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Figure C-8/Q.714 (sheet 1 of 4), p. 1

Figure C-8/Q.714 (sheet 2 of 4), p. 2

Figure C-8/Q.714 (sheet 3 of 4), p. 3

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Figure C-12/Q.714, p. 11

ANNEX D
(to Recommendation Q.714)

State transition diagrams (STD) for SCCP management control

D.1 *General*

This Annex contains the description of the SCCP management (SCMG) function according to the CCITT Specification and Description Language (SDL).

For the SCCP management function, Figure D-1/Q.714 illustrates a subdivision into functional blocks, showing their functional interactions as well as the functional interactions with the other major functions (e.g. SCCP connectionless control (SCLC)). This is followed by Figures D-2/Q.714 to D-10/Q.714 showing state transition diagrams for each of the functional blocks.

The detailed functional breakdown shown in the following diagrams is intended to illustrate a reference model, and to assist interpretation of the text of the SCCP management procedures. The state transition diagrams are intended to show precisely the behaviour of the signalling system under normal and abnormal conditions as viewed from a remote location. It must be emphasized that the functional partitioning shown in the following diagrams is used only to facilitate understanding of the system behaviour, and is not intended to specify the functional partitioning to be adopted in a practical implementation of the signalling system.

D.2 *Drafting conventions*

Each major function is designated by its acronym (e.g. SCMG = SCCP management).

Each functional block is also designated by an acronym which identifies it (e.g. SSAC = Sub-System Allowed Control).

External inputs and outputs are used for interactions between different functional blocks. Included within each input and output symbol in the state transition diagrams are acronyms which identify the functional blocks which are the source and the destination of the message, e.g.:

SSAC SSTC indicates that the message is sent from Sub-System Allowed Control to Sub-System Test Control.

Internal inputs and outputs are only used to indicate control of timers.

D.3 *Figures*

Figure D-1/Q.714 shows a subdivision of the SCCP management function (SCMG) into smaller functional blocks, and also shows the functional interactions between them. Each of these functional blocks is described in detail in a state transition diagram as follows:

a) Signalling Point Prohibited Control (SPPC) is shown in Figure D-2/Q.714;

b) Signalling Point Allowed Control (SPAC) is shown in Figure D-3/Q.714;

c) Signalling Point Congested Control (SPCC) is shown in Figure D-4/Q.714;

d) Sub-System Prohibited Control (SSPC) is shown in Figure D-5/Q.714;

e) Sub-System Allowed Control (SSAC) is shown in Figure D-6/Q.714;

f) Sub-System Status Test Control (SSTC) is shown in Figure D-7/Q.714;

g) Coordinated State Change Control (CSCC) is shown in Figure D-8/Q.714;

h) Local Broadcast (LBCS) is shown in Figure D-9/Q.714;

i) Broadcast (BCST) is shown in Figure D-10/Q.714.

D.4 *Abbreviations and timers*

Abbreviations and timers used in Figures D-1/Q.714 to D-10/Q.714 are listed below.

Abbreviations

BCST Broadcast

CSCC Cooordinated State Change Control

DPC Destination Point Code

LBCS Local Broadcast

MSG Message

MTP Message Transfer Part

SCCP Signalling Connection Control Part

SCLC SCCP Connectionless Control

SCMG SCCP Management

SCOC SCCP Connection-Oriented Control

SCRC SCCP Routing Control

SOG Sub-System Out of Service Grant

SOR Sub-System Out of Service Request

SP Signalling Point

SPAC Signalling Point Allowed Control

SPCC Signalling Point Congested Control

SPPC Signalling Point Prohibited Control

SS Sub-System

SSA Sub-System Allowed

SSAC Sub-System Allowed Control

SSP Sub-System Prohibited

SSPC Sub-System Prohibited Control

SST Sub-System Status Test

SSTC Sub-System Status Test Control

UIS User In Service

UOS User Out of Service

Timers

T(stat. info.) Delay between requests for sub-system status information

T(coord. chg.) Waiting for grant for sub-system to go out of service

T(ignore SST) Delay for sub-system between receiving grant to go out of service and actually going out of service

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Figure D-1/Q.714, p. 12

Figure D-2/Q.714, p. 13

Figure D-3/Q.714, p. 14

Figure D-4/Q.714, p. 15

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Figure D-5/Q.714 (sheet 2 of 2), p. 17

Figure D-6/Q.714 (sheet 1 of 2), p. 18

Figure D-6/Q.714 (sheet 2 of 2), p. 19

Figure D-7/Q.714, p. 20

Figure D-8/Q.714 (sheet 1 of 2), p. 21

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Figure D-10/Q.714, p. 25

Recommendation Q.716

SIGNALLIG CONNECTION CONTROL PART

(SCCP) PERFORMANCES

1 General

1.1 *Overview*

The Signalling Connection Control Part (SCCP) of Signalling System No. 7 is designed as a general message transport system common to the various sub-systems which are using its services.

SCCP must satisfy the requirements of these various sub-systems and therefore the most stringent sub-system requirements are considered when defining a value for a performance parameter (most stringent at the time of the specification). To this end, the requirements of ISDN-UP, the OMAP, the dialogue between an exchange and a Service Control Point (using the Transaction Capabilities), in particular, were investigated. It is assumed that a SCCP which satisfies the requirements of these users mentioned above will also meet those of future users.

SCCP performances are defined by parameters of two kinds:

— quality of service parameters as seen by a user of the SCCP;

— internal parameters which are not seen by the user but which contribute to a quality of service parameter: for example the transfer delay in a relay point which contributes to the total transit delay of messages as seen by the user.

The definitions of all these parameters are presented in Section 2 of this Recommendation. Then the values allowed for the internal parameters are defined in Section 3. Values for the quality of service parameters are given in Recommendation Q.709 which deals with HSRCs.

1.2 *Definitions*

Two concepts must be defined when dealig with SCCP performances: SCCP route and SCCP relation. These concepts are similar to the one defined for the MTP (i.e. signalling route and signalling relation). They are defined as follows:

— **SCCP route** : A SCCP route is composed of an ordered list of nodes where the SCCP is used (origin, relay(s), destination) for the transfer of SCCP messages from an originating SCCP user to the destination SCCP user.

— **SCCP relation** : A SCCP relation is a relation between two SCCP users which allows them to exchange data over it. A SCCP relation can consist of one or several SCCP routes.

Five types of nodes where SCCP functions are involved are defined as follows:

— **originating node** (origin of a UDT message or of a signalling connection).

— **destination node** (destination of a UDT message or of a signalling connection).

— **relay point** : signalling point where the translation functions of the SCCP for connectionless classes are implemented.

— **relay point without coupling** : signalling point where the relay functions of the SCCP connection oriented classes, but without the coupling of signalling connection sections function, are implemented.

— **relay point with coupling** : signalling point where the relay functions of the SCCP connection oriented classes, including the coupling of signalling connection sections function, are implemented.

2 Definition of performance parameters

Some parameters which are defined in this section cannot be measured from the outside of a signalling point and therefore no values are attributed to them in Section 3 where only measurable values are given. This is true for some internal parameters such as for example the transit time of a CR message for the relay function at a relay point without coupling: this parameter does not include in its definition the time due to the MTP and therefore in Section 3 values are given to the transit time at a relay point which icludes both the time spent in the SCCP and the MTP.

In networks containing implementations from a number of different vendors, it may be necessary where a parameter has a send and receive component to specify that parameter on such a basis. This will then ensure that the overall requirement is satisfied.

2.1 *Performance parameters for the connectionless classes*

2.1.1 *Quality of service parameters*

The following parameters define the quality of service as seen by a user of the connectionless classes of the SCCP:

— **undetected errors**

This parameter gives the probability that a UDT message is delivered with user data which is defective.

— **residual error probability**

This parameter gives the probability that a UDT message is lost, duplicated or delivered incorrectly by the set constituted of SCCP and the MTP (called Network Service Part or NSP). An incorrectly delivered UDT is one in which the user data are delivered in a corrupted condition (see undetected errors above), or the user data are delivered to an incorrect NSAP.

For class 1 only, a UDT message is considered as incorrectly delivered if it is delivered out of sequence by the NSP.

— **out of sequence probability**

This parameter gives the probability that UDT messages are delivered out of sequence to the user by the NSP.

Note — This parameter is relevant only for class 1.

— **total transit delay of a UDT message**

This parameter is the elapsed time between a N-UNITDATA request issued by a SCCP user at the originating node and the correponding N-UNIDATA indication issued to the SCCP user at the destination node.

This parameter is composed of several internal parameters:

— sending time of a UDT message by the SCCP

— MTP overall transfer time

— transit time of a UDT message for the relay function at a relay point

— receiving time of a UDT message by the SCCP

Depending on the configuration, the second parameter could appear one or several times and the third parameter could appear zero, one or several times. This is illustrated in Figure 1/Q.716.

A probabilistic approach has to be taken to give values to this parameter, considering the various possible SCCP routes and the existence of queues at several points.

— **unavailability of a SCCP relation**

This parameter characterizes the inability for two SCCP users to communicate via the NSP.

This parameter is determined by the unavailability of the individual components of a SCCP relation: SCCP at the two endpoints, one or several signalling relations and zero, one or several relay points.

This unavailability can be reduced by the duplication of routes at the SCCP level.

Figure 1/Q.716, p. 26

2.1.2 *Internal parameters*

The following parameters are internal to the network service but they contribute to the quality of service as components of a parameter of the previous section for connectionless classes of the SCCP.

— **sending time of a UDT message by the SCCP**

This parameter is the elapsed time between a N-UNIDATA request and the corresponding MTP-TRANSFER request at the originating node.

Note — The value of this parameter may differ substantially depending whether or not a translation function is used in the SCCP.

— **MTP overall transfer time**

This parameter is already defined in Recommendation Q.706 as parameter T0 in § 4.3.3.

— **transit time of a UDT message for the relay function at a relay point**

This parameter is the elapsed time between a MTP-TRANSFER indication primitive corresponding to an incoming UDT message at a relay point (i.e. a signalling point where are implemented the SCCP translation functions), and the associated MTP-TRANSFER request primitive corresponding to the outgoing UDT message (which may differ from the incoming one by the called party address).

A probabilistic approach has to be taken to give values to this parameter, considering the existence of queues and that it is possible for the translation functions to be congested.

— **receiving time of a UDT message by the SCCP**

This parameter is the elapsed time between a MTP-TRANSFER indication and the corresponding N-UNIDATA indication at the destination node.

—   **unavailability of a relay point**

This parameter characterizes the unavailability of the translation functions of the SCCP at a relay point.

2.2 *Performance parameters for the connection oriented classes*

2.2.1 *Quality of service parameters*

The following parameters define the quality of service as seen by a user of the connection oriented classes of the SCCP.

— **signalling connection establishment time**

This parameter is the elapsed time between a N-CONNECT request and the corresponding N-CONNECT confirmation primitive for a successful signalling connection establishment.

This delay is composed of two parameters: one which depends of the user at the destination node and one which depends of the NSP. The first one which is the elapsed time between a N-CONNECT indication and response at the destination will be specified for each user. The second one is an internal parameter of the SCCP and will be called SCCP component of the signalling connection establishment time. It will be specified in this SCCP performances Recommendation.

Moreover it is possible to specify here the maximum signalling connection establishment time. It is equal to the connection establishment timer (see Recommendation Q.714).

— **signalling connection establishment failure probability**

A signalling connection establishment failure is defined as a connection refusal or a time-out for the connection establishment timer coming from the SCCP.

The dimensioning of the SCCP regarding the number of local reference numbers will impact this signalling connection establishment failure probability. The unavailability of a SCCP relation is also an internal parameter impacting this probability.

The connection refusals coming from the called user must not be taken into account. This also applies for the time-out coming from this called user.

Note — It is possible for the connection refusals to distinguish between the one coming from the user and the one coming from the SCCP, but that is impossible for the time-out of the connection establishment timer.

— **throughput**

This parameter is specified independently for each direction of transmission and corresponds to a number of octets of user data (contained in NSDU) transferred per second on a signalling connection.

Note — Only successfully transferred user data are taken into account; that means: to the correct destination, error-free and without missequencing.

— **overall transit time of DT messages**

This parameter is the elapsed time between a N-DATA request and the corresponding N-DATA indication.

This parameter is composed of several internal parameters:

— sending time of a DT message by the SCCP,

— MTP overall transfer time,

— transit time of a DT message for the relay function at a relay point with coupling,

— receiving time of a DT message by the SCCP.

Depending of the configuration of the signalling connection, the second parameter could appear one or several times and the third parameter could appear zero, one or several times (see Figure 1/Q.716).

A probabilistic approach has to be taken to give values to this parameter, considering the various possible SCCP routes and the existence of queues at several points.

— **undetected errors**

This parameter gives the probability that a DT message is delivered with user data which is defective.

— **residual error rate for DT messages**

This parameter gives the probability that a DT message is lost, duplicated, missequenced or incorrectly delivered by the NSP.

A DT message is incorrectly delivered if user data is delivered in a corrupted condition (see undetected errors above), or the user data are delivered to an incorrect NSAP.

— **out of sequence probability for DT messages**

This parameter gives the probability that DT messages are delivered out of sequence to the user by the NSP.

— **signalling connection unsolicited reset and premature release probability**

This parameter gives the probability that a connection release or reinitialization due to the SCCP occurs on a signalling connection during a given time.

The unavailability of a SCCP relation is an internal parameter to be considered when calculating the probability of a connection release occurence due to the SCCP.

— **signalling connection reset delay**

This parameter is the elapsed time between a N-RESET request and the corresponding N-RESET confirmation primitive for a successful signalling connection reset.

2.2.2 *Internal parameters*

The following parameters are internal to the network service but they contribute to the quality of service as components of a parameter of the previous section for connection oriented classes of the SCCP.

— **SCCP component of the signalling connection establishment time**

This parameter is composed of two times:

— the elapsed time between a N-CONNECT request primitive at the origin node and the corresponding N-CONNECT indication primitive at the destination node.

— the elapsed time between a N-CONNECT response primitive at the destination node and the corresponding N-CONNECT confirmation primitive at the origin node.

It is composed of several internal parameters:

— Sending time of a CR message by the SCCP

— MTP overall transfer time

— Transit time of a CR message for the relay function at a relay point without coupling

— Transit time of a CR message for the relay function at a relay point with coupling

— Receiving time of a CR message by the SCCP

— Sending time of a CC message by the SCCP

— Transit time of a CC message for the relay function at a relay point with coupling

— Receiving time of a CC message by the SCCP

Depending on the configuration these parameters can appear zero, one or several times.

A probabilistic approach has to be taken to give values to this parameter, considering the various possible configurations and the existence of queues at several points.

— **sending time of a CR message by the SCCP**

This parameter is the elapsed time between the N-CONNECT request primitive and the corresponding MTP-TRANSFER request primitive (for the transfer of the CR message).

Note — The value of this parameter may differ substantially depending wether or not a translation function is used in the SCCP.

— **MTP overall transfer time**

This parameter is already defined in Recommendation Q.706 as parameter T0 in § 4.3.3.

— **transit time of a CR message for the relay function at a relay point without coupling**

This parameter is the elapsed time between a MTP-TRANSFER indication primitive corresponding to an incoming CR message at a relay point without coupling, and the associated MTP-TRANSFER request primitive corresponding to the outgoing CR message.

— **transit time of a CR message for the relay function at a relay point with coupling**

This parameter is the elapsed time between a MTP-TRANSFER indication primitive corresponding to an incoming CR message at a relay point with coupling, and the associated MTP-TRANSFER request primitive corresponding to the outgoing CR message (which may differ from the incoming one only by the called party address).

— **receiving time of a CR message by the SCCP**

This parameter is the elapsed time between a MTP-TRANSFER indication primitive (for an incoming CR message), and the corresponding N-CONNECT indication primitive.

— **sending time of a CC message by the SCCP**

This parameter is the elapsed time between a N-CONNECT respose primitive and the corresponding MTP-TRANSFER request primitive (for the transfer of the CC message).

— **transit time of a CC message for the relay function at a relay point with coupling**

This parameter is the elapsed time between a MTP-TRANSFER indication primitive corresponding to an incoming CC message at a relay point with coupling, and the associated MTP-TRANSFER request primitive corresponding to the outgoing CR message.

— **receiving time of a CC message by the SCCP**

This parameter is the elapsed time between a MTP-TRANSFER indication primitive (for an incoming CC message), and the corresponding N-CONNECT confirmation primitive.

— **unavailability of a SCCP relation**

This parameter characterizes the inability for two SCCP users to communicate via the NSP.

This parameter is determined by the unavailability of the individual components of a SCCP relation: SCCP at the two endpoints, one or several signalling relations and zero, one or several relay points with coupling and without coupling.

The unavailability can be reduced by the duplication of routes at the SCCP level.

— **unavailability of a relay point**

This parameter characterizes the unavailability of the SCCP at a relay point.

— **sending time of a DT message by the SCCP**

This parameter is the elapsed time between a N-DATA request primitive and the corresponding MTP-TRANSFER request primitive (for the transfer of a DT message).

— **transit time of a DT message for the relay function at a relay point with coupling**

This parameter is the elapsed time between a MTP-TRANSFER indication primitive corresponding to an incoming DT message at a relay point with coupling, and the associated MTP-TRANSFER request primitive corresponding to the outgoing DT message.

— **receiving time of a DT message by the SCCP**

This parameter is the elapsed time between a MTP-TRANSFER indication primitive (for an incoming DT message), and the corresponding N-DATA indication primitive.

2.3 *Correspondence between the QOS parameters and the class*

The correspondence between the quality of service parameters defined in §§ 2.1.1 and 2.2.1 above and their applicability to the various classes of the SCCP are illustrated in Table 1/Q.716 below.

3 Specified values for internal parameters

3.1 *Internal parameters for classes 0 and 1*

Transit time of a UDT message in a relay point

The transit time of a UDT message in a relay point is composed of the transit time of a UDT message for the relay function in a relay point and of the time elapsed in the MTP at this relay point for the UDT message: it is measurable externally. It is described in Figure 2/Q.716 and it should not exceed the values given in Table 2/Q.716.

Cuadro 1/Q.716 [T1.716], p. 27

Figura 2/Q.716, p. 28

Cuadro 2/Q.716 [T2.716], p. 29

The normal traffic load for the translation function is the load for which the point is dimensioned.

These figures assume a message length distribution as given in Table 2/Q.706 (short messages with a mean message length of 120 bits). For long messages (272 octets of SIF) it is necessary to add about 30 ms to each figure, to take into account the emitting time at 64 kbit/s much longer for long messages than for short messages.

Unavailability of a relay point

The unavailability of a relay point should not exceed 10DlF2614.

3.2 *Internal parameters for classes 2 and 3*

Transit time of a CR message at a relay point without coupling

The transit time of a CR message at a relay point without coupling is composed of the transit time of a CR message for the relay function in a relay point without coupling and of the time elapsed in the MTP at this relay point without coupling for the CR message: it is measurable externally. It should not exceed the values given in Table 3/Q.716.

H.T. [T3.716]
TABLE 3/Q.716

{	{	
	Mean	95%
Normal	50 | (hy | 55	100 | (hy | 10
+15%	100 | (hy | 33	200 | (hy | 65
+30%	250 | (hy | 88	500 | (hy | 75

Note — All values are provisional.

Table 3/Q.716 [T3.716], p. 30

The normal traffic load for the relay function is the load for which the point is dimensioned.

These figures assume a message length distribution as given in Table 2/Q.706 (short messages with a mean message length of 120 bits). For long messages (128 octets of SCCP user data) it is necessary to add about 15 ms to each figure, to take into account the emitting time at 64 kbit/s much longer for long messages than for short messages.

Transit time of a CR message in a relay point with coupling

The transit time of a CR message at a relay point with coupling is composed of the transit time of a CR message for the relay function in a relay point with coupling and of the time elapsed in the MTP at this relay point with coupling for the CR message: it is measurable externally. It should not exceed the values given in Table 4/Q.716.

H.T. [T4.716]

TABLE 4/Q.716

{	{	
	Mean	95%
Normal	75 | (hy | 80	150 | (hy | 60
+15%	150 | (hy | 70	300 | (hy | 40
+30%	375 | (hy | 50	750 | (hy | 00

Note — All values are provisional.

Table 4/Q.716 [T4.716], p. 31

The normal traffic load for the relay function is the load for which the point is dimensioned.

These figures assume a message length distribution as given in Table 2/Q.706 (short messages with a mean message length of 120 bits). For long messages (128 octets of SCCP user data) it is necessary to add about 15 ms to each figure, to take into account the emitting time at 64 kbit/s much longer for long messages than for short messages.

Transit time of a CC message in a relay point with coupling

The transit time of a CC message at a relay point with coupling is composed of the transit time of a CC message for the relay function in a relay point with coupling and of the time elapsed in the MTP at this relay point with coupling for the CC message: it is measurable externally. It should not exceed the values given in Table 5/Q.716.

H.T. [T5.716]

TABLE 5/Q.716

{	{	
	Mean	95%
Normal	30 | (hy | 10	60 | (hy | 20
+15%	60 | (hy | 65	120 | (hy | 30
+30%	150 | (hy | 75	300 | (hy | 50

Note — All values are provisional.

Table 5/Q.716 [T5.716], p. 32

The normal traffic load for the relay function is the load for which the point is dimensioned.

These figures assume a message length distribution as given in Table 2/Q.706 (short messages with a mean message length of 120 bits). For long messages (128 octets of SCCP user data) it is necessary to add about 15 ms to each figure, to take into account the emitting time at 64 kbit/s much longer for long messages than for short messages.

Transit time of a DT message in a relay point with coupling

The transit time of a DT message (DT1 or DT2) at a relay point with coupling is composed of the transit time of a DT message for the relay function in a relay point with coupling and of the time elapsed in the MTP at this relay point with coupling for the DT message: it is measurable externally. It should not exceed the values given in Table 6/Q.716.

H.T. [T6.716]

TABLE 6/Q.716

{	{	
	Mean	95%
Normal	30 | (hy | 10	60 | (hy | 20
+15%	60 | (hy | 65	120 | (hy | 30
+30%	150 | (hy | 75	300 | (hy | 50

Note — All values are provisional.

Table 6/Q.716 [T6.716], p. 33

The normal traffic load for the relay function is the load for which the point is dimensioned.

These figures assume a message length distribution as given in Table 2/Q.706 (short messages with a mean message length of 120 bits). For long messages (255 octets of SCCP user data) it is necessary to add about 30 ms to each figure, to take into account the emitting time at 64 kbit/s much longer for long messages than for short messages.

Unavailability of a relay point without coupling

The unavailability of a relay point without coupling should not exceed 10^{D}lF261^{4}.

Unavailability of a relay point with coupling

The unavailability of a relay point with coupling is for further study.

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