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SPECIFICATIONS OF SIGNALLING SYSTEM No. 7

SIGNALLING SYSTEM No. 7 – FUNCTIONAL DESCRIPTION OF THE SIGNALLING CONNECTION CONTROL PART

ITU-T Recommendation Q.711

(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.711 was revised 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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.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.

CONTENTS

SIGNALLING SYSTEM No. 7 – FUNCTIONAL DESCRIPTION OF THE SIGNALLING CONNECTION CONTROL PART

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

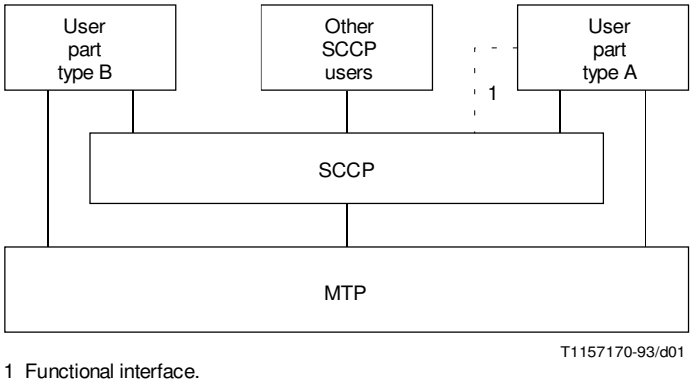
1 Introduction

1.1 General

The Signalling Connection Control Part (SCCP) provides additional functions to the Message Transfer Part (MTP) to cater for both connectionless as well as connection-oriented network services to transfer circuit related and non-circuit related signalling information and other types of information between exchanges and specialized centres in telecommunication networks (e.g. for management and maintenance purposes) via a Signalling System No. 7 network.

A functional block situated above the Message Transfer Part, which is described in Recommendations Q.701 through Q.707, performs the functions and procedures of the SCCP. Thus the Message Transfer Part remains unchanged (see Figure 1). The combination of the MTP and the SCCP is called Network Service Part (NSP).

The Network Service Part meets the requirements for Layer 3 services as defined in the OSI-Reference Model, Recommendation X.200.



1 Functional interface.

NOTE – The ISDN-UP as defined in Q.761–Q.64–Series Recommendations is a type A user part. No type B user parts have yet been specified in CCITT.

FIGURE 1/Q.711

Functional diagram for the SCCP in signalling system No. 7

1.2 Objectives

The overall objectives of the Signalling Connection Control Part are to provide the means for

a) logical signalling connections within the Signalling Network No. 7;

b) a transfer capability for Network Service Signalling Data Units with or without the use of logical signalling connections.

Functions of the SCCP are also used for the transfer of circuit related and call related signalling information of the ISDN User Part with or without set-up of end-to-end logical signalling connections. These functions are described in Recommendations Q.714 and Q.764. Figure 1 illustrates the embedding of the SCCP within the Signalling System No. 7.

1.3 General characteristic

1.3.1 Technique of description

The Signalling Connection Control Part (SCCP) is described in terms of

- services provided by the SCCP;
- services assumed from the MTP;
- functions of the SCCP.

The functions of the SCCP are performed by means of the SCCP-protocol between two systems which provide the NSP-service to the upper layers.

The service interfaces to the upper layers and to the MTP are described by means of primitives and parameters, as recommended in Recommendation X.200. Figure 2 illustrates the relationship between the SCCP protocol and the adjacent services.

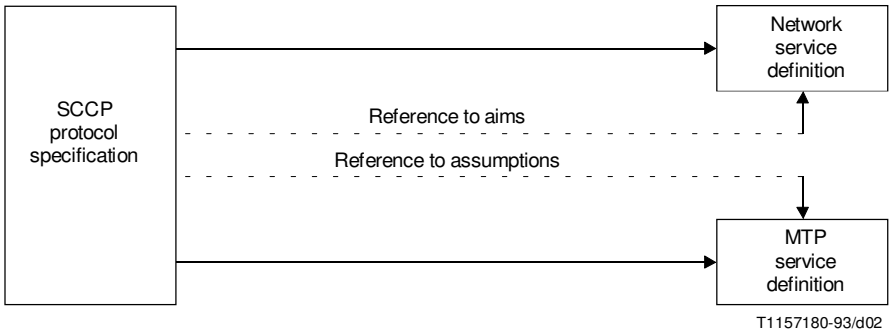


FIGURE 2/Q.711

Relationship between the SCCP protocol and adjacent services

1.3.2 Primitives

Primitives consist of commands and their respective responses associated with the services requested of the SCCP and of the MTP, see Figure 3. The general syntax of a primitive is specified in Recommendation Q.700.

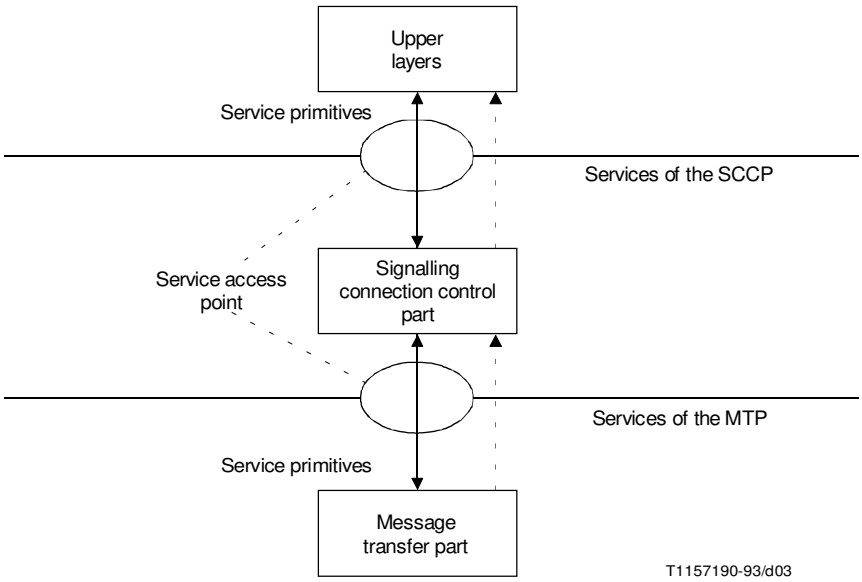


FIGURE 3/Q.711

Service primitives

1.3.3 Peer-to-peer communication

Exchange of information between two peers of the SCCP is performed by means of a protocol. The protocol is a set of rules and formats by which the control information (and user data) is exchanged between the two peers. The protocol caters for:

- the set-up of logical signalling connections;
- the release of logical signalling connections;
- the transfer of data with or without logical signalling connections.

A signalling connection is modelled in the abstract by a pair of queues. The protocol elements are objects on that queue added by the origination SCCP user and removed by the destination SCCP user. Each queue represents a flow control function. Figure 4 illustrates the modes described above. (A model for the connectionless service is for further study.)

1.3.4 Contents of the Q.71x – Series Recommendations

Recommendation Q.711 contains a general description of the services provided by the MTP, the services provided by the SCCP and the functions within the SCCP.

Recommendation Q.712 defines the set of protocol elements and their embedding into messages.

Recommendation Q.713 describes the formats and codes used for the SCCP messages.

Recommendation Q.714 is a detailed description of the SCCP procedures as a protocol specification.

Recommendation Q.716 defines and specifies values for the SCCP performance parameters, including quality of service parameters and internal parameters.

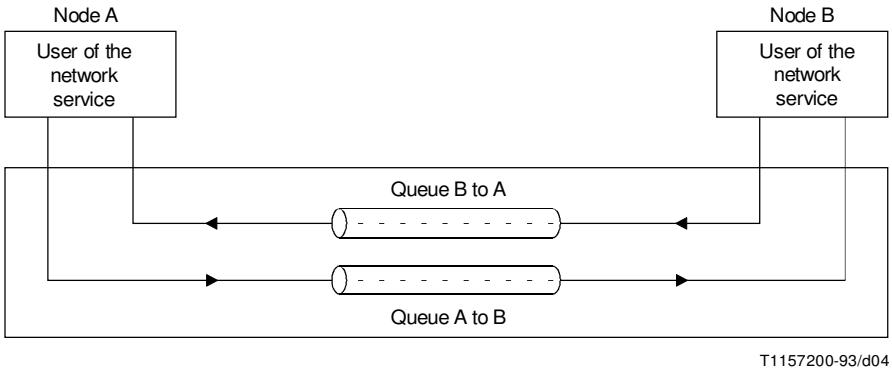


FIGURE 4/Q.711

Model for the internode communication with the SCCP (connection-oriented services)

2 Services provided by the SCCP

The overall set of services is grouped into:

- connection-oriented services;
- connectionless services.

Four classes of service are provided by the SCCP protocol, two for connectionless services and two for connection-oriented services.

The four classes are:

0 Basic connectionless class

1 Sequenced connectionless class

2 Basic connection-oriented class

3 Flow control connection-oriented class

2.1 Connection-oriented services

A distinction has to be made between

- temporary signalling connections; and
- permanent signalling connections.

Temporary signalling connection establishment is initiated and controlled by the SCCP user. Temporary signalling connections are comparable with dialled telephone connections.

Permanent signalling connections are established and controlled by the local (or remote) O&M-function or by the management function of the node and they are provided for the SCCP user on a semipermanent basis. They can be compared with leased telephone lines.

2.1.1 Temporary signalling connections

2.1.1.1 Description

The control of a signalling connection is divided into the following phases:

- connection establishment phase;
- data transfer phase;
- connection release phase.

2.1.1.1.1 Connection establishment phase

Connection establishment procedures provide the mechanism for establishing temporary signalling connections between users of the SCCP.

A signalling connection between two SCCP users may consist of one or more connection sections. A signalling connection between two SCCP users in the same node is considered an implementation dependent matter.

During connection establishment, routing functions are provided by the SCCP, in addition to those provided by the MTP.

At intermediate nodes, SCCP routing determines whether a signalling connection should be realized by one connection or by several concatenated connection sections.

The ISDN UP may provide the routing of the request for the set-up of a connection section.

The connection refusal procedure is invoked if the SCCP is unable to establish a signalling connection.

2.1.1.1.2 Data transfer phase

The data transfer service provides for an exchange of user data, called Network Service Data Units (NSDU), in either direction or in both directions simultaneously on a signalling connection.

A SCCP message between two peer consists of

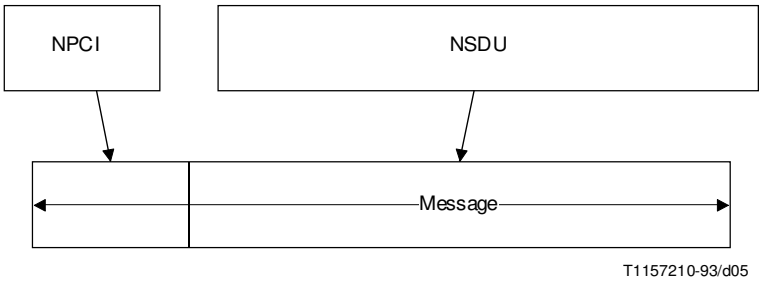
- Network Protocol Control Information (NPCI);
- Network Service Data Unit (NSDU).

The Network Protocol Control Information supports the joint operating of the SCCP-peer entities within the two nodes communicating with each other. It contains a connection reference parameter which allocates the message to a certain signalling connection.

The Network Service Data Unit contains a certain amount of information from the SCCP user which has to be transferred between two nodes using the service of the SCCP.

Network Protocol Control Information and Network Service Data Unit are put together and transferred as a message (Figure 5). If the size of user data is too big to be transferred within one message, user data are segmented into a number of portions. Each portion is mapped to a separate message, consisting of the NPCI and a NSDU (Figure 6).

The data transfer service caters for sequence control and flow control depending on the quality of service required by the SCCP user (two different classes of the connection-oriented service are provided by the protocol; see Recommendation Q.714).



NPCI Network protocol control information
NSDU Network service data unit
Message Protocol data unit

FIGURE 5/Q.711

Relation between NSDU and message neither segmenting nor blocking

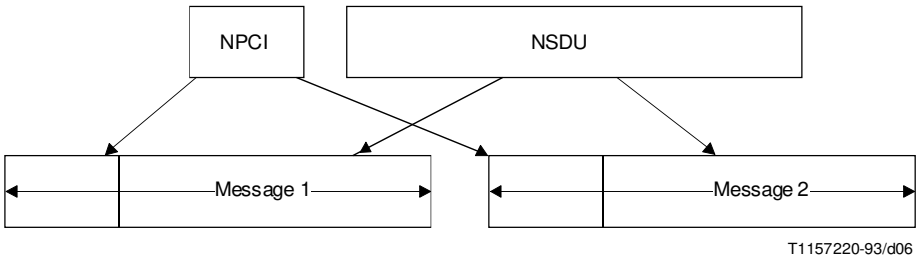


FIGURE 6/Q.711

Segmenting

2.1.1.1.3 Connection release phase

Connection release procedures provide the mechanism for disconnecting temporary signalling connections between users of the SCCP.

2.1.1.2 Network service primitives and parameters

2.1.1.2.1 Overview

Table 1 gives an overview of the primitives to the upper layers and the corresponding parameters for the (temporary) connection oriented network service. Figure 7 shows an overview state transition diagram for the sequence of primitives at a connection endpoint, refer to Recommendation X.213, Network Layer Service Definition of Open Systems Interconnection for CCITT application.

A more detailed description for the primitives and their parameters is given in the following chapters.

NOTE – In the following subclauses, the various primitives are described with their parameters. The notation X′ means the possible presence of the parameter in the primitive. Further study is required to replace X′ by more specific notations indicating a mandatory, provider option, user option, or a conditional parameter.

2.1.1.2.2 Connection establishment phase

A SCCP user (calling user) initiates the set-up of the connection by means of the primitive “N-CONNECT request” to the SCCP. The SCCP entity evaluates the primitive and adds the protocol control information. The SCCP message (consisting of the protocol control information (PCI) and possibly an NSDU) is transmitted by means of the MTP-services to the remote peer entity of the SCCP. It evaluates and strips the PCI and sends a primitive “N-CONNECT indication” to the local SCCP user. On both ends of the connection the status “pending” is assumed.

The called SCCP user answers with the primitive “N-CONNECT response” to the local SCCP, which sends the response SCCP message including PCI to the calling SCCP. The calling SCCP sends the primitive “N-CONNECT confirmation” to the calling SCCP-User. The connection is now ready for data transfer.

The four types of N-CONNECT, the request, the indication, the response and the confirmation contain the parameters as shown and further described in Table 2.

TABLE 1/Q.711

Network service primitives for connection-oriented services

Primitives		Parameters
Generic name	Specific name	
N-CONNECT	Request Indication Response Confirmation	Called address Calling address Responding address Receipt confirmation election Expedited data selection Quality of service parameter set User data Connection identification[a)]
N-DATA	Request Indication	Confirmation request User data Connection identification[a)]
N-EXPEDITED DATA	Request Indication	User data Connection identification[a)]
N-DATA ACKNOWLEDGE (for further study)	Request Indication	Connection identification[a)]
N-DISCONNECT	Request Indication	Originator Reason User data Responding address Connection identification[a)]
N-RESET	Request Indication Response Confirmation	Originator Reason Connection identification[a)]

[a)] In 5.3/X.213, this parameter is implicit. This parameter is for further study.

The parameters “Called address/Calling address” convey addresses identifying the destination/source of a communication. There are three types of address information elements:

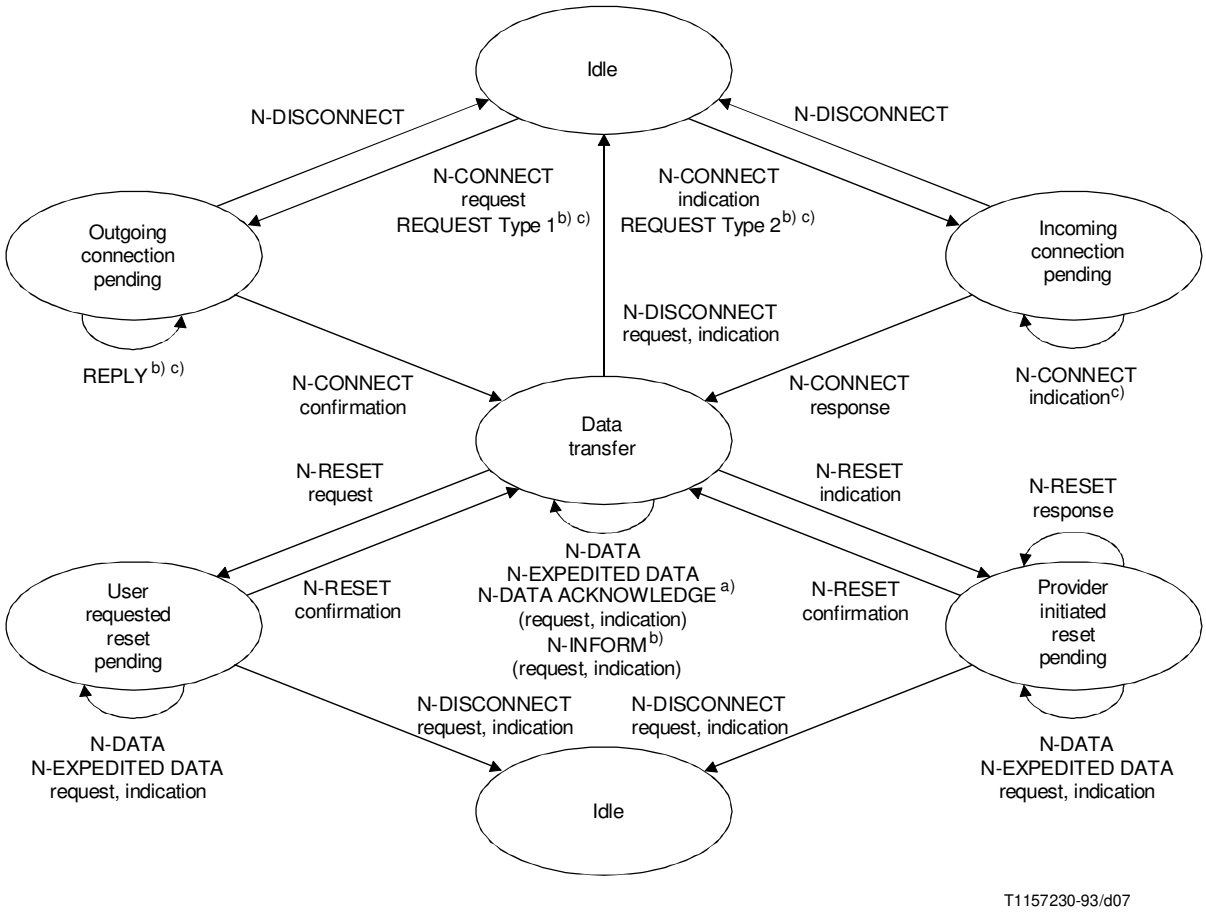
- Global Title,
- Subsystem Number,
- Signalling Point Code.

The Global Title is an address such as dialled digits which does not explicitly contain information that would allow routing in the signalling network, i.e. a translation function is required. The subsystem number is an identification of a specific user function within a certain signalling point (SP), like the ISDN-User Part, the SCCP-Management, etc. The Signalling Point Code identifies the origination or destination signalling point.

The parameter “Responding address” indicates to which destination the connection has been established or refused.

The “Responding address” parameter in the N-CONNECT primitive conveys the address of the service access point to which the signalling connection has been established. Under certain circumstances (e.g. a general Global Title identifying replicated subsystems), the value of this parameter may be different from the “Called address” in the corresponding N-CONNECT request.

The “Responding address” parameter is present in the N-DISCONNECT primitive only in the case where the primitive is used to indicate rejection of a signalling connection establishment attempt by an SCCP user function. The parameter conveys the address of the service access point from which the N-DISCONNECT-request was issued and under circumstances like that mentioned above the “Responding address” may be different from the “Called address” in the corresponding N-CONNECT request primitive.



a) The need for this primitive is for further study.
b) This primitive is not in Recommendation X.213 (see 2.1.1.3.1).
c) For user part type A only.

FIGURE 7/Q.711

State transition diagram for the sequence of primitives at a connection endpoint (basic transitions)

The parameter “Receipt confirmation selection” indicates the use/availability of the receipt confirmation service. The need for such a service is for further study.

The parameter “Expedited data selection” may be used to indicate during set-up whether expedited data can be transferred via the connection. A negotiation will be performed between SCCP users, local and remote.

The Quality of Service parameters are used during call set-up to negotiate the protocol class for the connection and, if applicable, the flow control window size.

The N-CONNECT primitives may or may not contain user data.

The parameter “Connection identification” is used to allocate a primitive to a certain connection. This parameter is for further study.

TABLE 2/Q.711

Parameters of the primitive N-CONNECT

Parameter	Primitive			
	N-CONNECT request	N-CONNECT indication	N-CONNECT response	N-CONNECT confirmation
Called address	X	X[d]		
Calling address	X[d]	X		
Responding address			X	X
Receipt confirmation election[a]	X	X	X	X
Expedited data selection	X	X	X	X
Quality of service parameter set	X	X	X	X
User data[b]	X	X	X	X
Connection identification[c]	X	X	X	X

X Parameter present within the primitive

a) This parameter is for further study.

b) User data within the connection primitives are defined as a provider option (refer to CCITT Recommendation X.213).

c) This parameter is not in Recommendation X.213 and is for further study.

d) This parameter may be implicitly associated with the SCCP service access point at which this primitive is issued.

In principle, the connection establishment has to be completed (i.e. data transfer status has to be reached) before sending or receiving data messages. If data messages arrive at the calling user before the connection establishment is finished these data messages are discarded.

In addition, user data can also be transferred to/from the SCCP within the primitives N-CONNECT and N-DISCONNECT.

2.1.1.2.3 Data transfer phase

During this phase four different primitives may occur:

a) N-DATA (see Table 3),

b) N-EXPEDITED DATA (see Table 4),

c) N-DATA ACKNOWLEDGE,

d) N-RESET (see Table 5).

The primitive “N-DATA” (see Table 3) exists only as a “request”, i.e. from the SCCP user to the local SCCP and as an “indication” at the remote end of the connection, i.e. from the SCCP to the local SCCP user. N-DATA can occur bidirectionally, i.e. from the calling as well as the called user of the SCCP-connection.

TABLE 3/Q.711

Parameters of the primitive N-DATA

Parameter	Primitive	
	N-DATA request	N-DATA indication
Confirmation request[a)]	X	X
User data	X	X
Connection identification[a)]	X	X
X Parameter present within the primitive a) This parameter is for further study.		

TABLE 4/Q.711

Parameters of the primitive N-EXPEDITED DATA

Parameter	Primitive	
	N-EXPEDITED DATA request	N-EXPEDITED DATA indication
User data	X	X
Connection identification[a)]	X	X
X Parameter present within the primitive a) This parameter is for further study.		

TABLE 5/Q.711

Parameters of the primitive N-RESET

Parameter	Primitive			
	N-RESET request	N-RESET indication	N-RESET response	N-RESET confirmation
Originator		X		
Reason	X	X		
Connection identification[a)]	X	X	X	X
X Parameter present within the primitive a) This parameter is for further study.				

The parameter “Confirmation request” is used in an N-DATA primitive to indicate the need to confirm the receipt of the N-DATA primitive by the remote SCCP user. The confirmation may be given by the N-DATA ACKNOWLEDGE primitive. Receipt confirmation is provided only on connections which get the Receipt Confirmation facility during set-up. The matter is for further study.

The primitive “N-EXPEDITED DATA” may only be used by the SCCP user in case of Protocol Class 3 connections.

The primitive “N-DATA ACKNOWLEDGE” is used when the delivery confirmation service is selected. This primitive is for further study.

The primitive N-RESET (see Table 5) can occur in the data transfer state of a connection with a protocol class including flow control. N-RESET overrides all other activities and causes the SCCP to start a re-initialization procedure for sequence numbering. N-RESET appears as a request, an indication, a response and a confirmation. After reception of a N-RESET request and before the sending of a N-RESET confirmation, all NSDUs from SCCP are discarded by the SCCP.

The parameter “Originator” indicates the source of the reset and can be any of the following: the “network service provider” (network originated), the “network service user” (user originated), or “undefined”. The parameter “Reason” indicates “network service provider congestion”, “reason unspecified” or “local SCCP originated” for a network originated reset, and indicates “user synchronization” for a user originated reset. The “Reason” parameter is “undefined” when the “Originator” parameter is “undefined”.

2.1.1.2.4 Release phase

The primitives for the release phase are N-DISCONNECT request and N-DISCONNECT indication. These primitives are also used for the connection refusal during connection establishment phase. Parameters are included to notify the reason for connection release/refusal and the initiator of the connection release/refusal procedure. User data may be also be included (see Table 6).

TABLE 6/Q.711

Parameters of the primitive N-DISCONNECT

Parameter	Primitive	
	N-DISCONNECT request	N-DISCONNECT indication
Originator		X
Responding address	X	X
Reason	X	X
User data	X	X
Connection identification[a)]	X	X

X Parameter present within the primitive

a) This parameter is for further study.

The parameter “Originator” indicates the initiator of the connection release or the connection refusal. It may assume the following values:

- the network service provider;
- the network service user;
- undefined.

The parameter “Reason” gives information about the cause of the connection release or the connection refusal. It may assume any of the following values in accordance with the value of the “Originator”:

1) When the "Originator" parameter indicates the "network service provider":
   - Disconnection – Abnormal condition of non-transient nature;
   - Disconnection – Abnormal condition of transient nature;
   - Disconnection – Invalid state[1)];
   - Disconnection – Release in progress[1)];
   - Connection refusal[2)] – Destination address unknown (non-transient condition)[1)];
   - Connection refusal[2)] – Destination inaccessible/non-transient condition[1)];
   - Connection refusal[2)] – Destination inaccessible/transient condition[1)];
   - Connection refusal[2)] – QOS not available/non-transient condition[1)];
   - Connection refusal[2)] – QOS not available/transient condition[1)];
   - Connection refusal[2)] –Reason unspecified/non-transient condition[1)];
   - Connection refusal[2)] – Reason unspecified/transient condition[1)];
   - Connection refusal[2)] – Local error[1)];
   - Connection refusal[2)] – Invalid state[1)];
   - Connection refusal[2)] – No translation[1)];
   - Connection refusal[2)] – In restart phase[1)].

2) When the "Originator" parameter indicates the "network service user":
   - Disconnection – Normal condition;
   - Disconnection – Abnormal condition;
   - Disconnection – End user congestion;
   - Disconnection – End user failure;
   - Disconnection – SCCP user originated;
   - Disconnection – Access congestion;
   - Disconnection – Access failure;
   - Disconnection – Subsystem congestion;
   - Connection refusal[2)] – Non-transient condition;
   - Connection refusal[2)] – Transient condition;
   - Connection refusal[2)] – Incompatible information in NSDUs;
   - Connection refusal[2)] – End user originated;
   - Connection refusal[2)] – End user congestion;
   - Connection refusal[2)] – End user failure;
   - Connection refusal[2)] – SCCP user originated;
   - Connection refusal[2)] – Access congestion;
   - Connection refusal[2)] – Access failure;
   - Connection refusal[2)] – Subsystem congestion.

3) When the "Originator" parameter is "undefined", then the "Reason" parameter is also "undefined".

NOTE – Addition to, or refinement of, this list of possible values for the parameter "Reason" to convey more specific diagnostic, cause and management information is for further study.

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1) These values may be used locally at the originating/initiating node as an implementation option.

2) It is noted that the term "connection rejection" is used in Recommendation X.213 for the "Reason" parameter values.

2.1.1.3 Additional SCCP primitive and interface elements

In addition to those primitives in Recommendation X.213, there is a primitive N-INFORM needed by the SCCP connection-oriented services during data transfer phase. There are also three interface elements used by User Part Type A, e.g. ISDN-UP, as in Figure 1.

2.1.1.3.1 Notice service

The provision of the notice service by use of the "N-INFORM" primitive is for further study.

The primitive N-INFORM (see Table 7) is used during data transfer to convey relevant network/user information. The primitive "N-INFORM" will contain the parameters "Reason", "Connection Identification" and "QOS parameter set".

TABLE 7/Q.711

Parameters of the primitive N-INFORM

Parameter	Primitive	
	N-INFORM request	N-INFORM indication
Reason	X	X
Connection identification[a)]	X	X
QOS parameter set[a)]	X	X
X Parameter present within the primitive [a)] Parameter is for further study.		

The primitive "N-INFORM request" is provided to inform the SCCP of the connection user failure/congestion, or anticipated QOS changes. A further primitive "N-INFORM indication" is provided to indicate actual failures of the SCCP to the SCCP-user functions or anticipated quality of service changes or other indications to the SCCP-user functions.

The parameter "Reason" contains the network/user information to be conveyed. It may assume the following values:

- network service provider failure;
- network service congestion;
- network service provider QOS change;
- network service user failure;
- network service user congestion;
- network service user QOS change;
- reason unspecified.

2.1.1.3.2 Connection establishment interface elements

For the User Part Type A in Figure 1, two mechanisms are available to set up a signalling connection. For example, the ISDN-User Part may use the mechanism described in 2.1.1.2.2 or may request the SCCP to initiate a connection and return the information to the ISDN-User Part for transmission within an ISDN-User Part call set-up message, like an Initial Address Message (IAM).

Three interface elements are defined for the information flow between SCCP and ISDN-User Part:

a) REQUEST to the SCCP, Type 1 and Type 2;

b) REPLY from the SCCP.

The REQUEST Type 1 contains the following parameters:

- connection identification (for further study);
- receipt confirmation selection (for further study);
- expedited data selection;
- Quality of Service parameter set.

The REQUEST Type 2 contains the following parameters:

- protocol class;
- credit;
- connection identification (for further study);
- source local reference;
- originating signalling point code;
- reply request;
- refusal indicator.

The REPLY contains the following parameters:

- source local reference;
- protocol class;
- credit;
- connection identification (for further study).

2.1.2 Permanent signalling connections

2.1.2.1 Description

The set-up/release service is controlled by the Administration (e.g. O&M application). The functions for set-up and release may be similar to those provided for temporary signalling connections and are for further study. The classes of service are the same.

Permanently established signalling connections may require additional safeguarding mechanisms within the endpoints (relaypoints) of the connection in order to guarantee their re-establishment in case of a processor outage followed by a recovery.

2.1.2.2 Primitives and parameters

The primitives and their parameters are listed in Table 8. Their content and functionality correspond to the description within 2.1.1.2.3.

2.2 Connectionless services

The SCCP provides the SCCP user with the ability to transfer signalling messages via the signalling network without set-up of a signalling connection. In addition to the MTP capability, a "Routing" function has to be provided within the SCCP, which maps the called address to the Signalling Point Codes of the MTP Service.

This mapping function may be provided within each node or might be distributed over the network or could be provided in some special translation centres.

The SCCP also provides the user with ability to segment/recombine messages for which it is otherwise not possible to transfer in one MTP message. More details can be found in 4.1.1/Q.714.

Under certain conditions of congestion and unavailability of subsystems and/or signalling points, connectionless messages could be discarded instead of being delivered. If the SCCP user wishes to be informed of the non-delivery of messages, the Return Option parameter must be set to "return message on error" in the primitive to the SCCP.

TABLE 8/Q.711

Primitives for the data transfer on permanent connections

Primitives		Parameters
Generic Name	Specific Name	
N-DATA	Request Indication	Confirmation request User data[a)] Connection identification[a)]
N-EXPEDITED DATA	Request Indication	User data Connection identification[a)]
N-DATA ACKNOWLEDGE (for further study)	Request Indication	Connection identification[a)]
N-RESET	Request Indication Response Confirmation	Originator Reason Connection identification[a)]
[a)] Parameter is for further study.		

2.2.1 Description

There are two possibilities to transfer data without a connection set-up with regard to the sequence control mechanisms provided by the MTP:

a) The MTP and SCCP guarantee (to a high degree of probability) an in-sequence delivery of messages which contain the same Signalling Link Selection (SLS) code. The SCCP user can demand this MTP service by allocating a parameter "Sequence control" into the primitive to the SCCP. The SCCP will put the same SLS code into the primitive to the MTP for all primitives from the SCCP user with the same "Sequence control" parameter.

b) If the in-sequence delivery is not required, the SCCP can insert SLS codes randomly or with respect to appropriate load sharing within the signalling network.

The rules to achieve load sharing are not defined in the SCCP Recommendations.

2.2.2 Primitives and parameters of the connectionless service

2.2.2.1 Overview

Table 9 gives an overview of the primitives to the upper layers and the corresponding parameters for the connectionless service.

2.2.2.2 Parameters

2.2.2.2.1 Address

The parameters "Called address" and "Calling address" serve to identify the destination and origination respectively, of the connectionless message. In some cases, the Calling and Called addresses need to be complimented by the MTP/SCCP information. In addition, the Called and Calling addresses may be different at the origination and destination. These parameters may contain some combination of global titles, subsystem numbers, and signalling point codes.

2.2.2.2.2 Sequence control

The parameter "Sequence control" indicates to the SCCP whether the user wishes the service "sequence guaranteed" or the service "sequence not guaranteed". In the case of "sequence guaranteed" service, this parameter is an indication to the SCCP that a given stream of messages with the same called address has to be delivered in sequence by making use of the features of the MTP. In addition, this parameter is also used to distinguish different streams of messages so that the SCCP can allocate SLS codes appropriately to help the MTP in achieving an even distribution of signalling traffic. If the SCCP user does not provide a sequence control parameter, then the SCCP assumes protocol class 0.

TABLE 9/Q.711

Primitives and parameters of the connectionless service

Primitives		Parameters
Generic Name	Specific Name	
N-UNITDATA	Request Indication	Called address Calling address Sequence control[a)] Return option[a)] User data
N-NOTICE	Indication	Called address Calling address Reason for return User data[a)]
[a)] In some cases, User data may not be complete.		

2.2.2.2.3 Return option

The parameter "Return option" is used to determine the handling of messages encountering transport problems.

"Return option" may assume the following values:

- discard message on error;
- return message on error.

If the SCCP user does not provide a return option parameter, then the SCCP assumes messages will be discarded on error.

2.2.2.2.4 Reason for return

The parameter "Reason for return" identifies the reason why a message was not able to be delivered to its final destination.

"Reason for return" may assume the following values:

- no translation for an address of such nature;
- no translation for this specific address;
- subsystem congestion;
- subsystem failure;
- unequipped user;
- MTP failure;
- network congestion;
- SCCP unqualified;
- error in message transport;
- error in local processing;
- destination cannot perform reassembly;
- SCCP failure.

2.2.2.2.5 User data

The parameter "User data" is information which is to be transferred transparently between SCCP users. In case of the N-NOTICE primitive, the "User data" parameter may be incomplete.

2.2.2.3 Primitives

In the following tables, the notations given below are used:

M Indicates a mandatory parameter;

O Indicates a provider option;

C Indicates that the parameter is conditional;

U Indicates a user option.

2.2.2.3.1 UNITDATA

The "N-UNITDATA request" primitive is the means by which a SCCP user requests the SCCP to transport data to another user.

The "N-UNITDATA indication" primitive informs a user that data is being delivered to it from the SCCP.

Table 10 indicates the parameters of the primitive N-UNITDATA.

TABLE 10/Q.711

Parameters of the primitive N-UNITDATA

Parameter	Primitive	
	N-UNITDATA request	N-UNITDATA indication
Called address	M	M
Calling address	M	M
Sequence control	U	O
Return option	U	O
User data	U	M (=)
(=) Indicates the paramter must have the same value in the indication primitive as provided in the corresponding request primitive.		

2.2.2.3.2 NOTICE

The "N-NOTICE indication" primitive is the means by which the SCCP returns to the originating user a message which could not reach the final destination.

Table 11 indicates the parameters of the primitive N-NOTICE.

TABLE 11/Q.711

Parameters of the primitive N-NOTICE

Parameter	Primitive
	N-NOTICE indication
Called address	M
Calling address	M
Reason for return	M
User data	M[a)]
a) The User data may not be complete in some cases.	

2.3 SCCP management

2.3.1 Description

The SCCP provides SCCP management procedures (see 5/Q.714) to maintain network performances by rerouting or throttling traffic in the event of failure or congestion in the network. These SCCP management procedures apply to both the connection-oriented and the connectionless services of the SCCP.

2.3.2 Primitives and parameters of the SCCP management

2.3.2.1 Overview

Table 12 gives an overview of the primitives to the upper layers and the corresponding parameters for the SCCP management.

TABLE 12/Q.711

Primitives and parameters of the SCCP management

Primitives		Parameters
Generic Name	Specific Name	
N-COORD	Request Indication Response Confirmation	Affected subsystem Subsystem multiplicity indicator
N-STATE	Request Indication	Affected subsystem User status Subsystem multiplicity indicator[a)]
N-PCSTATE	Indication	Affected DPC Signalling Point Status Remote SCCP Status

[a)] For further study.

2.3.2.2 Parameters

2.3.2.2.1 Address

See 2.2.2.2.1.

2.3.2.2.2 Affected subsystem

The parameter “Affected subsystem” identifies a user which is failed, withdrawn, congested, or allowed. The “Affected subsystem” parameter contains the same type of information as the “Called address” and “Calling address”.

2.3.2.2.3 User status

The parameter “User status” is used to inform a SCCP user of the status of the affected subsystem.

“User status” may assume one of the following values:

- User-in-service (UIS);
- User-out-of-service (UOS).

2.3.2.2.4 Subsystem multiplicity indicator

The parameter “Subsystem multiplicity indicator” identifies the number of replications of a subsystem. This parameter is for further study.

2.3.2.2.5 Affected DPC

The parameter "Affected DPC" identifies a signalling point which is failed, congested, or allowed. The "Affected DPC" parameter contains unique identification of a signalling point.

2.3.2.2.6 Signalling point status

The parameter "Signalling point status" is used to inform a user of the status of an affected DPC.

"Signalling point status" may assume the following values:

- Signalling point inaccessible;
- Signalling point congested;
- Signalling point accessible.

2.3.2.2.7 Remote SCCP Status

The parameter "Remote SCCP Status" is used to inform a user of the status of a remote SCCP.

"Remote SCCP Status" may assume the following values:

- Remote SCCP available;
- Remote SCCP unavailable, reason unknown;
- Remote SCCP unequipped;
- Remote SCCP inaccessible.

2.3.2.3 Primitives

2.3.2.3.1 COORD

The "N-COORD" primitive (see Table 13) is used by replicated subsystems to coordinate the withdrawal of one of the subsystems.

The primitive exists as a "request" when the originating user is requesting permission to go out of service; as an "indication" when the request to go out of service is delivered to the originator's replicate; a "response" when the originator's replicate announced it has sufficient resources to let the originator go out of service; and as a "confirmation" when the originator is informed that it may go out of service.

TABLE 13/Q.711

Parameters of the primitive N-COORD

Parameter	Primitive			
	N-COORD request	N-COORD indication	N-COORD response	N-COORD confirmation
Affected subsystem	X	X	X	X
Subsystem multiplicity indicator[a)]		X		X
[a)] For further study.				

2.3.2.3.2 STATE

The "N-STATE request" primitive (see Table 14) is used to inform the SCCP management about the status of the originating user. The "N-STATE indication" primitive is used to inform an SCCP user accordingly.

TABLE 14/Q.711

Parameters of the primitive N-STATE

Parameter	Primitive	
	N-STATE request	N-STATE indication
Affected subsystem	X	X
User status	X	X
Subsystem multiplicity indicator[a)]		X
[a)] For further study.		

2.3.2.3.3 PCSTATE

The "N-PCSTATE primitive (see Table 15) is used to inform a user about the status of a signalling point.

TABLE 15/Q.711

Parameters of the primitive N-PCSTATE

Parameter	Primitive
	N-PCSTATE indication
Affected DPC	X
Signalling Point Status	X
Remote SCCP Status	X

3 Services assumed from the MTP

3.1 Description

This subclause describes the functional interface offered by the MTP to the upper layer functions, i.e. the SCCP and the User Parts. In order to align the terminology with the OSI-Model, the description uses the terms "primitives" and "parameters".

3.2 Primitives and parameters

The primitives and parameters are shown in Table 16.

3.2.1 TRANSFER

The primitive "MTP-TRANSFER" is used between level 4 and level 3 (SMH) to provide the MTP message transfer service.

3.2.2 PAUSE

The primitive "MTP-PAUSE" indicates to the "Users" the total inability of providing the MTP service to the specified destination[3)].

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3) See 7.2.6/Q.701, items iii), iv) and v).

TABLE 16/Q.711

Message transfer part service primitives

Primitives		Parameters
Generic Name	Specific Name	
MTP-TRANSFER	Request Indication	OPC (see 2.2/Q.704) DPC (see 2.2/Q.704) SLS (see 2.2/Q.704)[a] SIO (see 14.2/Q.704) User Data (see 2.3.8/Q.703)
MTP-PAUSE (Stop)	Indication	Affected DPC[b]
MTP-RESUME (Start)	Indication	Affected DPC[b]
MTP-STATUS	Indication	Affected DPC Cause[b]

a) The MTP users should take into account that this parameter is used for load sharing by the MTP, therefore, the SLS values should be distributed as equally as possible. The MTP guarantees (to a high degree of probability) an in-sequence delivery of messages which contain the same SLS code.

b) The cause parameter has, at present, four values:

i) Signalling network congested (level)

The level value is included if national options with congestion priorities or multiple signalling link states without congestion priorities as in Recommendation Q.704 are implemented.

ii) User Part Unavailability: unknown;

iii) User Part Unavailability: unequipped remote user;

iv) User Part Unavailability: inaccessible remote user.

NOTE – The signalling point is inaccessible via the MTP. The MTP will determine when the signalling point is again accessible and send MTP-RESUME indication. The user should wait for such an indication and, meanwhile is not allowed to send messages to that signalling point. If the remote peer user is thought to be unavailable, that condition may be maintained or cancelled at the local user's discretion.

3.2.3 RESUME

The primitive "MTP-RESUME" indicates to the "Users" the ability of providing the MTP service to the specified destination[4].

This primitive corresponds to the destination accessible state as defined in Recommendation Q.704.

NOTE – When the "MTP-RESUME" indication is given to each user, the MTP does not know whether the remote peer user is available. This is the responsibility of each user.

3.2.4 STATUS

The primitive "MTP-STATUS" indicates to the "Users" the partial inability of providing the MTP service to the specified destination. The primitive is also used to indicate to a User that a remote corresponding User is unavailable and the cause for unavailability (see 11.2.7/Q.704).

In the case of national option with congestion priorities and multiple signalling link congestion states without priorities as in Recommendation Q.704 are implemented, this "MTP-STATUS" primitive is also used to indicate a change of congestion level.

This primitive corresponds to the destination congested state as defined in Recommendation Q.704.

4) See 7.2.6/Q.701, items iii), iv) and v).

NOTE – In the case of remote user unavailability, the user is responsible for determining the availability of this peer user. The user is cautioned not to send normal traffic to the peer user because, while such a peer user is unavailable, no message will be delivered but each will result in a repeated MTP-STATUS indication. The MTP will not send any further indications about the unavailability or availability of this peer user unless the local user continues to send messages to the peer user.

3.2.5 MTP Restart

When the MTP restart procedure is terminated, the MTP indicates the end of MTP restart to all local MTP Users showing each signalling point's accessibility or inaccessibility. The means of doing this is implementation dependent (see 9/Q.704).

4 Functions provided by the SCCP

This clause is an overview of the functional blocks within the SCCP.

4.1 Connection-oriented functions

4.1.1 Functions for temporary signalling connections

4.1.1.1 Connection establishment functions

The connection establishment service primitives defined in clause 2 are used to set up a signalling connection.

The main functions of the connection establishment phase are listed below:

- set-up of a signalling connection;
- establish the optimum size of NPDUs (Network Protocol Data Unit);
- map network address onto signalling relations;
- select functions operational during data transfer phase (for instance, layer service selection);
- provide means to distinguish network connections;
- transport user data (within the request).

4.1.1.2 Data transfer phase function

The data transfer phase functions provide means for a two-way simultaneous transport of messages between the two endpoints of the signalling connection.

The main functions of the data transfer phase as listed below are used or not used in accordance with the result of the selection performed in the connection establishment phase.

- Segmenting/reassembling;
- Flow control;
- Connection identification;
- NSDU delimiting (M-Bit);
- Expedited data;
- Missequence detection;
- Reset;
- Receipt confirmation[5];
- Others.

4.1.1.3 Release phase functions

These functions provide disconnection of the signalling connection, regardless of the current phase of the connection. The release may be performed by an upper layer stimulus or by maintenance of the SCCP itself. The release can start at each end of the connection (symmetrical procedure).

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5) The need for this function is for further study.

The main function of the release phase is the disconnection.

4.1.2 Functions for permanent signalling connections

4.1.2.1 Connection establishment phase and connection release phase functions

The set-up and release for permanent signalling connections are for further study. The stimuli for set-up and release of permanent connections are originated from the Administration function.

4.1.2.2 Data transfer phase functions

The functions for the data transfer on permanent signalling connections correspond to that for temporary connections. Differences may exist regarding the quality of service. This matter is for further study.

4.2 Connectionless service functions

The functions of the connectionless service are listed below:

- mapping the network address to signalling relations;
- sequence service;
- segmenting.

4.3 Management functions

The SCCP provides functions which manage the status of the SCCP subsystems. These functions allow other nodes in the network to be informed of the change in status of SCCP subsystems at a node, and to modify SCCP translation data if appropriate. Subsystem congestion management is for further study.

Functions are also provided to allow a coordinated change of status of replicated SCCP subsystems. At present, this allows a replicated subsystem to be withdrawn from service.

When a subsystem is out of service, SCCP test functions are activated at nodes receiving unavailability information. At periodic intervals the status of the unavailable subsystem is checked by a SCCP management procedure.

Broadcast functions within SCCP management broadcast subsystem status changes to nodes within the network which have an immediate need to be informed of a particular signalling point/subsystem status change.

Notification functions to local subsystems within the node (local broadcast) are also provided.

The capability of a remote SCCP node to test the availability of a subsystem at a restarting SCCP node before resuming traffic to that node or subsystem is for further study. The capability of a remote SCCP node to test the availability of the SCCP when the signalling point becomes accessible, before resuming traffic to/via that node, is for further study. In addition, the application of these tests and the protocol specification are for further study. See 5.2.3/Q.714 and 5.3.4.2/Q.714.

4.4 Routing and translation functions (for further study)

The SCCP routing provides a powerful address translation function, which is asked for connectionless and connection-oriented service. Detailed description of the SCCP routing function can be found in 2.2/Q.714 and 2.3/Q.714.

The basic translation function performed by the SCCP is to translate from a global title, and possibly other information, to a point code and a subsystem number. Other translation results are also possible. The global title form of the address could typically be dialed digits (e.g. a Freephone (800) number). Several standardized CCITT numbering plans may be supported by SCCP; details are given in 3.4/Q.713.

The address translation capabilities of the SCCP in relation to handling OSI Network Service Access Points (NSAP) are for further study.