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SERIES Q: SWITCHING AND SIGNALLING

Specifications of Signalling System No. 7 – Signalling connection control part (SCCP)

Functional description of the signalling connection control part

ITU-T Recommendation Q.711

(Formerly CCITT Recommendation)

ITU-T Q-SERIES RECOMMENDATIONS

SWITCHING AND SIGNALLING

SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE	Q.1–Q.3
INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING	Q.4–Q.59
FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN	Q.60–Q.99
CLAUSES APPLICABLE TO ITU-T STANDARD SYSTEMS	Q.100–Q.119
SPECIFICATIONS OF SIGNALLING SYSTEMS No. 4 AND No. 5	Q.120–Q.249
SPECIFICATIONS OF SIGNALLING SYSTEM No. 6	Q.250–Q.309
SPECIFICATIONS OF SIGNALLING SYSTEM R1	Q.310–Q.399
SPECIFICATIONS OF SIGNALLING SYSTEM R2	Q.400–Q.499
DIGITAL EXCHANGES	Q.500–Q.599
INTERWORKING OF SIGNALLING SYSTEMS	Q.600–Q.699
SPECIFICATIONS OF SIGNALLING SYSTEM No. 7	Q.700–Q.799
General	Q.700
Message transfer part (MTP)	Q.701–Q.709
Signalling connection control part (SCCP)	**Q.711–Q.719**
Telephone user part (TUP)	Q.720–Q.729
ISDN supplementary services	Q.730–Q.739
Data user part	Q.740–Q.749
Signalling System No. 7 management	Q.750–Q.759
ISDN user part	Q.760–Q.769
Transaction capabilities application part	Q.770–Q.779
Test specification	Q.780–Q.799
Q3 INTERFACE	Q.800–Q.849
DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1	Q.850–Q.999
PUBLIC LAND MOBILE NETWORK	Q.1000–Q.1099
INTERWORKING WITH SATELLITE MOBILE SYSTEMS	Q.1100–Q.1199
INTELLIGENT NETWORK	Q.1200–Q.1699
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR IMT-2000	Q.1700–Q.1799
BROADBAND ISDN	Q.2000–Q.2999

For further details, please refer to the list of ITU-T Recommendations.

ITU-T Recommendation Q.711

Functional description of the signalling connection control part

Summary

The Q.71X-series Recommendations defines the services of the SCCP. The SCCP is part of SS No. 7 and provides, above the MTP network or networks, connectionless, connection-oriented, routing and management services.

Source

ITU-T Recommendation Q.711 was revised by ITU-T Study Group 11 (2001-2004) and approved under the WTSA Resolution 1 procedure on 1 March 2001.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. 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 Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

		Page
1	Scope and field of application	1
2	References	2
2.1	Normative references	2
2.2	Informative references	2
3	Definitions	3
4	Abbreviations and acronyms	3
5	General characteristics	4
5.1	Technique of description	4
5.2	Primitives	5
5.3	Peer-to-peer communication	5
5.4	Model of the connection-oriented network service	6
5.5	Model of the connectionless network service	6
5.6	Contents of the Q.71X-series Recommendations	7
6	Services provided by the SCCP	7
6.1	Connection-oriented services	7
6.1.1	Temporary signalling connections	8
6.1.2	Permanent signalling connections	19
6.2	Connectionless services	20
6.2.1	Description	20
6.2.2	Primitives and parameters of the connectionless service	21
6.2.3	State transition diagram	24
6.3	SCCP management	24
6.3.1	Description	24
6.3.2	Primitives and parameters of the SCCP management	24
7	Definition of the lower boundary of the SCCP	27
7.1	MTP-SAP	27
7.2	MTP primitives and parameters	27
7.2.1	TRANSFER	28
7.2.2	PAUSE	28
7.2.3	RESUME	29
7.2.4	STATUS	29
7.2.5	Notification of completion of MTP restart procedure	29
7.3	State transition diagram	29
8	Functions provided by the SCCP	33

Page

8.1 Connection-oriented functions 33
8.1.1 Functions for temporary signalling connections 33
8.1.2 Functions for permanent signalling connections 33
8.2 Connectionless service functions 34
8.3 Management functions 34
8.4 Routing and translation functions 34

ITU-T Recommendation Q.711

Functional description of the signalling connection control part

1 Scope and field of application

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 above the message transfer part performs the functions and procedures of the SCCP. The SCCP is capable of using the services of the MTP as described in ITU-T Q.701 to ITU-T Q.707, and/or in ITU-T Q.2210. The combination of the MTP and the SCCP is called "network service part" (NSP).

The network service part follows the principles of the OSI-reference model as defined in ITU-T X.200, providing a subset of the layer 3 services defined in ITU-T X.213.

It is the intent of ITU-T Q.711, ITU-T Q.712, ITU-T Q.713 and ITU-T Q.714 to specify protocol entities which perform the functions according to the SCCP of the Signalling System No. 7. These protocol entities conform at their lower boundary to the upper boundary conditions specified in ITU-T Q.704 or ITU-T Q.2210 for use of the service offered by the underlying layers.

The SCCP making use of the services of the MTP, as specified in ITU-T Q.2210, provides the connectionless network service as specified in this Recommendation. A connection-oriented network service can only use the services which are common to ITU-T Q.2210 and ITU-T Q.704 for the MTP.

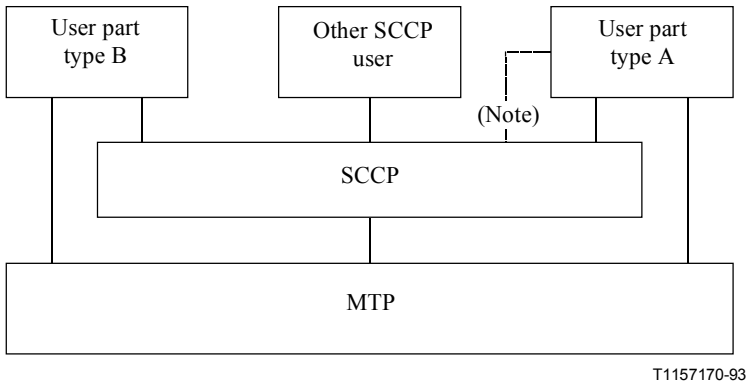
ITU-T Q.715 gives guidance on a number of specific issues related to the incorporation of SCCP in actual networks. These guidelines are in their entirety informal and do not specify any requirement.

The SCCP congestion control procedures may be subject to improvement pending further analysis of the impact of these procedures in different network scenarios and based on the results of operational experience. The overall objectives of the signalling connection control part are to provide the means for:

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

b) a transfer capability for network service 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 setup of end-to-end logical signalling connections. These functions are described in ITU-T Q.714 and ITU-T Q.730. Figure 1 illustrates the embedding of the SCCP within the Signalling System No. 7.



NOTE – Interface using the signals as defined in 6.1.1.3.3, i.e. for the connection-oriented network service.
The ISDN-UP that provides end-to-end signalling as defined in ITU-T Q.730 is a type A user part.

Figure 1/Q.711 – Functional diagram for the SCCP in Signalling System No. 7

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

The references contained in 2.1 and 2.2 contain the reference list for ITU-T Q.711, ITU-T Q.712, ITU-T Q.713 and ITU-T Q.714.

2.1 Normative references

– CCITT *Blue Book*, Fascicle VI.7, Glossary (1988), *Glossary of terms used in Signalling System No. 7*.

– ITU-T Q.701 (1993), *Functional description of the message transfer part (MTP) of Signalling System No. 7*.

– ITU-T Q.704 (1996), *Signalling network functions and messages*.

– ITU-T Q.712 (1996), *Definition and function of signalling connection control part messages*.

– ITU-T Q.713 (2001), *Signalling connection control part formats and codes*.

– ITU-T Q.714 (1996), *Signalling connection control part procedures*.

– ITU-T Q.2210 (1996), *Message transfer part level 3 functions and messages using the services of ITU-T Recommendation Q.2140*.

– ITU-T X.210 (1993), *Information technology – Open Systems Interconnection – Basic Reference Model: Conventions for the definition of OSI services*.

2.2 Informative references

– ITU-T Q.700 (1993), *Introduction to CCITT Signalling System No. 7*.

– ITU-T Q.706 (1993), *Message transfer part signalling performance*.

– ITU-T Q.715 (1996), Signalling connection control part user guide.

– ITU-T Q.716 (1993), *Signalling System No. 7 – Signalling Connection Control Part (SCCP) performance*.

– ITU-T Q.1400 (1993), *Architecture framework for the development of signalling and OA&M protocols using OSI concepts*.

– ITU-T Q.2110 (1994), *B-ISDN ATM adaptation layer – Service specific connection oriented protocol (SSCOP)*.

– ITU-T Q.2140 (1995), *B-ISDN ATM adaptation layer – Service specific coordination function for signalling at the network node interface (SSCF at NNI)*.

– ITU-T X.200 (1994), *Information Technology – Open Systems Interconnection – Basic Reference Model: The basic model*.

– ITU-T X.213 (1995), *Information technology – Open Systems Interconnection – Network service definition* (Note).

NOTE – Further study is required to see which new parts of SCCP can use this Recommendation normatively.

3 Definitions

Definitions of SCCP terms are provided in the glossary of CCITT *Blue Book*, Fascicle VI.7.

In addition to the definitions referenced, the following definitions apply:

3.1 MTP-SAP instance: A logical point in the MTP network at which an MTP user can access the services provided by the MTP-3 or the MTP-3b and the MTP can deliver its services to the MTP user.

3.2 SCCP-SAP instance: A logical point in the SCCP network at which an SCCP user can access the services provided by the SCCP and the SCCP can deliver its services to the SCCP user.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

AAL	ATM Adaptation Layer
ATM	Asynchronous Transfer Mode
B-ISDN	Broadband Integrated Services Digital Network
B-ISUP	Broadband ISDN User Part (of SS No. 7)
DPC	Destination Point Code
ISUP	Integrated Services User Part (of SS No. 7)
L3	Level 3
LSB	Least Significant Bit
MSB	Most Significant Bit
MTP	Message Transfer Part
MTP-SAP	SAP to access the services provided by MTP
MTP-3	MTP Level 3 according to ITU-T Q.704
MTP-3b	MTP Level 3 according to ITU-T Q.2210
NI	Network Indicator

NNI	Network Node Interface
NPCI	Network Protocol Control Information
NSDU	Network Service Data Unit
NSP	Network Service Part
OPC	Originating Point Code
SAAL	Signalling ATM Adaptation Layer
SAP	Service Access Point
SCCP	Signalling Connection Control Part (of SS No. 7)
SCCP-SAP	SAP to access the services provided by SCCP
SDU	Service Data Unit
SI	Service Indicator
SIO	Service Information Octet
SLC	Signalling Link Code
SLS	Signalling Link Selection
SSCF	Service Specific Coordination Function
SSCOP	Service Specific Connection Oriented Protocol
SS No. 7	ITU-T Signalling System No. 7
STP	Signalling Transfer Point
TUP	Telephone User Part (of SS No. 7)
UP	User Part (of SS No. 7)

5 General characteristics

5.1 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 that 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 ITU-T X.200. Figure 2 illustrates the relationship between the SCCP protocol specification and the definition of adjacent services.

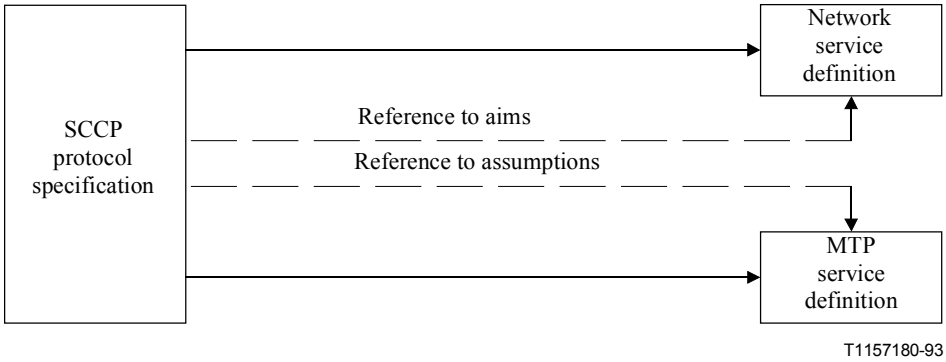


Figure 2/Q.711 – Relationship between the SCCP protocol specification and the definition of adjacent services

5.2 Primitives

Primitives define the information flow associated with the services requested of the SCCP and of the MTP (see Figure 3).

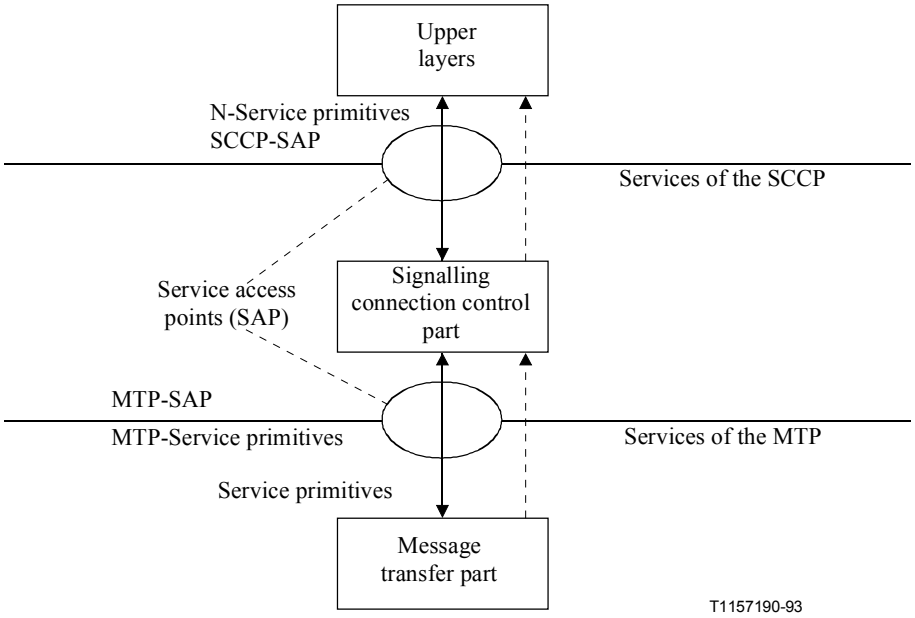


Figure 3/Q.711 – Service primitives

This diagram shows the points at which service primitives are invoked. It is not intended to constrain the architecture. For the architectural considerations, some information is provided in ITU-T Q.1400.

5.3 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 connection;

– the release of logical signalling connections;

– the transfer of data with or without logical signalling connections.

5.4 Model of the connection-oriented network service

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.

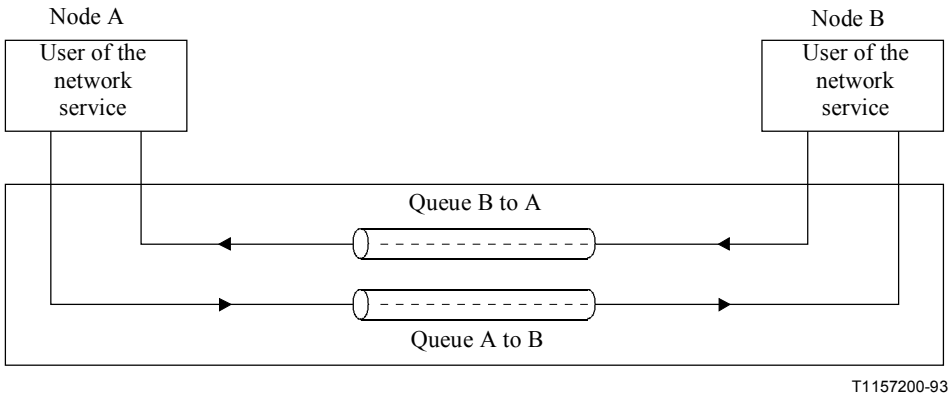


Figure 4/Q.711 – Model for the internode communication with the SCCP (connection-oriented services)

5.5 Model of the connectionless network service

This service definition uses the abstract model for a layer service defined in clause 5/X.210. The model defines the interactions between the user and the provider of the connectionless network service. These interactions take place at the two SCCP-SAPs (see Figure 5).

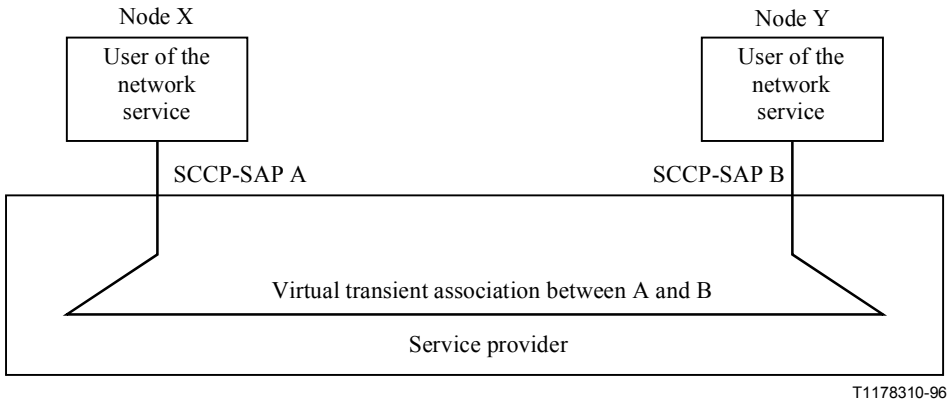


Figure 5/Q.711 – Model of a network connectionless transmission

A defining characteristic of network-connectionless transmission is the independent nature of each invocation of the connectionless network service. This basic service has been enhanced to provide sequence integrity between SDUs (see protocol class 1 service).

The connectionless network service, as provided between SCCP-SAPs, can be modelled in the abstract as a virtual transient association between the SCCP-SAPs (see Note).

NOTE – This model is intended solely to describe the appearance of the connectionless-mode network service to the SCCP users. It is not intended to be a model of the internal operation of the service provider in providing the connectionless network service.

Only one type of object, the Unitdata, can be exchanged between the users of the service. This relationship is illustrated in Figure 5.

5.6 Contents of the Q.71X-series Recommendations

ITU-T 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.

ITU-T Q.712 defines the function of the messages, the set of protocol elements and their embedding into messages.

ITU-T Q.713 describes the formats and codes used for the SCCP messages.

ITU-T Q.714 is a detailed description of the SCCP procedures as a protocol specification.

ITU-T Q.715 is the SCCP user guide. Implementation-dependent aspects may be found in ITU-T Q.715.

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

6 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 in-sequence delivery connectionless class;

2 basic connection-oriented class;

3 flow control connection-oriented class.

In the tables defining individual primitives, the notations given below are used:

M indicates a mandatory parameter;

O indicates an SCCP implementation option;

C indicates that the parameter is conditional;

U indicates a user option;

n.a. not applicable;

= indicates that the parameter must have the same value in the indication primitive, or confirm primitive as provided in the corresponding request primitive, or response primitive, respectively.

6.1 Connection-oriented services

A distinction has to be made between:

– temporary signalling connections;

– permanent signalling connections.

Temporary signalling connections are under control (establishment, data transfer including reset, release) of the SCCP user. Further details are given in 6.1.1.

Permanent signalling connections are established and released by Management (O&M function or management function) and are provided to the SCCP user on a semi-permanent basis, while data transfer including reset is under control of the SCCP user. Further details are given in 6.1.2.

6.1.1 Temporary signalling connections

6.1.1.1 Description

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

– connection establishment phase;

– data transfer phase;

– connection release phase.

6.1.1.1.1 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 concatenated connection sections (i.e. coupling of connections). The criteria for deciding on coupling are implementation dependent.

For connection establishment there are two alternative boundaries between SCCP and SCCP user with different procedures:

– the "X.213-like" boundary that is described further in 6.1.1.2;

– the "ISUP-embedded" boundary that is described further in 6.1.1.3.

The "X.213-like" boundary requires that establishment procedures are performed by SCCP while in the case of "ISUP-embedded" boundary the ISUP provides the routing of the request for the set-up of a connection section.

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

6.1.1.1.2 Data transfer phase

The data transfer service provides for an exchange of user data, called Network Service Data Units (NSDUs), in either direction or in both directions simultaneously on a signalling connection. An SCCP message between two peers consists of:

– Network Protocol Control Information (NPCI);

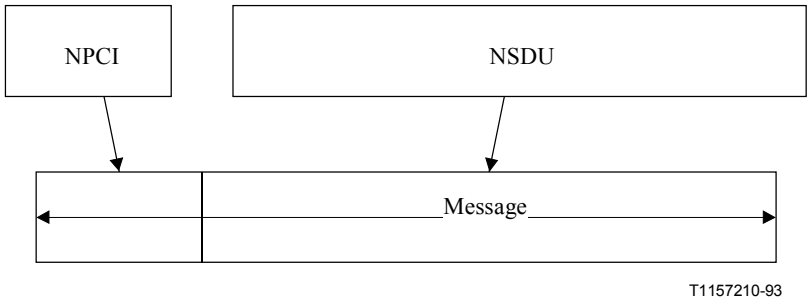
– Network Service Data Unit (NSDU).

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.

The network protocol control information and the network service data unit are put together and transferred as a message (Figure 6). 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 an NSDU (Figure 7).



NPCI Network Protocol Control Information
NSDU Network Service Data Unit
Message Protocol data unit

Figure 6/Q.711 – Relation between NSDU and message neither segmenting nor blocking

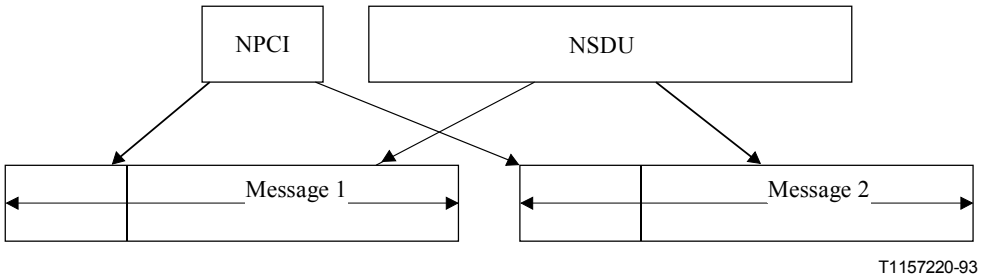


Figure 7/Q.711 – Segmenting

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 ITU-T Q.714).

6.1.1.1.3 Connection release phase

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

6.1.1.2 Network service primitives and parameters applicable to the X.213-like connection-oriented boundary

6.1.1.2.1 Overview

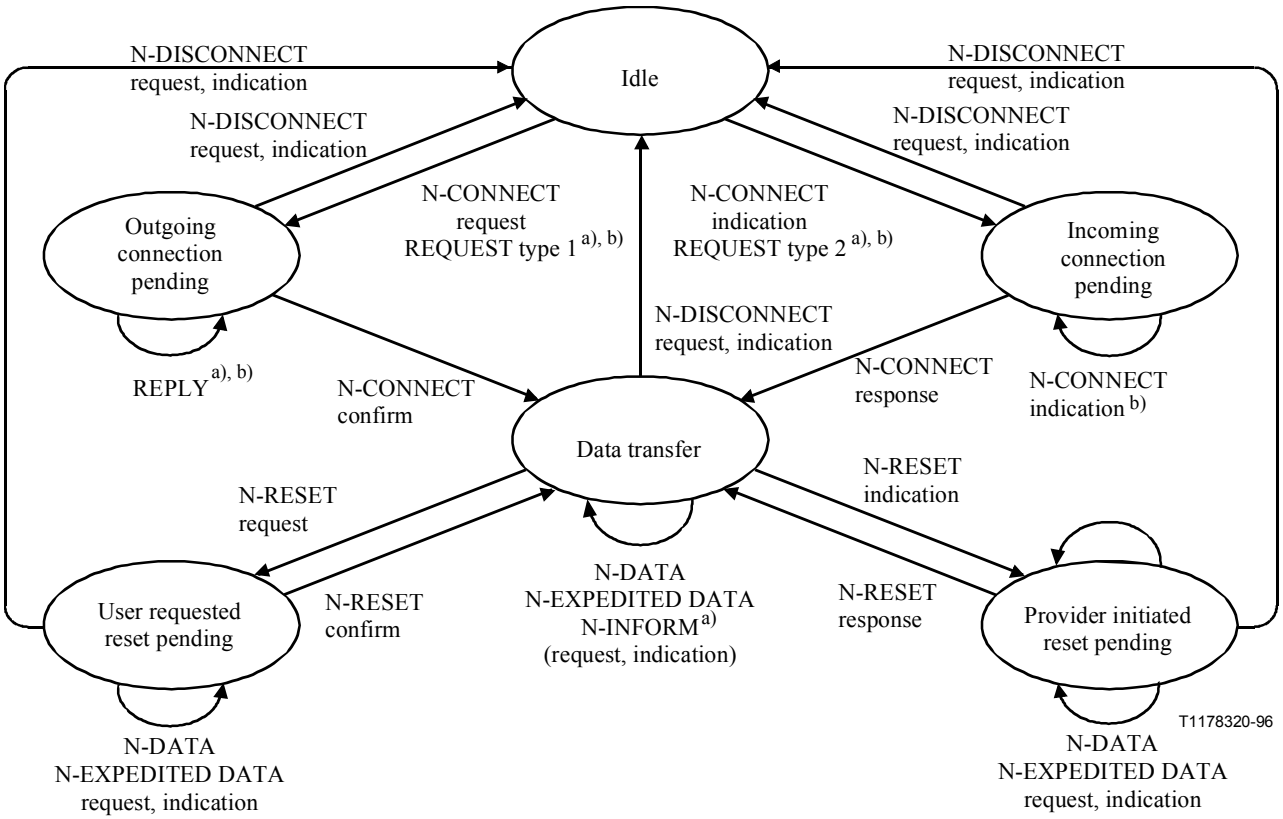
Table 1 gives an overview of the primitives to the upper layers and the corresponding parameters for the (temporary) connection-oriented network service. Figure 8 shows an overview state transition diagram for the sequence of primitives at a connection endpoint. Refer to the ITU-T X.213 network service definition for open systems interconnection for ITU-T application.

Table 1/Q.711 – Network service primitives for X.213-like connection-oriented services

Primitives		Parameters
Generic name	**Specific name**	
N-CONNECT	Request Indication Response Confirm	Called address Calling address Responding address Expedited data selection Quality of service parameter set User data Importance Connection identification[a)]
N-DATA	Request Indication	Importance User data Connection identification[a)]
N-EXPEDITED DATA	Request Indication	User data Connection identification[a)]
N-DISCONNECT	Request Indication	Originator Reason User data Responding address Importance Connection identification[a)]
N-RESET	Request Indication Response Confirm	Originator Reason Connection identification[a)]
N-INFORM[b)]	Request Indication	Reason Connection identification Quality of service parameter set

a) In 5.3/X.213, this parameter is implicit.

b) This primitive is not in ITU-T X.213.



a) This primitive is not in ITU-T X.213. (See 6.1.1.3.2.)

b) For user part type A only.

Figure 8/Q.711 – State transition diagram for the sequence of primitives at a connection endpoint (basic transitions)

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

6.1.1.2.2 Connection establishment phase

An 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 responding 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 confirm" to the calling SCCP user. The connection is now ready for data transfer.

The four types of N-CONNECT applicable to the X.213-like boundary, the request, the indication, the response and the confirm contain the parameters as shown and further described in Table 2.

Table 2/Q.711 – Parameters of the primitive N-CONNECT applicable to the X.213-like boundary

Parameter	Primitive			
	N-CONNECT request	**N-CONNECT indication**	**N-CONNECT response**	**N-CONNECT confirm**
Called address	M	M[a2)]	n.a.	n.a.
Calling address	U[a1)]	C[c1)]	n.a.	n.a.
Responding address	n.a.	n.a.	U[a3)]	C[c1)]
Expedited data selection	U	n.a.	U	n.a.
Quality of service parameter set	M	M	M	M(=)
User data	U	C(=)[c1)]	U	C(=)[c1)]
Connection identification[b)]	O	O	O	O
Importance	U	O	U	O

[a1)] This parameter is associated with the SCCP service access point at which this primitive is issued if the calling address is absent.

[a2)] This parameter is associated with the SCCP service access point at which this primitive is issued if the called address is absent.

[a3)] This parameter is associated with the SCCP service access point at which this primitive is issued if the responding address is absent.

[b)] In 5.3/X.213, this parameter is implicit.

[c1)] If present in the received SCCP message.

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 (together with the MTP-SAP instance).

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 parameter "responding address" identifies the SCCP user to which the connection has been established or refused.

The "responding address" parameter in the N-CONNECT primitive conveys the address of the SCCP 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.

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 parameter set is 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. The connection identification is an internal representation of the "connection endpoint identifier" defined in the OSI-RM. Its use and format is implementation dependent.

The "importance" parameter is a user optional parameter in request and response primitives that result in the transmission of SCCP messages. Its use allows the SCCP user to assign and indicate to SCCP a certain importance to the primitive. During MTP and/or SCCP congestion, SCCP will take decisions to send out or reject the resulting message, based on this importance and on the severity of the congestion. Its presence in the indication and confirmation primitive is an SCCP implementation option.

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 and from the SCCP within the primitives N-CONNECT and N-DISCONNECT.

6.1.1.2.3 Data transfer phase

During this phase three different primitives may occur:

a) N-DATA (Table 3);

b) N-EXPEDITED DATA (Table 4);

c) N-RESET (Table 5).

Table 3/Q.711 – Parameters of the primitive N-DATA

Parameter	Primitive	
	N-DATA request	**N-DATA indication**
User data	M	M(=)
Connection identification	O	O
Importance	U	O

Table 4/Q.711 – Parameters of the primitive N-EXPEDITED DATA

Parameter	Primitive	
	N-EXPEDITED DATA request	**N-EXPEDITED DATA indication**
User data	M	M(=)
Connection identification	O	O

Table 5/Q.711 – Parameters of the primitive N-RESET

Parameter	Primitive			
	N-RESET request	**N-RESET indication**	**N-RESET response**	**N-RESET confirm**
Originator	(Always NSU)	M	n.a.	n.a.
Reason	M	M	n.a.	n.a.
Connection identification	O	O	O	O

The primitive "N-DATA" (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.

The primitive "N-EXPEDITED DATA" may only be used by the SCCP user in case of protocol class 3 connections.

The primitive N-RESET (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 confirm. After reception of an N-RESET request and before the sending of an N-RESET confirm, all NSDUs from the remote SCCP and the local SCCP user are discarded by the local 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[1]" 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".

6.1.1.2.4 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).

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

Table 6/Q.711 – Parameters of the primitive N-DISCONNECT

Parameter	Primitive	
	N-DISCONNECT request	**N-DISCONNECT indication**
Originator	(Always NSU)	M
Responding address	U[a)]	C[c2), a)]
Reason	M	M
User data	U	C(=)[c2)]
Connection identification	O	O
Importance	U	O
[a)] Only applicable in the case of connection refusal. [c2)] If present in the received SCCP message.		

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);
   - connection refusal[2] – destination inaccessible/non-transient condition;
   - connection refusal[2] – destination inaccessible/transient condition;
   - connection refusal[2] – QOS not available/non-transient condition;
   - connection refusal[2] – QOS not available/transient condition;
   - connection refusal[2] – reason unspecified/non-transient condition;
   - connection refusal[2] – reason unspecified/transient condition;
   - 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];
   - connection refusal[2] – hop counter violation.

[2] It is noted that the term "connection rejection" is used in ITU-T X.213 for the "reason" parameter values.

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".

6.1.1.3 Network service primitives, interface elements and parameters applicable to the ISUP-embedded connection-oriented boundary

6.1.1.3.1 Overview

Table 7 gives an overview of the primitives to the SCCP user layer and the corresponding parameters for the (temporary) "ISUP-embedded" connection-oriented network service. The state transition diagram for the sequences of the primitives at a connection endpoint is left for further study.

Table 7/Q.711 – Network service primitives and interface elements for ISUP embedded connection-oriented services

Primitives		Parameters
Generic name	**Specific name**	
N-CONNECT	Indication Response Confirm	Called address Calling address Responding address Expedited data selection Quality of service parameter set User data Importance Connection identification[a)]
N-DATA	Request Indication	Importance User data Connection identification[a)]
N-EXPEDITED DATA	Request Indication	User data Connection identification[a)]
N-DISCONNECT	Request Indication	Originator Reason User data Responding address Importance Connection identification[a)]
N-RESET	Request Indication Response Confirm	Originator Reason Connection identification[a)]
N-INFORM	Request Indication	Reason Connection identification Quality of service parameter set
REQUEST type 1	–	Connection identification Expedited data selection Quality of service parameter set
REQUEST type 2	–	Quality of service parameter set Connection identification Source local reference Originating signalling point code Reply request
REPLY	–	Source local reference Quality of service parameter set Connection identification[a)]

[a)] In 5.3/X.213, this parameter is implicit.

6.1.1.3.2 Notice service

The provision of the notice service by use of the "N-INFORM" primitive is implementation dependent.

The primitive N-INFORM (Table 8) 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 8/Q.711 – Parameters of the primitive N-INFORM

Parameter	Primitive	
	N-INFORM request	**N-INFORM indication**
Reason	M	M
Connection identification	O	O
QOS parameter set	C[c3)]	C[c3)]
[c3)] Present in inform reasons that lead to a QOS parameter set change.		

The primitive "N-INFORM request" is provided to inform the local 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 local 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.

6.1.1.3.3 Connection establishment making use of the ISUP-embedded procedures

An SCCP user (calling user) may, instead of using the N-CONNECT request thereby requesting SCCP to transmit an appropriate PDU, use the REQUEST to solicit the SCCP to provide in the REPLY information relevant for connection establishment. The forward direction of the connection is established hop-by-hop making use of PDUs of ISUP thereby is embedded in the forward call set-up. In the backward direction, normal SCCP PDUs are used. The N-CONNECT request is replaced at the origin by the two interface elements REQUEST type 1 and REPLY. Within intermediate nodes the two interface elements REQUEST type 2 and REPLY are required.

The three types of N-CONNECT applicable to the ISUP embedded boundary, the indication, the response and the confirm contain the parameters as shown in Table 9.

Table 9/Q.711 – Parameters of the primitive N-CONNECT applicable to the ISUP embedded boundary

Parameter	Primitive		
	N-CONNECT indication	**N-CONNECT response**	**N-CONNECT confirm**
Called address	O	n.a.	n.a.
Calling address	n.a.	n.a.	n.a.
Responding address	n.a.	U[a1)]	C[c3)]
Expedited data selection	n.a.	U	n.a.
Quality of service parameter set	O	M	M(=)
User data	n.a	U	C(=)[c3)]
Connection identification	O	O	O
Importance	n.a	U	O

[a1)] This parameter is associated with the SCCP service access point at which this primitive is issued if the responding address is absent.

[c3)] If present in the received SCCP message.

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 (O);

– expedited data selection (U);

– quality of service parameter set (U).

The REQUEST type 2 contains the following parameters:

– quality of service parameter set (M);

– connection identification (O);

– source local reference (M);

– originating signalling point code (M);

– reply request (U);

– refusal indicator (U).

The REPLY contains the following parameters:

– source local reference (M);

– quality of service parameter set (M);

– connection identification (O).

6.1.2 Permanent signalling connections

6.1.2.1 Description

The set-up/release service is controlled by the administration (e.g. OMAP). The functions for set-up and release may be similar to those provided for temporary signalling connections. The classes of service are the same.

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

6.1.2.2 Primitives and parameters

The primitives and their parameters are listed in Table 10. Their content and functionality correspond to the description within 6.1.1.2.3.

Table 10/Q.711 – Primitives for the data transfer on permanent connections

Primitives		Parameters
Generic name	**Specific name**	
N-DATA	Request Indication	Importance User data Connection identification
N-EXPEDITED DATA	Request Indication	User data Connection identification
N-RESET	Request Indication Response Confirm	Originator Reason Connection identification

6.2 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 is provided within each node, or is distributed over the network or is provided in some special translation centres.

The SCCP also includes the ability to segment/reassemble user data that cannot be transferred 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 in support of SCCP-SDUs could be discarded instead of being transferred. If the SCCP user wishes to be informed of the non-delivery of a SCCP-SDU caused by the discard of a message, the return option parameter must be set to "return SCCP-SDU on error" in the primitive to the SCCP.

6.2.1 Description

The connectionless SCCP offers two services:

Class 0: The basic connectionless class without guaranteed in-sequence delivery of SCCP-SDUs. The SCCP user can invoke this service by means of the parameter "sequence control" in the N-UNITDATA request primitive being absent; and

Class 1: The in-sequence delivery connectionless class with guaranteed[3] in-sequence delivery of SCCP-SDUs. The SCCP user can invoke this service by means of the parameter "sequence control" in the N-UNITDATA request primitive being present.

NOTE – These two services are provided by SCCP making use of the sequence control mechanisms provided by the MTP in a distinct way:

a) The class 0 service allows the SCCP to insert SLS values randomly, or with the aim to achieve an appropriate load sharing within the underlying MTP network.

b) The class 1 service requires the SCCP to insert the same SLS for all the SCCP-SDUs associated with given parameters "sequence control" and "called address".

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

6.2.2 Primitives and parameters of the connectionless service

6.2.2.1 Overview

Table 11 gives an overview of the primitives to the upper layers and the corresponding parameters for the connectionless service.

Table 11/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 Return option Importance User data
N-NOTICE	Indication	Called address Calling address Reason for return User data Importance

6.2.2.2 Parameters

6.2.2.2.1 Address

The parameters "called address" and "calling address" serve to identify the destination and origination respectively, of the SCCP-SDU to be conveyed in connectionless messages. It should be noted that the called and calling addresses may be different at the origination and destination. These parameters may contain some combination of global title, subsystem number and signalling point code.

[3] By the MTP network or by concatenated MTP networks concerned (for further information, see ITU-T Q.706).

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 node, like the ISDN-user part, the SCCP-management, etc.

6.2.2.2.2 Sequence control

The presence of the parameter "sequence control" indicates to the SCCP that the user requires to invoke the "sequence guaranteed" service. In the case of "sequence guaranteed" service, this parameter is an indication to the SCCP that a given stream of SCCP-SDUs has to be delivered in sequence. The value of this parameter together with the called address 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.

6.2.2.2.3 Return option

The parameter "return option" is used to determine the handling of SCCP-SDUs encountering transport problems.

"Return option" may assume the following values:

– discard SCCP-SDU on error;

– return SCCP-SDU on error.

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

6.2.2.2.4 Reason for return

The parameter "reason for return" identifies the reason why a SCCP-SDU 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;

– hop counter violation;

– segmentation not supported;

– segmentation failed.

6.2.2.2.5 User data

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

6.2.2.2.6 Importance

The "importance" parameter is a user optional parameter in request primitives that result in the transmission of SCCP messages. Its use allows the SCCP user to assign and indicate to SCCP a certain importance to the primitive. During MTP and/or SCCP congestion, SCCP will take decisions to send out or reject the resulting message, based on this importance and on the severity of the congestion. Its presence in the indication primitives is an SCCP implementation option.

6.2.2.3 Primitives

6.2.2.3.1 UNITDATA

The "N-UNITDATA request" primitive is the means by which an SCCP user requests the SCCP to transfer SCCP-SDUs to a peer SCCP user.

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

Table 12 indicates the parameters of the primitive N-UNITDATA.

Table 12/Q.711 – Parameters of the primitive N-UNITDATA

Parameter	Primitive	
	N-UNITDATA request	**N-UNITDATA indication**
Called address	M	M
Calling address	U[a)]	M
Sequence control	U	O
Return option	U	O
User data	M	M(=)
Importance	U	O

a) This parameter is associated with the SCCP service access point at which the primitive is issued if the calling address is absent.

6.2.2.3.2 NOTICE

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

Table 13 indicates the parameters of the primitive N-NOTICE.

Table 13/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
Importance	O

6.2.3 State transition diagram

The network-connectionless transmission service primitive can be used to transmit a self-contained SCCP-SDU from one SCCP-SAP to another SCCP-SAP in a single service access; thus no initial establishment or subsequent release of a network-connection is required. This SCCP-SDU can be independent (class 0) or appear in a sequence where sequence integrity is preserved (class 1).

The state transition diagram, as seen by the SCCP user using the services provided by the connectionless SCCP, is shown in Figure 9.

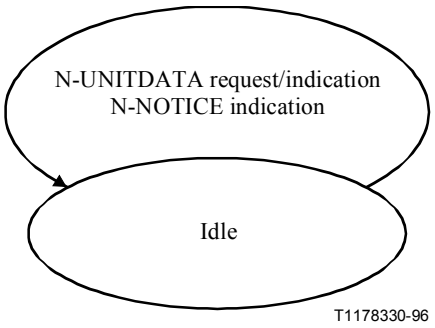


Figure 9/Q.711 – State transition diagram for sequence of connectionless service primitives at one SCCP-SAP

6.3 SCCP management

6.3.1 Description

The SCCP provides SCCP management procedures (see clause 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.

6.3.2 Primitives and parameters of the SCCP management

6.3.2.1 Overview

Table 14 gives an overview of the primitives to the upper layers and the corresponding parameters for the SCCP management.

Table 14/Q.711 – Primitives and parameters of the SCCP management

Primitives		Parameters
Generic name	**Specific name**	
N-COORD	Request Indication Response Confirm	Affected subsystem Subsystem multiplicity indicator
N-STATE	Request Indication	Affected subsystem User status Subsystem multiplicity indicator
N-PCSTATE	Indication	Affected signalling point (together with the MTP-SAP instance) Signalling point status Restricted importance level Remote SCCP status

6.3.2.2 Parameters

6.3.2.2.1 Affected subsystem

The parameter "affected subsystem" identifies a user which is failed, withdrawn, or allowed. The "affected subsystem" parameter contains the same type of information as the "called address" and "calling address", except the global title portion.

6.3.2.2.2 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).

6.3.2.2.3 Subsystem multiplicity indicator

The parameter "subsystem multiplicity indicator" identifies the number of replications of a subsystem. This parameter is reserved for national application.

6.3.2.2.4 Affected signalling point

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

6.3.2.2.5 Signalling point status

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

"Signalling point status" may assume the following values:

– signalling point inaccessible;

– signalling point congested;

– signalling point accessible.

6.3.2.2.6 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;
– remote SCCP congested.

6.3.2.2.7 Restricted importance level

The parameter "restricted importance level" is used to inform an SCCP user of the importance level at which traffic is being restricted by SCCP towards a remote signalling point or SCCP. When the user is able to identify the remote signalling point or SCCP, it may decide not to send any primitives of importance numerically below the level indicated that will result in messages towards the (SCCP at that) remote signalling point. Primitives of importance numerically equal to or greater than the level indicated will still be sent (to ensure equitable treatment with users not in a position to identify the remote signalling point or SCCP).

6.3.2.3 Primitives

6.3.2.3.1 COORD

The "N-COORD" primitive (Table 15) is used by replicated subsystems to coordinate the withdrawal of one of the subsystems.

Table 15/Q.711 – Parameters of the primitive N-COORD

Parameter	Primitive			
	N-COORD request	**N-COORD indication**	**N-COORD response**	**N-COORD confirm**
Affected subsystem	M	M	M	M
Subsystem multiplicity indicator	n.a.	O	n.a.	O

The primitive exists as: a "request" when the originating user is requesting permission to go out-of-service; 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 "confirm" when the originator is informed that it may go out-of-service.

6.3.2.3.2 STATE

The "N-STATE request" primitive (Table 16) 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 16/Q.711 – Parameters of the primitive N-STATE

Parameter	Primitive	
	N-STATE request	N-STATE indication
Affected subsystem	M	M
User status	M	M
Subsystem multiplicity indicator	n.a.	O

6.3.2.3.3 PCSTATE

The "N-PCSTATE primitive" (Table 17) is used to inform a user about the status of a signalling point or a remote SCCP.

Table 17/Q.711 – Parameters of the primitive N-PCSTATE

Parameter	Primitive
	N-PCSTATE indication
Affected signalling point	M
Signalling point status	M
Remote SCCP status	C[c5)]
Restricted importance level	C[c6)]
[c5)] Present if this is the result of an MTP-STATUS reporting user part unavailability or the reception of an SSC message reporting a change of restricted importance level, or a time-out (T_{con}) to detect the abatement of SCCP congestion. [c6)] Present if this is the result of a change in the restricted importance level of the affected signalling point or remote SCCP.	

7 Definition of the lower boundary of the SCCP

7.1 MTP-SAP

The services provided by the MTP are offered at two different MTP-SAPs:

a) An MTP-SAP that supports a maximum MTP-SDU size of 272 octets, including the MTP routing label (see 2.3.8/Q.703).

b) An MTP-SAP that supports a maximum MTP-SDU size of 4095 octets, including the MTP routing label (see 9.1/Q.2210).

With the exception of the maximum supported SDU size, these two SAPs offer equivalent services.

7.2 MTP primitives and parameters

The primitives supported by the MTP are specified in Table 1/Q.701 (MTP-3), and Table 1/Q.2210 (MTP-3b), respectively. Table 18 specifies how the MTP primitives apply when SCCP is using the services of the MTP. In the case of conflicting statements between this Recommendation and ITU-T Q.701 or ITU-T Q.2210, ITU-T Q.701 and ITU-T Q.2210 take precedence.

Table 18/Q.711 – Message transfer part service primitives

Primitives		Parameters
Generic name	**Specific name**	
MTP-TRANSFER	Request Indication	OPC (2.2/Q.704) DPC (2.2/Q.704) SLS (2.2/Q.704)[a)] SIO (14.2/Q.704) User data[c)]
MTP-PAUSE (stop)	Indication	Affected DPC
MTP-RESUME (start)	Indication	Affected DPC
MTP-STATUS	Indication	Affected DPC Cause[b)]

a) The SCCP should assist load sharing within the underlying MTP network by making use of an appropriate choice of SLS values (distributed as equally as possible). Where in-sequence delivery is required, the same SLS value should be used.

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

i) Signalling network congested (plus optional level).

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

ii) User part unavailability: unknown (user part identity is SCCP).

iii) User part unavailability: unequipped remote user (user part identity is SCCP).

iv) User part unavailability: inaccessible remote user (user part identity is SCCP).

If the cause was "unknown", "inaccessible remote user" or "signalling network congestion" without "level", it is the responsibility of the SCCP to determine when the remote SCCP is again available.

c) If the selected MTP-SAP instance is an MTP as described in ITU-T Q.701 to ITU-T Q.707, the "user data" parameter is defined in 2.3.8/Q.703. If the selected MTP-SAP instance is an MTP as described in ITU-T Q.2210 ("MTP-3b"), the parameter "user data" is as defined in 9.1/Q.2210.

7.2.1 TRANSFER

The primitive "MTP-TRANSFER" is used between SCCP and MTP to provide the MTP message transfer service.

7.2.2 PAUSE

The primitive "MTP-PAUSE" indicates to the SCCP the total inability of providing the MTP service to the specified destination[4].

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.

4 If MTP provides services according to ITU-T Q.704, see 7.2.6/Q.701, items iii), iv) and v); otherwise, this reference to ITU-T Q.701 does not apply.

7.2.3 RESUME

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

This primitive corresponds to the destination accessible state as defined in ITU-T 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.

7.2.4 STATUS

The primitive "MTP-STATUS" indicates to the SCCP 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 ITU-T 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/user part unavailable state as defined in ITU-T Q.704.

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 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.

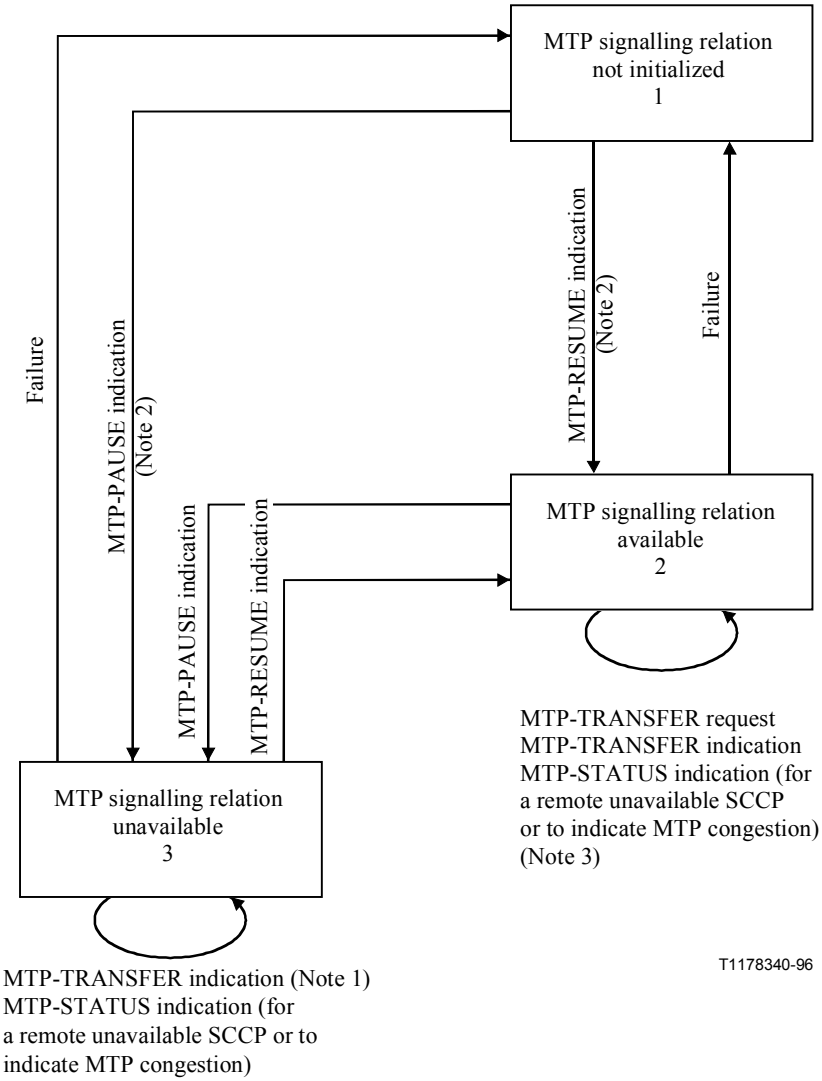
7.2.5 Notification of completion of MTP restart procedure

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 clause 9/Q.704), but it is modelled by the MTP-RESUME indications or MTP-PAUSE indications at the appropriate MTP-SAP instance in the state transition diagrams of 7.3.

7.3 State transition diagram

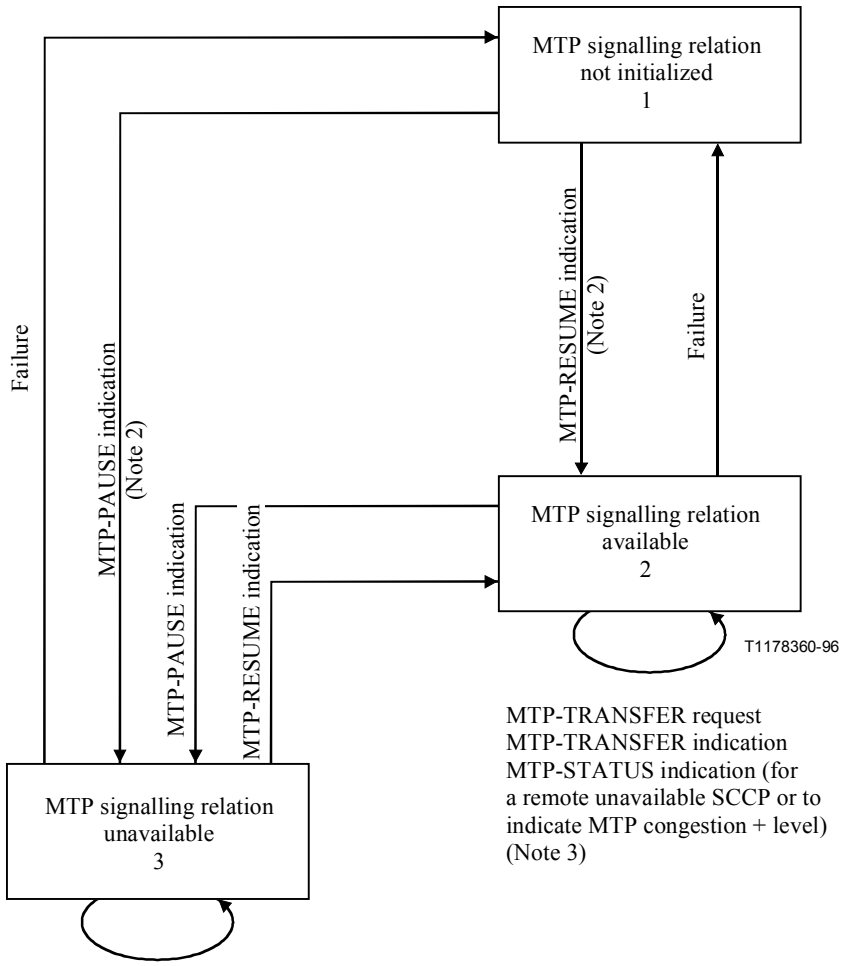
The state transition diagrams, as seen by the SCCP using the services provided by the MTP, are shown in Figures 10, 11 and 12.

Each state transition diagram applies to a single signalling relation; therefore, there exist as many state transition diagrams as there are signalling relations. Figure 10 is an abstract model of the interface between the MTP and the SCCP. It is not reflected in the management procedures and the SDL diagrams in ITU-T Q.714.



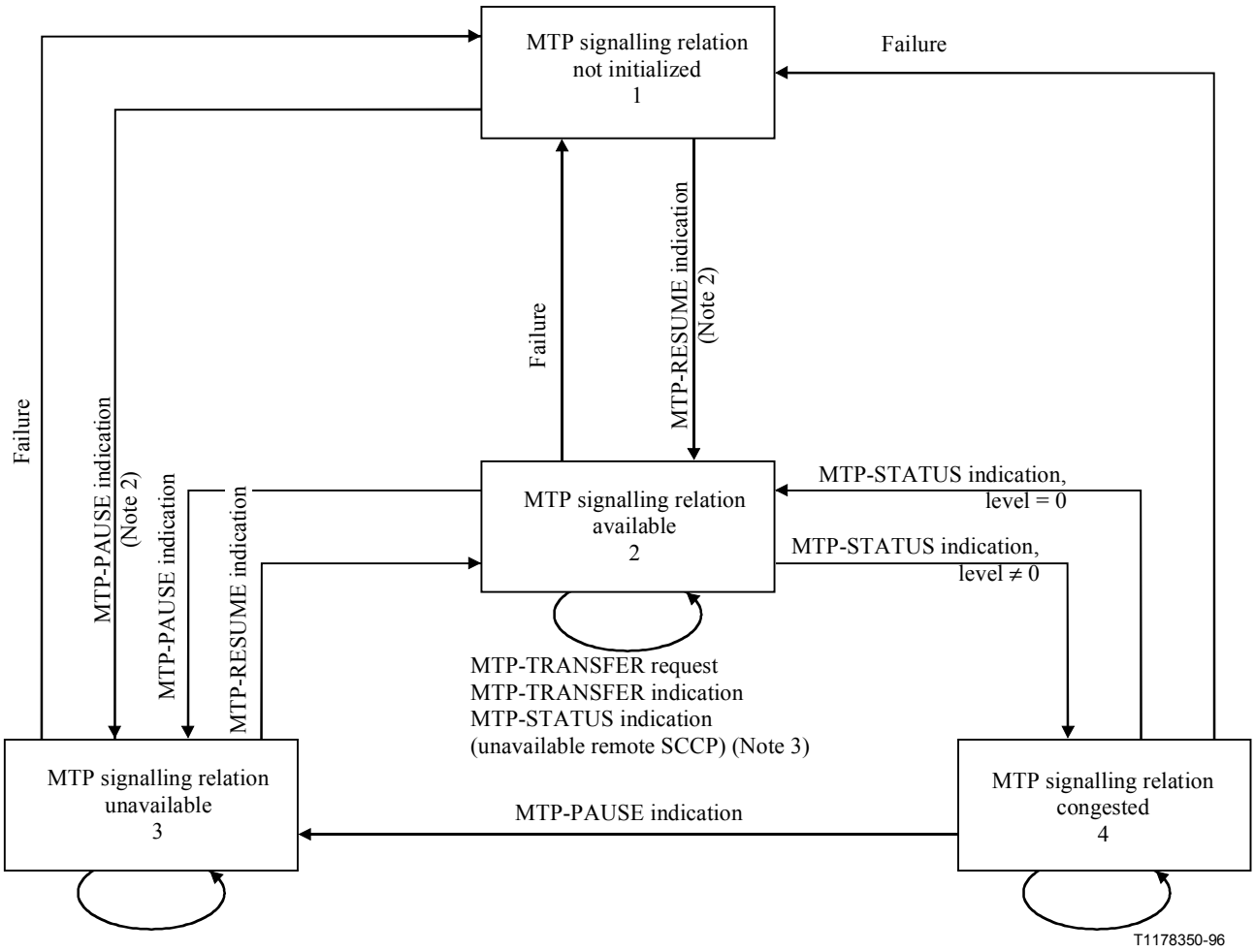
NOTE 1 – MTP-TRANSFER indication in state 3 is a result of the availability of the signalling relation towards the local MTP, but the unavailability of the signalling relation towards the remote MTP.
NOTE 2 – These transitions are implicity triggered by the MTP restart procedure. The end of the MTP restart is communicated to the local MTP users by means of implementation-dependent indications showing each signalling point's accessibility or inaccessibility.
NOTE 3 – The MTP itself does not keep track of the status of the remote MTP users, so the SCCP is responsible for detecting the availability of its remote peer SCCP.

Figure 10/Q.711 – State transition diagram for sequence of MTP-primitives across the upper boundary of the MTP-3 for one MTP signalling relation that is managed by the SCCP-MTP international method of congestion reporting



NOTE 1 – MTP-TRANSFER indication in state 3 is a result of the availability of the signalling relation towards the local MTP, but the unavailability of the signalling relation towards the remote MTP.
NOTE 2 – These transitions are implicitly triggered by the MTP restart procedure. The end of the MTP restart is communicated to the local MTP users by means of implementation-dependent indications showing each signalling point's accessibility or inaccessibility.
NOTE 3 – The MTP itself does not keep track of the status of the remote MTP users, so the SCCP is responsible for detecting the availability of its remote peer SCCP.

Figure 11/Q.711 – State transition diagram for sequence of MTP-primitives across the upper boundary of the MTP-3 for one MTP signalling relation that is managed by the SCCP-MTP multiple congestion levels without priorities



NOTE 1 – MTP-TRANSFER indication in state 3 is a result of the availability of the signalling relation towards the local MTP, but the unavailability of the signalling relation towards the remote MTP.
NOTE 2 – These transitions are implicitly triggered by the MTP restart procedure. The end of the MTP restart is communicated to the local MTP users by means of implementation-dependent indications showing each signalling point's accessibility or inaccessibility.
NOTE 3 – The MTP itself does not keep track of the status of the remote MTP users, then, the SCCP is responsible for detecting the availability of its remote peer SCCP.
NOTE 4 – Further study is required to take into account the MTP level congestion procedure into the SCCP congestion procedures.

Figure 12/Q.711 – State transition diagram for sequence of MTP-primitives across the upper boundary of the MTP-3 for one MTP signalling relation that is managed by the SCCP-MTP multiple congestion levels with congestion priorities

8 Functions provided by the SCCP

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

8.1 Connection-oriented functions

8.1.1 Functions for temporary signalling connections

8.1.1.1 Connection establishment functions

The connection establishment service primitives defined in 6.1 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).

8.1.1.2 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 (Mbit);
– expedited data;
– missequence detection;
– reset;
– others.

8.1.1.3 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).

The main function of the release phase is the disconnection.

8.1.2 Functions for permanent signalling connections

8.1.2.1 Connection establishment phase and connection release phase functions

The stimuli for set-up and release of permanent connections are originated from the administration function.

8.1.2.2 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.

8.2 Connectionless service functions

The functions of the connectionless service are listed below:

– mapping the network address to signalling relations;

– sequence service;

– segmenting.

8.3 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.

SCCP management also keeps track of the congestion status of MTP destinations and remote SCCPs.

For subsystems running in dominant mode or loadshared mode, a possibility is foreseen to negotiate taking one replicated subsystem out of service with the other subsystem remaining in service. This allows to check whether the other side is capable (i.e. has enough resources, real time) to receive the extra traffic load. The replicated subsystem initiating the procedure is taken out of service only after the other subsystem has answered positively to the request.

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 an 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.

8.4 Routing and translation functions

The SCCP routing provides a powerful address translation function, which is asked for connectionless and connection-oriented service. The SCCP routing provides a powerful addressing information translation function on behalf of its users. This function makes it unnecessary for SCCP users to store knowledge of SCCP signalling routing information. The routing function also responds to the MTP and SCCP congestion reports. Detailed description of the SCCP routing function can be found in 2.3/Q.714 and 2.4/Q.714.

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