INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

X.321

(10/96)

SERIES X: DATA NETWORKS AND OPEN SYSTEM COMMUNICATION

Interworking between networks – General

General arrangements for interworking between Circuit-Switched Public Data Networks (CSPDNs) and Integrated Service Digital Networks (ISDNs) for the provision of data transmission services

ITU-T Recommendation X.321

(Previously CCITT Recommendation)

ITU-T X-SERIES RECOMMENDATIONS

DATA NETWORKS AND OPEN SYSTEM COMMUNICATION

PUBLIC DATA NETWORKS	X.1–X.199
Services and facilities	X.1–X.19
Interfaces	X.20–X.49
Transmission, signalling and switching	X.50–X.89
Network aspects	X.90–X.149
Maintenance	X.150–X.179
Administrative arrangements	X.180–X.199
OPEN SYSTEM INTERCONNECTION	X.200–X.299
Model and notation	X.200–X.209
Service definitions	X.210–X.219
Connection-mode protocol specifications	X.220–X.229
Connectionless-mode protocol specifications	X.230–X.239
PICS proformas	X.240–X.259
Protocol Identification	X.260–X.269
Security Protocols	X.270–X.279
Layer Managed Objects	X.280–X.289
Conformance testing	X.290–X.299
INTERWORKING BETWEEN NETWORKS	X.300–X.399
General	**X.300–X.349**
Satellite data transmission systems	X.350–X.399
MESSAGE HANDLING SYSTEMS	X.400–X.499
DIRECTORY	X.500–X.599
OSI NETWORKING AND SYSTEM ASPECTS	X.600–X.699
Networking	X.600–X.629
Efficiency	X.630–X.649
Naming, Addressing and Registration	X.650–X.679
Abstract Syntax Notation One (ASN.1)	X.680–X.699
OSI MANAGEMENT	X.700–X.799
Systems Management framework and architecture	X.700–X.709
Management Communication Service and Protocol	X.710–X.719
Structure of Management Information	X.720–X.729
Management functions	X.730–X.799
SECURITY	X.800–X.849
OSI APPLICATIONS	X.850–X.899
Commitment, Concurrency and Recovery	X.850–X.859
Transaction processing	X.860–X.879
Remote operations	X.880–X.899
OPEN DISTRIBUTED PROCESSING	X.900–X.999

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.321 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.

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 general arrangements for the interworking between CSPDNs 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 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 ISDNs and CSPDNs for the provision of data transmission services.

Recommendation X.321

GENERAL ARRANGEMENTS FOR INTERWORKING BETWEEN CIRCUIT-SWITCHED PUBLIC DATA NETWORKS (CSPDNs) AND INTEGRATED SERVICE 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 CSPDNs 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.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 service*.

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.

This Recommendation makes use of the 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 CSPDN

The CSPDN provides circuit switched data transmission services as defined in Recommendations X.1 and X.2 for the provision of data transmission services, the CSPDN may be accessed by DTEs by the category of access B as defined in

Recommendation X.1. In addition, the CSPDN may also be accessed via other networks, i.e. PSPDN (see X.1, categories C, D and Recommendation X.75), MSS (see Recommendation X.75), or ISDN (this Recommendation). Private network access to the CSPDN is for further study (see Recommendation X.300).

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.

NOTE 2 – 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 (see X.1, category B, and this Recommendation), PSPDN (see Recommendations X.325 and X.1, categories C, D), MSS (see Recommendation X.324), or ISDN (SS No. 7, see Recommendations X.75 and X.1, category Y).

NOTE 3 – In the context of this Recommendation, and for the 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 CSPDN and ISDN

The general arrangements for call control between the CSPDN and ISDN are as defined in Recommendation X.301. Network utilities used between the CSPDN 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 CSPDN 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 packet switched or frame-relaying data transmission service/bearer service, the functionality of the CSPDN and ISDN differ. Therefore, in order to enable interworking, procedures must be operated over the circuit switched bearer on the CSPDN to achieve functional compatibility. In the case where the ISDN is used to provide a circuit switched data transmission service/bearer service, the CSPDN and ISDN are functionally compatible (see Table 1).

7 Specific interworking arrangements

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

a) interworking between CSPDN and ISDN where a packet switched bearer is used;

b) interworking between CSPDN and ISDN where a circuit switched bearer is used;

c) interworking between CSPDN and ISDN where a frame-relaying bearer is used.

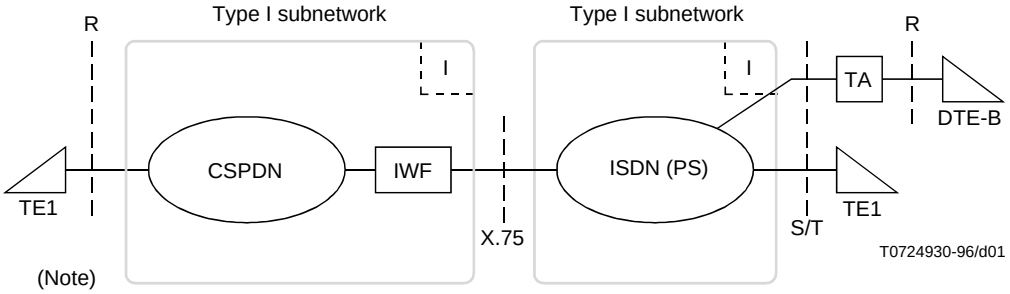
TABLE 1/X.321

Comparison of general characteristics of CSPDN and ISDN

General characteristics	CSPDN	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 category B	X.1 categories T, S, U See also 5.2
Access via other networks		
PSTN	–	I.530
CSPDN	X.71, X.60	This Recommendation, X.1 category B
PSPDN	X.322, X.1 categories C, D	X.325, 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 CSPDN and ISDN where a packet switched bearer is requested

The detailed procedures for interworking are defined in Recommendation X.75. See Figure 1. In particular, the following applies.



NOTE – The exact protocols to be used in this case are for further study.

FIGURE 1/X.321

CSPDN/ISDN (PS) interworking

7.1.1 Transfer of addressing information

ISDNs and CSPDNs 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 two 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 CSPDN (i.e. the 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 user class supported on the CSPDN.

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

For further study.

7.1.4 Arrangements for facilities related to specific routing conditions requested by the user

For further study.

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

For further study.

7.1.7 Arrangements for other facilities

For further study.

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 CSPDN 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 CSPDN and ISDN where a circuit switched bearer is requested

The detailed procedures for interworking are defined in Recommendation X.81 (see Figure 2). In particular, the following applies.

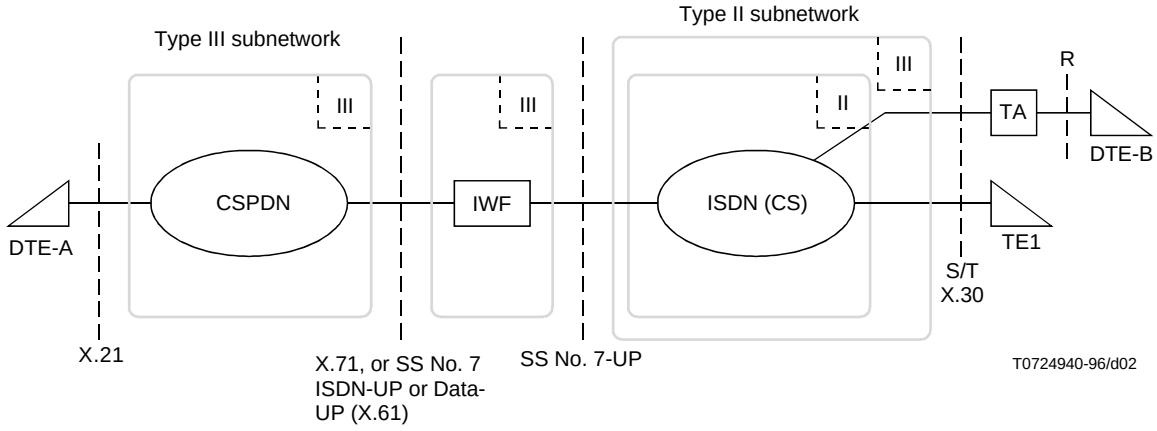


FIGURE 2/X.321

CSPDN/ISDN interworking where a circuit switched bearer is requested to the ISDN

7.2.1 Transfer of addressing information

ISDNs and CSPDNs 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 two numbering plans concerned are detailed in Recommendation E.166/X.122.

7.2.2 Arrangements related to QOS of the call

These arrangements for the CSPDN are described in Recommendation X.301. For the ISDN (CS), the arrangements are for further study.

7.2.3 Arrangements for facilities related to the charging condition requested by the user of the call

For further study.

7.2.4 Arrangements for facilities related to specific routing conditions requested by the user of the call

For further study.

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

These arrangements for CSPDN are described in Recommendation X.301. Arrangements for ISDN (CS) are for further study.

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

For further study.

7.2.7 Arrangements for other facilities

For further study.

7.2.8 Arrangements for internal network

These arrangements for CSPDN are described in Recommendation X.302. The arrangements for ISDN (CS) are for further study.

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

The detailed procedures for interworking are defined in Recommendation X.76. See Figure 3. In particular, the following applies.

7.3.1 Transfer of addressing information

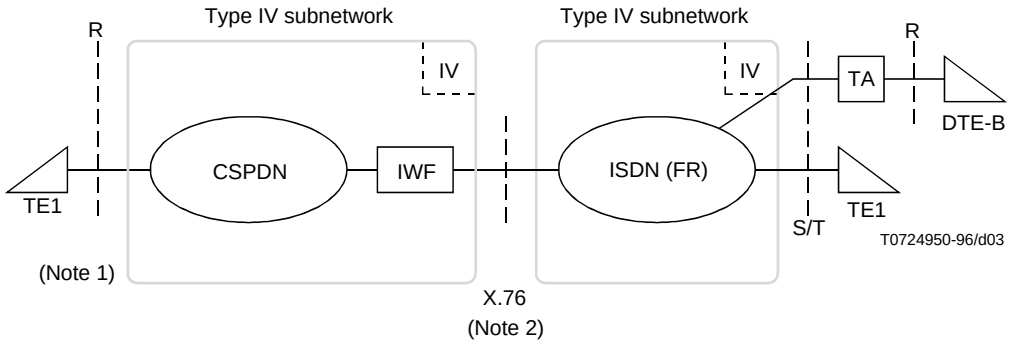
ISDNs and CSPDNs typically utilize different numbering plans (i.e. E.164 and X.121 respectively). The considerations on the transfer of addressing information of the two different types as described in Recommendation X.301 apply. Further specifics on interworking between the two numbering plans concerned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

7.3.2 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 CSPDN. 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 user class supported on the CSPDN.

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

For further study.



NOTE 1 – The exact protocols to be used in this case are for further study.

NOTE 2 – The use of other Recommendations is for further study.

FIGURE 3/X.321

CSPDN/ISDN interworking where a frame-relaying bearer is requested to the ISDN (interworking by call-control mapping)

7.3.4 Arrangements for facilities related to specific routing conditions requested by the user

For further study.

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

These arrangements are as described in Recommendation X.301.

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

For further study.

7.3.7 Arrangements for other facilities

For further study.

7.3.8 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 CSPDN is identified by the DNIC/DCC method;
- the ISDN is identified by the Recommendation X.302 method.

ITU-T RECOMMENDATIONS SERIES

Series A	Organization of the work of the ITU-T
Series B	Means of expression
Series C	General telecommunication statistics
Series D	General tariff principles
Series E	Telephone network and ISDN
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media
Series H	Transmission of non-telephone signals
Series I	Integrated services digital network
Series J	Transmission of sound-programme and television signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	Maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits
Series N	Maintenance: international sound-programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminal equipments and protocols for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	**Data networks and open system communication**
Series Z	Programming languages