified in ISO/IEC 8208. Other received packet-images are defined to be under-length if they contain fewer than three octets, and unsupported if they contain three octets or more.

An identifiable packet-image is unacceptable if it has a Logical Channel Identifier field other than 1, or contains a non-zero Address Length field, or has a format error.

10.2 Timers and retransmission count

The SNDCP procedures use two timers and one retransmission count. These correspond exactly to the Call Request Response Timer (T21), Clear Request Response Timer (T23) and Clear Request Retransmission Count (R23) defined for a Virtual Call in clause 18 of ISO/IEC 8208, including ISO/IEC 8208's default values. Non-default values may be used in accordance with ISO/IEC 8208, taking into account the values of the real timers and retransmission counts used by the packet layer entity for the PVC.

10.3 State-images and procedures for packet-image transfer

Sending and receiving of packet-images shall be as specified for call setup and call clearing packets in clause 5 of ISO/IEC 8208 and the relevant tables (or parts thereof) in clauses 17, 18 and 20 of ISO/IEC 8208, subject to the following points of detailed interpretation and to the additional procedures specified in 10.5 below.

a) For the purposes of this International Standard, state-images are defined, one for each of the ISO/IEC 8208 call setup and call clearing states p1 to p7.

b) In order to distinguish between state-images — which apply to the sending and receiving of packet-images on a PVC — and the actual states of the underlying logical channel for the PVC, the state-images of ISO/IEC 8208's p1 to p7 are denoted in this International Standard by ip1 to ip7.

c) Each PVC on which these SNDCP procedures can operate supports only the logical channel identifier 1 for use in packet-images (see 10.1 above), and hence has just one associated set of state-images ip1 to ip7.

d) Packet-image transfer can occur only in state d1 of the PVC, FLOW CONTROL READY (any packet-images received in other PVC states are subject to the normal DISCARD or ERROR procedures of ISO/IEC 8208 as applicable to the PVC).

e) If the logical channel is in state f2 (DXE RECEIVE NOT READY) when a CLEAR REQUEST or CLEAR CONFIRMATION packet-image is to be sent, the IWU shall initiate resetting of the logical channel. The IWU may also initiate resetting if the logical channel is in state f2 when a CALL REQUEST packet-image is to be sent.

f) Identifiable received packet-images shall be processed in accordance with the state table for call setup and call clearing states in clause 20 of ISO/IEC 8208, and with the relevant provisions of clause 5 of ISO/IEC 8208.

g) Unsupported packet-images shall be treated as "Packets having a Packet Type not supported by the DTE", and under-length packet-images shall be treated as "Packets having a Packet Type Identifier shorter than one octet", according to the ISO/IEC 8208 state table, regardless of the contents of octets one and two, if present, of the packet-images. These packet-images shall cause the call clearing ERROR procedure to be invoked in state-image ip4, rather than resetting.

h) In order to resolve call collisions, state-image ip5, one of the DTEs operating the PVC shall be assigned the role of DCE and the other shall be assigned the role of DTE.

j) If a RESET REQUEST packet remains unconfirmed after R22 retransmissions and timer expiries in any state-image except ip1, this shall be treated as a packet-layer error causing call clearing, as at 8.4 above; no call clearing packet-image can be transmitted but state ip1 shall be entered.

10.4 Data transfer phase

Data transfer phase of an NC corresponds to state-image ip4. The mapping of clause 9 above applies, to the real packets transferred on the PVC's logical channel.

10.5 Unexpected packets received

If the IWU receives a RESET INDICATION packet on the PVC during state-image ip2, ip3 or ip5, it shall transmit a RESET CONFIRMATION packet and invoke the NC release procedure.

If the IWU receives a RESET INDICATION packet during state-image ip1, ip6 or ip7, it shall transmit a RESET CONFIRMATION packet but shall otherwise ignore the received packet with respect to the SNDCP procedures.

If the IWU receives an INTERRUPT packet or a DATA packet with Q-bit set to zero during state-image ip3, ip5 or ip6, it shall process it as specified in the ISO/IEC 8208 state table for call setup and call clearing states.

If the IWU receives an INTERRUPT packet or a DATA packet with Q-bit set to zero during state-image ip1, ip2 or ip7, it shall ignore it for the purposes of this International Standard.

NOTE — The above procedure permits co-existence of the SNDCP specified here with other protocols, provided that such other protocols do not set the Q-bit to 1 in the first DATA packet of an instance of communication. Such co-existence applies to successive, not simultaneous, use of the protocols. Determination of priority between protocols in collision cases (e.g., in ip2) is outside the scope of this International Standard.

Annex A *
(normative)
PICS Proforma

A.1 Introduction

The supplier of a protocol implementation which is claimed to conform to ISO/IEC 10177 shall complete the following Protocol Implementation Conformance Statement (PICS) proforma.

A completed PICS proforma is the PICS for the implementation in question. The PICS is a statement of which capabilities and options of the protocol have been implemented. The PICS can have a number of uses, including use:

— by the protocol implementor, as a check-list to reduce the risk of failure to conform to the standard through oversight;

— by the supplier and acquirer — or potential acquirer — of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the standard PICS proforma;

— by the user — or potential user — of the implementation, as a basis for initially checking the possibility of interworking with another implementation (note that, while interworking can never be guaranteed, failure to interwork can often be predicted from incompatible PICS's);

— by a protocol tester, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

A.2 Abbreviations and special symbols

A.2.1 Status symbols

M	mandatory
O	optional
O.1	optional, but support of at least one of the group of options labelled in this way is required
<item>:	conditional symbol, status is dependent on the support marked for <item> (see A.3.4)

A.2.2 Other symbols

AEF	Address Extension facility
AF	Address field
D-bit	Delivery Confirmation bit
ED	expedited data
EETDN	End-To-End Transit Delay Negotiation facility
LC	logical channel
MTCN	Minimum Throughput Class Negotiation facility
NC	Network connection
PICS	Protocol Implementation Conformance Statement
PVC	Permanent Virtual Circuit
Q-bit	Qualifier bit
QOS	quality of service
RC	receipt confirmation
TDSAI	Transit Delay Selection And Indication
VC	Virtual Call

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*) **Copyright release for PICS proformas**

Users of this International Standard may freely reproduce the PICS proforma in this annex so that it can be used for the intended purpose and may further publish the completed PICS.

A.3 Instructions for completing the PICS proforma

A.3.1 General structure of the PICS proforma

The first part of the PICS proforma — Implementation Identification and Protocol Summary — is to be completed as indicated with the information necessary to identify fully both the supplier and the implementation.

The main part of the PICS proforma is a fixed-format questionnaire, divided into three subclauses each containing a number of individual items. Answers to the questionnaire items are to be provided in the rightmost column, usually by simply marking a Yes or No answer.

Each item is identified by an item reference in the first column; the second column contains the question to be answered; the third column contains the reference or references to the material that specifies the item in the main body of ISO/IEC 10177. The remaining columns record the status of the item — whether support is mandatory, optional or conditional — and provide the space for the answers: see also A.3.4 below.

A supplier may also provide — or be required to provide — further information, categorized as either Additional Information or Exception Information. When present, each kind of further information is to be provided in a further subclause of items labelled A<i> or X<i> respectively for cross-referencing purposes, where <i> is any unambiguous identification for the item (eg, simply a numeral): there are no other restrictions on its format and presentation.

A completed PICS proforma, including any Additional Information and Exception Information, is the Protocol Implementation Conformation Statement for the implementation in question.

A.3.2 Additional Information

Items of Additional Information allow a supplier to provide further information intended to assist the interpretation of the PICS. It is not intended or expected that a large quantity will be supplied, and a PICS can be considered complete without any such information. Examples might be an outline of the ways in which a (single) implementation can be set up to operate in a variety of environments and configurations.

References to items of Additional Information may be entered next to any answer in the questionnaire, and may be included in items of Exception Information.

A.3.3 Exception Information

It may occasionally happen that a supplier will wish to answer an item with mandatory status (after any conditions have been applied) in a way that conflicts with the indicated requirement. No pre-printed answer will be found in the Support column for this: instead, the supplier shall write the missing answer into the Support column, together with an X<i> reference to an item of Exception Information, and shall provide the appropriate rationale in the Exception item itself.

An implementation for which an Exception item is required in this way does not conform to ISO/IEC 10177.

NOTE — A possible reason for the situation described above is that a defect in ISO/IEC 10177 has been reported, a correction for which is expected to change the requirement not met by the implementation.

A.3.4 Conditional items

The PICS proforma contains a number of conditional items. These are items for which both the applicability of the item itself, and its status if it does apply — mandatory or optional — are dependent upon whether or not certain other items are supported.

Where a group of items is subject to the same condition for applicability, a separate preliminary question about the condition appears at the head of the group, with an instruction to skip to a later point in the questionnaire if the "Not Applicable" answer is selected. Otherwise, individual conditional items are indicated by a conditional symbol of the form "<item>: <s>" in the Status column, where <item> is an item reference that appears in the first column of the table for some other item, and <s> is a status symbol, M or O.

If the item referred to by the conditional symbol is marked as supported, the conditional item is applicable, and its status is given by <s>: the support column is to be completed in the usual way. Otherwise, the conditional item is not relevant and the Not Applicable (N/A) answer is to be marked.

Each item whose reference is used in a conditional symbol, or in a preliminary question for grouped conditional items, is indicated by an asterisk in the Item column.

A.4 PICS Proforma — ISO/IEC 10177 : Identification

A.4.1 Implementation identification

Supplier	
Contact point for queries about the PICS	
Implementation Name(s) and Version(s)	
Other information necessary for full identification — eg, name(s) and version(s) of machines and/or operating systems; system names	

NOTES

1 Only the first three items are required for all implementations; other information may be completed as appropriate in meeting the requirement for full identification.

2 The terms Name and Version should be interpreted appropriately to correspond with a supplier's terminology (eg, Type, Series, Model).

A.4.2 Protocol summary, ISO/IEC 10177 : 1993

Identification of protocol specification	ISO/IEC 10177 : 1993	
Identification of amendments and corrigenda to this PICS proforma which have been completed as part of this PICS	ISO/IEC 10177 : 1993/ Amd. : Corr. : Amd. : Corr. :	
Have any Exception items been required (see A.3.3)? (The answer Yes means that the implementation does not conform to ISO/IEC 10177 : 1993)	No ☐	Yes ☐

Date of Statement	

A.5 PICS Proforma — ISO/IEC 10177 : NC establishment and release

Item	Protocol feature	References	Status	Support	
NC	NC mapping to Logical Channels	7	M	Yes ☐	
	NC establishment:				
* VI	— incoming on VC	8.1	O.1	Yes ☐	No ☐
* VO	— outgoing on VC	8.1	O.1	Yes ☐	No ☐
* PI	— incoming on PVC	8.1, 10	O.1	Yes ☐	No ☐
* PO	— outgoing on PVC	8.1, 10	O.1	Yes ☐	No ☐
AE	full N-address encoding (in AEF)	8.8	M	Yes ☐	
	AF-only N-address encoding of:	8.9			
AFa	sent Calling Address		VO: O	N/A ☐ Yes ☐	No ☐
AFb	sent Called Address		VO: O	N/A ☐ Yes ☐	No ☐
AFc	received Responding Address		VO: O	N/A ☐ Yes ☐	No ☐
AFd	received Calling Address		VI: O	N/A ☐ Yes ☐	No ☐
AFe	received Called Address		VI: O	N/A ☐ Yes ☐	No ☐
AFf	sent Responding Address		VI: O	N/A ☐ Yes ☐	No ☐
CS	RC selection	8.10	M	Yes ☐	
ES	ED selection	8.11	M	Yes ☐	
	QOS negotiation:				
QT	— throughput	8.12	M	Yes ☐	
QD	— transit delay	8.13	M	Yes ☐	
QP	— priority	8.14	M	Yes ☐	
CC	connection control parameters	8.16	O	Yes ☐	No ☐
UD	NS-User-Data at NC establishment and NC release	8.15	M	Yes ☐	
RL	NC release	8.2 - 8.6	M	Yes ☐	
YY	Error diagnostics	8.17, 8.18	M	Yes ☐	

NOTE — Item PI is used in a conditional symbol in A.7. Items VI, VO, PI and PO are used in the modified PICS requirements for ISO/IEC 8208 specified in Annex B, as basis for conditional status of certain sets of ISO/IEC 8208 items: see B.4, B.5, B.6, B.7.

A.6 PICS Proforma — ISO/IEC 10177 : Data transfer phase

Item	Protocol feature	References	Status	Support	
DT	normal data transfer	9.1.1, 9.1.2	M	Yes ☐	
FC	flow control	9.1.3 - 9.1.6	M	Yes ☐	
RS	NC reset	9.3.1 - 9.3.7	M	Yes ☐	
* ED	expedited data transfer	9.2	O	Yes ☐	No ☐
* RC	receipt confirmation	9.1.2, 9.1.7	O	Yes ☐	No ☐

NOTE — Item ED is used in the modified PICS requirements for ISO/IEC 8208 specified in Annex B, as basis for conditional status of certain ISO/IEC 8208 items: see B.3, B.6, B.7. Item RC is used similarly, see B.3.

A.7 PICS Proforma — ISO/IEC 10177 : Mapping-protocol violations

Item	Protocol feature		References	Status	Support	
	Action on erroneous received packets (RL: NC release; RS: NC reset)					
MVe1 MVe2	INTERRUPT when non-use of ED has been negotiated	RL: RS:	8.6 9.3.2	O O	Yes ☐ Yes ☐	No ☐ No ☐
MVd1 MVd2	D-bit set to 1 when non-use of RC has been negotiated	RL: RS:	8.6 9.3.2	O O	Yes ☐ Yes ☐	No ☐ No ☐
MVq1 MVq2	Q-bit set to 1	RL: RS:	8.6 9.3.2	O O	Yes ☐ Yes ☐	No ☐ No ☐
MVz1 MVz2 MVz3	Zero-length M-bit sequence	RL: RS: ignore:	8.6 9.3.2 9.1.1	O O O	Yes ☐ Yes ☐ Yes ☐	No ☐ No ☐ No ☐
	If incoming NCs, item VI or PI, are not supported, mark N/A and continue at item MVca: Is the NC released on the following errors in received packets or packet-images:				N/A ☐	
MVia	Called Address error in INCOMING CALL		8.7.1 (1)	M	Yes ☐	
MVib	Calling Address error in INCOMING CALL		8.7.1 (1)	M	Yes ☐	
MVic	Fast Select facility missing from INCOMING CALL		8.7.1 (2)	M	Yes ☐	
MVid	Throughput Class Negotiation facility missing from INCOMING CALL		8.7.1 (2)	M	Yes ☐	
MVie	MTCN, TDSAI or EETDN missing from INCOMING CALL packet-image		8.7.1 (3)	**PI:** M	N/A ☐	Yes ☐
MVif	Inconsistent QOS subparameters in INCOMING CALL		8.7.1 (4)	M	Yes ☐	
	If outgoing NCs, item VO or PO, are not supported, mark N/A:				N/A ☐	
MVca	Responding Address error in CALL CONNECTED		8.6, 8.7.2 (a), 8.7.2 (b)	M	Yes ☐	
MVcb	EETDN facility missing from CALL CONNECTED		8.6, 8.7.2 (c)	M	Yes ☐	
MVcc	Invalid Selected QOS value in CALL CONNECTED		8.6, 8.7.2 (d)	M	Yes ☐	

Annex B
(normative)

Modified PICS requirements for ISO/IEC 8208

B.1 Introduction

Use of ISO/IEC 10177 imposes requirements on the underlying ISO/IEC 8208 implementation that go beyond those of ISO/IEC 8208 itself; these result in modifications to the requirements expressed in the ISO/IEC 8208 PICS proforma. This annex specifies the modifications that apply to the status of the items affected in the ISO/IEC 8208 PICS proforma, with consequently modified requirements on the answers to be provided.

The set of applicable modifications depends upon whether the Virtual Call service or Permanent Virtual Circuit service (or both) is to be used in support of Network connections, and in the case of the Virtual Call service upon whether incoming or outgoing Network connections (or both) are to be supported. These different cases are covered in different subclauses of this annex. Note that each affected ISO/IEC 8208 item appears in only one subclause below: that is, no modification made by one subclause is affected by any other.

Most of the modifications consist in a change from optional or conditional status to mandatory or, in a few cases, prohibited status; there is a small group of modifications that are conditional upon support of one particular ISO/IEC 8208 item.

There are five ISO/IEC 8208 items for which the modification is conditional, depending upon whether or not the optional expedited data transfer feature of ISO/IEC 10177 is supported (as marked in the PICS proforma in annex A), and one ISO/IEC 8208 item for which the modification is conditional, depending upon whether or not the optional receipt confirmation feature of ISO/IEC 10177 is supported.

B.2 Abbreviations and special symbols

B.2.1 Status symbols

M	mandatory
X	prohibited
<item>:	conditional symbol, status is dependent on the support marked for <item> (see A.3.4)

B.2.2 Other symbols

D-bit	Delivery Confirmation bit
LC	logical channel
NC	Network connection
PICS	Protocol Implementation Conformance Statement
PVC	Permanent Virtual Circuit