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FUNCTIONAL DESCRIPTION OF THE ISDN USER PART OF SIGNALLING SYSTEM No. 7

ITU-T Recommendation Q.761

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T 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 World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation Q.761 was revised prepared by the ITU-T Study Group XI (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 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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CONTENTS

			Page
1	General		1
2	Introduction to ISDN User Part (ISUP) signalling procedures		1
	2.1	Address signalling	1
	2.2	Basic procedures	2
	2.3	Signalling methods	2
	2.4	Interworking	2
3	Capabilities supported by the ISDN User Part		2
	3.1	Internationally applicable class	3
	3.2	National use class	4
4	Services assumed from the Message Transfer Part (MTP)		4
	4.1	General	4
	4.2	Description of primitives	4
5	End-to-end signalling		6
	5.1	General	6
	5.2	SCCP method of end-to-end signalling	6
	5.3	Pass-along method of end-to-end signalling	6
6	Future enhancements and Compatibility procedure		6
	6.1	Version compatibility	7
	6.2	Additional coding guidelines for compatibility of ISDN User Parts	9

Recommendation Q.761

FUNCTIONAL DESCRIPTION OF THE ISDN USER PART OF SIGNALLING SYSTEM No. 7

(Malaga-Torremolinos, 1984; modified at Helsinki, 1993)

1 General

The ISDN User Part is the Signalling System No. 7 protocol which provides the signalling functions required to support basic bearer services and supplementary services for voice and non-voice applications in an integrated services digital network.

The ISDN User Part is also suited for application in dedicated telephone and circuit switched data networks and in analogue and mixed analogue/digital networks. In particular the ISDN User Part meets the requirements defined by CCITT for worldwide international semi-automatic and automatic telephone and circuit switched data traffic.

The ISDN User Part is furthermore suitable for national applications. Most signalling procedures, information elements and message types specified for international use are also required in typical national applications. Moreover, coding space has been reserved in order to allow national Administrations and recognized operating agencies to introduce network specific signalling messages and elements of information within the internationally standardized protocol structure.

The ISDN User Part makes use of the services provided by the Message Transfer Part (MTP) and in some cases by the Signalling Connection Control Part (SCCP) for the transfer of information between ISDN User Parts.

The ISDN User Part protocol which supports the basic bearer service is described in Recommendations Q.761 to Q.764 and Q.766. A general description of ISDN User Part signals and messages is provided in Recommendation Q.762. Message formats and message field codings are defined in Recommendation Q.763. The signalling procedures for the set-up and cleardown of national and international ISDN connections are described in Recommendation Q.764. Recommendation Q.766 deals with ISDN User Part performance objectives.

ISDN User Part protocol elements which support supplementary services are described in Recommendation Q.730, 1992-Series Recommendations.

Numbering requirements are described in Recommendation E.164. It is assumed that the ISDN follows the international numbering plan defined for the ISDN and provides a basic circuit switched service between ISDN terminals or between ISDN terminals and terminals being connected to the existing international telephone network.

Requirements on exchange capabilities for support of the ISDN User Part are described in the Q.500-Series Recommendations.

Requirements or functions for interworking between the ISDN User Part and the other User Parts of the Signalling System No. 7 and other signalling systems are described in the Q.600-Series Recommendations.

NOTE – The message set, message formats and procedures specified in this version of the ISDN User Part protocol are not in complete alignment with those of the 1984 version *(Red Book)*. The two versions of the protocol are therefore not compatible in all aspects.

2 Introduction to ISDN User Part (ISUP) signalling procedures

2.1 Address signalling

In general, the call set-up procedure described is standard for both speech and non-speech connections using en-bloc address signalling for calls between ISDN terminals. Overlap address signalling is also specified.

2.2 Basic procedures

The basic call control procedure is divided into three phases; call set-up, the data/conversation phase and call cleardown. Messages on the signalling link are used to establish and terminate the different phases of a call. Standard in-band supervisory tones and/or recorded announcements are returned to the caller on appropriate connection types to provide information on call progress. Calls originating from ISDN terminals may be supplied with more detailed call progress information by means of additional messages in the access protocol supported by a range of messages in the network.

2.3 Signalling methods

Two signalling methods are used in this Recommendation:

- link-by-link;
- end-to-end.

The link-by-link method is primarily used for messages that need to be examined at each exchange (see 5). The end-to-end methods are used for messages of end point significance (see Recommendation Q.730, 1992).

The link-by-link method may be used for messages of end point significance.

2.4 Interworking

2.4.1 ISUP interworking

In call control interworking between two (ISUP) protocols the call control provides the interworking logic.

Peer to peer interworking takes place between two exchanges that support different implementations of the same protocol.

Interworking is realized following interpretation of the protocol information received by either exchange.

For this the 1992 version of ISUP, ISUP'92, only one ISUP protocol implementation may be present in an exchange since ISUP'92 is backwards compatible with previous versions of ISUP as a result of:

- The basic call procedures and the supplementary service procedures of ISUP'92 ensure backwards compatibility with the ISUP procedures conforming to the 1988 version *(Blue Book)* and those conforming to Recommendation Q.767. No knowledge is required to be stored in the exchange to this effect.
- From ISUP'92 onwards, the forward compatibility is ensured by the guidelines given for future protocol enhancements and the compatibility procedure as outlined in 6.

2.4.2 Interworking with other signalling systems or user parts

The examples included in this Recommendation are typical only and should not be used as a definitive interworking guide.

3 Capabilities supported by the ISDN User Part

Table 1 lists the signalling capabilities supported by the ISDN User Part. These capabilities are categorized into two classes, internationally applicable class and national use class. These classes are defined as follows.

TABLE 1/Q.761

Function/service	National use	International
Basic call		
Speech/3.1 kHz audio	/	/
64 kbit/s unrestricted	/	/
Multirate connection types (Note)	/	/
Signalling procedures for connection type allowing fallback capability	/	/
Compatibility procedure	/	/
Confusion procedure	/	/
Simple segmentation	/	/
User part availability control	/	/
Propagation delay determination procedure	/	/
Dynamic echo control procedure	/	/
Tones and announcements	/	/
MTP pause and resume	/	/
Access delivery information	/	/
Transportation of User teleservice information	/	/
Generic signalling procedures for supplementary services		
End-to-end signalling – Pass along method	/	–
End-to-end signalling – SCCP Connection Orientated	/	/
End-to-end signalling – SCCP Connectionless	/	–
Generic number transfer	/	/
Generic digit transfer	/	–
Generic notification procedure	/	/
Simple service activation procedure	/	–
Remote operations procedure	/	–
Network specific procedures	/	–
Supplementary services		
DDI	/	/
MSN	/	/
CLIP/CLIR	/	/
COLP/COLR	/	/
MCID	/	/
Sub-addressing	/	/
Terminal portability	/	/
Call forwarding	/	/
Call deflection	/	/
Call waiting	/	/
Call hold	/	/
Conference calling	/	/
Three party service	/	/
CUG	/	/
MLPP	/	/
UUS, Service 1 (implicit)	/	/
UUS, Service 1 (explicit)	/	/
UUS, Service 2	/	/
UUS, Service 3	/	/
/ Represents CCITT support – Represents CCITT non-support	/	/
NOTE – Multirate connection types are 2 × 64, 384, 1536 and 1920 kbit/s		

3.1 Internationally applicable class

The signalling capabilities of this class are to be supported over the international boundary. It is recommended that all international network operators support these capabilities. This set of capabilities indicate the target of implementation for the international network operators. Each operator may implement these capabilities one-by-one or enhance the implementation from time to time towards the target set of capabilities. These capabilities are also applicable nationally except for thosespecific to the international interface. Any international exchange implemented with ISUP'92, however,

has to be able to recognize all the messages and parameters defined for the international interface and properly react on them. If a capability of this class is requested internationally, the network operator should make one of the following reactions:

a) provide the capability;

   however, if it is not possible to provide the requested capability, the following actions are deemed appropriate:

b) release the call with an appropriate cause parameter;

c) ignore the request and if necessary inform the preceding network of this fact; or

d) provide an appropriate interworking action (e.g. fallback).

3.2 National use class

The signalling capabilities of this class are basically supported only in national networks. However, they may also be applied internationally if a bilateral or multilateral agreement is reached among the network operators concerned. It is up to each Administration or recognized operating agency (ROA) whether or not to support the capabilities of this class.

All the signalling elements qualified as of national use class are marked "national use" in the ISDN User Part Recommendations.

4 Services assumed from the Message Transfer Part (MTP)

4.1 General

This subclause describes the functional interface presented by the Message Transfer Part to the ISDN User Part. In accordance with the description techniques defined by the Open System Interconnection (OSI) model, information is transferred to and from the MTP in the form of Parameters carried by Primitives.

The general syntax of a primitive is as follows:

X	Generic name	Specific name	Parameter

where

X designates the function providing the Service (the MTP, in this case);

the Generic name describes an action by X;

the Specific name indicates the purpose of the primitive, i.e. whether it conveys a request for service, an indication that service related information has been received, a response to a service request or a confirmation that the requested service has been performed; and

the Parameters contain the elements of supporting information transferred by the primitive.

4.2 Description of primitives

The following subclauses describe the primitives used across the ISDN User Part – Message Transfer Part functional interface. The primitives together with the parameters carried by each primitive are also shown in Table 2.

4.2.1 Transfer

The MTP-TRANSFER primitive is used either by the ISDN User Part to access the Signalling Message Handling function of the Message Transfer Part or by the latter to deliver signalling message information to the ISDN User Part.

4.2.2 Pause

The MTP-PAUSE primitive is sent by the Message Transfer Part to indicate its inability to transfer messages to the destination specified as a parameter.

4.2.3 Resume

The MTP-RESUME primitive is sent by the Message Transfer Part to indicate its ability to resume unrestricted transfer of messages to the destination specified as a parameter.

4.2.4 Status

The MTP-STATUS primitive is sent by the Message Transfer Part to indicate that the signalling route to a specific destination is congested or the ISDN User Part at the destination is unavailable. Unavailability causes can be unequipped, inaccessible, or unknown. The affected destination and the cause are carried as parameters (see Table 2) in the primitive.

TABLE 2/Q.761

Message Transfer Part Service Primitives

Primitives		Parameters
Generic Name	Specific Name	
MTP-Transfer	Request Indication	OPC DPC SLS SIO Signalling info.
MTP-Pause	Indication	Affected DPC
MTP-Resume	Indication	Affected DPC
MTP-Status	Indication	Affected DPC + Cause (Note)

OPC Originating point code

DPC Destination point code

SLS Signalling link selection code

SIO Service information octet

NOTE – The cause parameter can assume four values:

– signalling network congested (level), where level is included only if national options with congestion priorities and multiple signalling states without congestion priorities (see Recommendation Q.704) are implemented;

– user part unavailability – unequipped remote user.

– user part unavailability – inaccessible remote user.

– user part unavailability – unknown.

5 End-to-end signalling

5.1 General

End-to-end signalling is defined as the capability to transfer information of end points significance directly between signalling end points in order to provide a requesting user with a basic or supplementary service.

End-to-end signalling is used typically between all originating and terminating local exchanges, to request or to respond to requests for additional call related information, to invoke a supplementary service or to transfer user-to-user information transparently through the network.

End-to-end signalling procedures are described in 1.4/Q.730 (1992).

The following two methods of end-to-end signalling are supported.

5.2 SCCP method of end-to-end signalling

Connection-oriented or connectionless transfer of end-to-end signalling information can be accomplished by using the service provided by the Signalling Connection Control Part (SCCP) of Signalling System No. 7.

The relevant procedures are described in 1.4.3/Q.730 (1992).

5.3 Pass-along method of end-to-end signalling

The pass-along method of end-to-end signalling provides transfer of signalling information without requiring the services of the SCCP.

This method may be used between two exchanges when the information to be transferred relates to an existing call for which a physical connection between the same two exchanges has been established. The information transfer in this case occurs over the same signalling path as that used to set up the call and establish the physical connection.

The relevant procedures are described in 1.4.2/Q.730 (1992).

6 Future enhancements and Compatibility procedure

Requirements for additional protocol capabilities, such as the ability to support new supplementary services, will result from time to time in the need to add to or modify existing protocol elements and thus to create a new protocol version.

In order to ensure adequate service continuity, the insertion of a new protocol version into one part of a network should be transparent to the remainder of the network. Compatible interworking between protocol versions is optimized by adhering to the following guidelines when specifying a new version:

1) Existing protocol elements, i.e. procedures, messages, parameters and codes, should not be changed unless a protocol error needs to be corrected or it becomes necessary to change the operation of the service that is being supported by the protocol.

2) The semantics of a message, a parameter or of a field within a parameter should not be changed.

3) Established rules for formatting and encoding messages should not be modified.

4) The addition of parameters to the mandatory part of an existing message should not be allowed.

5) A parameter may be added to an existing message as long as it is allocated to the optional part of the message.

6) The addition of new octets to an existing mandatory fixed length parameter should be avoided. If needed, a new optional parameter should be defined containing the desired set of existing and new information fields.

7) The sequence of fields in an existing variable length parameter should remain unchanged. New fields may be added at the end of the existing sequence of parameter fields. If a change in the sequence of parameter fields is required, a new parameter should be defined.

8) The all zeros code point should be used exclusively to indicate an unallocated (spare) or insignificant value of a parameter field. This avoids an all zeros code, sent by one protocol version as a spare value, to be interpreted as a significant value in another version.

9) The compatibility mechanism described in 6.1 applies to this and future versions of the ISDN UP Recommendations.

Rules 1) to 8) also apply, and in addition principles, which allow this and future versions of the ISDN UP to directly interwork with each other, maintaining protocol and service compatibility, and including end-to-end transparency. This is further outlined below.

6.1 Version compatibility

From this version of the ISDN UP onwards, compatibility between this and future versions will be guaranteed, in the sense that any two versions can be interconnected directly with each other, and the following requirements are fulfilled:

i) *Protocol compatibility*

Calls between any two ISDN UPs do not fail for the reason of "not satisfying" protocol requirements.

ii) *Service and functional compatibility*

This feature may be considered as compatibility typically between originating and destination exchanges. Services and functions available at these exchanges, but possibly not yet taken into account in the intermediate exchanges, are supported, provided they require only transparency of the intermediate exchanges. If this is not the case, a controlled call rejection or service rejection is required.

Signalling for a facility completely provided between the originating and destination local exchanges will utilize one of the end-to-end methods defined in 1.3/Q.730, i.e. such facilities do not have to be supported by transit exchanges.

iii) *Resource control and management compatibility*

For these functions, occurring only link-by-link, at least a backward notification is needed, if correct handling is not possible.

The compatibility mechanism is common for all ISDN UPs from this, the 1992 version of the ISDN UP onwards. It is based on forward compatibility information associated with new signalling information.

The compatibility method eases the network operation, e.g. for the typical case of an ISDN UP mismatch during a network upgrading, to interconnect two networks on a different functional level, for networks using a different subset of the same ISDN UP, etc.

All messages and parameters not contained in the following Table 3 and Table 4 are subject to the rules of the compatibility mechanism (refer to 6.2.1 and 6.2.2).

All messages and parameters contained in these tables shall be recognized by the exchanges. This does not impose a requirement that the related functions are implemented, but the function shall be rejected correctly (where applicable).

TABLE 3/Q.761

Minimum message set recognized at the international interface

1	Address complete
2	Answer
3	Blocking
4	Blocking Acknowledgement
5	Call Progress
6	Circuit Group Blocking
7	Circuit Group Blocking Acknowledgement
8	Circuit Group Reset
9	Circuit Group Reset Acknowledgement
10	Circuit Group Unblocking
11	Circuit Group Unblocking Acknowledgement
12	Connect
13	Continuity
14	Confusion
15	Continuity Check Request
16	Facility Accepted
17	Facility Reject
18	Facility Request
19	Forward Transfer
20	Initial Address
21	Release
22	Release Complete
23	Reset Circuit
24	Resume
25	Subsequent Address
26	Suspend
27	Unblocking
28	Unblocking Acknowledgement
29	User-to-user information

TABLE 4/Q.761

Minimum parameter set recognized at the international interface

1	Access transport
2	Automatic congestion level
3	Backward call indicator
4	Called party number
5	Calling party number
6	Calling party's category
7	Cause indicators
8	Circuit group supervision mess.type indic.
9	Closed user group interlock code
10	Connected number
11	Continuity indicators
12	End of optional parameters indicator
13	Event information
14	Facility indicator
15	Forward call indicators
16	Nature of connection indicators
17	Optional backward call indicators
18	Optional forward call indicators
19	Original called number
20	Range and status
21	Redirecting number
22	Redirection information
23	Redirection number
24	Subsequent number
25	Suspend/Resume indicators
26	Transmission medium requirement
27	User service information
28	User-to-user indicators
29	User-to-user information

6.2 Additional coding guidelines for compatibility of ISDN User Parts

The following guidelines are mandatory.

6.2.1 Messages

All new messages, not part of the *Blue Book* ISDN UP 1988 use only parameters coded according to the coding rules for the parameters of the optional part of ISDN UP messages. They always contain a Message Compatibility Information Parameter.

If *Blue Book* 1988 ISDN UP messages not contained in Table 3 are received and are not recognized, they are handled as described in 2.9.5/Q.764.

6.2.2 Parameters

As a general principle, mixing information for different application associations (requiring different functional entity actions) inside a new ISUP parameter should be avoided so that the behaviour of cooperating nodes can be defined using the compatibility mechanism.

All new parameters introduced for ISUP'92 and beyond, shall have associated compatibility information contained in the Parameter Compatibility Information Parameter.

Unrecognized parameter handling procedures can be found in 2.9.5/Q.764 (1992).