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TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

SERIES X: DATA NETWORKS AND OPEN SYSTEM COMMUNICATION

Interworking between networks – General

General arrangements for interworking between Packet Switched Public Data Networks (PSPDNs) and Integrated Services Digital Networks (ISDNs) for the provision of data transmission services

ITU-T Recommendation X.325

(Previously CCITT Recommendation)

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For further details, please refer to ITU-T List of Recommendations.

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.325 was revised by ITU-T Study Group 7 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 5th of October 1996.

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NOTE

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

CONTENTS

SUMMARY

This Recommendation defines arrangements for the interworking between PSPDNs and ISDNs 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.

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 other networks for the provision of data transmission services. Recommendation X.300 indicates in particular how collections of physical equipment ca be represented as "subnetworks" for consideration in interworking situation.

This Recommendation describes the interworking arrangements between ISDNs and PSPDNs for the provision of data transmission services.

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

(Melbourne, 1988; revised in 1996)

1 Scope

The purpose of this Recommendation is to describe the general arrangements for the interworking between PSPDNs and ISDNs 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.

NOTE – The typing of subnetworks in this Recommendation is based on the support for the OSI connection-mode network service and is therefore only valid in this context.

2 References

The following Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

– CCITT Recommendation E.164 (1991), *Numbering plan for the ISDN era*.

– ITU-T Recommendation E.166/X.122 (1996), *Numbering plan interworking for the E.164 and X.121*.

– I.230-Series Recommendations, *Integrated services digital network – Service capabilities – Bearer services supported by an ISDN*.

– I.250-Series Recommendations, *Integrated services digital network – Service capabilities – Supplementary services in ISDN*.

– ITU-T Recommendation I.500 (1993), *General structure of the ISDN interworking Recommendations*.

– ITU-T Recommendation X.1 (1996), *International user classes of service in, and categories of access to, public data networks and Integrated Services Digital Networks (ISDNs)*.

– ITU-T Recommendation X.2 (1996), *International data transmission services and optional user facilities in public data networks and ISDNs*.

– ITU-T Recommendation X.10 (1993), *Categories of access for Data Terminal Equipment (DTE) to public data transmission services*.

– ITU-T Recommendation X.31 (1995), *Support of packet mode terminal equipment by an ISDN*.

– ITU-T Recommendation X.33 (1996), *Access to packet switched data transmission services via frame relaying data transmission services*.

– ITU-T Recommendation X.75 (1996), *Packet-switched signalling system between public networks providing data transmission services*.

– ITU-T Recommendation X.76 (1995), *Network-to-network interface between public data networks providing the frame relay data transmission service*.

– ITU-T Recommendation X.121 (1996), *International numbering plan for public data networks*.

– ITU-T Recommendation X.300 (1996), *General principles for interworking between public networks and between public networks and other networks for the provision of data transmission services*.

–   ITU-T Recommendation X.301 (1996), *Description of the general arrangements for call control within a subnetwork and between subnetworks for the provision of data transmission services.*

–   CCITT Recommendation X.302 (1988), *Description of the general arrangements for internal network utilities within a subnetwork and intermediate utilities between subnetworks for the provision of data transmission services.*

–   CCITT Recommendation X.305 (1988), *Functionalities of subnetworks relating to the support of OSI connection-mode network services.*

–   ITU-T Recommendation X.321 (1996), *General arrangements for interworking between Circuit Switched Public Data Networks (CSPDNs) and Integrated Services Digital Networks (ISDNs) for the provision of data transmission services.*

3   Terms and definitions

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

a)   transmission capability;

b)   communication capability;

c)   subnetwork functionality;

d)   data transmission service;

e)   interworking by call-control mapping;

f)   interworking by port access.

This Recommendation makes use of following terms defined in the I.230-Series Recommendations:

a)   circuit switched bearer service;

b)   packet switched virtual circuit bearer service;

c)   frame relaying bearer service.

4   Abbreviations

For the purposes of this Recommendation, the following abbreviations apply:

CNIC	Clearing Network Identification Code
CUG	Closed User Group
CUG/OA	Closed User Group with Outgoing Access
DTE	Data Terminal Equipment
ISDN	Integrated Services Digital Network
IWF	Interworking function
MSS	Mobile Satellite System
PSPDN	Packet Switched Public Data Network
SS No. 7	Signalling System No. 7
TA	Terminal Adaptor
TE	Terminal Equipment
TNIC	Transit Network Identification Code

5   Conventions

No particular conventions are used.

6 General aspects

This Recommendation, in describing interworking arrangements between two subnetworks 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. See also Table 1.

6.1 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 in Recommendation X.1. In addition, the PSPDN may also be accessed via other networks, i.e. PSTN (X.1 categories L, P), CSPDN (X.1, categories K, O), PSPDN (Recommendation X.75), MSS (Recommendation X.75), or ISDN (this Recommendation and X.1 category Q). Private networks access the PSPDN via X.1, category of access D.

6.2 ISDN

The ISDN may provide packet switched and/or circuit switched and/or frame relaying data transmission services/bearer services as defined in Recommendations X.1, I.230-Series, and X.2.

> NOTE 1 – Supplementary services/optional user facilities for the circuit-mode operation on ISDN are in the I.250-Series Recommendations. Recommendation X.2 applies to ISDN packet switched data transmission services/bearer services. Supplementary services/optional user facilities for the frame relaying operation on ISDN are for further study.

For the provision of data transmission services, the ISDN may be accessed by DTEs/TEs by the categories of access S, T, U, as defined in Recommendation X.1 and/or the access methods defined in the I.230-Series Recommendations. In addition, the ISDN may also be accessed via other networks, i.e. PSTN (see Recommendation I.530), CSPDN (Recommendation X.1, category B and Recommendation X.321), PSPDN (this Recommendation), MSS (see Recommendation X.324), FRPDN (see Recommendation X.328), or ISDN (SS No. 7, Recommendations X.75 and X.1, category Y).

> NOTE 2 – In the context of this Recommendation, and for purpose of provision of data transmission services only, the following categories of bearer services defined in the I.230-Series Recommendations are considered (others are for further study):

   a) circuit-mode 64 kbit/s unrestricted, 8 kHz structured;

   b) circuit-mode 64 kbit/s, 8 kHz structured, usable for speech information transfer;

   c) circuit-mode 64 kbit/s, 8 kHz structured, usable for 3.1 kHz audio information transfer;

   d) virtual call and permanent virtual circuit;

   e) frame-relaying bearer service.

6.3 Call control between the PSPDN and ISDN

The general arrangements for call control between PSPDN and ISDN are as defined in Recommendation X.301. Network utilities used between the PSPDN and ISDN are as defined in Recommendation X.302 (not visible for users). Supplementary services/optional user facilities for the circuit-mode operation on ISDN are in the I.250-Series Recommendations.

> NOTE – Supplementary services/optional user facilities for the frame relaying operation on ISDN are for further study.

6.4 Functionalities of the PSPDN and ISDN

The functionalities of different types of subnetworks are described in Recommendation X.305. In the case where the ISDN is used to provide a circuit switched or frame relaying data transmission service/bearer service, the functionality of the PSPDN and ISDN differ. Therefore, in order to enable interworking, procedures must be operated over the circuit switched or frame relaying bearer on the ISDN to achieve functional compatibility. In the case where the ISDN is used to provide a packet switched data transmission service/bearer service, the PSPDN and ISDN are functionally compatible.

7 Specific interworking arrangements

As described in Recommendation X.300, the following interworking cases should be distinguished:

   a)   interworking between PSPDN and ISDN where a packet mode bearer is used;

   b)   interworking between PSPDN and ISDN where a circuit mode bearer is used:

       1)   interworking by call-control mapping;

       2)   interworking by port access;

   c)   interworking between PSPDN and ISDN where a frame mode bearer is used:

       1)   interworking by call-control mapping;

       2)   interworking by port access.

TABLE 1/X.325

Comparison of general characteristics of PSPDN and ISDN

General characteristics	PSPDN	ISDN
Data transmission service/Bearer service	X.1, X.2	X.1, I.230-Series
Optional user facilities/Supplementary service	X.2	Circuit-Mode I.250-Series Packet-Mode X.301 Frame-Mode for further study
Categories of access	X.1 categories C, D	X.1 categories S, T, U See also 5.2
Access via other networks		
PSTN	X.1 categories L, P	I.530
CSPDN	X.1 categories K, O	X.321, X.1 category B
PSPDN	X.75	This Recommendation, X.1 categories C, D
FRPDN	(For further study)	X.328
MSS	X.75	X.324
ISDN	This Recommendation	SS No. 7, X.75, X.76 X.1 category Y

7.1 Interworking between PSPDN and ISDN where a packet switched bearer is requested
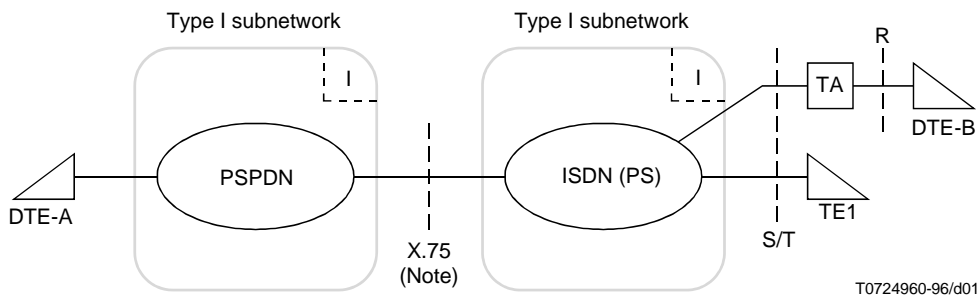
The detailed procedures for interworking by call-control mapping are defined in Recommendation X.75 (see Figure 1). In particular, the following applies.

7.1.1 Transfer of addressing information

ISDNs and PSPDNs typically utilize different numbering plans (i.e. E.164 and X.121 respectively). The considerations on the transfer of addressing information of the two different types as described in Recommendation X.301 apply. Further specifics on interworking between the numbering plans concerned, are detailed in Recommendation E.166/X.122.

7.1.2 Arrangements for facilities related to the QOS of the call

These arrangements are as described in Recommendation X.301. However, for the throughput facility, different classes are supported in the ISDN and PSPDN (i.e. class of 64 kbit/s). Whenever a request is made for a throughput class higher than 48 kbit/s from the ISDN, the request should be negotiated down to a lower class supported on the PSPDN.

NOTE – A functionally equivalent internal network protocol may be used when PSPDN and ISDN are or the same network provider, or by bilateral agreement.

FIGURE 1/X.325

Use of an ISDN virtual circuit bearer service, ISDN (PS)/PSPDN interworking

7.1.3 Arrangements for facilities related to charging conditions applying to the call

These arrangements are as described in Recommendation X.301.

7.1.4 Arrangements for facilities related to specific routing conditions applying to the call

These arrangements are as described in Recommendation X.301.

7.1.5 Arrangements for facilities related to protection mechanisms requested by the user of a call

These arrangements are as described in Recommendation X.301. In particular, for the CUG and CUG/OA facilities, the interlock code mechanism described in Recommendation X.180 shall be applied.

7.1.6 Arrangements for facilities to convey user data in addition to the normal data flow in the data transfer phase

These arrangements are as described in Recommendation X.301.

7.1.7 Arrangements for other facilities

These arrangements are as described in Recommendation X.301.

7.1.8 Arrangements for internal network utilities *(not visible for users)*

These arrangements are as described in Recommendation X.302. In particular, the mechanisms for network identification are applied as follows:

– the PSPDN is identified by the DNIC/DCC method;

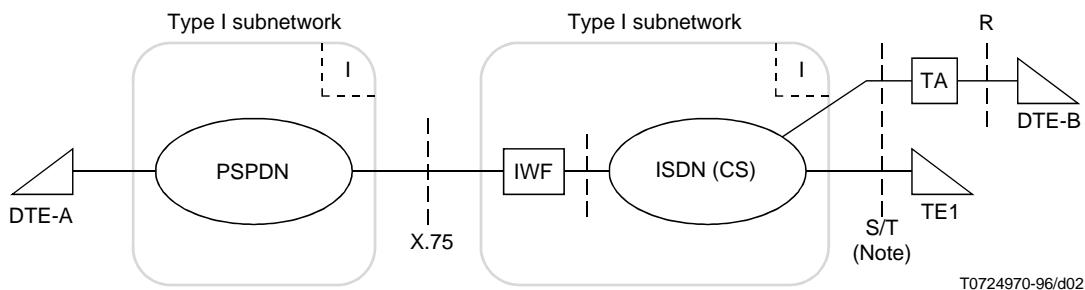– the ISDN is identified by the Recommendation X.302 method.

These network identifications are then further applied in the TNIC and CNIC utilities of Recommendation X.75.

7.2 Interworking between a PSPDN and ISDN where a circuit switched bearer is requested

7.2.1 Interworking by call-control mapping

This case of interworking by call-control mapping is not covered in Recommendation X.31. In order to enable interworking, procedures must be operated over the ISDN circuit switched bearer to achieve functional compatibility. However, these procedures are for further study. In general, the following applies:

– Call-control arrangements in the ISDN (i.e. I.420 or the functionally identical SS No. 7 protocol or functionally identical internal network protocol) should be mapped in the IWF to the call-control arrangements in the PSPDN (i.e. X.75, or functionally identical internal network protocol). This mapping is for further study.

– Data transfer arrangements in the PSPDN (i.e. X.75, or a functionally identical internal network protocol) should be mapped in the IWF to the procedures operated over the circuit switched bearer between IWF and TE/DTE. This mapping is for further study.

NOTE 1 – This interworking arrangement is not covered in Recommendation X.31 and therefore requires further study.

FIGURE 2/X.325

Interworking by call-control mapping

7.2.2 Interworking by port access

In order to enable interworking, procedures must be operated over the ISDN circuit switched bearer to achieve functional compatibility. These procedures follow Recommendation X.25 (see Recommendations X.31 and X.1 category Y). Aspects of Recommendation X.32 apply as noted in Recommendation X.31.

In general, the following aspects:

– X.75, or a functionally identical internal network protocol is operated between the PSPDN and the IWF.

– I.420, or ISDN-UP, or functionally identical internal network protocol is operated between the ISDN and the IWF, and used to control the circuit switched bearer.

– X.25 is operated between the IWF and the DTE/TE over the ISDN circuit switched bearer.
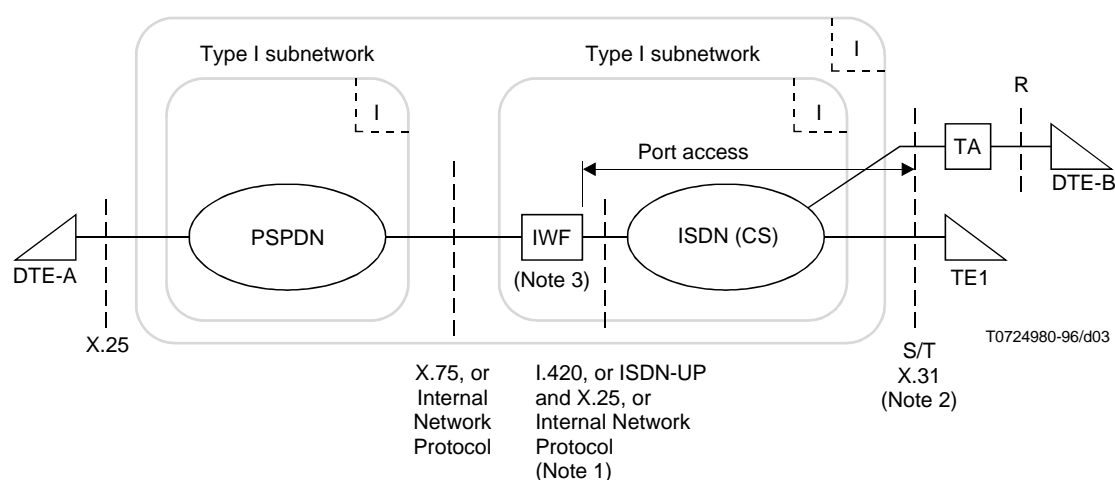
"Dialling out" considerations

A circuit switched bearer will be set up through the ISDN upon receipt of a X.75 call-request packet, i.e.:

– The Q.931 called party number (and subaddress, if provided) are derived from the X.75 call request packet.

– The Q.931 bearer capability is coded as circuit mode.

–   After establishment of the circuit switched bearer, a link connection will be established and the X.75 call request packet will be mapped by the IWF to an X.25 incoming call packet.

–   Further procedures are as detailed in Recommendation X.31.

"Dialling in" considerations

–   The Q.931 called party number is the address of the IWF (port address).

–   The Q.931 bearer capability is coded as circuit mode.

–   After establishment of the circuit switched bearer, a link connection will be established.

–   An X.25 call request packet will be mapped by the IWF to an X.75 call request packet.

–   Further procedures are as detailed in Recommendation X.31.

NOTE 1 – For international interworking the internal network protocol does not apply.

NOTE 2 – The ISDN terminal (TE1) or DTE + TA is, in this case, different from a terminal connected to an ISDN supporting the ISDN virtual circuit bearer services as defined in Recommendation X.31.

NOTE 3 – In this case, which is an X.31 access to the data transmission services provided by the PSPDN, the IWF logically belongs to the PSPDN.

FIGURE 3/X.325

**The data transmission services provided by PSPDNs interworking
with ISDN where a circuit switched bearer is requested to the ISDN**

7.3   Interworking between PSPDN and ISDN where a frame relaying bearer is requested

7.3.1   Interworking by call-control mapping

In order to enable interworking, procedures must be operated over the ISDN frame relaying bearer to achieve functional compatibility. However, these procedures are for further study. In general, the following applies:

–   Call-control arrangements in the ISDN (i.e. Q.933 or the functionally identical internal network protocol) should be mapped in the IWF to the call-control arrangements in the PSPDN (i.e. X.75, or a functionally identical internal protocol). This mapping is for further study.

– Data transfer arrangements in the PSPDN (i.e. X.75, or functionally identical internal network protocol) should be mapped in the IWF to the procedures operated over the frame relaying bearer between IWF and TE/DTE. This mapping is for further study.

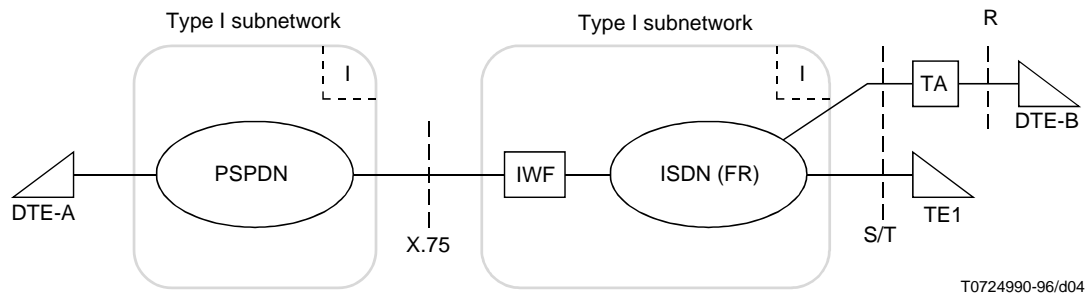– X.33 is operated between the IWF and the DTE/TE over the ISDN frame relaying bearer.
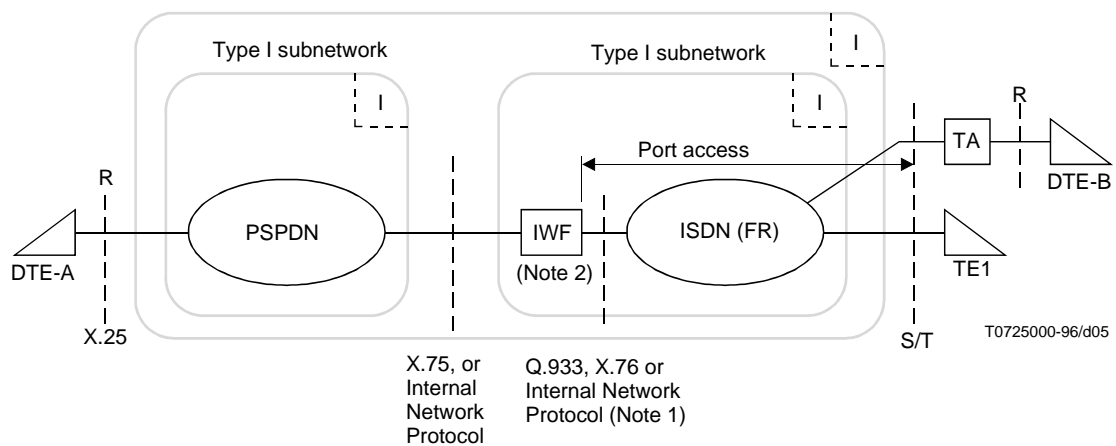

FIGURE 4/X.325

**PSPDN/ISDN interworking where frame relaying
bearer is requested to the ISDN
(call-control mapping)**

7.3.2 Interworking by port access

In order to enable interworking, procedures must be operated over the ISDN frame relaying bearer to achieve functional compatibility. These procedures follow Recommendation X.25.

In general, the following applies:

– X.75, or a functionally identical internal network protocol is operated between the PSPDN and the IWF.

– Q.933, or a functionally identical internal protocol is operated between the ISDN and the IWF, and used to control the frame relaying bearer.

– X.33 is operated between the IWF and the DTE/TE over the ISDN frame relaying bearer.

NOTE 1 – For international interworking the internal protocol does not apply.
NOTE 2 – The IWF logically belongs to the PSPDN.

FIGURE 5/X.325

**PSPDN/ISDN interworking where frame relaying
bearer is requested to the ISDN
(port access)**

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