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DATA NETWORKS AND OPEN SYSTEM COMMUNICATIONS

INTERWORKING BETWEEN NETWORKS

GENERAL ARRANGEMENTS FOR INTERWORKING BETWEEN PACKET SWITCHED PUBLIC DATA NETWORKS (PSPDNs) AND PRIVATE DATA NETWORKS FOR THE PROVISION OF DATA TRANSMISSION SERVICES

ITU-T Recommendation X.327

(Previously “CCITT Recommendation”)

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation X.327 was revised by ITU-T Study Group 7 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 16th of November 1993.

NOTE

In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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SUMMARY

This Recommendation describes the interworking arrangements between PSPDNs and private data networks for the provision of data transmission services. These interworking arrangements include the capabilities required to support the network service for Open Systems Interconnection for ITU-T applications as described in Recommendation X.213. The current Recommendation has taken into account the market demand for the PSPDN to provide the gateway function allowing interconnection on a peer-to-peer basis between the public and private network.

INTRODUCTION

This Recommendation is one of a set of Recommendations produced to facilitate considerations of interworking between networks. It is based on Recommendation X.300 which defines the general principles for interworking between public networks, and between public networks and other networks for the provision of data transmission services. Recommendation X.300 indicates in particular how collections of physical equipment can be represented as "subnetworks" for consideration in interworking situations.

This Recommendation describes the interworking arrangements between PSPDNs and Private Data Networks for the provision of data transmission services. These interworking arrangements should include all the capabilities required to support the Network Service for open systems interconnection as described in Recommendation X.213.

GENERAL ARRANGEMENTS FOR INTERWORKING BETWEEN PACKET SWITCHED PUBLIC DATA NETWORKS (PSPDNs) AND PRIVATE DATA NETWORKS FOR THE PROVISION OF DATA TRANSMISSION SERVICES

(Melbourne, 1988; revised Geneva, 1993)

1 Scope

The purpose of this Recommendation is to describe the general arrangements for the interworking between PSPDNs for the provision of data transmission services. These arrangements are applicable only to the interworking involving transmission capabilities and not to interworking involving communication capabilities as described in Recommendation X.300.

2 References

– Recommendation X.1 *International User Classes of Service in and Categories of Access to Public Data Networks and Integrated Services Digital Networks (ISDNs).*

– Recommendation X.2 *International Data Transmission Services and Optional User Facilities in Public Data Networks and ISDNs.*

– Recommendation X.25 *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.*

– Recommendation X.35 *Interface Between a PSPDN and a Private PSDN which is based on X.25 Procedures and Enhancements to Define a Gateway Function that is Provided by the PSPDN.*

– Recommendation X.75 *Packet Switched Signalling System Between Public Networks Providing Data Transmission Services.*

– Recommendation X.121 *International Numbering Plan for Public Data Networks.*

– Recommendation X.213 *Information Technology-Network Service Definitions for Open Systems Interconnection.*

– Recommendation X.223 *Use of X.25 to Provide the OSI Connection-Mode Network Service for CCITT Applications.*

– Recommendation X.300 *General Principles for Interworking Between Public Networks, and Between Public Networks and Other Networks for the Provision of Data Transmission Services.*

– Recommendation X.301 *Description of the General Arrangements for Call Control Within a Subnetwork and Between Subnetworks for the Provision of Data Transmission Services.*

– Recommendation X.302 *Description of the General Arrangements for Internal Network Utilities within a Subnetwork and Intermediate Utilities Between Subnetworks for the Provision of Data Transmission Services.*

– Recommendation X.305 *Functionalities of Subnetworks Relating to the Support of OSI Connection-Mode Network Services.*

– Recommendation X.324 *General Arrangements for Interworking Between Packet Switched Public Data Networks (PSPDNs) and Public Mobile Systems for the Provision of Data Transmission Services.*

– Recommendation X.325 *General Arrangements for Interworking Between Packet Switched Public Data Networks (PSPDNs) and Integrated Services Digital Networks (ISDNs) for the Provision of Data Transmission Services.*

3 Definitions

This Recommendation makes use of the following terms defined in Recommendation X.300:

a) transmission capability;

b) subnetwork;

c) data transmission service.

4 Abbreviations

CONS Connection-mode Network Service

CSPDN Circuit Switched Public Data Network

DTE Data Terminal Equipment

ISDN Integrated Services Digital Network

IWF Interworking Function

PSPDN Packet Switched Public Data Network

PSTN Public Switched Telephone Network

PvtDN Private Data Network

5 General aspects

This Recommendation, in describing interworking arrangements between two subnetworks (a PSPDN and a PvtDN) for the provision of data transmission services, adheres to the general principles of Recommendation X.300. The environments of these two subnetworks are described in the following subclauses. Interworking should provide the connection-mode network layer service, as defined in Recommendation X.213.

5.1 PSPDN

The PSPDN provides packet switched data transmission services as defined in Recommendations X.1 and X.2 for the provision of data transmission services. The PSPDN may be accessed by DTEs by the categories of access C and D as defined in Recommendation X.1.

In addition, the PSPDN may also be accessed via other networks, i.e. PSTN (X.10 category L, P), CSPDN (X.1 category K, O), PSPDN (Recommendation X.75), Mobile systems (Recommendation X.324) or ISDN (Recommendation X.325), or Private data networks (this Recommendation).

The PSPDN could be considered globally as an abstract OSI relay system (or “Type I subnetwork” as described in Recommendation X.300).

Figure 1 depicts the general interworking arrangement when the interworking function resides within the public network as defined in Recommendation X.35.

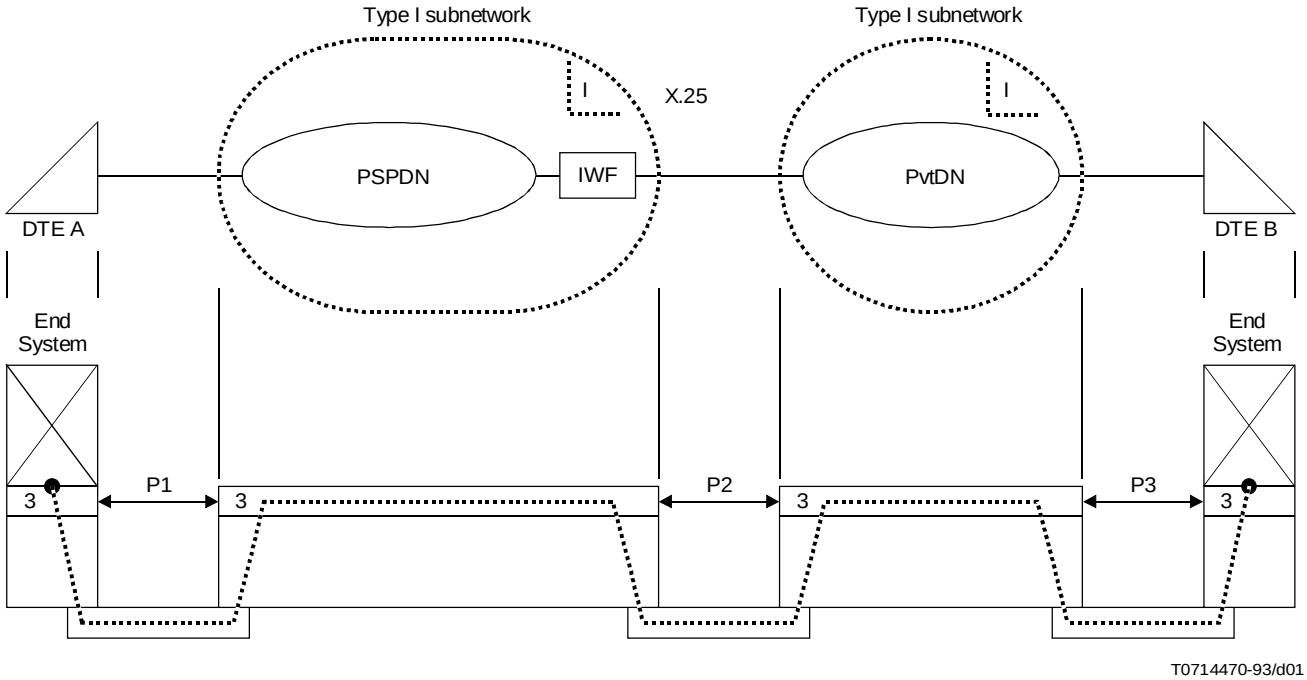


FIGURE 1/X.327

Interworking at the network layer between a PSPDN and a PvtDN

5.2 Private Data Network

The Private Data Network provides data transmission services. In the context of this Recommendation, the Private Data Network may be one of the following:

a) a subnetwork providing packet switched data transmission services as defined in Recommendations X.1 and X.2 for the provision of data transmission services. The Private Data Network may be accessed by DTEs by the categories of access D as defined in Recommendation X.1;

b) a subnetwork providing circuit switched data transmission services as defined in Recommendations X.1 and X.2 for the provision of data transmission services. The Private Data Network may be accessed by DTEs by the category of access B as defined in Recommendation X.1;

c) a point-to-point subnetwork providing leased circuit data transmission services as defined in Recommendation X.1;

d) a subnetwork conforming to ISO 8802.

Furthermore, in the context of this Recommendation, DTEs accessing the Private Data Network make use at the Network Layer of the protocol defined in ISO 8208.

In the context of OSI, the PvtDN and associated IWF could be considered as an abstract OSI relay system (or “Type I subnetwork” as described in Recommendation X.300).

Figure 2 depicts the general interworking arrangement when the interworking function resides within the private network.

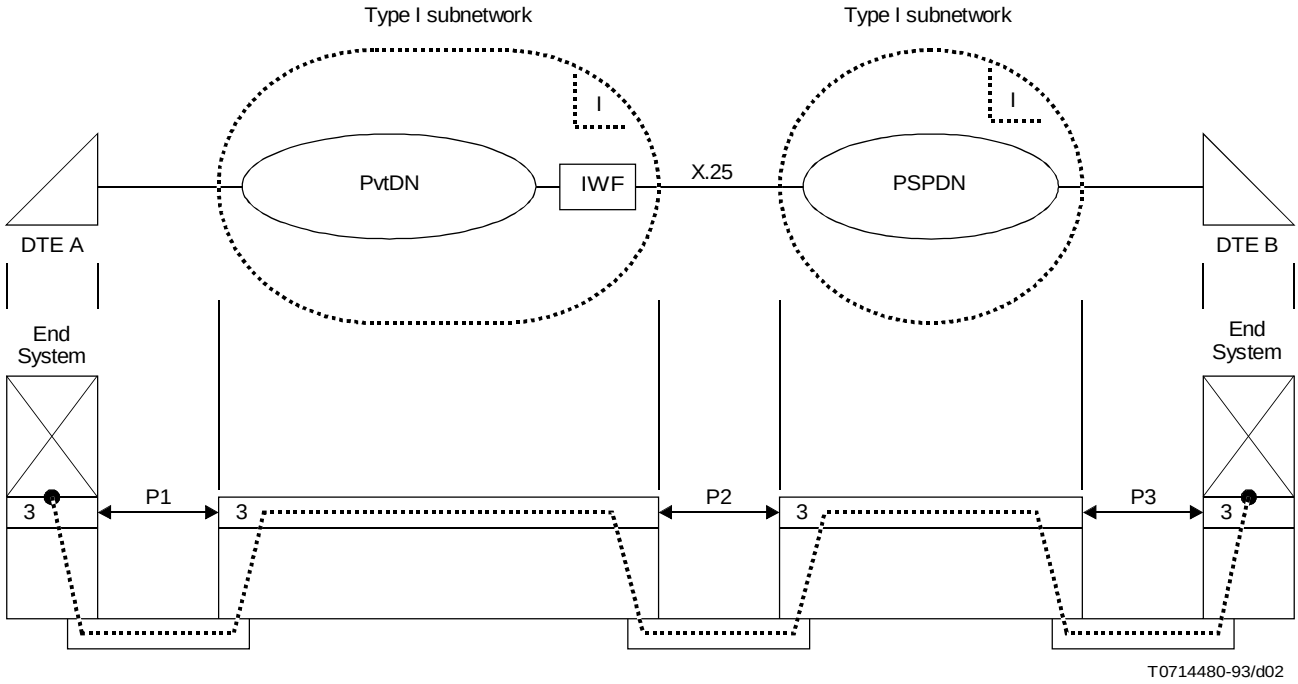


FIGURE 2/X.327

Interworking at the network layer between PvtDN and PSPDN

5.3 General interworking arrangements

The arrangements at the interface between both "Type I subnetworks" should be based on Recommendation X.25.

At that interface, a mapping needs to be done between X.25 packets used on each side of the IWF. Clause 6 deals such a mapping for each phase of the connection: connection establishment, connection release, data transfer. This mapping is related to the corresponding primitives of the OSI Network Layer Service.

In general, each type of primitive of the OSI Network Layer Service, corresponds to a type of packet on the PSPDN or the PvtDN side. Each type is recognized by the "packet type" parameter.

Each connection is identified by

– a Logical Channel number, on the PvtDN;

– a Logical Channel number, on PSPDN side.

NOTE – A Logical Channel number is usually local to an X.25 interface. On the same connections, its value usually changes between two interfaces.

6 Interworking arrangements

6.1 Connection establishment phase

6.1.1 Table 1 shows the relationships between the primitives used during the establishment of an OSI Network Connection through interconnected PvtDN and PSPDN, and the X.25 packets associated with that connection establishment (see also Recommendation X.223).

6.1.2 The actions and events at the interfaces to PvtDN or PSPDN which correspond to those primitives are also described in 6/X.305.

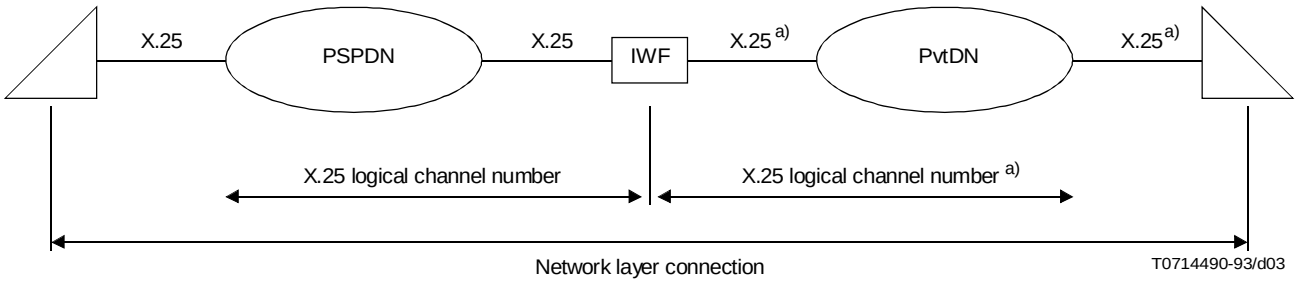
6.1.3 In the context of interworking between PvtDN and PSPDN, Table 1 describes a mapping to be performed between X.25 packets on each interface in relation with the OSI Network Layer service. In particular, the following mapping takes place:

a) a received INCOMING CALL packet results in a transmitted CALL REQUEST packet; and

b) a received CALL ACCEPTED packet results in a transmitted CALL CONNECTED packet.

6.1.4 Any call set-up packet sent or received by the IWF should convey OSI Network Layer addresses, as needed to identify the called and calling parties involved in the connection.

6.1.5 Since several simultaneous connections may be required, it is necessary to identify each of those connections at the interworking between PvtDN and PSPDN (see also 5.3). In order to map the logical channel numbering schemes on both sides, the interworking function (IWF) should connect a logical channel on one side to a logical channel on the other side, as illustrated in Figure 3.



a) Depending on the type of PvtDN, the two X.25 interfaces shown to the PvtDN may actually be one X.25 interface.

FIGURE 3/X.327

6.1.6 During the establishment of a connection, quality of service (QOS) parameters are used to adjust the quality of the connection.

6.2 Connection release phase

6.2.1 Table 2 shows the relationships between the primitives used during the release of an OSI Network Connection through interconnected PvtDN and PSPDN, and the X.25 packets associated with that connection release (see also Recommendation X.223).

6.2.2 The actions and events at the interfaces to PvtDN or PSPDN which correspond to those primitives are also described in 7/X.305.

6.2.3 In the context of interworking between PvtDN and PSPDN, Table 2 describes a mapping to be performed between X.25 packet on each interface in relation with the OSI Network Layer service. In particular, the following mapping takes place.

A received CLEAR INDICATION packet results in a transmitted CLEAR REQUEST packet (see also 6.4.1) and confirmation of the CLEAR INDICATION packet.

6.3 Data transfer phase

6.3.1 The following Tables 3 to 5 show the relationships between the primitives used for the transfer of data on an OSI Network Connection through interconnected PvtDN and PSPDN, and the packets associated with that data transfer (see also Recommendation X.223).

6.3.2 The actions and events at the interfaces to PvtDN and PSPDN which correspond to those primitives are also described in 8/X.305.

6.3.3 In the context of interworking between PvtDN and PSPDN, Tables 3 to 5 describe a mapping to be performed between X.25 packets in relation with the OSI Network Layer service. In particular, the following mappings take place:

a) a received DATA packet results in a transmitted DATA packet (see 6.4.2);

b) a received INTERRUPT packet results in a transmitted packet;

c) a received INTERRUPT CONFIRMATION packet results in a transmitted INTERRUPT CONFIRMATION packet;

d) a received RESET INDICATION packet results in a transmitted RESET REQUEST packet and confirmation of the RESET INDICATION packet.

6.3.4 Resets may occur during the data transfer phase of a connection.

6.4 Additional considerations

6.4.1 Restart

In the context of interworking between a PvtDN and a PSPDN, the receipt of a Restart Indication packet on an interface:

a) in confirmed by a RESTART CONFIRMATION packet on that interface; and

b) results in clearing of each Virtual Call on the other interface.

6.4.2 Packet sizes and window sizes

There is no requirement that the packet sizes and window sizes used at one interface be the same as those used at the other interface. However, the integrity of complete packet sequences must be maintained through proper settings of the M-bit and D-bit.

6.4.3 Flow control

There is no requirement, in general, that flow control procedures on the two interfaces be coupled. However, receipt of a DATA packet with D-bit set to 1 shall not result in window rotation on one interface until rotation of the window on the other interface for all user data in the originally received DATA packet.

TABLE 1/X.327

CONS – X.25/PLP mapping for the network connection establishment phase

CONS	X.25/PLP
Primitives	Packets
N-CONNECT request N-CONNECT indication N-CONNECT response N-CONNECT confirm	CALL REQUEST INCOMING CALL CALL ACCEPTED CALL CONNECTED
Parameters	Fields (including facilities)
Called address	Called DTE address field Called address extension facility
Calling address	Calling DTE address field Calling address extension facility
Responding address	Called DTE address field Called address extension facility
Receipt confirmation selection	General format identifier
Expedited data selection	Expedited data negotiation facility
QOS-Parameter set	Throughput class negotiation facility [a)] Minimum throughput class negotiation facility Transit delay selection and indication facility End-to-end transit delay negotiation facility
NS-User-data	Calling and called user data field Fast select facility [b)]

[a)] For proper operation, this optional user facility shall also be agreed to for use on the interface.

[b)] For proper operation, the Fast Select Acceptance Facility shall also be agreed to for use on the interface.

TABLE 2/X.327

CONS – X.25 /PLP mapping for the network connection release phase

CONS	X.25/PLP
Primitives N-DISCONNECT request N-DISCONNECT indication	Packets CLEAR REQUEST CLEAR INDICATION
Parameters Originator and reason NS-User-data Responding address	Fields (including facilities) Cause code and diagnostic code fields Clear user data Called DTE address field Called address extension facility

TABLE 3/X.327

CONS – X.25/PLP mapping for the data transfer service

CONS	X.25/PLP
Primitives N-DATA request N-DATA indication	Packets DATA DATA
Parameters NS-User-data Confirmation request	Fields User data, M-bit D-bit, P(S)

TABLE 4/X.327

CONS – X.25/PLP mapping for the expedited data transfer service

CONS	X.25/PLP
Primitives N-EXPEDITED DATA request N-EXPEDITED DATA indication	Packets INTERRUPT INTERRUPT
Parameters NS-User data	Fields Interrupt user data

TABLE 5/X.327

CONS – X.25/PLP mapping for the reset service

CONS	X.25/PLP
Primitives N-RESET request N-RESET indication N-RESET response N-RESET confirm	Packets RESET REQUEST RESET INDICATION None None
Parameters Originator and request	Fields Cause code and diagnostic code fields