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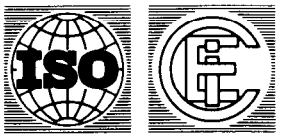
Information technology — Telecommunications and information exchange between systems — Operation of an X.25 interworking unit

Systèmes de traitement de l'information — Communication de données — Fonctionnement d'une unité d'interfonctionnement X.25



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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) together form a system for worldwide standardization as a whole. 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.

The main task of a technical committee is to prepare International Standards but in exceptional circumstances, the publication of a technical report of one of the following types may be proposed:

- type 1, when the necessary support within the technical committee cannot be obtained for the publication of an International Standard, despite repeated efforts;

- type 2, when the subject is still under technical development requiring wider exposure;

- type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ('state of the art', for example).

Technical reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/IEC/TR 10029, which is a technical report of type 2, was prepared by ISO/IEC JTC 1, *Information technology.*

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Introduction

The preparation of ISO 8881 included, as an annex, the operation of an interworking unit that would enable a Local Area Network (LAN) to be interconnected to other X.25 Wide Area Networks (WANs). During these studies it became clear that the field of application of the X.25 interworking unit was not limited to LAN/WAN interconnection and the work was separated from ISO 8881 and attached to ISO 8880-2.

Following further development as part of ISO 8880-2 it was observed that the technical content was in the form of guidance to implementors and as a consequence the document contained no specification nor conformance requirements. However those studies indicated that further consideration should be directed towards ISO 8208 and in particular to the classification of facilities. For example, a facility marked as applicable only to DTE/DCE operation could also be applicable to DTE/DTE operation where one of the DTE's is an X.25 interworking unit (IWU) as described in this technical report.

Rather than delay the publication of this technical material until the complementary studies have been concluded, this technical report is published in order to give guidance to implementors on the operation of an IWU.

Various networks employ the ISO 8208 X.25 Packet Layer Protocol (PLP) to carry communications between data terminals. An IWU provides the means to interconnect those networks in order that a terminal on one network can communicate with a terminal or make use of facilities on a different network. Typically, an IWU could be located between a LAN where the attached terminals use the X.25 PLP as defined in ISO 8881, and a WAN which is a Packet Switched Data Network where the terminals use the X.25 PLP protocol as defined in ISO 8208, or between LANs.

This Technical Report describes the functions performed by an IWU which operates between subnetworks that use ISO 8208 in conjunction with various lower layer protocols. The ISO 8208 protocols on each side of the IWU are closely coupled but are not necessarily equal in configuration. The protocols at the lower layers are independent of each other.

NOTE — The method of interworking described in this Technical Report is a method of internetworking at the level of the ISO 8208 Protocol Data Units. A standard specifying internetworking using the semantics of the OSI Network Service is currently being developed.

In order to avoid duplicating the definitions for the operation of the X.25 PLP in this Technical Report, extensive reference to specific text in ISO 8208 is made. The references given are to clauses, figures, and tables as identified in the first edition of ISO 8208.

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Information technology — Telecommunications and information exchange between systems — Operation of an X.25 interworking unit

1 Scope

This Technical Report describes the function of the IWU in terms of the mapping between Protocol Data Units (PDUs) that it receives from one interface, and PDUs that it then transmits, which could be on either interface of the IWU. Additionally, this Technical Report describes the procedures that an IWU can initiate on each interface independently.

Each interface corresponds to one instance of a DTE/DXE connection, and both interfaces of the Interworking Unit operate as a DTE as specified by ISO 8208.

NOTE – The term 'DXE' is used as defined in ISO 8208 meaning "...those contexts where it would not matter whether a DTE or a DCE was being referred to."

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Technical Report. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Technical Report 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 8208:1987, *Information processing systems — Data communications — X.25 Packet Level Protocol for Data Terminal Equipment.*

ISO 8880-2: —[1], *Information processing systems — Protocol combinations to provide and support the OSI network service — Part 2: Provision and support of the connection-mode network service.*

ISO 8881: —[1], *Information processing systems — Data communications — Use of the X.25 Packet Level Protocol in Local Area Networks.*

1) To be published.

3 Abbreviations

DCE	Data Circuit-terminating Equipment
DTE	Data Terminal Equipment
IWU	Interworking unit
LAN	Local Area Network
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
PLP	Packet Level Protocol
WAN	Wide Area Network

4 General considerations

4.1 Logical channels

The logical channel identifiers used on one interface of the IWU will not, in general, correspond to those used on the other interface of the IWU. The IWU performs the mapping function between logical channel identifiers on the two interfaces. This mapping is one-to-one and is established during Virtual Call setup.

4.2 Interface types and references

The operation of the IWU is described in terms of its two interfaces. For ease of reference only, the two interfaces are referred to as 'interface 1' and 'interface 2'. Refer to figure 1.

The procedures described in this Technical Report are applicable to either interface. In this Technical Report external events, are described in terms of one direction only; in some cases a corresponding event occurs on interface 2. For events initiated by the IWU the procedures at both interfaces are described.

4.3 Mapping between dissimilar protocol configurations

Mapping between PDUs received on interface 1 might not be on a one-to-one basis to those transmitted on interface 2 due to the differences which are possible within ISO 8208.

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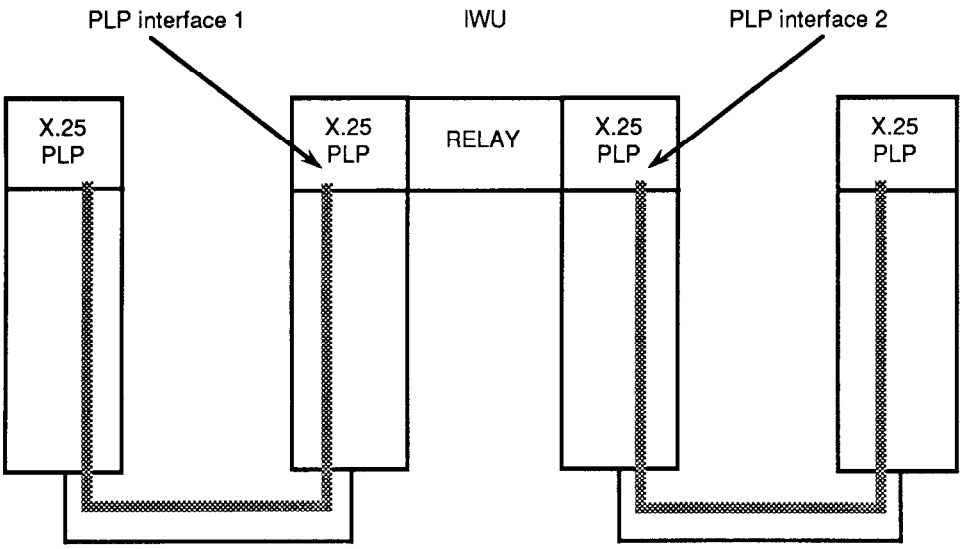

Each interface corresponds to one instance of a DTE/DXE connection. Both interfaces operate as a DTE as specified by ISO 8208.

Figure 1 – Operation of an X.25 to X.25 IWU

5 Procedures for restart

5.1 Interface restart not initiated by the IWU

When receiving a RESTART INDICATION packet on interface 1, the IWU confirms this restart by sending a RESTART CONFIRMATION packet across interface 1 according to the procedures in clause 4 of ISO 8208.

For each Virtual Call, if any, that had existed on interface 1, the IWU initiates clearing procedures on interface 2. The Clearing Cause Field is set to either "00000000" or "10000000" as indicated in table 5 of ISO 8208.

5.2 Interface restart initiated by the IWU

To restart interface 1, the IWU transmits a RESTART REQUEST packet as specified in 4.1 of ISO 8208. The restarting cause code to be used is given in table 7 of ISO 8208. For each Virtual Call, if any, that had existed on interface 1, the IWU initiates clearing procedures on interface 2.

6 Procedures for virtual call setup and clearing

6.1 Virtual call setup

6.1.1 Virtual call initiation

When the IWU receives an INCOMING CALL packet on interface 1 it

a) determines the remote interface (interface 2);

b) matches window sizes and packet sizes for interface 1 (implied by default or explicitly requested in the INCOMING CALL packet) to those available on interface 2 (available by default or through negotiation if allowed on the interface);

NOTE — If the IWU does not have segmentation and reassembly capabilities, the IWU should ensure that the maximum DATA packet size on each interface is identical. If the packet sizes on interface 1 and interface 2 are dissimilar, the IWU should clear the call. If the IWU does have segmentation and reassembly capabilities, then the relationship of packet sizes on the two interfaces is a result of IWU action during virtual call setup.

c) matches optional user facilities requested from interface 1 to those available on interface 2 (see also clause 14 of ISO 8208);

d) selects a free logical channel on interface 2; and

e) transmits a CALL REQUEST packet on interface 2.

If any anomalies result from the above procedures (for example, no logical channel allowing outgoing access available on interface 2, or requested facilities not being available on interface 2) the IWU clears the call on interface 1. A CALL REQUEST packet is not transmitted on interface 2 in this case.

NOTE — Where the data link layer is not already active at an interface, the IWU should establish a data link connection using the procedures appropriate to that interface, for example according to ISO 7776 or ISO 8802-2.

6.1.2 Virtual call response

6.1.2.1 Successful call response

If the IWU receives a CALL CONNECTED packet as a result of having transmitted a CALL REQUEST packet on interface 2, it transmits a CALL ACCEPTED packet on the logical channel corresponding to the original INCOMING CALL packet on interface 1.

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6.1.2.2 Unsuccessful call response

If the IWU receives a CLEAR INDICATION packet as a result of having transmitted a CALL REQUEST packet on interface 2, it

a) follows the procedures of 5.5.2 of ISO 8208 for responding to a CLEAR INDICATION packet on interface 2; and

b) initiates a clearing procedure on the logical channel corresponding to the original INCOMING CALL packet on interface 1.

Details of the clearing cause and diagnostic codes to be transmitted on interface 1 are given in annex A of ISO 8208.

6.2 Virtual call clearing

6.2.1 Clearing not initiated by the IWU

When the IWU receives a CLEAR INDICATION packet on an interface, it

a) follows the procedures of 5.5.2 of ISO 8208 for responding to a CLEAR INDICATION packet; and

b) initiates clearing procedures on the corresponding interface if the logical channel indicated in the CLEAR INDICATION packet is associated with a logical channel on another interface.

Details of the clearing cause and diagnostic codes to be transmitted on interface 1 are given in annex A of ISO 8208.

6.2.2 Clearing initiated by the IWU

To clear a Virtual Call on interface 1, the IWU transmits a CLEAR REQUEST packet as specified in 5.5.1 of ISO 8208. The clearing cause codes defined in table 5 of ISO 8208 (with bit 8 set to 1) are used. The clearing diagnostic codes defined in figure 14 of ISO 8208 are used.

If the Virtual Call is associated with a logical channel on interface 2, the IWU initiates clearing procedures on interface 2.

7 Procedures for data and interrupt transfer

7.1 Procedures for data transfer

The aspects of data transfer, as defined in clause 6 of ISO 8208, that are relevant to IWU operation are

a) the maximum User Data field size of the two interfaces and the need to perform segmentation and reassembly using the M-bit (see 6.2 and 6.4 of ISO 8208); and

b) the integrity of complete packet sequences, including the settings of the D-bit and Q-bit (see 6.3, 6.5, and 6.6 of ISO 8208) in each DATA packet.

7.2 Procedures for interrupt

When the IWU receives an INTERRUPT packet on interface 1, it follows the procedures indicated in 6.8.2 of ISO 8208. The Interrupt User Data carried in the INTERRUPT packet received on interface 1 is transmitted in an INTERRUPT packet on interface 2 following the procedures for interrupt transmission specified in 6.8.1 of ISO 8208.

When the IWU receives an INTERRUPT CONFIRMATION packet on interface 2 having previously transmitted an Interrupt packet on that interface, the IWU transmits an INTERRUPT CONFIRMATION packet on interface 1 as specified in 6.8.3 of ISO 8208.

NOTE — The procedures for error conditions associated with interrupt are defined in 6.8.2 of ISO 8208.

8 Procedures for flow control

The aspects of flow control, as defined in clause 7 of ISO 8208, that are relevant to IWU operation are

a) that the IWU may use flow control procedures independently on each interface; and

b) that the receipt of a DATA packet with the D-bit set to 1 should not result in window rotation on interface 1 until rotation of the window on interface 2 for all the user data in the originally received DATA packet.

9 Procedures for reset

9.1 Resetting not initiated by the IWU

If the IWU receives a RESET INDICATION packet on interface 1 it

a) follows the procedures of 8.2 of ISO 8208 for responding to a RESET INDICATION packet; and

b) initiates a resetting procedure for the corresponding logical channel on interface 2 as defined in 8.1 of ISO 8208.

9.2 Resetting initiated by the IWU

If the IWU needs to reset a Virtual Call (other than as a result of 9.1 b) it follows the procedures of 8.1 of ISO 8208 for originating a RESET REQUEST on interface 1 and the corresponding logical channel on interface 2.

The resetting cause codes defined in table 6 of ISO 8208 (with bit 8 set to 1) are used. The resetting diagnostic codes defined in figure 14 of ISO 8208 are used. The IWU buffers subsequent user data received after the resetting of interface 1 is completed but before the resetting on interface 2 is completed.

10 Optional user facilities

10.1 Categorization of facilities

The IWU is required to administer the X.25 optional user facilities. It is necessary for the IWU to have knowledge of the administrative arrangements of the subnetworks which it interconnects. In this regard the IWU is asymmetrical with respect to the two interfaces (as distinct from the general procedures described earlier). The IWU gains this knowledge by local administrative arrangements, or by use of the On-line Facility Registration facility.

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The optional user facilities, as specified in clause 13 and clause 14 of ISO 8208, are categorized as follows.

A Facilities where the IWU can prevent the progress of virtual call establishment for local reasons, or due to incompatibilities between the subnetworks.

B Facilities that are not to be modified by the IWU, since such modification would result in incorrect operation.

C Facilities that the IWU may modify.

D Facilities which are only applicable to one interface (ie, they are not visible at the other interface).

NOTE — These categories are not exclusive, and an optional user facility may exist in more than one category.

Table 1 depicts the categorization of the optional user facilities.

10.2 Additional considerations

10.2.1 Transit Delay Selection And Indication, and End-to-End Transit Delay Negotiation facilities

The IWU modifies the values in these facilities to reflect the transit delay introduced by the subnetwork and the IWU. If the total delay then exceeds the maximum acceptable transit delay value, if specified by the remote calling DTE in the End-to-End Transit Delay Negotiation Facility, then the IWU clears the Virtual Call.

10.2.2 Closed user group related facilities

For a subnetwork the allocation of indices in Closed User Group Related Facilities is administered by the network administration, or administered by the IWU.

NOTE — When subscribing to a PSDN interface, the IWU needs to subscribe to proper optional user facilities (see for example annex A of ISO 8208).

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Table 1 – Categorization of optional user facilities

Optional User Facility (Refer to ISO 8208 clause 13 and clause 14)	CATEGORY A	B	C	D
Online Facility Registration				•
Extended Packet Sequence Numbering				•
D-bit Modification			•	
Packet Retransmission Facility				•
Incoming Calls Barred	•			•
Outgoing Calls Barred	•			
One-way Logical Channel Outgoing				•
One-way Logical Channel Incoming				•
Non-standard Default Packet Sizes	•			•
Non-standard Default Window Sizes	•			•
Default Throughput Classes Assignment				•
Flow Control Parameter Negotiation	•		•	•
Throughput Class Negotiation			•	
Closed User Group Related Facilities	•		•	
Bilateral Closed User Group Related Facilities	•		•	
Fast Select	•	•		
Fast Select Acceptance	•			
Reverse Charging	•			
Reverse Charging Acceptance	•			•
Local Charging Prevention	•			•
Network User Identification				•
Charging Information				•
RPOA Selection		•		
Hunt Group				•
Call Redirection				•
Called Line Address Modified Notification		•		
Call Redirection Notification		•		
Transit Delay Selection And Indication			•	
Calling Address Extension		•		
Called Address Extention		•		
Minimum Throughput Class Negotiation	•			
End-to-End Transit Delay Negotiation	•		•	
Expedited Data Negotiation	•		•	

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Descriptors : data processing, information interchange, telecommunications, input-ouputs units.

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