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Information technology — Use of X.25 Packet Layer Protocol to provide the OSI connection-mode Network Service over the telephone network

Technologies de l'information— Utilisation du protocole X.25 de couche de paquet pour fournir le service réseau OSI en mode connexion sur le réseau téléphonique



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Foreword

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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 10732 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in collaboration with the CCITT. The identical text is published as CCITT Recommendation X.614.

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CCITT RECOMMENDATION

INFORMATION TECHNOLOGY – USE OF X.25 PACKET LAYER PROTOCOL TO PROVIDE THE OSI CONNECTION-MODE NETWORK SERVICE OVER THE TELEPHONE NETWORK

1 Scope

This CCITT Recommendation | International Standard is applicable to the environments where the X.25 packet layer protocol, as standardized in (PLP) ISO/IEC 8208, is operated over a telephone network connection to provide the OSI Connection-mode Network Service (CONS). These environments include

a) telephone network leased circuit connection between two DTEs;

b) telephone network switched connection between two DTEs;

c) DTE access to a PSDN via a telephone network leased circuit connection; and

d) DTE access to a PSDN via a telephone network switched connection.

This provision is achieved by specifying the mapping of the CONS primitives and parameters to and from the elements of the protocols used.

2 Normative references

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

2.1 Identical Recommendations | International Standards

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

2.2 Paired Recommendations | International Standards equivalent in technical content

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

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

- CCITT Recommendation X.210 (1988), *Open Systems Interconnection Layer Service Definition Conventions.*

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

- CCITT Recommendation X.223 (1988), *Use of X.25 to provide the OSI connection-mode network service for CCITT applications.*

  ISO 8878:1987, *Information processing systems – Data communications – Use of X.25 to provide the OSI Connection-Mode Network Service.*

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2.3 Additional references

- CCITT Recommendation V.25 (1988), *Automatic answering equipment and/or parallel automatic calling equipment on the general switched telephone network including procedures for disabling of echo control devices for both manually and automatically established calls.*
- CCITT Recommendation V.25 *bis* (1988), *Automatic calling and/or answering equipment on the general switched telephone network (GSTN) using the 100-Series interchange circuits.*
- CCITT Recommendation X.25 (1988), *Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit.*
- CCITT Recommendation X.32 (1988), *Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and accessing a packet switched public data network through a public switched telephone network or an integrated services digital network or a circuit switched public data network.*
- ISO 7776:1986, *Information processing systems – Data communication – High-level data link control procedures – Description of the X.25 LAPB-compatible DTE data link procedures.*
- ISO/IEC 8208:1990, *Information technology – Data communications – X.25 Packet Layer Protocol for Data Terminal Equipment.*

3 Definitions

For the purposes of this Recommendation | International Standard, the following definitions apply.

3.1 Reference model definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Recommendation X.200 | ISO 7498:

a) Network Connection;
b) Network Layer;
c) Network Service.

3.2 Service conventions definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Recommendation X.210 | ISO/TR 8509:

a) Network Service provider;
b) Network Service user.

3.3 Network service definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Recommendation X.213 | ISO/IEC 8348:

a) N-CONNECT request;
b) N-DISCONNECT indication.

3.4 X.25 definitions

This Recommendation | International Standard makes use of the following terms defined in CCITT Recommendation X.25 and ISO/IEC 8208:

a) Data circuit-terminating equipment;
b) Data terminal equipment;
c) Registration packet;
d) Virtual call.

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4 Abbreviations

4.1 Reference model abbreviations

NL Network Layer

NS Network Service

OSI Open Systems Interconnection

4.2 Network service abbreviations

CONS Connection-mode Network Service

NSAP Network Service access point

QOS Quality of service

SNPA Subnetwork point of attachment

4.3 X.25 abbreviations

DCE Data circuit-terminating equipment

DTE Data terminal equipment

HIC Highest incoming channel

HOC Highest outgoing channel

HTC Highest two-way channel

LAPB Link access procedure – balanced

LIC Lowest incoming channel

LOC Lowest outgoing channel

LTC Lowest two-way channel

PLP Packet layer protocol

4.4 Other abbreviations

PSDN Packet switched data network (public or private)

5 Overview

There are two basic configurations where the X.25 packet layer protocol (PLP), as standardized in ISO/IEC 8208, may be operated over a telephone network connection to provide the OSI Connection-mode Network Service (CONS) defined in CCITT Rec. X.213 | ISO/IEC 8348.

The first configuration is shown in Figure 1a) where two X.25 DTEs are directly connected by a telephone network connection. In this case each DTE operates the DTE/DTE mode of ISO/IEC 8208 (X.25 PLP) and ISO 7776 (X.25 LAPB). The telephone network connection may be a leased circuit or switched.

The second configuration is shown in Figure 1b) where an X.25 DTE accesses a PSDN. In this case the DTE operates the DTE/DCE mode of ISO/IEC 8208 (X.25 PLP) and ISO 7776 (X.25 LAPB). When the telephone network connection is a leased circuit this configuration is a regular X.25 scenario, while it relates to X.32 when the telephone network connection is switched.

CCITT Rec. X.223 | ISO 8878 specifies the method for providing the OSI Connection-mode Network Service (CONS) through the use of the X.25 packet layer protocol (PLP). CCITT Rec. X.223 | ISO 8878 covers the case of an X.25 DTE directly connected to another DTE or directly connected to a packet switched data network. When a switched telephone network connection is introduced into the path between the DTEs or between the DTE and a PSDN, a few provisions additional to those contained in CCITT Rec. X.223 | ISO 8878 are necessary. These additional provisions for a DTE connected to the switched telephone network are specified by this Recommendation | International Standard.

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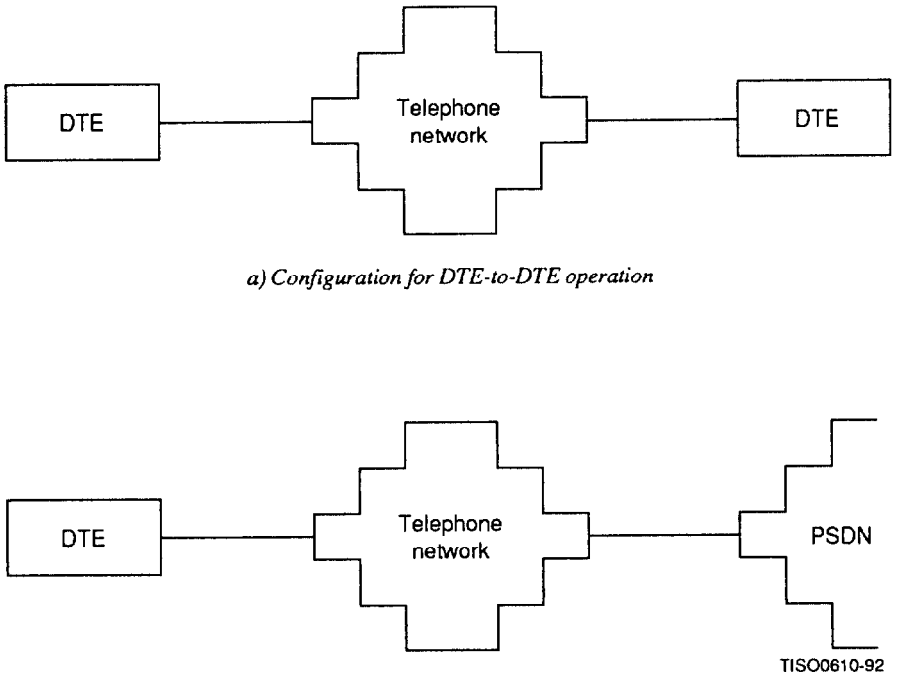
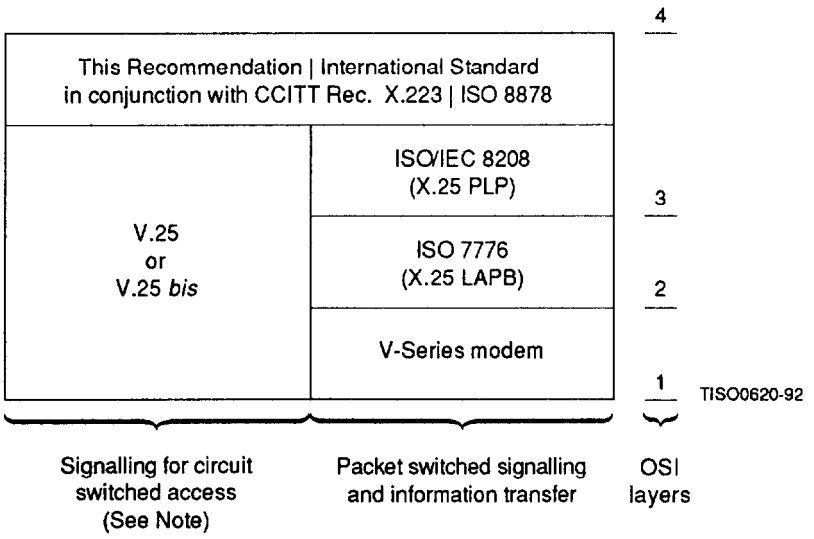


a) Configuration for DTE-to-DTE operation

b) Configuration for DTE-to-PSDN operation

Figure 1 – Configurations

The applicable protocol stack is given in Figure 2. The X.25 PLP is used to convey all elements of all three phases of the OSI CONS. CCITT Rec. X.223 | ISO 8878 applies with regard to the mapping of the CONS primitives and parameters to the elements of the X.25 PLP. However, in certain cases discussed in the clauses below, additional provisions apply before these mappings can take place (e.g. to cover establishment of a switched connection over the telephone network) or in addition to these mappings (e.g. to cover an unexpected disconnection of the switched connection).



NOTE – These procedures are not used in the leased circuit case.

Figure 2 – Protocol stack

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At the physical layer a V-series modem interface is used. Either Recommendation V.25 or V.25 *bis* may be used for signaling for a switched connection over the telephone network.

At the data link layer ISO 7776, as constrained by clause 7 of this Recommendation I International Standard, is used.

At the network layer ISO/IEC 8208, as constrained by clause 8 of this Recommendation I International Standard, is used.

The mapping of the elements of the CONS to the protocol and procedures of ISO/IEC 8208 shall be as required by CCITT Rec. X.223 I ISO 8878. The remaining clauses of this Recommendation I International Standard specify the provisions required in addition to these mappings.

6 Control of underlying connections

The following clauses cover the two types of underlying connections that can be operated: leased circuit connection and switched connection.

6.1 Leased circuit connection

No additional procedures are required.

6.2 Switched connection

6.2.1 Switched connection originated by DTE

The following additional procedures shall be used if a telephone network connection is not already established or if an additional telephone network connection is needed to support the additional traffic.

The receipt by layer 3 of an N-CONNECT request primitive shall first cause the procedures to be used to establish the telephone network connection. Following the successful establishment of this connection and the modems have entered the data transfer phase, the ISO 7776 and ISO/IEC 8208 procedures shall apply as constrained by clauses 7 and 8 of this Recommendation I International Standard.

Failure to establish the connection is indicated to the NS user by means of an N-DISCONNECT indication primitive with the originator parameter indicating "NS provider" and the reason parameter indicating "connection rejection – reason unspecified – transient".

6.2.2 Switched connection originated toward DTE

Once the telephone network connection is established and the modems have entered the data transfer phase, the ISO 7776 and ISO/IEC 8208 procedures shall apply as constrained by clauses 7 and 8 of this Recommendation I International Standard.

6.2.3 Disconnection of the switched connection

If one or more OSI Network Connections are established or in the process of being established on an established switched telephone network connection and this switched connection is disconnected or has failed (e.g. a failure occurred and a recovery might have been attempted but was not possible), then the provisions of ISO/IEC 8208 and CCITT Rec. X.223 I ISO 8878 concerning the failure of layer 1 apply to the mapping to an N-DISCONNECT indication primitive for each OSI Network Connection established or in the process of being established.

It is a local matter as to under what conditions a DTE would initiate a disconnection of the switched telephone network connection (e.g. upon clearing of the last Virtual Call).

It is also a local matter whether the data link connection is released prior to the release of the switched telephone network connection.

NOTE – It is possible that a switched telephone network connection can be disconnected and a new connection established very quickly without the higher layers of the DTE being informed. Indeed a temporary loss of a connection may be short enough to be totally masked from the higher layers by the normal operation of the ISO 7776 procedures. If the possibility of such a change of connection is undesirable to the DTE, steps should be taken to detect such a brief loss of the connection, and the connection should be explicitly disconnected by the DTE. In addition, the DTE should also refrain from attempting to establish a new switched telephone network connection too soon after disconnecting the connection.

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6.2.4 Identification

When establishing a switched connection, it may be necessary to exchange identification information for various reasons (e.g. for billing or security purposes). The need for, and method(s) of, identification exchange will, in general, be known *a priori* and depend on the mode of operation.

For the mode of operation where a switched telephone network connection is used to connect two DTEs directly, there are three cases governing the need for identification exchange:

a) no exchange is ever needed between the two DTEs;

b) an exchange is always needed between the two DTEs; or

c) the need, or lack of need, of an exchange depends on other factors known to the two DTEs.

For the mode of operation where a switched telephone network connection is used to connect a DTE and a DCE, the need for an identification exchange is governed by the PSDN requirements and the PSDN services the DTE desires to use (services are defined in Recommendation X.32).

When an exchange of identification information is needed, the method(s) of exchange will be selected from the methods given in Recommendation X.32 (see the Note below). For DTE-to-DTE operation, the method is agreed between the two DTEs on an *a priori* basis. For DTE-to-DCE operation, the requirements of the PSDN will govern which method is to be used.

NOTE – Although Recommendation X.32 specifies the identification procedures as DTE-to-DCE, they are applied to the DTE-to-DTE case by this Recommendation | International Standard.

7 Data link layer

7.1 Mode of protocol

The basic mode (modulo 8) single link procedures shall be implemented. The extended mode (modulo 128) single link procedure may also be implemented.

7.2 Address assignment

For DTE-to-DTE operation over a switched connection and for DTE access to a PSDN via a switched connection, the A and B addresses of ISO 7776 shall be determined as follows: the calling end is assigned address A and the called end is assigned address B unless the assignment is known *a priori*.

For access to a PSDN via a leased circuit, the A and B addresses shall be as specified in Recommendation X.25. For DTE-to-DTE operation over a leased circuit, the A and B addresses shall be known *a priori*.

7.3 Parameter values

It is recommended that the T1 timer be capable of being set to a value of 5 s in order to cope with multiple satellite links.

It is recommended that 1 031 octet frames be supported in order to accommodate satellite connections.

NOTE – In addition to these recommendations, the use of large windows, requiring the use of extended mode (modulo 128) operation may be advisable, particularly if multiple satellite hops are likely.

8 Packet layer

8.1 General

In general the features defined in CCITT Rec. X.223 | ISO 8878 apply with regards to the QOS parameters and addressing. The following additional considerations apply to the operation of some specific mechanisms in Recommendations X.25 and X.32.

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8.2 Addressing

8.2.1 DTE-to-DTE Configuration

Telephone network addressing is used to establish the telephone network connection between the two concerned SNPAs.

The X.25 Address Field is not used (i.e. it is empty) in this case, and the Called and Calling NSAP addresses are entirely conveyed in the Called and Calling Address Extension facilities.

If packets are received which contain addressing information in the Address Field, this information shall be ignored.

8.2.2 DTE-to-DCE Configuration

Telephone network addressing is used to establish the telephone network connection between the two concerned SNPAs (i.e. the DTE and the PSDN).

The X.25 Address Field and the Called and Calling Address Extension facilities are used as defined in CCITT Rec. X.223 | ISO 8878.

8.3 QOS parameters

8.3.1 Throughput QOS parameters

The calling NL entity should have an *a priori* knowledge of the data signalling rate employed by the modems operating over the telephone network.

This knowledge is used to determine the value of the throughput and to determine if a new telephone network connection is to be established to meet the NS user requirements.

8.3.2 Transit delay QOS parameter

Due to the limited signalling capabilities of the telephone network, the calling NL entity should have an *a priori* knowledge of the transit delay of the connection. This *a priori* knowledge may be obtained via knowledge of the network topology or via monitoring of the connection characteristic.

The value of the telephone network transit delay is used as part of the calculation in determining the cumulative transit delay carried in the End-to-End Transit Delay Negotiation facility (see CCITT Rec. X.223 | ISO 8878).

8.4 Window size and packet size parameters

If only one virtual circuit is to be used, an appropriate window size should be supported.

NOTE – For consistency with protocol implementations operating over other types of transparent connections, it may be desirable to support 1024 octet data packets.

8.5 Logical channel ranges

The logical channel ranges (LIC, HIC, LTC, HTC, LOC and HOC in ISO/IEC 8208) to be used are determined by local knowledge if available. If local knowledge is not available, then only a single two-way logical channel is available and LTC and HTC shall be set to 1.

If additional logical channels are required, they may be negotiated by using the Registration packet as described in ISO/IEC 8208. In order to avoid collision of Registration packets, the circuit initiator is responsible for initiating the negociation.

8.6 Role selection

In the absence of *a priori* knowledge, the Restart procedure shall be used for role selection as described in ISO/IEC 8208.

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Annex A

Bibliography

(This annex does not form an integral part of this Recommendation | International Standard.)

Additional references

- CCITT Recommendation X.610 (1992), *Provision and support of the OSI connection-mode network service.*
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