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Foreword

ETSI Technical Reports (ETRs) are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim-European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or I-ETS.

This ETR has been produced by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI), and defines the interworking cases for the Memorandum of Understanding (MoU) on ISDN priority 1 and 2 services.

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1 General

This ETSI Technical Report (ETR) defines interworking cases for MoU-ISDN priority 1 and 2 services which are indicated as areas of main interest in the questionnaire provided by the ISDN MoU Implementation and Management Group (IMIMG) in July 1990.

The structure of the IMIMG questionnaire is shown in table 1. In accordance with the IMIMG questionnaire the areas of main interest in teleservice interworking are dedicated to:

- teletex with teletex interworking;
- teletex with telex interworking;
- telefax Group 4 with telefax Group 3 interworking;
- all CCITT Recommendation X.31 [16] related cases interworking with PSPDN;
- all CCITT Recommendation X.400 [7] related interworking;
- videotex with ISDN syntax-based videotex;
- CCITT Recommendation V.110 [13] rate adapted data transmission on ISDN with voice band data transmission on PSTN.

It is the purpose of this ETR to describe each of the above listed interworking situations with a view to its feasibility and to highlight open issues, if any, on required interworking arrangements, numbering and routing.

2 References

- [1] CCITT Recommendation E.164 (1988): "Numbering plan for the ISDN era".
- [2] ETS 300 102-1: "User-network interface layer 3; Specifications for basic call control".
- [3] ETS 300 007: "Integrated Services Digital Network (ISDN); Support of packet-mode terminal equipment by an ISDN".
- [4] ETS 300 099: "Integrated Services Digital Network (ISDN); Specification of the Packet Handler Access Point Interface (PHI)".
- [5] CCITT Recommendation F.201: "Interworking between teletex service and telex service - General principles".
- [6] CCITT Recommendation I.515: "Parameter exchange for ISDN interworking".
- [7] CCITT Recommendation X.400 (1988): "Message handling system and service overview".
- [8] CCITT Recommendation I.540: "General arrangements for interworking between circuit switched public data networks (CSPDNs) and integrated services digital networks (ISDNs) for the provision of data transmission".
- [9] CCITT Recommendation I.550: "General arrangements for interworking between Packet Switched Public Data Networks (PSPDNs) and Integrated Services Digital Networks (ISDNs) for the provision of data transmission".
- [10] CCITT Recommendation T.90 (1988): "Characteristics and protocols for terminals for telematic services in ISDN".

- [11] CCITT Recommendation U.201: "Interworking between the teletex service and the telex service".
- [12] CCITT Recommendation U.202: "Requirements to be met in providing the telex service within the ISDN".
- [13] CCITT Recommendation V.110: "Support of data terminal equipments (DTEs) with V-series type interfaces by an integrated services digital network (ISDN)".
- [14] CCITT Recommendation X.21 (1988): "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for synchronous operation on public data networks".
- [15] 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".
- [16] CCITT Recommendation X.31 (1988): "Support of packet mode terminal equipment by an ISDN".
- [17] 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".
- [18] CCITT Recommendation X.61: "Signalling System No. 7 - Data user part".
- [19] CCITT Recommendation X.71: "Decentralised terminal and transit control signalling system on international circuits between synchronous data networks".
- [20] CCITT Recommendation X.75 (1988): "Packet-switched signalling system between public networks providing data transmission services".
- [21] CCITT Recommendation X.81: "Interworking between an ISDN circuit-switched and a circuit-switched public data network (CSPDN)".
- [22] CCITT Recommendation X.82: "Detailed arrangements for interworking between CSPDNs and PSPDNs based on Recommendation T.70".
- [23] CCITT Recommendation X.121 (1988): "International numbering plan for public data networks".
- [24] CCITT 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".
- [25] CCITT Recommendation X.325 (1988): "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 Symbols and abbreviations

The following symbols and abbreviations are used within this document.

AU	Access Unit
CSPDN	Circuit Switched Public Data Network
DSS1	Digital Subscriber Signalling System No.one
DNIC	Data Network Identification Code
ETSI	European Telecommunications Standards Institute
ETR	ETSI Technical Report
HLC	Higher Layer Compatibility
ISDN	Integrated Services Digital Network
IMING	ISDN MoU Implementation and Management Group
IWF	Interworking Function
MoU	Memorandum of Understanding
NPI	Numbering Plan Identification
PDN	Public Data Network
PSPDN	Public Switched Packet Data Network
PH	Packet Handler
SS No.7	Signalling System No.7
TTx-TE	Teletex-Terminals

4 Interworking cases

Interworking cases which need to be defined for realisation of MoU-ISDN priority 1 and 2 services are summarised in table 1. Each of the interworking cases is commented by a NOTE with a view of its feasibility. More detailed information is given in the following annexes:

Annex A: Communications between teletex (ISDN) and teletex (PDN);

Annex B: Interworking between teletex (ISDN) and telex.

Table 1: Service interworking

ISDN based	Existing Networks other than ISDN							
	Teletex (CSPDN, PSPDN)	Telex	Telefax (Gr. 3 on PSTN)	Data Transmission on PSTNs	X.25 [15] (PSPDN) Data Transmission Services	X.21 [14] (CSPDN) Data Transmission Services	Videotex	X.400 [7] (MHS)
Teletex	NOTE 1 Annex 1	NOTE 2 Annex 2						NOTE 3
Telefax Gr. 4			NOTE 4					NOTE 3
X.31 [16] case A					NOTE 5			
X.31 [16] case B (D-channel)					NOTE 5			
X.31 [16] case B (B-channel)					NOTE 5			
Videotex syntax based							NOTE 6	
Videotex photographic mode								
X.400 [7] (MHS)	NOTE 3	NOTE 3	NOTE 3					
V110 [13] adapted Data Transmission				NOTE 7				

NOTES to table 1:

NOTE 1: Teletex (ISDN) interworking with teletex (PDN) may be subdivided into:

- teletex (ISDN) interworking with teletex (CSPDN);
- teletex (ISDN) interworking with teletex (PSPDN).

For teletex (ISDN) interworking with teletex (CSPDN) no open issues exist. The relevant CCITT Recommendations for interworking are:

- scenario description CCITT Recommendation X.321 [24];
- functional description CCITT Recommendation X.81 [21].

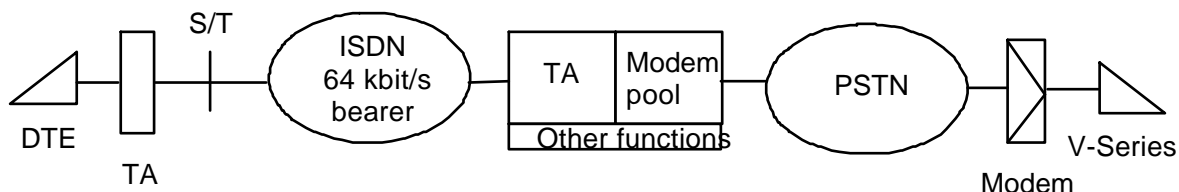
For teletex (ISDN) interworking with teletex (PSPDN) there are open issues regarding routing towards the ISDN and definition of the function level. Relevant CCITT Recommendation for the scenario description is X.325 [25]. For the functional level on protocol mapping no standard exists yet. Short term and longer term solutions to the unsolved issues are proposed in Annex A.

NOTE 2: Teletex (ISDN) interworking with telex is discussed in Annex B. No open issues exist. Interworking based on one-stage selection and two-stage selection may be provided. Relevant CCITT Recommendations for the description of the general principles of this interworking case are F.201 [5] and U.201 [11]. Description of the functional level to be applied in specific network arrangements, e.g. protocol mapping between teletex (ISDN) and telex signalling, may not be required, since the conversion facility may follow store and forward switching principles. The functional level is defined by specifying the signalling system at each side of the conversion.

(continued)

Table 1 (concluded): Service interworking

	Teletex (CSPDN, PSPDN)	Telex	Telefax (Gr.3 on PSTN)	Data Transmission on PSTNs	X.25 [15] (PSPDN) Data Transmission Services	X.21 [14] (CSPDN) Data Transmission Services	Video- tex	X.400 [7] (MHS)
Existing Networks other than ISDN								
NOTE 3:	For all CCITT Recommendation X.400 [7] related cases, no InterWorking Functions (IWFs) are required, since message handling systems are interconnected to public networks (ISDN, PSTN, PDNs) on the basis of a customer access. For interconnections between a message handling system and different types of networks, however, different types of ports to the message handling system may be defined in order to cater for various types of user/network-interfaces. These ports are regarded as part of the message handling system. They are defined by the standards specifying the user/networking interfaces and the universal input/output of the message handling system. For a message handling system accessing an ISDN also the requested bearer capability may be of importance taking into account different types of terminal adaption, if applicable. The ISDN port of a message handling system may comply with a TE1-function supporting the capability of a 64 kbit/s UDI bearer or may require adaption to a TE2-function (CCITT Recommendation V.110 [13], etc.).							
NOTE 4:	Terminal adaption for communications between telefax Gr.4 on the ISDN and telefax Gr.3 on the PSTN is accomplished within the Gr.4 ISDN terminal. Thus, no specific interworking arrangement between ISDN and PSTN for the support of telefax is required.							
NOTE 5:	ISDN access to a packet handler or a PSPDN may be specified as interworking by port access as defined in CCITT Recommendation X.325 [25], ETS 300 007 [3] CCITT Recommendation X.31 [16] and the packet handler interface specification ETS 300 099 [4]. No specific interworking arrangement between the packet handler and a PSPDN is required. Interconnection may be accomplished by use of X.75 [20], or an equivalent internal network protocol.							
NOTE 6:	Videotex services which are defined for and used in a PSTN/PSPDN environment will also be accessible by ISDN syntax-based videotex terminals. The ISDN is only used in an access network between the terminal function and the access function. (The access function is the functional entity which gives access to the videotex systems; it is an integral part of the videotex service). No IWF has to be provided by the ISDN.							
NOTE 7:	The scenario for interworking between CCITT Recommendation V.110 [13] adapted data transmission in the ISDN and data transmission in the PSTN is shown in figure 1 below, which is taken from CCITT Recommendation I.515 [6]. The details for that interworking case are under study. The planned Recommendation on this subject will be CCITT Recommendation I.516.							



NOTE 1: IWF is distributed. The representation in the figure is not a physical representation.

NOTE 2: The TA shown in this figure is a CCITT Recommendation V.110 [13] Terminal Adapter.

Figure 1: ISDN-PSTN interworking for circuit switched calls

Annex A: Communications between teletex (ISDN) and teletex (PDN)

This Annex describes the communications between Teletex-Terminals (TTx-TE) supported by the ISDN and TTx-TE supported by Public Data Networks (PDNs) and outlines the requirements for:

- interworking;
- numbering;
- routing;

Since teletex, if offered through dedicated networks, is currently supported by CSPDNs and Public Switched Packet Data Networks (PSPDNs), it seems to be adequate to split into the following sub-sections.

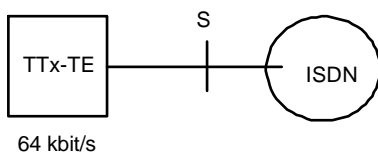
- teletex on the ISDN with teletex on the CSPDN;
- teletex on the ISDN with teletex on the PSPDN.

It is important to note that this type of interworking may be characterised as "network interworking" supporting the interworking of networks with different low layer capabilities. To satisfy the needs for communications between teletex (ISDN) and teletex (PDN), network provided IWFs are required.

A.1 Terminal configurations

Configurations assumed for teletex terminals at the ISDN and at PDNs are given below.

A.1.1 ISDN



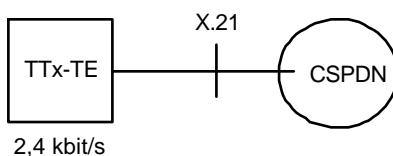
requested bearer:

circuit-switched, 64 kbit/s
unrestricted digital in-
formation; user rate
64 kbit/s

NOTE: Utilisation of the full 64 kbit/s user rate (= ISDN 64 kbit/s transfer rate) can only be applied in ISDN to ISDN connections.

S/T: Coincident S and T reference point.

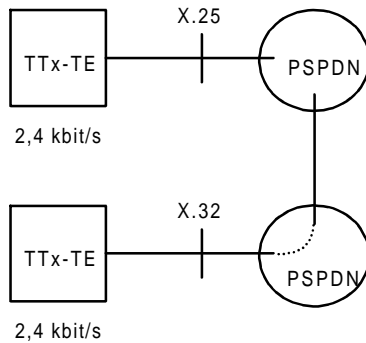
A.1.2 CSPDN



supporting bearer:

X.50 envelope-structured;
circuit-switched
2,4 kbit/s data channel;
user rate 2,4 kbit/s

A.1.3 PSPDN



supporting bearer:

packet-switched data
channel; user rate
2,4 kbit/s

a TTx-TE may access the
PSPDN via another circuit-
switched network, e.g.
a PSTN according to
CCITT Recommendation
X.32 [17].

A.2 Network interconnections

For considerations on relevant network interconnections it is assumed that the teletex service in each country may be supported by the ISDN and another dedicated network (see figures 1 to 3). With regard to network capabilities for the support of numbering plans the following routing principles have been envisaged:

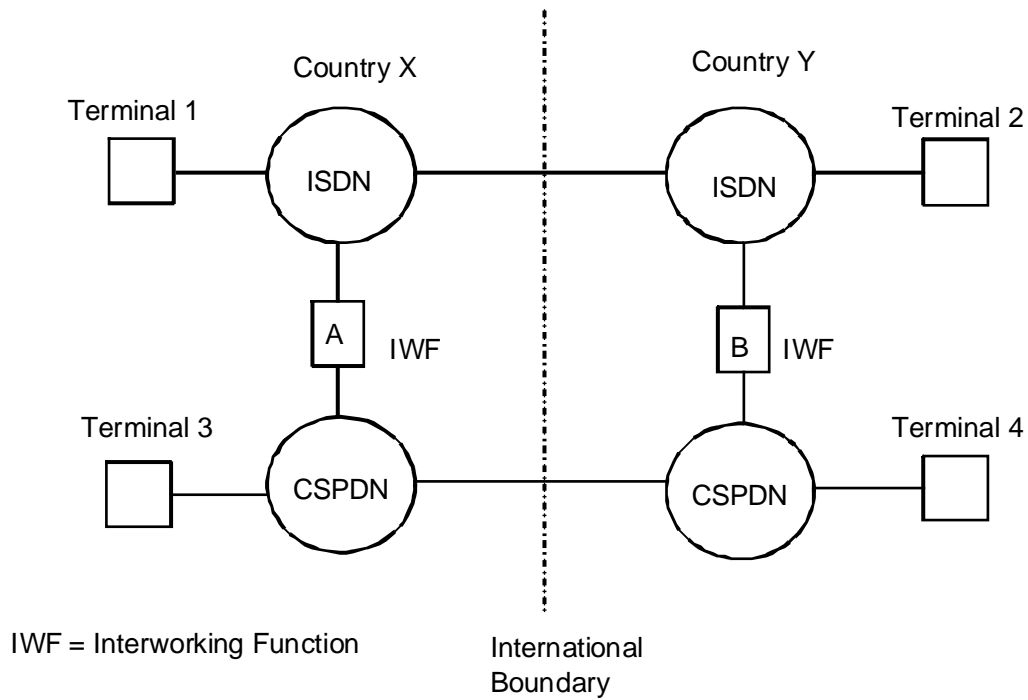
- a) calls outgoing from an ISDN and terminating in an ISDN are routed directly between the ISDNs. For international calls ISDN links are used;
- b) calls originating in the ISDN but terminating in a data network in another country are first routed in the originating country via the IWF located between the ISDN and the relevant data network. For international calls data links are used;
- c) calls originated in the data network but terminating in the ISDN of another country are first routed via the interworking function located between the data network and the ISDN of the originating country. For international calls ISDN links are used.

If in one of the two countries teletex is supported by both ISDN and CSPDN while the other country offers ISDN and PSPDN, the international traffic is routed between two PSPDNs. This assumes that the country supporting teletex by ISDN and CSPDN also operates a PSPDN or an appropriate IWF to allow the use of CCITT Recommendation X.75 [20] on the international link.

The network interconnections as discussed in figures 1 to 3 below are focussing on two ISDN interworking scenarios for the provision of teletex to teletex communications, namely:

- interworking ISDN-CSPDN;
- interworking ISDN-PSPDN.

These interworking scenarios are dealt with in Clause A.3.

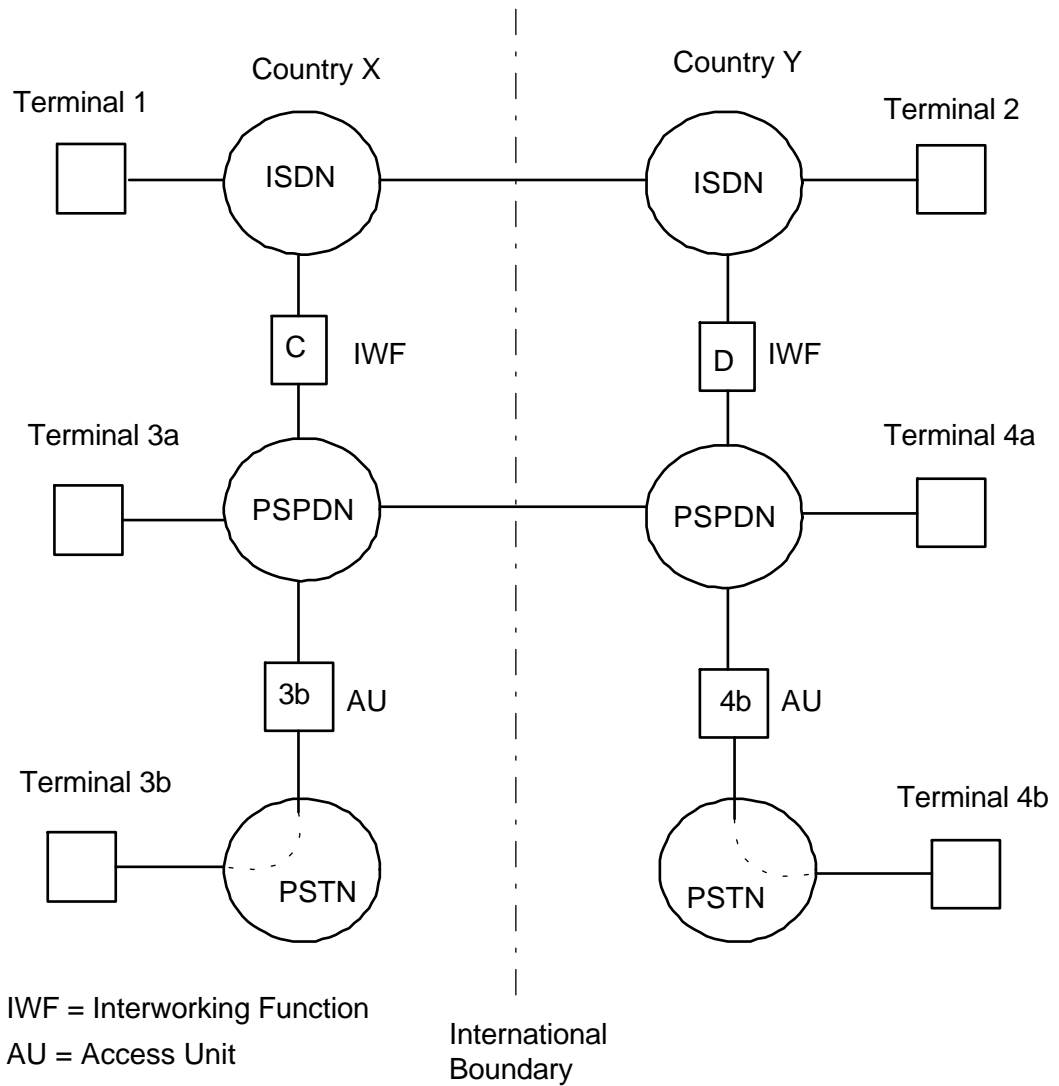


Communications:

Terminal 1	----	Terminal 2	no IWF required
1	----	4	via IWF A
2	----	3	via IWF B
3	----	2	via IWF A
4	----	1	via IWF B
3	----	4	no IWF required

NOTE: Interworking functions A and B are of the same type.

Figure A.1: Teletex provided in ISDN and CSPDN

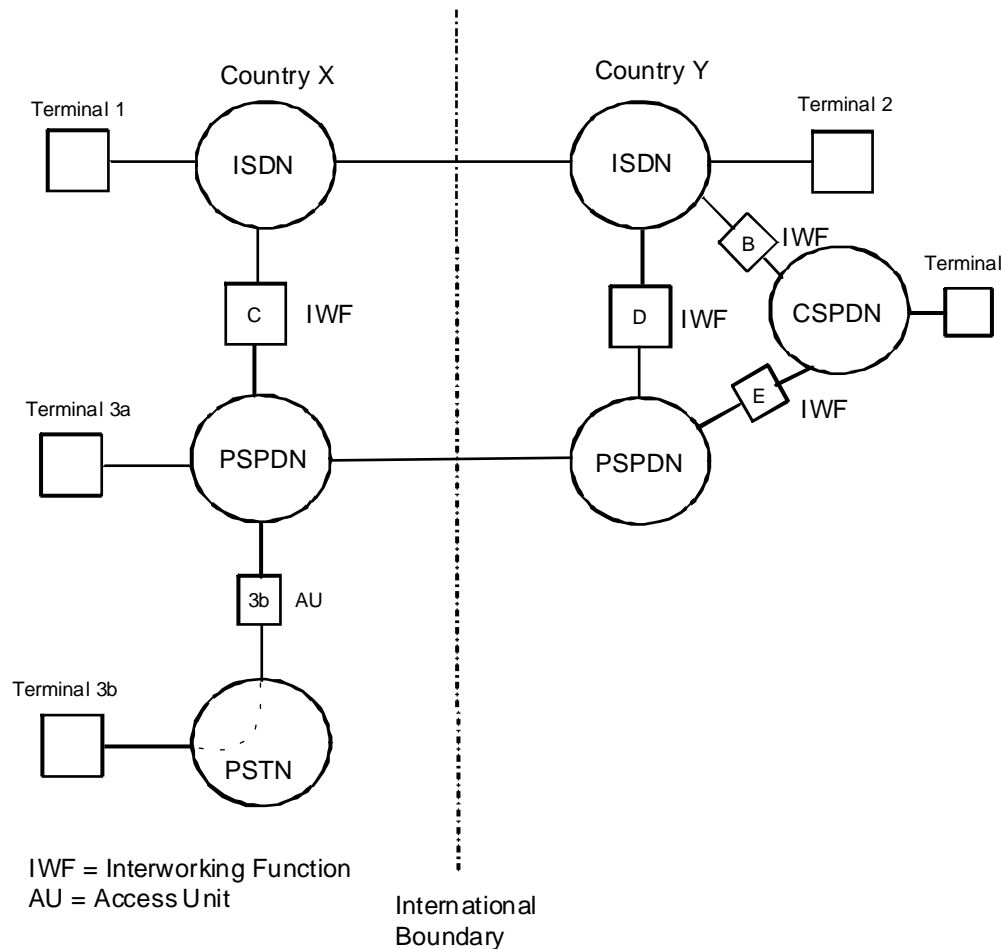


Communications:

Terminal 1	----	Terminal 2	no	IWF required
1	----	4a/4b	via	IWF C
2	----	3a/3b	via	IWF D
3a/3b	----	2	via	IWF C
4a/4b	----	1	via	IWF D
3a/3b	----	4a/4b	no	IWF required

NOTE: Interworking functions C and D are of the same type.

Figure A.2: Teletex provided in ISDN and PSPDN/PSTN



Communications:

Terminal 1	----	Terminal 2	no	IWF required
1	----	4	via	IWFs C and E
2	----	3a/3b	via	IWF D (If IWF D is not implemented, traffic may be routed via IWFs B and E over the CSPDN)
3a/3b	----	2	via	IWF C
4	----	1	via	IWF B
3a/3b	----	4	via	IWF E (PSPDN - CSPDN Interworking)

NOTE: Interworking functions C and D are of the same type.

Figure A.3: Teletex provided in a mixed environment

A.3 Interworking scenarios

A.3.1 Teletex (ISDN) - teletex (CSPDN)

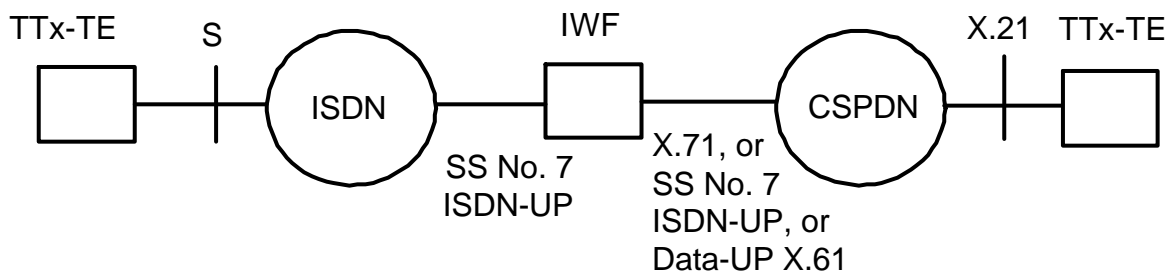


Figure A.4: Teletex on ISDN interworking with teletex on CSPDN

A.3.1.1 Interworking aspects

As far as interworking is concerned the scenario level is given in CCITT Recommendation I.540 [8] (X.321 [24]) and the functional level (protocol mapping and speed conversion) is defined in CCITT Recommendation X.61 [18].

Selection of the required IWF for calls in both directions is achieved within numbering and the routing process. Thus no specific procedure is necessary.

A.3.1.2 Numbering aspects

For numbering aspects in the direction ISDN to CSPDN the calling terminal sends an CCITT Recommendation X.121 [23] address preceded by a prefix. The allocation of prefixes is a national matter. This is regarded as short term solution.

NOTE: The term "short term solution" is used for the realisation of MoU services priorities 1 and 2.

The short term solution given is a specific national implementation. It is a national matter to determine whether a prefix, escape code or combination is used. These solutions cannot be used internationally unless except by bilateral agreement.

As a longer term solution the use of a Numbering Plan Identifier (NPI) together with the DNIC instead of the prefix has been proposed. NPI has been included in the ETSI D-channel standard ETS 300 102-1 [2].

For numbering in the direction CSPDN to ISDN, the calling terminal sends an CCITT Recommendation E.164 [1] address preceded by the escape code of CCITT Recommendation X.121 [23]. Terminal selection in the ISDN is done by means of a second user class character as defined by CCITT Recommendation X.71 [19].

The second user class character received from the CSPDN indicating the service "teletex" may be converted by the IWF to the appropriate BC/LLC/HLC-elements and thus allowing terminal selection in the ISDN.

A.3.1.3 Routing aspects

Figure A.1 shows a possible network configuration where teletex is provided in two countries in ISDN and CSPDN. The routing principles are described in Clause A.2.

A.3.2 Teletex (ISDN) - teletex (PSPDN)

Figure A.5 defines the scenario for teletex on ISDN interworking with teletex on PSPDN together with data communication supported by the same network arrangements.

A.3.2.1 Interworking aspects

Figure A.5 shows one possible solution for protocol arrangements at the interworking point. This is to use SS No. 7, ISDN-UP at the ISDN side and CCITT Recommendation X.75 [20] at the PSPDN side. CCITT Recommendation X.325 [25] (CCITT Recommendation I.550 [9]) defines this interworking case in § 6.2.1 as "interworking by call control mapping" in contrast to "interworking by port access" described in subclause 6.2.2 of CCITT Recommendation X.325 [25], which applies to the Data Communication cases shown in figure A.5. Protocol mapping from SS No. 7 to CCITT Recommendation X.75 [20] and vice versa is not yet defined. For the specification of the functional level of this interworking situation a technical standard similar to CCITT Recommendation X.82 [22] (CSPDN-PSPDN) is required.

For routing calls to the appropriate IWF (selection of IWF) the direction of call establishment has to be taken into consideration.

A.3.2.2 Numbering aspects

A.3.2.2.1 Teletex-calls terminating in the PSPDN

For calls originated in the ISDN and terminating in the PSPDN the calling terminal sends a CCITT Recommendation X.121 [23] address in the DSS1 call set-up message. As a short term solution the use of a prefix could be envisaged. As a longer term solution the use of NPI together with DNIC is proposed. Both elements, prefix as well as NPI followed by the CCITT Recommendation X.121 [23] number, would allow the selection of the required IWF.

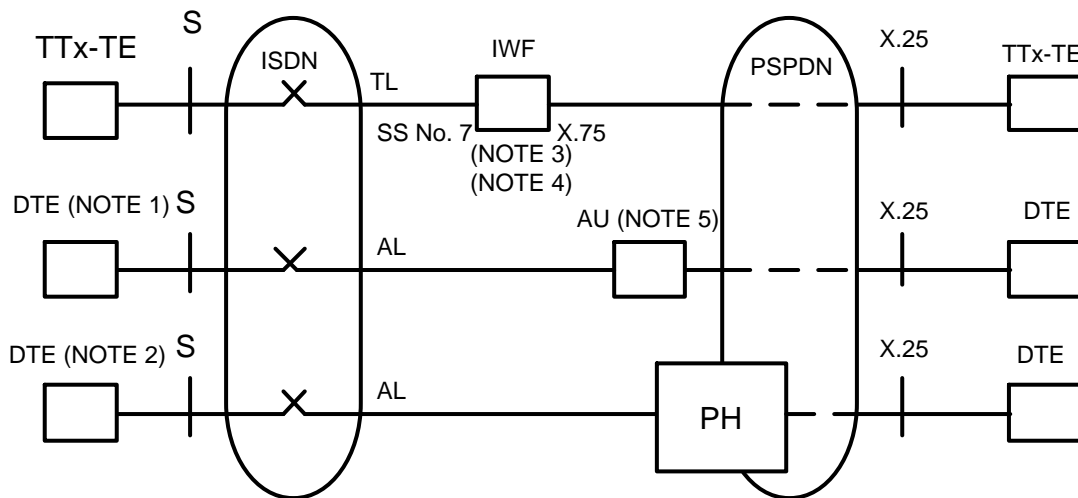
A.3.2.2.2 Teletex-calls terminating in the ISDN

In general, for calls originated in the PSPDN and terminating in the ISDN, the calling terminal sends an CCITT Recommendation E.164 [1] ISDN address with the CCITT Recommendations X.25 [15]/X.75 [20] call request packet. For the time being there is no mechanism in packet switching to indicate the service analogous to the HLC element in the ISDN. Consequently this creates difficulties in selecting a specific IWF or AU or PH for teletex for accessing the ISDN. The possibility to define a service indicating element for CCITT Recommendations X.25 [15]/X.75 [20] analogous to the HLC element in the ISDN is under discussion within CCITT Study Group VII.

A possible short term solution is the use of a CCITT Recommendation X.121 [23] address with a specific DNIC.

A.3.2.3 Routing aspects

Figure A.2 shows a possible network configuration where teletex is provided in two countries in ISDN and PSPDN/PSTN. The routing principles are described in Clause A.2.



Legend:

IWF: Interworking Functions
 AU: Access Unit
 PH: Packet Handler
 TL: Trunk Line
 AL: Access Line

NOTE 1: CCITT Recommendation X.31 [16], case A, B-channel access to the PSPDN.

NOTE 2: CCITT Recommendation X.31 [16], case B, B-channel access, ISDN virtual circuit service

For call controlling:

NOTE 3: The use of SS No. 7 ISDN-UP and CCITT Recommendation X.75 [20] is one possible solution for protocols at the interworking point.

NOTE 4: The use of an AU instead of an IWF may be an alternative solution which requires further study.

NOTE 5: For the data transfer phase, CCITT Recommendation T.90 [10] applies. The AU may also be connected to the PH.

Figure A.5: teletex on ISDN interworking with teletex on PSPDN

Annex B: Interworking between teletex (ISDN) and telex

B.1 General

Interworking between the teletex service and the telex service is generally defined by the following CCITT Recommendations:

- CCITT Recommendation F.201 [5] general principles for interworking between the teletex service and the telex service;
- CCITT Recommendation U.201 [11] procedures to be followed for interworking between the teletex service and the telex service.

These Recommendations do not cover specific network arrangements. They take into account that the teletex service may be provided upon various networks.

For the description of the interworking situation where teletex is supported by the ISDN it is assumed that for teletex on the ISDN the access configuration as stated in Annex A, Clause A.1, applies.

Two different scenarios to provide interworking between teletex on the ISDN and telex exist:

- a) the telex network is directly interconnected with the ISDN;
- b) the telex network is connected with the ISDN via a data network.

Figure B.1 shows possible configurations for network interconnection.

NOTE: It is important to note, that CCITT Recommendation U.202 [12] which defines the provision of the telex service within the ISDN does not apply to the interworking scenarios discussed in this section.

B.2 Interworking aspects

The principles outlined in CCITT Recommendation U.201 [11] apply for both scenarios mentioned above.

In case of scenario a), the ISDN side of the IWF/conversion unit has to comply with the characteristics of a 64 kbit/s circuit - switched unrestricted digital information ISDN bearer. The other side has to reflect the telex characteristics.

B.3 Numbering aspects

In telex networks the total length of selection information to be transferred is limited to 12 digits. Therefore in many cases it may not be possible to address a telex terminal in the ISDN within a one-stage selection procedure may apply.

B.4 Routing aspects

According to CCITT the service provider of the teletex service has to provide a teletex/telex conversion facility.

Therefore, the following routing principles apply:

- a) teletex calls originated in the ISDN but terminating in a telex network in another country are first routed in the originating country from the ISDN to the national telex network. For the international call telex links are used;
- b) telex calls terminating in the ISDN of another country are first routed via international telex links to the foreign telex network and then to the ISDN.

If both countries are offering telex and teletex service, conversion facilities are to be provided in each of the countries. Deviating routing principles could be applicable.

In case of two-stage selection the IWF/conversion facility is addressed by the calling terminal. Therefore, depending on the network provides agreements, the call could be routed either via the IWF/conversion facility located in the country where the call is originated or located in the destination country.

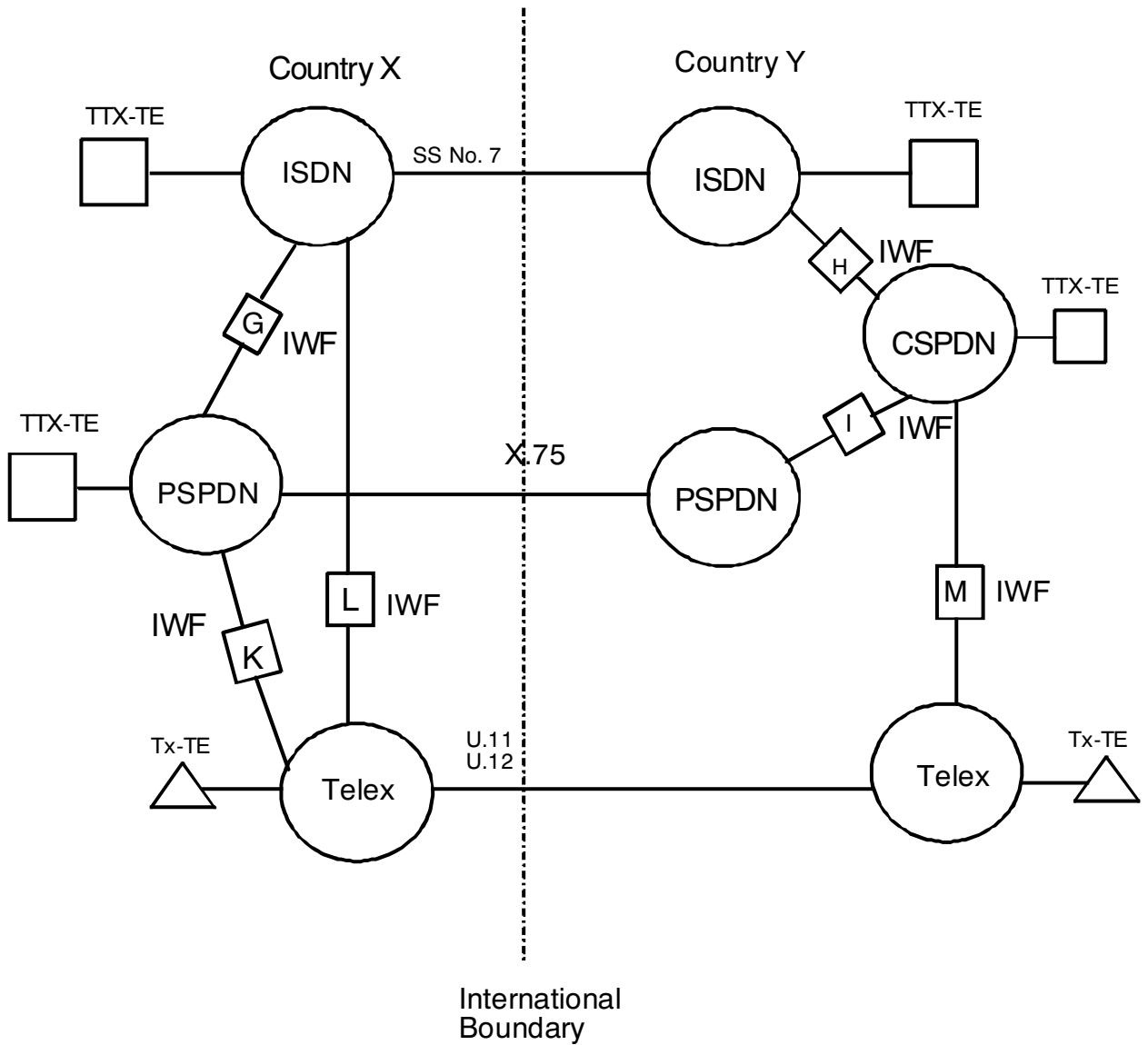


Figure B.1: Interworking teletex on the ISDN with telex (possible configuration for network interconnection)

History

Document history	
July 1992	First Edition
March 1996	Converted into Adobe Acrobat Portable Document Format (PDF)