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TELEPHONE NETWORK AND ISDN OPERATION, NUMBERING, ROUTING AND MOBILE SERVICE

ISDN ROUTING PLAN



Recommendation E.172

FOREWORD

The CCITT (the International Telegraph and Telephone Consultative Committee) is a permanent organ of the International Telecommunication Union (ITU). CCITT is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The Plenary Assembly of CCITT which meets every four years, establishes the topics for study and approves Recommendations prepared by its Study Groups. The approval of Recommendations by the members of CCITT between Plenary Assemblies is covered by the procedure laid down in CCITT Resolution No. 2 (Melbourne, 1988).

Recommendation E.172 was prepared by Study Group II and was approved under the Resolution No. 2 procedure on the 30th October 1992.

CCITT NOTE

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

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Recommendation E.172**ISDN ROUTING PLAN***(1992)***1 Introduction and scope**

1.1 ISDN capabilities are currently being introduced into national and international networks. ISDN provides access to a wide range of services, each of which must be supported by a minimum level of network capabilities. For each service requested by a user, the network must provide the appropriate switching, signalling and transmission capabilities required to successfully complete the call. In practical ISDN implementations some of the ISDN functions will be implemented within the same network elements whereas other ISDN functions, such as those required for interworking, packet handling, etc. will be implemented in “special” network elements.

1.2 The purpose of this Recommendation is to provide network operators with the information necessary to ensure that ISDN services can be routed effectively and efficiently by the various networks which support them.

1.3 The Recommendation establishes basic principles on which to base network design and routing decisions. It provides detailed information on the mapping between ISDN bearer services, ISDN connection types and network capabilities (e.g. transmission links, signalling systems, etc.) required to support a call. Guidance on the conveyance and use of routing information within network components is also included. Further information on the routing implications of network interworking is included at Annex C.

1.4 The Recommendation is intended to provide a single definitive reference Recommendation for ISDN routing. It supersedes earlier ISDN routing Recommendations, specifically Recommendation E.172 (1988) – Call routing in the ISDN era, and Recommendation I.335 (1988) – ISDN routing principles.

1.5 The scope of the Recommendation is limited to circuit and packet switched bearer services. It is further limited to services supported by Recommendation Q.767. Broadband services routing requirements are for further study.

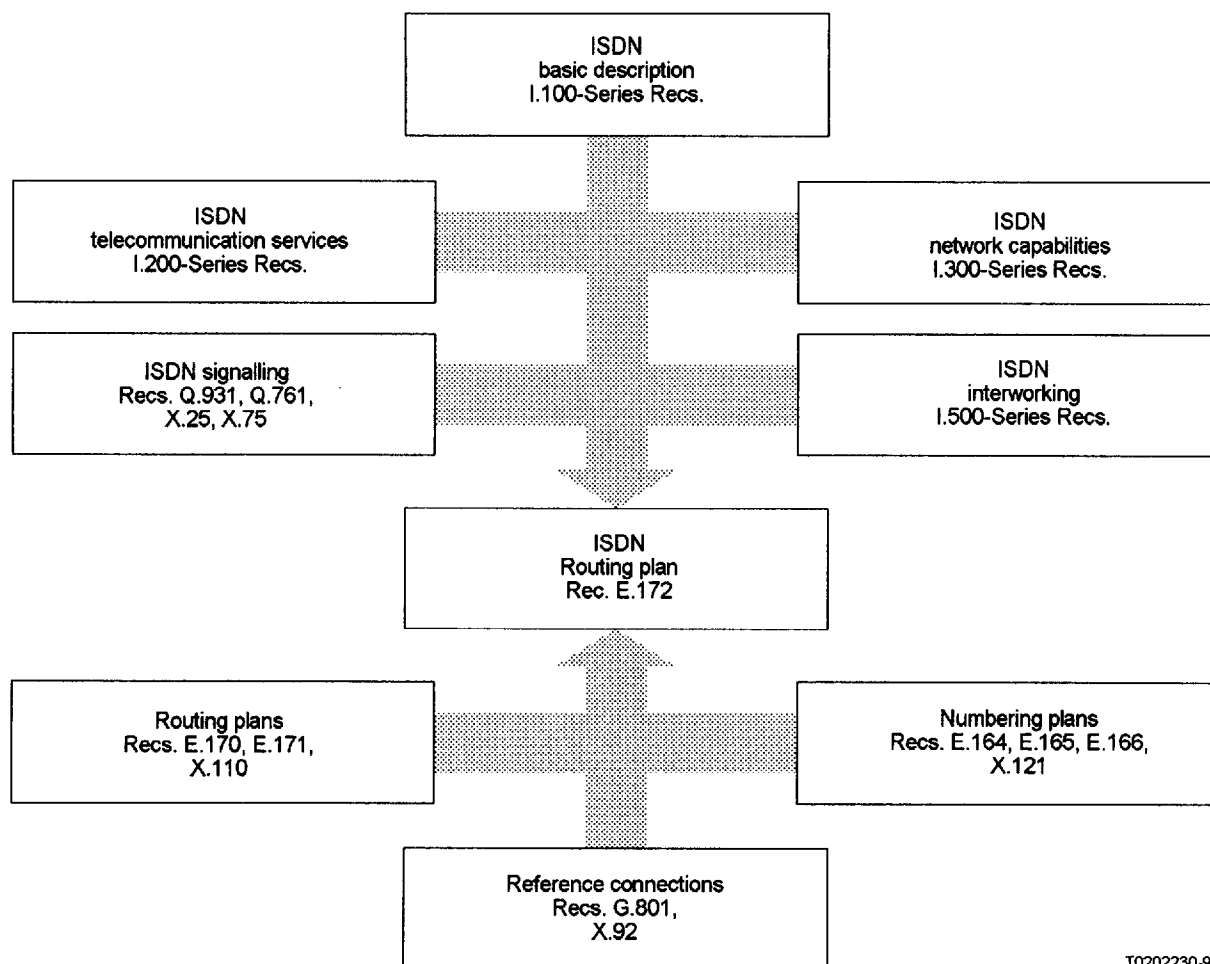
2 References and related Recommendations

The related Recommendations and their relationship to Recommendation E.172 are depicted below in Figure 1/E.172.

3 ISDN routing principles

3.1 The following basic ISDN routing principles are recommended to assist in managing the trade-off between customer satisfaction and network optimization.

- a) complete as many calls as possible;
- b) utilize network resources efficiently:
 - match network capability to service demand;
 - minimize the use of “overmatching” network capability;
 - minimize the number of links in a route;



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FIGURE 1/E.172

- c) adhere to network performance parameters:
 - delay (call set up delay, transfer delay, post-dialling delay);
 - transmission quality;
 - error rates;
 - throughput;
 - availability;
- d) minimize translation complexity;
- e) minimize digit analysis and manipulation;
- f) ensure efficient access to special network functionalities, such as:
 - signalling systems;
 - modems;
 - echo control devices;
 - mobile interfaces;
 - data bases;
- g) avoid “non-standard” arrangements.

4 The concept of service defined network connections

4.1 In the Public Switched Telephone Network (PSTN) environment a single level of network performance is assured. That level of network performance ensures, within certain parameters, that services such as speech, facsimile and data will be supported. No standard means exists in the PSTN, on a call-by-call basis, to influence the type or capability of network components which are selected by the network to establish a connection. Routing in the PSTN is basically performed through analysis of the called address to allow selection of the chain of physical trunk routes to the destination. Many techniques have been introduced to improve completion rates and efficiencies (see Recommendation E.170), and all are based on finding an available path to a destination using the called address, with no consideration given to service variables.

4.2 ISDN introduces the concept of customer selected service requirements on a call-by-call basis. Each telecommunication service demands a predefined minimum level of network capability to support the connection. Networks are in a constant state of evolution, and consequently contain varying levels of capabilities. The matching between the telecommunication service request and network component capability is a new dimension of routing introduced by ISDN.

4.3 Telecommunication services must be viewed from two perspectives:

- feature capabilities as seen by the customer;
- network, operational and commercial attributes as seen by the service providers.

4.4 From a network routing perspective, the physical requirements of a network connection may be determined through analysis of parameters (assessed in detail in § 7). Bearer service definitions dictate the minimum capability for information transfer between ISDN access points. The service aspect of ISDN routing is based primarily on the bearer service requested by the customer. ISDN bearer services are defined in Recommendation I.230.

4.5 This Recommendation provides guidance on the incorporation of service requirements into the network routing process.

5 Routing process

5.1 *General*

5.1.1 This subsection describes the ISDN routing process. Information generated and processed from the originating terminal equipment, signalling links and switching nodes is discussed. The basic reference for the ISDN architecture is taken from Recommendation I.324.

5.1.2 The routing process is the sequence of functions required to establish a connection between the originating terminal equipment and the terminating terminal equipment or network service node.

5.2 *User-Network Interface*

5.2.1 The user initiates a request for service through ISDN capable terminal equipment. The user provides, through the terminal equipment the following information:

- service request details (including supplementary service);
- called address;
- calling address;
- other information required for call set up.

5.2.2 The terminal equipment converts this information into a Recommendation Q.931 (network layer protocol standard) call setup message which is transmitted to the originating local exchange.

5.3 *Originating local exchange*

5.3.1 The originating local exchange performs the most critical function in ISDN call routing. That function is to assemble essential call routing information, which is uniquely available to it, into an information package which will be used by all subsequent exchanges to make the required routing decisions.

5.3.2 The originating local exchange uses:

- call specific information provided in the Recommendation Q.931 call setup message;
- customer subscription profile data in exchange memory;
- environmental and administrative conditions;

to establish:

- the route treatment of that specific call (i.e. route selection, block, etc.);
- the routing parameters which are associated with the call for use at subsequent exchanges in the connection.

5.3.3 The originating local exchange therefore defines the minimum network resources (switching, signalling, transmission) which are needed to support the service request. These call/routing parameters are transported through the network via SS No. 7.

5.3.4 Details of ISDN call routing parameters and their application and/or generation at various exchanges are contained in § 7.

5.4 *Transit exchanges (national and international)*

5.4.1 Each transit exchange in the route sequence will receive the routing parameters generated by the previous exchange. These parameters will be used as the basis for selecting an appropriate outgoing route. In addition, routing parameters may be added to or modified to update such information as connection history.

5.4.2 This process continues until either the terminating local exchange is reached or the call is failed due to conditions encountered in the network.

5.4.3 The incoming and outgoing Initial Address Message (IAM) contains the following parameter fields which may be used for routing purposes:

- nature of connection indicators;
- forward call indicators (including ISUP preference indicator);
- calling party's category;
- transmission medium requirement (TMR);
- called party number;
- user service information (USI);
- transit network selection (for further study).

5.4.4 The IAM message may contain other parameters whose presence may influence the choice of signalling systems capability for the call. These parameters are

- call reference;
- calling party number;
- optional forward call indicators;
- redirecting number;

- CUG interlock code;
- connection request;
- user-to-user information;
- access transport.

5.4.5 In the international network, the TMR is set to the value that represents the minimum network capability to provide the requested service and is not modified.

5.4.6 The parameters listed within this sub-section contain all the signalling information needed to perform routing in the international network.

5.4.7 In summary it should be noted that while many new parameters are potentially involved in selecting an ISDN route, most calls can be successfully completed by matching the service request with idle facilities which are capable of supporting it.

6 Network structure

6.1 *Circuit switched services*

6.1.1 In the ISDN era, it is suggested that

- a) the network structure should be non-hierarchical;
- b) for call routing purposes the network can be sub-divided into national and international connection elements; the national element being sub-divided into local and trunk if appropriate;
- c) Administrations should be free to change their own call routing arrangements providing they are still within the guidelines outlined in this plan;
- d) the routing concepts outlined in Recommendation E.170 can apply in any network element (e.g. local, national or international) but only by agreement should they be used across a connection element boundary.

6.1.2 The network structure for ISDN has been taken from Recommendation G.801 which provides a hypothetical reference connection for the digital environment. From that Recommendation the maximum allocations established for circuit switched services are as shown in Table 1/E.172.

TABLE 1/E.172
Maximum allocation of nodes and links
for circuit switched services in ISDN

National element		International element		National element	
Nodes	Links	Nodes	Links	Nodes	Links
4	4	5	4	4	4

6.1.3 The limiting case on any routing configuration will be when an international extension is required. It is assumed that all special and manual nodes will be taken from the national links and node allocation.

6.2 *Packet switched services*

6.2.1 For international packet switched calls in ISDN the network structure consists of two circuit switched elements (or packet switched in the D-channel) and three packet switched elements as shown in Table 2/E.172.