INTERNATIONAL TELECOMMUNICATION UNION

ITU-T I.340

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

INTEGRATED SERVICES DIGITAL NETWORK (ISDN)

OVERALL NETWORK ASPECTS AND FUNCTIONS

ISDN CONNECTION TYPES

ITU-T Recommendation I.340

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation I.340 was published in Fascicle III.8 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

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

Recommendation I.340

ISDN CONNECTION TYPES

(Malaga-Torremolinos, 1984; amended at Melbourne, 1988)

1 General

The ISDN may be described by a limited set of user-network interfaces (refer to Recommendation I.411) and a limited set of ISDN connection types to support the telecommunication services described in the I.200-Series of Recommendations. This Recommendation identifies and defines these connection types which are a description of the lower layer functions (refer to Recommendation I.310) of the ISDN network needed to support the basic services.

This Recommendation should be considered in conjunction with other Recommendations in the I-Series, with particular reference to Recommendations I.120, I.200-Series, I.310, I.320, I.324, I.411 and I.412. For definitions of terms used in this Recommendation, refer to Recommendation I.112.

2 Basic concept of ISDN connection types

2.1 *Introduction*

An ISDN provides a set of network capabilities which enable telecommunication services to be offered to a user (refer to I.200-Series Recommendations).

ISDN connection types are a description, using the attribute method of Recommendation I.140, of the basic low layer functions (BLLFs) of the ISDN. The set of possible values of attributes is given in § 3. It is possible to select combinations of attribute values which are either impractical or of little use; therefore, a set of agreed connection types is given in § 3.

An ISDN connection is a connection established between ISDN reference points (see Recommendations I.310, I.410 and I.411). All ISDN connections are made to support a request for an ISDN service and are time dependent and of finite duration. All ISDN connections will fall under the category of one or other of the connection types. It follows therefore that an ISDN connection type is a time dependent description and an ISDN connection is an instance of a type.

2.2 *Purpose of international connection types*

The definition of a set of ISDN connection types provides the necessary input to identify the network capabilities of ISDNs. Other key requirements of an ISDN are contained in other I-Series Recommendations, in particular in Recommendations I.310, I.410 and I.411.

In addition to describing network capabilities of an ISDN, the identification of ISDN connection types facilitates the specification of network-to-network interfaces. It will also assist in the allocation of network performance parameters.

It should be noted that the user specifies only the service required while the network allocates resources to set up a connection of the specific type as necessary to support the requested service. It is further noted that for certain services additional functions (e.g. additional lower layer functions and or higher layer functions) may be required as depicted in Figure 1/I.340. For examples of such cases, refer to Recommendation I.310.

2.3 *Functions associated with ISDN connection types*

Any ISDN connection type involves an association of functions to support telecommunication services. These functions are fully described in Recommendation I.310.

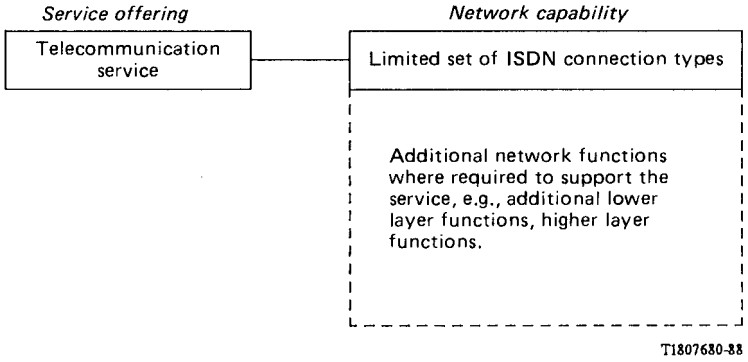

FIGURE 1/I.340

The role of network capabilities in supporting service offerings

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2.4 *Applications of ISDN connection types*

Four situations have been identified thus far to which ISDN connection types apply:

– between two ISDN user-network interfaces, i.e. between S/T reference points (refer to Figure 2a/I.340);

(*Note* – There may be a need in certain cases to differentiate between the S and T reference points. This is for further study.)

– between an ISDN user-network interface and an interface to a specialized network resource (refer to Figure 2b/I.340));

– between an ISDN user-network interface and a network-to-network interface (refer to Figure 2c/I.340);

– between two ISDN-to-other network interfaces (refer to Figure 2d/I.340).

2.5 *ISDN connection involving several networks*

An ISDN connection may comprise a number of tandem network connections. Figure 3/I.340 shows an example in which each end network is an ISDN. The intermediate networks may or may not be ISDNs but they offer the appropriate network capabilities for the service supported by the (overall) ISDN connection. Other configurations are for further study.

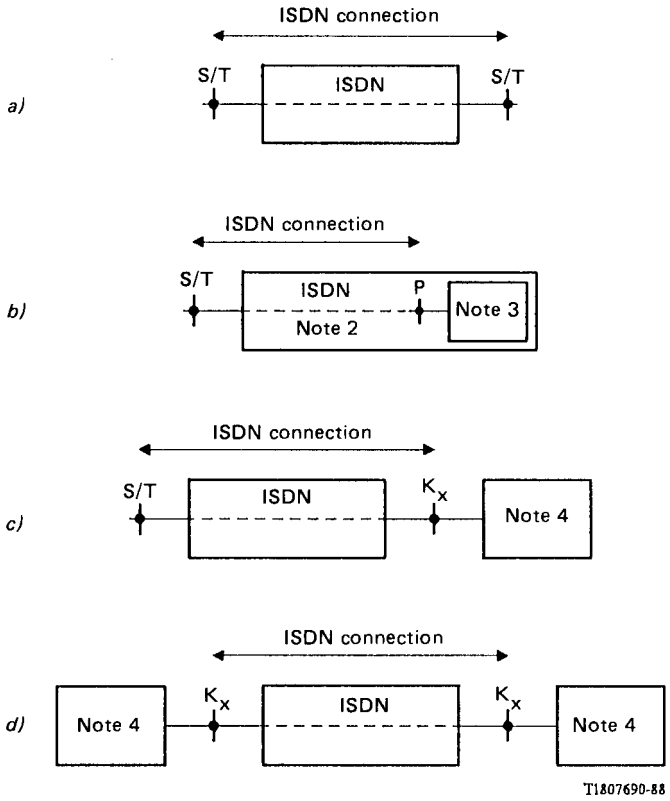
In (overall) ISDN connections involving several networks, each network provides a part of the connection and may be categorized by different attribute values. In such cases, the characterization of the performance for the overall ISDN connection is for further study.

3 ISDN connection types and their attributes

3.1 *Attributes and their values*

ISDN connection types are characterized by a set of attributes. Each attribute has a set of admissible values. The definitions of these attributes are given in Recommendation I.140. Table 1/I.340 of this Recommendation lists the set of attributes and their possible values for connection types and connection elements. The concept of connection elements is explained in detail in § 4.

Figure 4/I.340 shows an example of three different ISDN connections distinguished by differing values for the attribute “topology” in their ISDN connection types. Values for the other attributes of the connection type may be the same, e.g. speech.



Note 1 – The location of reference points used in this figure is defined in Recommendations I.324 and I.411.

Note 2 – This reference point becomes reference point M if the network specialized resource is outside the ISDN.

Note 3 – This box represents a specialized network resource. The use of a network specialized resource originates from a service request or is for internal administrative purposes. Some examples are:

1) a network node incorporating additional lower layer functions (ALLFs) and or higher layer functions (HLFs), (refer to Recommendation I.310);
2) a network provided database (which may also be used to fulfil network functions);
3) an operation or management centre.

Note 4 – This box represents either an existing telephone network or a dedicated network.

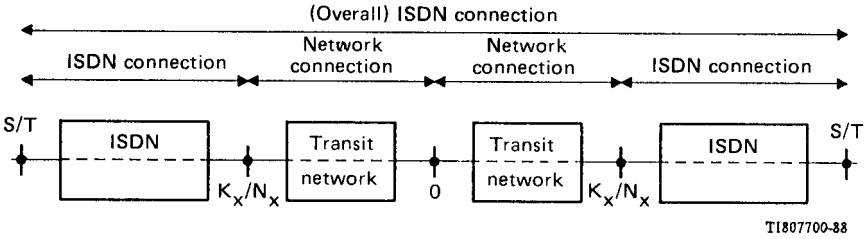
FIGURE 2/I.340

Applications of ISDN connection types

The attributes which are associated with the ISDN connection types have a similarity to those used to define telecommunication services in Recommendations I.211 and I.212. However, the two sets of attributes differ in several important aspects. For example:

a) ISDN connection types represent the technical capabilities of the network and are a means to ensure defined performance and interworking between networks. Telecommunication services supported by the ISDN are the packages offered to users and the definition of their attributes is the means to standardize the service offerings worldwide.

b) Quality of service and commercial attributes are relevant to telecommunication services, whereas network performance, network operation and maintenance attributes are relevant to connection types.



Note – Reference points are defined in Recommendation I.324 and I.411. Reference point 0 may or may not be an ISDN defined reference point.

FIGURE 3/I.340

Example of an ISDN connection involving several networks

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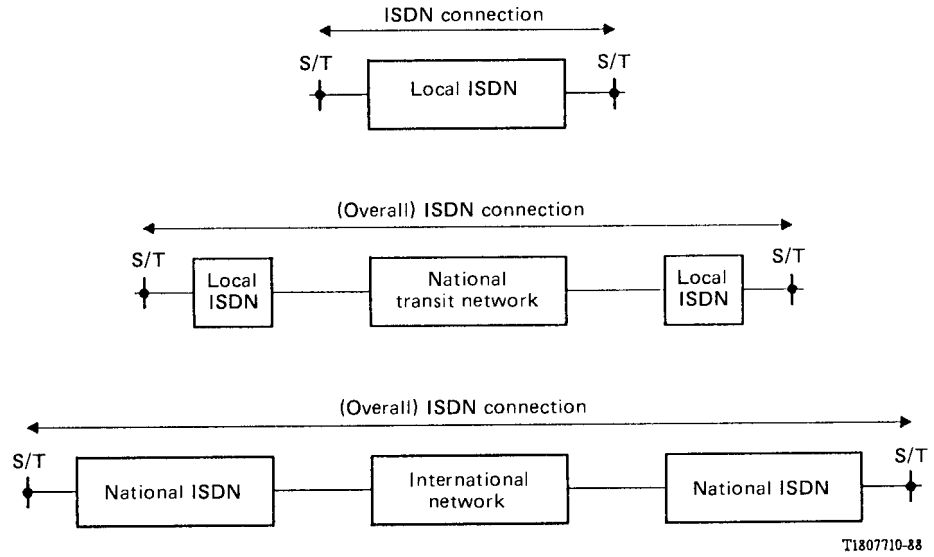

Note 1 – (Overall) ISDN connections involving several networks are covered in § 2.5.

Note 2 – The interface points between the national ISDNs and the international network need not necessarily be at the highest hierarchical level of the national ISDNs.

FIGURE 4/I.340

An example of three different ISDN connections distinguished by differing values for the attribute "topology" in their ISDN connection types

d04

3.2 *Rules of association for the attribute values of connection elements and connection types*

This section describes the relationship between the attribute values of connection elements and connection types (see Table 1/I.340). For each attribute the possible values recommended are listed. The definitions of the attributes and attribute values are contained in Recommendation I.140. In addition to the (possible) attribute values applicable to the connection elements, an association law is given (where appropriate) for each attribute to show how the value of the attribute for the overall connection type is obtained from the values of the attribute applicable to the connection elements.

TABLE 1/I.340

Values already identified for attributes for ISDN connection elements and connection types

Attributes	Values for attributes		
	Access connection element	National or international transit connection element	Overall connection type
1 Information transfer mode	Circuit, packet	Circuit, packet	Circuit, packet
2 Information transfer rate			
Layer 1	64, 2 × 64, 384, 1536, 1920	(16, 32), 64, 2 × 64, 384, 1536, 1920	(16, 32), 64, 2 × 64, 384, 1536, 1920
Layer 2	Throughput options for FS	Throughput options for FS	Throughput options for FS
Layer 3	Throughput options for FS	Throughput options for FS	Throughput options for FS
3 Information transfer susceptance	Speech processing equipment e.g. LRE, speech interpolation, μ/A conversion, echo suppression equipment, null	Speech processing equipment e.g. LRE, speech interpolation, μ/A conversion, echo suppression equipment, multisatellite hops, null	Unrestricted digital, 3.1 kHz audio, speech
4 Establishment of connection	Switched, semi-permanent, permanent	Switched, semi-permanent, permanent	Switched, semi-permanent, permanent
5 Symmetry	Unidirectional, bidirectional, symmetric, bidirectional asymmetric	Unidirectional, bidirectional, symmetric, bidirectional asymmetric	Unidirectional, bidirectional, symmetric, bidirectional asymmetric
6 Connection configuration			
Topology	Point-to-point (simple, tandem or 2 × 64 parallel)	Point-to-point (simple, tandem or 2 × 64 parallel) multipoint	Local, national, international (simple or 2 × 64 parallel)
Uniformity	Uniform, non uniform	Uniform, non uniform	Not applicable
Dynamics	Not applicable	Not applicable	Concurrent, sequential, add/remove, symmetry and/or topology change
7 Structure			
Layer 1	8 kHz integrity, 8 kHz integrity with RDTD, unstructured	8 kHz integrity, 8 kHz integrity with RDTD, unstructured	8 kHz integrity, 8 kHz integrity with RDTD, unstructured
Layer 2	SDU integrity, unstructured	SDU integrity, unstructured	SDU integrity, unstructured
Layer 3	SDU integrity, unstructured	SDU integrity, unstructured	SDU integrity, unstructured
8 Channel (rate)			
Information channel	D(16), D(64), B(64), H_0(384), H_{11}(1536), H_{12}(1920)	64, 1536, 1920, analogue	Not applicable
Signalling channel	D(16), D(64), D(16) + B(64), D(64) + B(64)	Common channel signalling system, packet	

TABLE 1/I.340 *(cont.)*

Attributes	Values for attributes		
	Access connection element	National or international transit connection element	Overall connection type
9 Connection control protocol [a]			Not applicable
			Layer 1, Rec. I.430, Rec. I.431, Rec. Q.702, Rec. X.75 physical level [c], Rec. X.25 physical level [c]
Layer 2	Rec. I.441, Rec. X.25 link level [c] [d], or null	Rec. Q.703, Rec. X.75 link level [c], Rec. X.25 link level [c]	
Layer 3	Rec. I.451, Rec. X.25 packet level [c] [d]	Rec. Q.704 + SCCP, Rec. X.75 packet level, Rec. Q.704 + ISUP, Rec. X.25 packet level [c], null	
10 Information transfer coding protocol [a]			Not applicable
Layer 1	Rec. I.430, Rec. I.431, Rec. G.711	Rec. G.711, Rec. Q.702, Rec. X.75 physical level [c], Rec. X.25 physical level [c]	
Layer 2	Rec. I.441, Rec. X.25 link level [c], or null	Rec. Q.703, Rec. X.75 link level [c], Rec. X.25 link level [c] or null	
Layer 3	Rec. I.451, Rec. X.25 packet level [c] [d] or null	Rec. Q.704 + SCCP, Rec. X.75 packet level [c], Rec. Q.704 + ISUP, Rec. X.25 packet level [c] or null	
11 Network performance [b]			
a) Error performance	Rec. G.821	Rec. G.821	Rec. G.821
b) Slip performance	Rec. G.822	Rec. G.822	Rec. G.822
12 Network interworking	FS	FS	FS
13 Operations and management	FS	FS	FS

FS further study

[a] Where there are two or more S/T interfaces, different values of access attributes (attributes 8, 9 and 10) may occur at each interface. Values need to be specified for each channel of the interface structure. The role of the access attributes in determining connection types is for further study. Interfaces to network specialized resources and to other networks are for further study.

[b] Examples of the additional performance attributes which may be defined are:

- call and packet processing delays;
- probability of call failure due to congestion;
- probability of call failure due to network malfunction or packet mishandling;
- information transfer delay;
- error performance [including attributes 11 a) and 11 b)].

[c] Use of Rec. X.25 and X.75 in ISDN can be found in Rec. X.31.

[d] Packet connection establishment/release may be a two stage process: stage 1 the selection of a B-channel, stage 2 the setting up of a packet connection. For further details, see Rec. X.31.

3.2.1 *Information transfer mode*

Attribute values for connection elements

Circuit or packet.

Attribute values for overall connection type

Circuit or packet.

Association law

Due to the nature of current packet systems, the use of packet mode in any connection element would make the overall connection type a packet type.

3.2.2 *Information transfer rate (kbit/s)*

Attribute values for connection elements

16 or 32 or 64 or 2 × 64 or 384 or 1536 or 1920

(Values 16 and 32 are not allowed in the access connection element).

Attribute values for overall connection type

(16 or 32) or 64 or 2 × 64 or 384 or 1536 or 1920.

Association law

The value for the overall connection type will be equal to the lowest value of any of its connection elements.

3.2.3 *Information transfer susceptance*

Attribute values for connection elements

Speech processing functions (e.g. low rate encoding (LRE) equipment, speech interpolation, μ/A law conversion) and/or echo suppression functions and/or multiple satellite hops or null.

The exact means of specification of the attribute is for further study. One method would be an appropriate reference to a Recommendation detailing operational requirements in the ISDN.

Attribute values for overall connection types

Unrestricted digital information or 3.1 kHz audio or speech.

Association law

For an overall connection type to have the value *unrestricted digital*, no connection element may contain speech processing functions or echo suppression functions. Connection elements containing speech processing devices having the flexibility to change operation between speech and 64 kbit/s unrestricted would on the other hand be allowed to be a part of a number of different connection types.

For an overall connection type to have the value *3.1 kHz audio*, it may contain echo suppression functions (or it has to disable them prior to data transfer); it must however contain μ/law conversion equipment when appropriate.

For an overall connection type to have the value *speech*, it must contain μ/law conversion equipment and echo suppression functions when appropriate.

These matters are dealt with in more detail in Recommendation I.335.

3.2.4 *Establishment of connection*

Attribute values for connection elements

Switched or semi-permanent or permanent.

Attribute values for overall connection type

Switched or semi-permanent or permanent.

Association law

If all connection elements are permanent, then the overall connection type is permanent.

If any of the connection elements are switched, then the overall connection type is switched. If one or more of the connection elements are semi-permanent and none of the connection elements are switched, then the overall connection type is semi-permanent.

3.2.5 *Symmetry*

Attribute values for connection elements

Unidirectional or bidirectional symmetric or bidirectional asymmetric.

Attribute values for the overall connection type

Unidirectional or bidirectional symmetric or bidirectional asymmetric.

Association law

The overall symmetry can only be generated from the connection elements by analysis of the connection element values in the context of the architecture of the connection.

3.2.6 *Connection of configuration*

3.2.6.1 *Topology*

Attribute values for connection elements

Point-to-point (simple, tandem or 2 × 64 parallel), or multipoint.

(The access connection element may not be multipoint.)

Attribute values for the overall connection type

Local or national or international. (Each simple or 2 × 64 parallel.)

Association law

No association is possible.

3.2.6.2 *Uniformity*

Attribute values for connection elements

Uniform or non-uniform.

Attribute values for the overall connection type

Not applicable.

Association law

Not applicable.

3.2.6.3 *Dynamics*

Attribute values for connection elements

Not applicable.

Attribute values for the overall connection type

Concurrent or sequential or add/remove, or symmetry and/or topology change.

Association law

Not applicable.

3.2.7 *Structure*

Attribute values for connection elements

Layer 1: 8 kHz integrity or 8 kHz integrity with RDTD (Restricted Differential Time Delay)[1), 2)] or unstructured

Layer 2: Service data integrity or unstructured

Layer 3: Service data integrity or unstructured

Attribute values for the overall connection type

As per values for connection elements.

Association law

For further study.

3.2.8 *Channels*

3.2.8.1 *Information channel (rate)*

Attribute values for connection elements

Access connection element: D(16) or D(64) or B(64) or H_0(384) or H_{11}(1536) or H_{12}(1920)

Transit connection element: 64 kbit/s or equivalent in a higher order multiplex or packet system or analogue transmission.

Attribute values for the overall connection type

Not applicable

3.2.8.2 *Signalling channel (rate)*

Attribute values for connection elements

Access connection element: D(16) or D(64) or B(64) + D(16) or B(64) + D(64)

Transit connection element: common channel signalling system or packet

Attribute values for the overall connection type

Not applicable

3.2.9 *Connection control protocol*

Attribute values for connection elements

Access connection element:

Layer 1: I.430 or I.431

Layer 2: I.441 or I.441 + X.25 link level

Layer 3: I.451 or I.451 + X.25 packet level

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1) The term **RTTD** in the connection type context is defined as follows:

This value applies when:

i) at each point in a connection or connection element, the time slots are explicitly or implicitly demarcated for each information channel or an aggregate of information channels, and

ii) the information parts submitted to the time slots at the the transmitting end are delivered to the receiving end with a differential time delay or not more than 50 ms.

2) 50 ms is a provisional value that needs to be confirmed. This value has to take into account the maximum differential time delay of an appropriate HRX or part thereof as defined in the G-Series Recommendations.

Transit connection element:

Layer 1: Q.702 or X.75 physical level

Layer 2: Q.703 or X.75 link level or Q.703 + X.25 link level

Layer 3: Q.704 + SCCP or Q.704 + ISUP or X.75 packet level or Q.704 + SCCP + X.25 packet level or Q.704 + ISUP + X.25 packet level

Attribute values for the overall connection type

Not applicable.

3.2.10 *Information transfer coding/protocol*

Attribute values for connection elements

Access connection element:

Layer 1: I.430 or I.431 or I.430 + G.711 or I.431 + G.711

Layer 2: I.441 or X.25 link level or null

Layer 3: I.451 or X.25 link packet level or null

Transit connection element:

Layer 1: G.711 or G.702 or X.75 physical level

Layer 2: Q.703 or X.25 link level or X.75 link level or null

Layer 3: X.25 packet level or X.75 packet level or Q.704 + ISUP or null

Attribute values for the overall connection type

Not applicable.

3.2.11 *Network performance*

3.2.11.1 *Error performance*

Attribute values for connection elements

G.821

Attribute values for the overall connection type

G.821

Association law

G.821

3.2.11.2 *Slip performance*

Attribute values for connection elements

G.822

Attribute values for overall connection type

G.822

Association law

G.822

3.2.12 *Further attributes and attribute values*

Section 3.2 has outlined the relationships between those attributes values presently existing; the possibility for new values being added remains.

3.3 *Limited set of ISDN connection types*

From the given list of attributes and their possible values, a large number of connection types can be identified. However, some of these attributes are of a general or dominant nature and an initial set of ISDN connection types can be based on these dominant attributes.

Table 2/I.340 enumerates a limited set of connection types based on the following dominant attributes: information transfer mode, information transfer rate, information transfer susceptance, establishment of connection and symmetry. These connection types are intended to be sufficient to support the basic telecommunication services identified in the I.200-Series of Recommendations. Additional connection types are for further study.

4 Connection elements

The ISDN network architecture Recommendation I.324 explains how an ISDN connection type is made up of connection elements (CEs). This concept is illustrated in Figure 5/I.340 and this is valid for all connection types between S/T reference points. A particular ISDN connection may be local (i.e. only access connection elements are involved), national transit (i.e. involving access and national transit CEs), or international (i.e. involving all three kinds of CEs).

Current Recommendations allow collocation and non-collocation of each of the types of CRFs indicated in Figure 5/I.340. This is a national matter.

4.1 *Access connection element*

The access connection element is the portion of the connection from the S/T reference point to the local connection related function (CRF). In the case of permanent connection types an equivalent point to the local CRF needs to be defined.

4.2 *National transit connection element*

The national transit connection element is the portion of the connection between the local CRF and the international CRF. In the case of a national connection this would default to a “transit connection element”, i.e. between two local CRFs, but could involve network elements from more than one network operator.

4.3 *International connection element*

The international connection element is the portion of the connection between the originating and destination international CRFs.

4.4 *Use of connection elements*

By using connection elements and attributes which have a layered nature, the construction of a connection type is more easily described. The use of different values for the same attribute in different connection elements allows for a greater degree of description and flexibility.

The connection element analysis may assist in the description of a complex and asymmetric ISDN connection. This is illustrated in Figure 6/I.340, in which the configuration attributes of topology, uniformity and dynamics for a connection type are described using the concept of connection elements.

Different connection elements which constitute an ISDN connection may have different sets of attributes. In this case the attributes across the connection are not homogeneous, and the available attributes of the connection are limited by the most restrictive set of attributes of all the connection elements of the connection.

TABLE 2/I.340

Set of ISDN connection types

ISDN connection type identity		Attributes												
		Dominant attributes which define ISDN connection types						Additional attributes						
		1	2	3	4	5	6	7	8	9	10	11	12	13
CT No.	ISDN CT category	Inform. transfer mode	Inform. transfer rate (kbit/s)	Inform. transfer susceptance	Establish-ment of connection	Symmetry	Connection configuration	Structure	Channel (rate) [a]	Connec-tion control protocol	Inform transfer coding/ protocol	Network perform-ance [c]	I/W	O & M
A 1	64 kbit/s unres-tricted digital	Circuit	64	Unrestricted digital	Switched	Bidirectional symmetric	Pt-pt multipoint	8 kHz	B(64)	[e]				
A 2		Circuit	64	Unrestricted digital	Semi-permanent	Bidirectional symmetric	Pt-pt multipoint	8 kHz	B(64)					
A 3		Circuit	64	Unrestricted digital	Permanent	Bidirectional symmetric	Pt-pt multipoint	8 kHz	B(64)					
A 4	Speech	Circuit	64	Speech	Switched	Bidirectional symmetric	Pt-pt multipoint	8 kHz	B(64)					
A 5		Circuit	64	Speech	Semi-permanent	Bidirectional symmetric	Pt-pt multipoint	8 kHz	B(64)					
A 6		Circuit	64	Speech	Permanent	Bidirectional symmetric	Pt-pt multipoint	8 kHz	B(64)					
A 7	3.1 kHz audio	Circuit	64	3.1 kHz audio	Switched	Bidirectional symmetric	Pt-pt multipoint	8 kHz	B(64)					
A 8		Circuit	64	3.1 kHz audio	Semi-permanent	Bidirectional symmetric	Pt-pt multipoint	8 kHz	B(64)					
A 9		Circuit	64	3.1 kHz audio	Permanent	Bidirectional symmetric	Pt-pt multipoint	8 kHz	B(64)					

TABLE 2/I.340 *(cont.)*

ISDN connection type identity		Attributes												
		Dominant attributes which define ISDN connection types						Additional attributes						
		1	2	3	4	5	6	7	8	9	10	11	12	13
CT No.	ISDN CT category	Inform. transfer mode	Inform. transfer rate (kbit/s)	Inform. transfer susceptance	Establish-ment of connection	Symmetry	Connection configuration	Structure	Channel (rate) [a]	Connec-tion control protocol	Inform transfer coding/ protocol	Network perform-ance [c]	I/W	O & M
A 10	Circuit 2 × 64	Circuit	2 × 64	Unrestricted	Switched	Bidirectional symmetric	Pt-pt multipoint +2 × 64 k	8 kHz RDTD	2 × B					
A 11		Circuit	2 × 64	Unrestricted	Semi-permanent	Bidirectional symmetric	Pt-pt multipoint +2 × 64 k	8 kHz RDTD	2 × B					
A 12		Circuit	2 × 64	Unrestricted	Permanent	Bidirectional symmetric	Pt-pt multipoint +2 × 64 k	8 kHz RDTD	2 × B					
B 1	Packet	Packet	64 (FS)	Unrestricted	Switched	Bidirectional symmetric	Pt-pt multipoint	SDU	B(64)					
B 2		Packet	64 (FS)	Unrestricted	Semi-permanent	Bidirectional symmetric	Pt-pt multipoint	SDU	B(64)					
C 1	Broad-band [d]	Circuit	384	Unrestricted	Switched	Bidirectional symmetric	Pt-pt multipoint	8 kHz	H_0(384)					
C 2		Circuit	384	Unrestricted	Semi-permanent	Bidirectional symmetric	Pt-pt multipoint	8 kHz	H_0(384)					
C 3		Circuit	384	Unrestricted	Permanent	Unidirectional [b]	Pt-pt multipoint	8 kHz	H_0(384)					

TABLE 2/I.340 *(end)*

ISDN connection type identity		Attributes												
		Dominant attributes which define ISDN connection types						Additional attributes						
		1	2	3	4	5	6	7	8	9	10	11	12	13
CT No.	ISDN CT category	Inform. transfer mode	Inform. transfer rate (kbit/s)	Inform. transfer susceptance	Establish-ment of connection	Symmetry	Connection configuration	Structure	Channel (rate) [a]	Connec-tion control protocol	Inform transfer coding/ protocol	Network perform-ance [c]	I/W	O & M
C 4	Broad band [d]	Circuit	1536	Unrestricted	Switched	Unidirectional [b]	Pt-pt multipoint	8 kHz	H_{11}(1536)					
C 5		Circuit	1536	Unrestricted	Semi-permanent	Unidirectional [b]	Pt-pt multipoint	8 kHz	H_{11}(1536)					
C 6		Circuit	1536	Unrestricted	Permanent	Unidirectional [b]	Pt-pt multipoint	8 kHz	H_{11}(1536)					
C 7		Circuit	1920	Unrestricted	Switched	Unidirectional [b]	Pt-pt multipoint	8 kHz	H_{12}(1920)					
C 8		Circuit	1920	Unrestricted	Semi-permanent	Unidirectional [b]	Pt-pt multipoint	8 kHz	H_{12}(1920)					
C 9		Circuit	1920	Unrestricted	Permanent	Unidirectional [b]	Pt-pt multipoint	8 kHz	H_{12}(1920)					

CT Connection type

FS Further study

I/W Interworking

O & M Operations and management

RDTD Restricted differential time delay

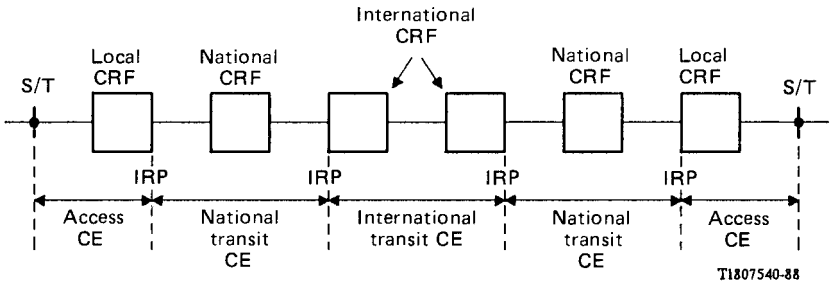
[a] D(16, 64) for signalling.

[b] Unidirectional: further study.

[c] Parameters have to be based on network performance parameter values as described in Recommendations G.821, G.822 and others.

[d] Some networks will not support these connection types until some future date; additionally, Recommendations are not yet available for the switching of H_0 and H_1 channels.

[e] Overall connection control protocol is the resultant of the interactions of the access and inter-exchange connection control protocols.



IRP Internal reference point
CRF Connection related function

FIGURE 5/I.340

General reference configuration for ISDN

d05

4.5 *Basic connection components*

A connection element is composed of basic connection components. These are identified by the appropriate functional groupings and delimiting reference points.

Two categories of basic connection components are considered:

– where CRFs are not included, e.g. transmission links (Figure 7/I.340 shows such a basic connection component for the digital subscriber line section);

– where CRFs are included, e.g. exchange connections as they are defined in Recommendation Q.513. (Figure 8/I.340 shows such a basic connection component for a circuit switched, 64 kbit/s, point-to-point connection in a local or combined exchange.)

When referencing to the relevant switching and transmission Recommendations, the basic connection components provides a bridge between the connection type and the physical network. The definition of appropriate rules for the selection of references is for further study.

5 Relationship between services and ISDN connection types

5.1 *General relationship*

Given a user request for a telecommunication service at the initiation of a call, the network must choose a connection of a connection type that supports the attributes of the service requested. This selection of a connection is effected at the time of call set-up as a routing function based on a table of options derived during the planning and implementation of the network. The options a network implements will be based on the capabilities needed to support the services the network intends to offer.

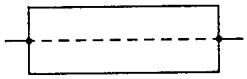
5.2 *Network capability to support a change in service during a call*

Recommendation I.231 identifies a bearer service alternate speech/64 kbit/s unrestricted which has a value of the information transfer capability attribute which can alternate.

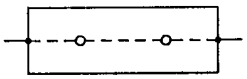
When the user requests this service, this alterable attribute value should be identified in the signalling messages during call set-up. During the call, the user will also use signalling messages to request a change in absolute value of this attribute when it is actually desired; and the network will confirm the request for change.

a) *Topology*

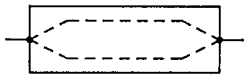
i) Simple



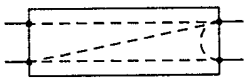
ii) Tandem



iii) Parallel



iv) Multipoint [a]



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v) Others (for further study)

vi) Combination of the above

b) *Uniformity*

i) Uniform (all connection elements identical)

ii) Non-uniform (some connection elements different)

c) *Dynamics*

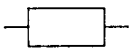
i) Concurrent (all connection elements established and released simultaneously)

ii) Sequential (only one connection element established at a given time)

iii) Add/remove (connection elements may be added and/or removed during a call)

iv) Symmetry and/or topology change (the symmetry attribute value may be changed during a call).

Connection element



ISDN connection type

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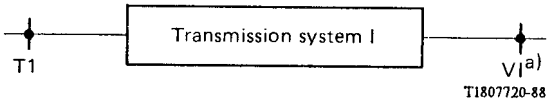
[a] Each segment of the multipoint connection consists in general of several connection elements in tandem. The use of non-hierarchical networks, e.g. a satellite based network, may allow a reduction of the connection elements for each segment.

FIGURE 6/I.340

Description of the connection configuration attributes of an ISDN connection using the connection element analysis

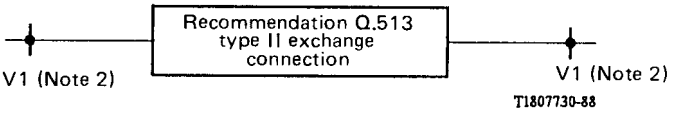
d06



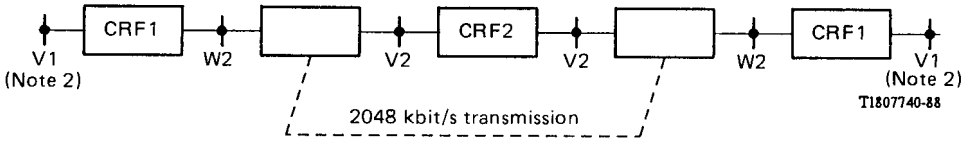
a) Or at other interfaces at the local exchange to be identified.

FIGURE 7/I.340

A basic connection component for the transmission section of a basic subscriber access d07



a) Basic connection components for a circuit switched, 64 kbit/s, point-to-point connection in a local or combined exchange for a local call, between basic accesses



CRF1 + CRF2 + CRF1 is equivalent to type II exchange connection.

b) Basic connection components for a circuit switched, 64 kbit/s, point-to-point connection in a local or combined exchange for a local call between basic accesses, where remote concentrators are used

Note 1 – Depending on national implementations a basic connection component can be split into more than one BC. This can apply for example to a local network where a remote switching unit is used [see part b) of the figure which is a splitting of part a) of the figure when remote concentrators are used].

Note 2 – Or at other interfaces at the local exchange to be identified.

FIGURE 8/I.340 d08

Unless the change in service capability is requested by the user (and agreed to by the network) at the time of call establishment, a change in service request during a call may or may not be granted by the network. The user always has, of course, the option of terminating the call and establishing a new call with different service characteristics.

For service and operational reasons a rapid and reliable changeover is required and this should be considered in implementing the capability for change in service during a call.

When the connection elements/components have an inherent alterable feature which can be dynamically changed from the adjoining exchanges using out-of-band control signalling, then a rapid and reliable changeover can be achieved. The changes may involve disabling, bypassing or introduction of particular network functions (e.g. circuit multiplication equipment, A/μ law converters, echo control, digital pads). The inter-exchange signalling principles to support the alternate speech/64 kbit/s unrestricted ISDN bearer service are contained in Recommendation Q.764. The network capability to support a change in service during a call is for further study.