

2. Recommendation I.510

Normally, each instance of communication within an ISDN will take place between the users of services with identical attribute values. However, communication may also take place between users of services with non-identical attribute values. In these cases interworking functions (IWFs) will be required. In general, when an ISDN user communicates with the user of another network, if the service perceived by the user of that other network were to be defined by the attribute method, the values would not be identical to those of the ISDN user.

The purpose of interworking is to enable the users of "different" services on an ISDN to establish a useful communication or for an ISDN user to establish a useful communication with a user of another network and vice-versa. The term "service" in this Recommendation implies a telecommunication service as defined in Recommendation I.210.

5. Telecommunication services to be supported by ISDN interworking configurations

This section contains a list of telecommunication services that are supported by interconnections between ISDNs and between ISDNs and other networks and defines the types of interworking functions required.

The concepts of section 5 take into account:

End-to-end communication may require:

- a) interworking at lower layers;
- b) interworking at higher layers;
- c) interworking at both lower and higher layers.

Table 1/I.510 displays the networks that support telecommunication services which are also supported by an ISDN and which are candidates, therefore, for interworking with an ISDN in the provision of one of those telecommunication services. Furthermore, Table 1/I.510 depicts the type of interworking functions that may be required for each interworking configuration. Note that the table does not indicate the opportunity for interworking between different telecommunication services (e.g., telex-to-Teletex).

TABLE 1/I.510

Network support of telecommunication services

services supported by the ISDN	Telecommunication		ISDN interconnected with				
	ISDN	PSTN	CSPDN	Other Networks	PSPDN	Telex	Dedicated
a) Telephony	0	N	-	-	-	N	
b) Data transmission (see Note 2)	(L)	N,L	N,(L)	N,(L)	-	N,(L)	
c) Telex	0	-	-	-	N,L	N,L	
d) Teletex	0	N,L	N,L	N,L	-	N,L,H	

e) Facsimile	0	N,L	N,L	N,L	-	N,L			

Note 1 - The list of services in Table 1/I.510 is not exhaustive and is therefore for further study. In particular, bearer services must be included.

Note 2 - See Recommendation X.1 for a description of data transmission services.

Note 3 - It is assumed for Table 1/I.510 that, for the cases of ISDN-to-ISDN interworking, the telecommunication services listed above are supported in both ISDNs by the same bearer, no interworking functions are therefore required. ISDN-to-ISDN interworking situations that involve different bearers, as an extension of Table 1/I.510, are for further study.

Legend to Table 1/I.510

- 0 No interworking functions foreseen
- N Connection-dependent interworking needed
- L Lower layer communication-dependent interworking needed
- H Higher layer communication-dependent interworking needed
- () N/L/H may be needed

6.1 Reference points for network interconnections

The protocol reference model for ISDN interworking is outlined in section 5 of Recommendation I.320.

The reference points K_x and N_x for network interconnections are defined in Recommendation I.324, § 4.2.4.

According to Note 1 to Figure 8/I.324 the value $\neq 1$ signifies that interworking functions exist in the ISDN. The value $\neq 2$ signifies that no interworking functions are required in the ISDN. No assumption is made regarding interworking functions outside the ISDN. Regardless of the value of \neq , the possibility of interworking functions in the other networks, between the networks, or of some combination of these situations, is kept open. The case of N_1 covers the situation when interworking functions are split between the two ISDNs involved.

6.1.1 Interworking using one-stage selection (one-stage interworking)

Interworking using one-stage selection is possible when the interconnection of networks takes place by interconnecting

trunk lines. It is also possible when the networks are physically inseparable (for an example, see Figure 6-4/I.510, part b, and associated text). In this type of interworking, each of the terminals involved in a communication has assigned to it a directory number from the numbering plan of the network to which it is connected. For call establishment, one-stage selection is assumed. An example of this type of interworking is the interconnection of a CSPDN using X.71 interexchange signalling and an ISDN using SS No. 7 interexchange signalling.

For interworking by one-stage selection, the interconnection of networks takes place at reference points K_x or N_x (see Figure 6-1/I.510).

The application of existing interfaces and the specification of new interfaces at the K_x and N_x reference points for interworking by one-stage selection needs further study.

Note - In Recommendation X.300 this category of interworking is defined as "interworking by call control mapping" (see section 6.2.1 of Recommendation X.300).

6.1.2 Interworking using two-stage selection (two-stage interworking)

Interworking using two-stage selection is sometimes required; e.g., access to a PSPDN through an ISDN according to case A of Recommendation X.31. In this example, each of the terminals involved in a communication has assigned to it a directory number from the numbering plan of the PSPDN. For call establishment, two-stage selection is assumed: first, a connection is established through the ISDN to the appropriate PSPDN port; second, a connection is established through the PSPDN to the called terminal.

The logical appearance of interworking by two-stage selection at reference point K_2 (see Note 1) may be that of a customer access (see Figure 6-2/I.510).

The application of existing interfaces and the specification of new interfaces at the K₂ reference point for interworking by two-stage selection is for further study.

Note 1 - Since, in the case of interworking using two-stage selection depicted in Figure 6-2/I.510, no IWFs are required in the ISDN, only reference point K₂ is relevant.

Note 2 - In Recommendation X.300 examples of this category of interworking are defined as "interworking by port access" (see section 6.2.2 of Recommendation X.300).

6.2 ISDN-to-ISDN Interconnection

6.2.1 Reference configuration

With regard to ISDN-to-ISDN interworking in the context of the I.500-Series of Recommendations, the functionality required for bearer service interworking is contained in ISDN-to-ISDN internetwork interfaces.

Figure 6-3/I.510 shows a reference configuration for ISDN-to-ISDN interworking.

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ISDN circuit mode - ISDN circuit mode (both ISDNs supporting a circuit switched bearer service);

ISDN packet-mode - ISDN packet-mode (both ISDNs supporting the ISDN virtual circuit bearer service defined in Recommendation X.31 under case b);

ISDN packet-mode - ISDN circuit mode (interworking where a packet switched bearer is requested by one ISDN and a circuit switched bearer by the other ISDN);

ISDN packet-mode - ISDN circuit mode (interworking, where a circuit switched bearer is requested in one ISDN to get access to the packet handler of another ISDN for communication over an ISDN virtual circuit bearer service).

The services offered at the endpoints may be different.

Not all aspects of internal ISDN interworking may be subject to standardization. The existence and functionality of such interworking, however, may have an impact on the required functionality of network interworking or ISDN-to-ISDN interworking.

6.5 Network concatenation configurations

Note 1 - The impact of network concatenation configurations (i.e., cascaded networks) on ISDN and existing networks and on the mechanisms and functionalities for the realization of these networks is for further study.

Note 2 - In the case of cascaded (concatenated) other than ISDN networks, a requirement may exist for interworking functions between pairs of such networks.

a. network characteristics related to the connection type, such as interface characteristics, switching mode, bit rate, transfer mode, etc., and non-protocol conversion-related characteristics such as numbering plan and special routing;

c. no meaningful mapping is possible due to the fact that crucial parts of one protocol cannot be represented in the other protocol.

When the IWF is not an addressed entity, the following concept for the selection of interworking functions is therefore defined:

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a. Connection-dependent interworking functions are selected by evaluation of user-network and network-network signalling information. Relevant information includes:

- bearer capability

- low layer compatibility

- service indication

- routing information (address information, transit network information)

- information on supplementary services (facilities), if applicable