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ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

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SERIES I: INTEGRATED SERVICES DIGITAL NETWORK

Internetwork interfaces

General arrangements for B-ISDN interworking

ITU-T Recommendation I.581

(Previously CCITT Recommendation)

ITU-T I-SERIES RECOMMENDATIONS

INTEGRATED SERVICES DIGITAL NETWORK

GENERAL STRUCTURE	I.100–I.199
Terminology	I.110–I.119
Description of ISDNs	I.120–I.129
General modelling methods	I.130–I.139
Telecommunication network and service attributes	I.140–I.149
General description of asynchronous transfer mode	I.150–I.199
SERVICE CAPABILITIES	I.200–I.299
Scope	I.200–I.209
General aspects of services in ISDN	I.210–I.219
Common aspects of services in the ISDN	I.220–I.229
Bearer services supported by an ISDN	I.230–I.239
Teleservices supported by an ISDN	I.240–I.249
Supplementary services in ISDN	I.250–I.299
OVERALL NETWORK ASPECTS AND FUNCTIONS	I.300–I.399
Network functional principles	I.310–I.319
Reference models	I.320–I.329
Numbering, addressing and routing	I.330–I.339
Connection types	I.340–I.349
Performance objectives	I.350–I.359
Protocol layer requirements	I.360–I.369
General network requirements and functions	I.370–I.399
ISDN USER-NETWORK INTERFACES	I.400–I.499
Application of I-series Recommendations to ISDN user-network interfaces	I.420–I.429
Layer 1 Recommendations	I.430–I.439
Layer 2 Recommendations	I.440–I.449
Layer 3 Recommendations	I.450–I.459
Multiplexing, rate adaption and support of existing interfaces	I.460–I.469
Aspects of ISDN affecting terminal requirements	I.470–I.499
INTERNETWORK INTERFACES	**I.500–I.599**
MAINTENANCE PRINCIPLES	I.600–I.699
B-ISDN EQUIPMENT ASPECTS	I.700–I.799
ATM equipment	I.730–I.749
Management of ATM equipment	I.750–I.799

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

ITU-T RECOMMENDATION I.581

GENERAL ARRANGEMENTS FOR B-ISDN INTERWORKING

Summary

This Recommendation gives guidelines of general arrangements and specifies requirements for B-ISDN interworking with other networks. Detailed description of B-ISDN interworking with dedicated network is given in the I.500-Series Recommendations.

Source

ITU-T Recommendation I.581 was prepared by ITU-T Study Group 13 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 19th of September 1997.

FOREWORD

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The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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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As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

Recommendation I.581

GENERAL ARRANGEMENTS FOR B-ISDN INTERWORKING

(Geneva, 1997)

1 Introduction

An ISDN has two aspects, one is a 64 kbit/s-based aspect and the other is a broadband aspect. To achieve their own aspect, they use different technologies, e.g. Circuit/Packet/Frame Mode and ATM (Asynchronous Transfer Mode), respectively. It is necessary to provide interworking between the two aspects of the ISDN to allow communication between terminals belonging to each part of the ISDN.

Considering the services which are available in the B-ISDN, there will be a need for interworking with other networks such as PSTN, PSPDN, PLMNs (Public Land Mobile Networks), Satellite Networks (the necessity of this is for further study) as well as Private Networks. Accordingly there is a need to summarize interworking configurations and requirements to consider the evolutionary steps of public networks, the time at which B-ISDN services will be available to the user and the status of interworking related Recommendations.

2 Scope

The objectives of this Recommendation are to give guidelines of general arrangements and to specify requirements for B-ISDN interworking with other networks as in Figure 1. Detailed description of B-ISDN interworking with dedicated network is given in the I.500-Series Recommendations.

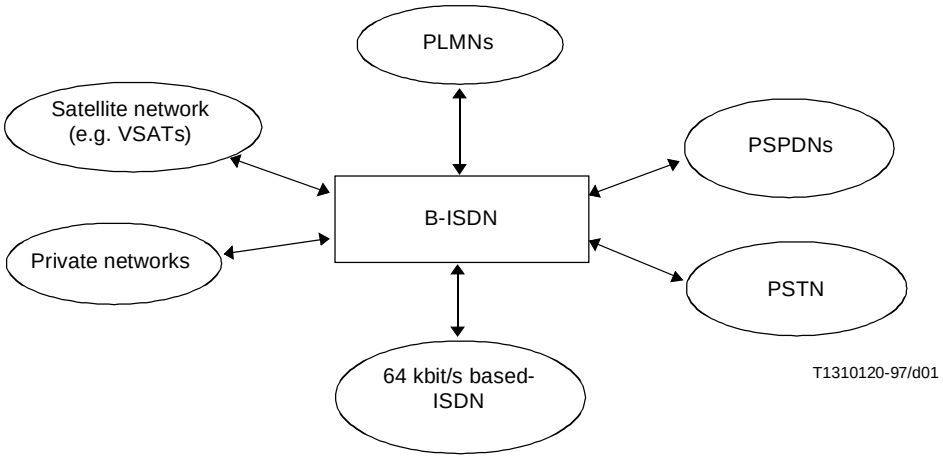


Figure 1/I.581 – B-ISDN interwording with other networks

3 Terms and definitions

The terms and definitions that are related to ISDN interworking are already defined in other Recommendations, and all of those terms and definitions are applicable to B-ISDN interworking. The following Recommendations are used to refer the terms and definitions of B-ISDN interworking with other networks.

– ITU-T Recommendation I.112 (1993), *Vocabulary of terms for ISDNs*.

– ITU-T Recommendation I.113 (1997), *Vocabulary of terms for broadband aspects of ISDN*.

– ITU-T Recommendation I.210 (1993), *Principles of telecommunication services supported by an ISDN and the means to describe them*.

– Recommendations I.230-Series, *Bearer services supported by an ISDN*.

– Recommendations I.240-Series, *Teleservices supported by an ISDN*.

– Recommendations I.250-Series, *Supplementary services in ISDN*.

– ITU-T Recommendation I.327 (1993), *B-ISDN functional architecture*.

– ITU-T Recommendation I.510 (1993), *Definition and general principles for ISDN interworking*.

– ITU-T Recommendation I.520 (1993), *General arrangements for network interworking between ISDNs*.

– ITU-T Recommendation I.525 (1996), *Interworking between networks operating at bit rates less than 64 kbit/s with 64 kbit/s-based ISDN and B-ISDN*.

– ITU-T Recommendation I.530 (1993), *Network interworking between an ISDN and a Public Switched Telephone Network (PSTN).*

– ITU-T Recommendation X.321/I.540 (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.*

– ITU-T Recommendation X.325/I.550 (1996), *General arrangements for interworking between Packet-Switched Public Data Networks (PSPDNs) and Integrated Services Digital Networks for the provision of data transmission services.*

– ITU-T Recommendation I.555 (1997), *Frame relaying bearer service interworking*.

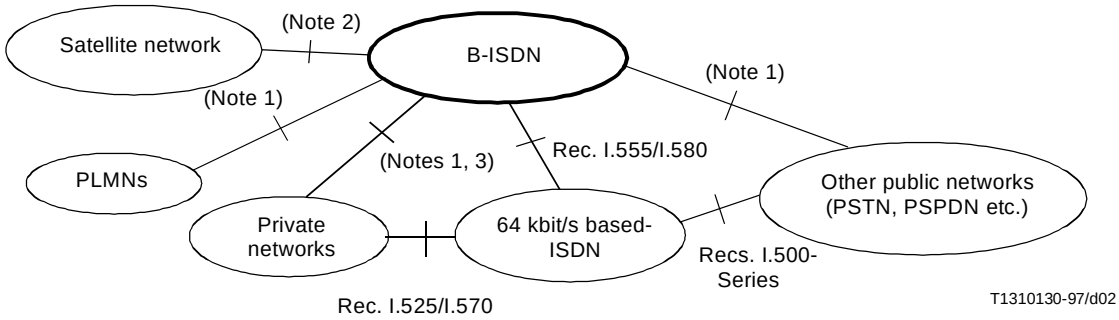
– ITU-T Recommendation I.570 (1993), *Public/private ISDN interworking*.

– ITU-T Recommendation I.580 (1995), *General arrangements for interworking between B-ISDN and 64 kbit/s-based ISDN.*

– ITU-T Recommendation X.34 (1996), *Access to packet switched data transmission services via B-ISDN*.

4 Recommendations related to B-ISDN interworking

Recommendations which relate to B-ISDN interworking are shown in Figure 2. This figure describes relationships among many Recommendations on B-ISDN interworking with other networks.



NOTE 1 – It is not yet defined.

NOTE 2 – The need for a Recommendation should be identified.

NOTE 3 – Reference points for this are described in Recommendation I.413.

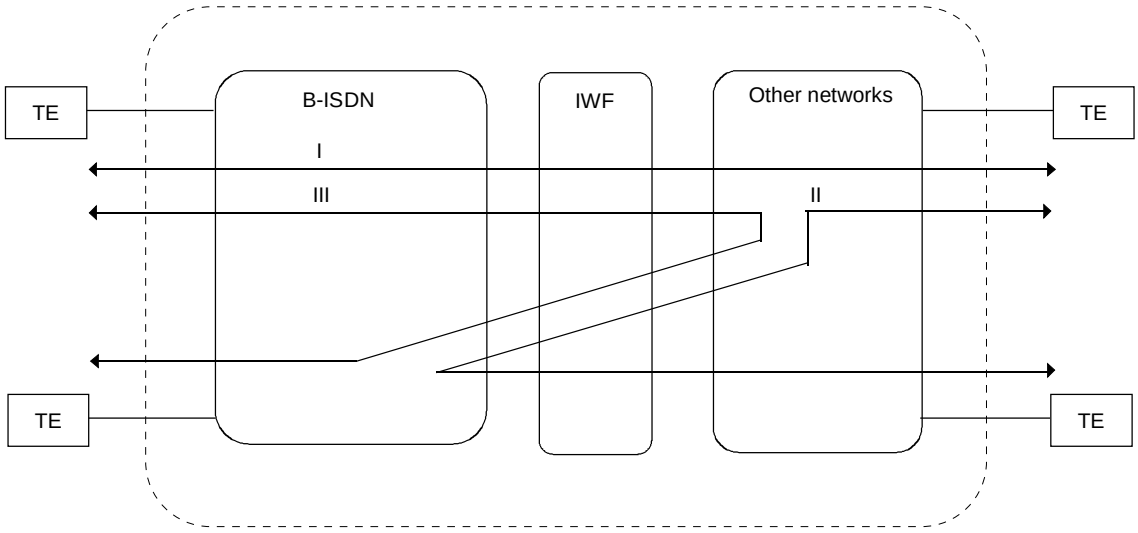
Figure 2/I.581 – Recommendation status for B-ISDN interworking

5 Interworking scenarios and configurations

5.1 Interworking scenarios

5.1.1 Communication scenarios

Considering various possibilities for interworking between B-ISDN and other networks, communication scenarios are classified as follows (see Figure 3):



TE Terminal Equipment
IWF Interworking Function

Figure 3/I.581 – Communication scenario model

– Scenario I is a direct interconnection scenario between B-ISDN and other networks;

– Scenario II is a network concatenation interworking scenario;

– Scenario III, the service capabilities provided between broadband user access points are restricted to one particular network capability.

5.1.2 Interworking scenarios

Interworking scenarios between B-ISDN and other public networks (e.g. PSTN, PSPDNs) are classified into two types as depicted in Figure 4. One is an Indirect interworking with other public networks, and the other is a Direct interworking between B-ISDN and other public networks.

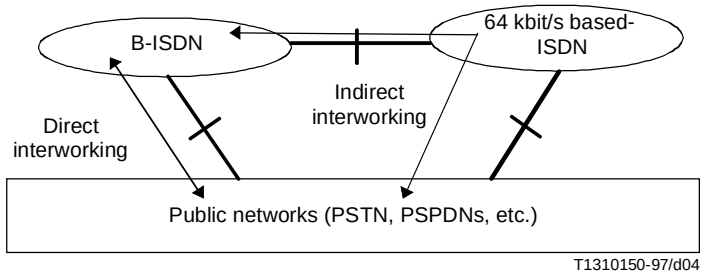


Figure 4/I.581 – B-ISDN interworking configuration with public networks

5.1.2.1 Indirect interworking scenario

In this scenario, interworking between B-ISDN and existing public networks (e.g. PSTN, PSPDN, etc.) takes place indirectly. That means interworking between B-ISDN and other public networks occurs through 64 kbit/s-based ISDN. Therefore, B-ISDN interconnects with 64 kbit/s-based ISDN and then 64 kbit/s-based ISDN connects with other public networks as depicted in Figure 5. This scenario is one of the examples using interworking configuration d) as in Figure 7. In this case, existing ITU-T Recommendations are applied.

5.1.2.2 Direct interworking scenario

In this scenario, interworking between B-ISDN and existing public networks (e.g. PSTN, PSPDN, etc.) takes place directly. That is, interworking between B-ISDN and other public networks happens without the intervention of 64 kbit/s-based ISDN as illustrated in Figure 6.

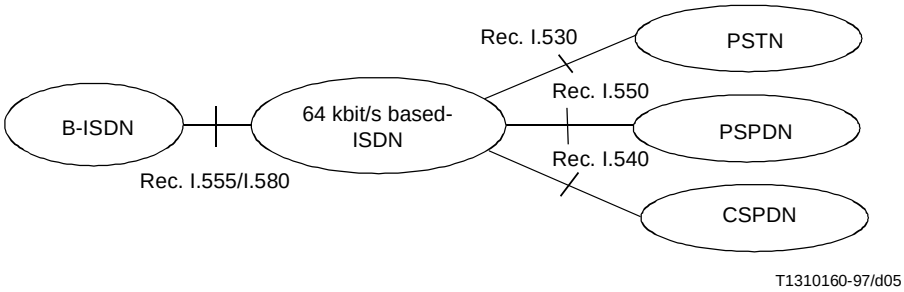
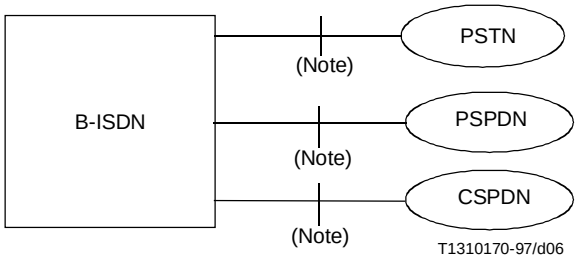


Figure 5/I.581 – Indirect interworking configuration

So, in this case, B-ISDN has several Interworking Functions for interworking with each public network and more Recommendations are expected to be specified. This is for further study.

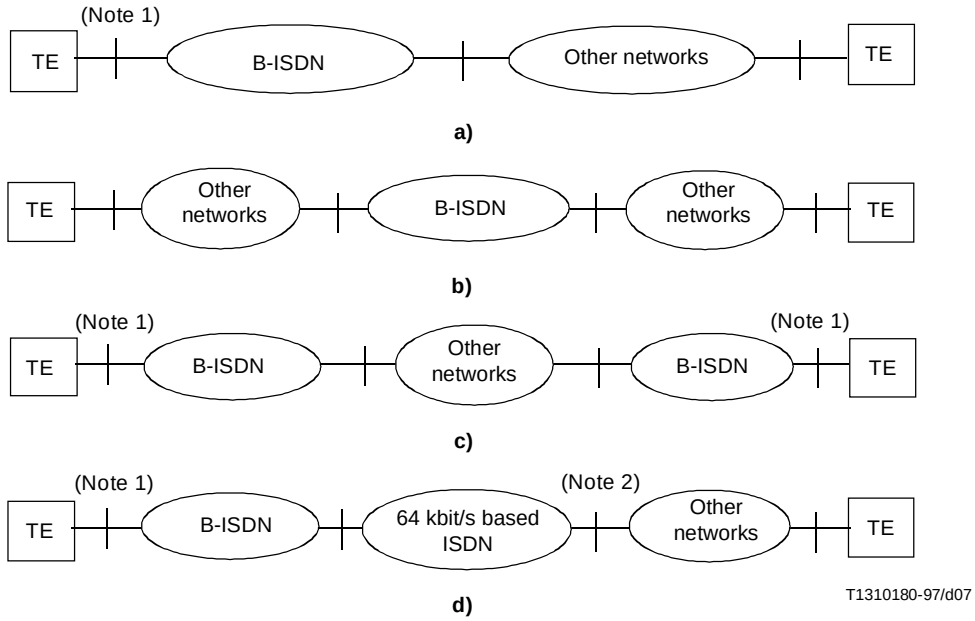


NOTE – It is not yet defined. This is for further study.

Figure 6/I.581 – Direct interworking scenario

5.2 Interworking configurations

Various interworking configurations are possible according to the applications and the situations of each country. Possible interworking configurations are illustrated in Figure 7.



NOTE 1 – Defined by Recommendation I.413.

NOTE 2 – Interworking with some networks (e.g. PSTN, PSPDN and CSPDN) is already specified in the I. 500-Series of Recommendations.

Figure 7/I.581 – Possible interworking configurations

5.2.1 B-ISDN interworking with PSTN

To give end-to-end telephony based services (e.g. Voice and Voiceband data service), B-ISDN interworking with PSTN is required. In this case, service features are restricted by a bearer service of PSTN (detailed service characteristics are referred in Tables 2 and 3). The AAL type for PSTN interworking with B-ISDN is for further study.

Interworking configuration for this is described as in Figure 8.

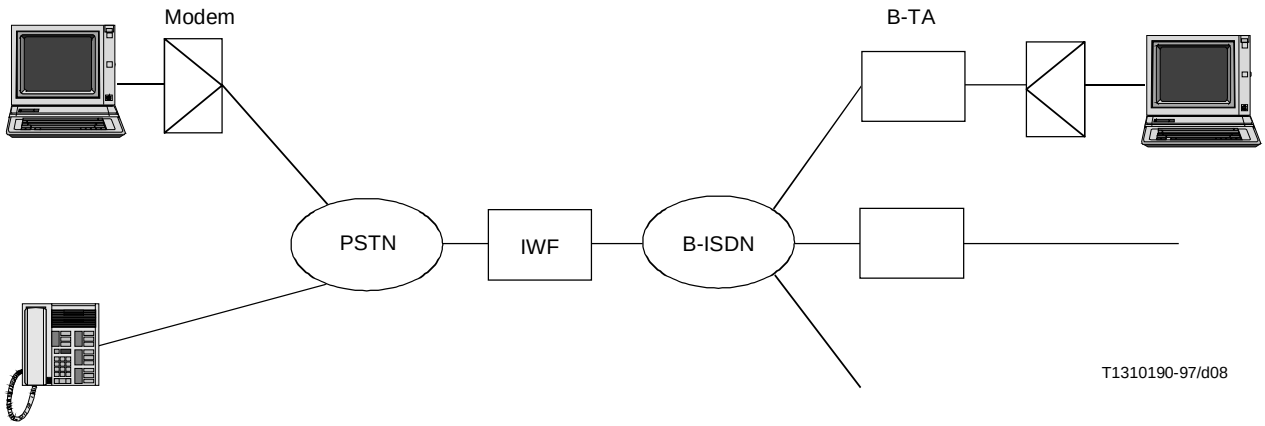
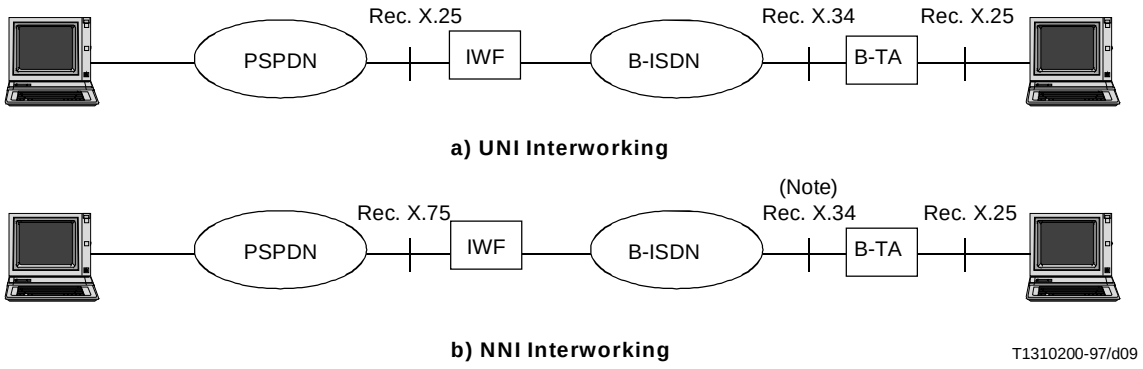


Figure 8/I.581 – Interworking configuration of B-ISDN interworking with PSTN

5.2.2 B-ISDN interworking with PSPDN

To use existing packet based data transmission services, B-ISDN interworking with PSPDN is required. In this case, service features are also restricted by a bearer service of PSPDN (detailed service characteristics are referred in Tables 2 and 3). UNI interworking and NNI interworking with PSPDN are useful for each network provider's situation, and there are small differences from protocol point of view (e.g. UNI uses X.25 protocol and NNI uses X.75 protocol).

Interworking configurations for these are shown in Figure 9. Access to Packet Switched Data Transmission service via B-ISDN is defined by the Recommendation X.34 as UNI interworking. NNI interworking is for further study.



NOTE – This is for further study.

Figure 9/I.581 – Interworking configurations of B-ISDN interworking PSPDN

5.2.3 B-ISDN interworking with private network

To give communication between terminals attached to private networks via public B-ISDN, B-ISDN interworking with private network is required as shown in Figure 10.

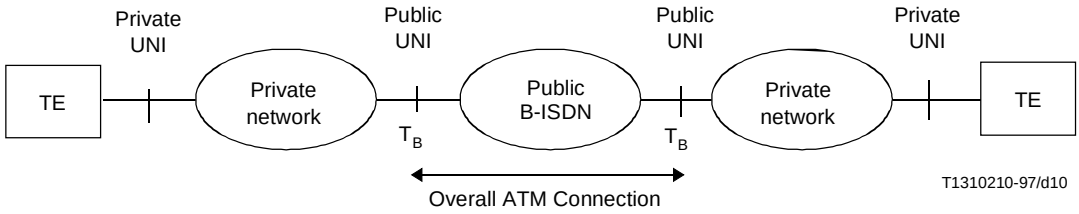


Figure 10/I.581 – General B-ISDN – Private network interworking configuration

In the case that private network is based on the ATM transport capabilities, overall ATM connection can be defined as end-to-end basis shown in Figure 11.

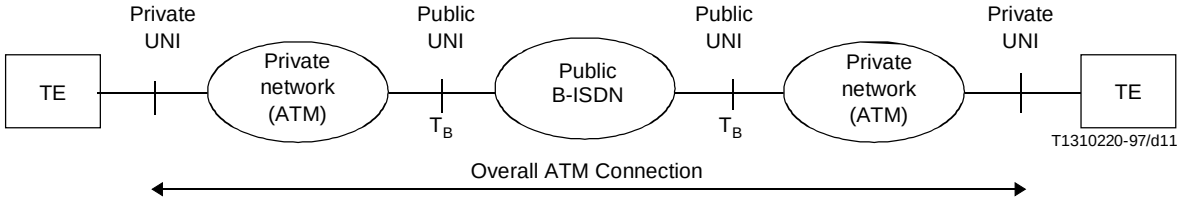


Figure 11/I.581 – Overall ATM Connection for a mixed private ATM network/public B-ISDN scenario

Interworking with ATM-based private network shall be applicable by overall ATM connection described in Table 1. Mapping of ATM Transfer Capabilities between private network and public network is for further study.

Table 1/I.581 – Attributes of overall ATM connection

Category	Value of attributes
Establishment of communication	Switched, reserved, permanent
Symmetry	Bidirectional symmetric, bidirectional asymmetric, unidirectional
Communication configuration	Point-to-point, point-to-multipoint, others are for further study
Type of connection	VCC

6 Service mapping between B-ISDN and other networks

Analysis of service characteristics and mapping of service attributes are very useful for securing end-to-end communication when B-ISDN interworking occurs with other networks. This clause describes various service mappings for this purpose.

6.1 Bearer service mapping

In the case of B-ISDN interworking with other networks, there are many alternatives to map bearer services between two different networks according to their own specific bearer services. To give maximum connectivity between two terminal equipments connected to these different networks, proper types of bearer services are identified and mapped for each direction from B-ISDN to other networks and vice versa.

6.1.1 From B-ISDN to other networks

When interworking occurs from the B-ISDN to other networks, the bearer service in B-ISDN may be limited by the bearer service of the other networks. In this case, bearer service mapping is described from the other networks viewpoint, as shown in Table 2.

Table 2/I.581 – Bearer service mapping for interworking from B-ISDN to other networks

Bearer Services supported by other networks	B-ISDN interconnected with: (Note)			
	64 kbit/s based-ISDN	PSTN	PSPDN	PLMN
Speech	O	–	–	–
3.1 kHz audio	O	O	–	O
64 kbit/s UDI, circuit mode	O	–	–	–
64 kbit/s UDI, packet mode	O	–	O	–
N × 64 kbit/s UDI	O	–	–	–
FMBS	O	–	–	–

FMBS Frame Mode Bearer Service
UDI Unrestricted Digital Information
O Applied
– Not appplied
NOTE – Possibilities for other networks (e.g. Private Network and Satellite network, etc.) are for further study.

6.1.2 From other networks to B-ISDN direction

B-ISDN consists of two types of bearer services, one is BCOBS (Broadband Connection Oriented Bearer Service) and the other is Broadband Connectionless Data Bearer Service. In case of BCOBS, ATM Transfer Capabilities (e.g. DBR, SBR, ABR and ABT) play a major role in B-ISDN interworking with other networks for each application.

When interworking occurs from other networks to B-ISDN direction, the bearer service of B-ISDN shall be selected based on the above ATM Transfer Capabilities to secure the required services from the other networks. In this case, ATM Transfer Capability mapping is described from B-ISDN viewpoints as given in Table 3.

Table 3/I.581 – ATM Transfer Capability mapping for interworking from other networks to B-ISDN

ATM Transfer Capability supported by B-ISDN (see Rec. I.371)	B-ISDN interconnected with: (Note 1)			
	64 kbit/s based-ISDN	PSTN	PSPDN	PLMN
DBR (Deterministic Bit Rate)	O	O		O
SBR (Statistical Bit Rate)	For further study			
ABR (Available Bit Rate)				
ABT (ATM Block Transfer)				

O Applied
NOTE 1 – Possibilities for other networks (e.g. Private Network and Satellite network, etc.) are for further study.
NOTE 2 – The case of Connectionless Bearer service is for further study.

6.2 Higher Layer information mapping

For further study.

6.3 Supplementary service mapping

For further study.

7 Requirements of interworking functions

7.1 Types of interworking functions and their applications

The state conversion and the protocol mapping between different networks which have different physical/electrical/optical and protocol characteristics play key roles of interworking functions. Based on these key roles, Interworking Functions (IWF) are classified into two types: Connection Dependent IWF and Communication Dependent IWF with the following definitions (see Recommendation I.510):

- Connection Dependent IWF (CNI) are those functions needed in order to interconnect B-ISDNs or B-ISDN and other networks. This function is mainly related to Low Layer services (e.g. Bearer Service).
- Communication Dependent IWF (CDI) are those functions in addition to CNI needed in order to establish a specific end-to-end communication and which may differ from application-to-application. This function is mainly related to High Layer services (e.g. Teleservice).

See Figure 12 and Table 4.

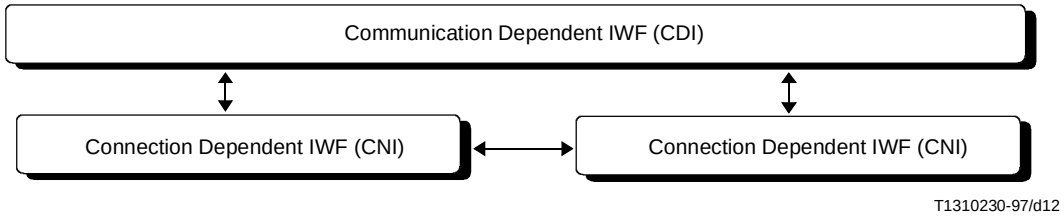


Figure 12/I.581 – Types of interworking functions

Table 4/I.581 – Applications of IWFs for various interworking cases

Service Features	HLS 1 + LLS 1	HLS 1 + LLS 2
HLS 1 + LLS 1	Not Applicable	CNI is required
HLS 2 + LLS 1	CDI is required	CDI + CNI are required
NOTE – HLS/LLS means High Layer Service and Low Layer Service.		

7.2 General requirements of interworking functions between B-ISDN and other networks

For interworking between B-ISDN and other networks, Tables 1 and 3 show various possible bearer service mappings between two interworked networks. Besides these bearer service mappings, there are more to clarify, for example, translation of numbering plans and mapping of layer protocols between two networks.

Figure 13 describes general requirements of IWFs between two different networks as well as B-ISDN interworking with other networks.

- Numbering Plan: Translation (eg. IP/X.121↔E.164)
- OAM information: Mapping
- Control/User Plane Protocol
  - Layer 1: State conversion
  - Above Layer 2: Mapping
- Others: for further study

Figure 13/I.581 – General requirements of IWF

8 Routing requirements

For further study.

9 OAM information mapping

For further study.

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