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SERIES Q: SWITCHING AND SIGNALLING
Specifications of Signalling System No. 7 – General

INTRODUCTION TO CCITT SIGNALLING SYSTEM No. 7

Reedition of CCITT Recommendation Q.700 published in the Blue Book, Fascicle VI.7 (1988)

NOTES

1 CCITT Recommendation Q.700 was published in Fascicle VI.7 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

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

Recommendation Q.700

INTRODUCTION TO CCITT SIGNALLING SYSTEM No. 7

1 General

This Recommendation provides an overview of the Signalling System by describing the various functional elements of CCITT No. 7 and the relationship between these functional elements. This Recommendation provides a general description of functions and capabilities of the Message Transfer Part (MTP), Signalling Connection Control Part (SCCP), Telephone User Part, ISDN User Part (ISDN-UP), Transaction Capabilities (TC), and the Operations, Maintenance and Administration Part (OMAP) which are covered elsewhere in the Q.700 to Q.795 series of Recommendations. However, in the case of contradiction between the specifications and Q.700, the Q.700 to Q.795 specification shall apply.

Supplementary Services in CCITT S.S. No.7 ISDN applications are described in the Q.73x series of Recommendations.

In addition to these functions in the CCITT No. 7 signalling system, the Q.700 to Q.795 series of Recommendations describes the CCITT No. 7 network structure, and also specifies the Tests and Measurements applicable to CCITT No. 7.

This Recommendation is also a specification of those aspects such as CCITT S.S. No. 7 Architecture, Flow Control and general compatibility rule which are not specified in separate Recommendations, and are applicable to the overall scope of S.S. No. 7.

The remainder of this Recommendation describes:

– § 2: Signalling network concepts components and modes;
– § 3: The functional blocks within CCITT Signalling System No. 7 and the services provided by them;
– § 4: CCITT Signalling System No. 7 protocol layering and its relationship to OSI modelling;
– § 5: Node, application entity and user part addressing;
– § 6: Operations, administration and maintenance aspects of CCITT S.S. No. 7;
– § 7: Performance aspects of the functional blocks within CCITT S.S. No. 7;
– § 8: Flow control for both the signalling network and within nodes;
– § 9: Rules for evolving CCITT S.S. No. 7 protocols while preserving compatibility with earlier versions;
– § 10: A cross-reference to a glossary of terms.

1.1 *Objectives and fields of application*

The overall objective of Signalling System No. 7 is to provide an internationally standardised general purpose common channel signalling (CCS) system:

– optimised for operation in digital telecommunications networks in conjunction with stored program controlled exchanges;
– that can meet present and future requirements of information transfer for inter-processor transactions within telecommunications networks for call control, remote control, and management and maintenance signalling;
– that provides a reliable means for transfer of information in correct sequence and without loss or duplication.

The signalling system meets requirements of call control signalling for telecommunication services such as the telephone, ISDN and circuit switched data transmission services. It can also be used as a reliable transport system for other types of information transfer between exchanges and specialised centres in telecommunications networks (e.g. for management and maintenance purposes). The system is thus applicable for multipurpose uses in networks that are dedicated for particular services and in multiservices networks. The signalling system is intended to be be applicable in international and national networks.

The scope of CCITT S.S. No. 7 encompasses both circuit related and non-circuit related signalling.

Examples of applications supported by CCITT S.S. No. 7 are:

– PSTN,

– ISDN,
– Interaction with Network Databases, Service Control Points for service control,
– Mobiles (Public Land Mobile Network),
– Operations Administration and Maintenance of Networks.

The signalling system is optimized for operation over 64-kbit/s digital channels. It is also suitable for operation over analogue channels and at lower speeds. The system is suitable for use on point-to-point terrestrial and satellite links. It does not include the special features required for use in point-to-multipoint operation but can, if required, be extended to cover such an application.

1.2 *General characteristics*

Common channel signalling is a signalling method in which a single channel conveys, by means of labelled messages, signalling information relating to, for example, a multiplicity of circuits, or other information such as that used for network management. Common channel signalling can be regarded as a form of data communication that is specialised for various types of signalling and information transfer between processors in telecommunications networks.

The signalling system uses signalling links for transfer of signalling messages between exchanges or other nodes in the telecommunication network served by the system. Arrangements are provided to ensure reliable transfer of signalling information in the presence of transmission disturbances or network failures. These include error detection and correction on each signalling link. The system is normally applied with redundancy of signalling links and it includes functions for automatic diversion of signalling traffic to alternative paths in case of link failures. The capacity and reliability for signalling may thus be dimensioned by provision of a multiplicity of signalling links according to the requirements of each application.

1.3 *Components of CCITT S.S. No. 7*

CCITT S.S. No. 7 consists of a number of components or functions which are defined as a series of Q.700 to Q.795 Recommendations.

CCITT S.S. No. 7 function	*Recommendations*
Message Transfer Part (MTP)	Q.701-Q.704, Q.706, Q.707
Telephone User Part (TUP) (including supplementary services)	Q.721-Q.725
Supplementary services	Q.730
Data User Part (DUP)	Q.741 (note 1)
ISDN User Part (ISDN-UP)	Q.761-Q.764, Q.766
Signalling Connection Control Part (SCCP)	Q.711-Q.714, Q.716
Transaction Capabilities (TC)	Q.771-Q.775
Operations Maintenance and Administration Part (OMAP)	Q.795

Note 1 – Functions of the DUP are fully specified in Recommendation X.61.

Other Q.700 to Q.795 series Recommendations which describe other aspects of the signalling system but not part of the CCITT S.S. No. 7 signalling interfaces are:

Title	*Recommendations*
Signalling Network Structure	Q.705
Numbering of International Signalling Point Codes	Q.708
Hypothetical signalling reference connection	Q.709
PABX application	Q.710
CCITT S.S. No. 7 Test Specification (General)	Q.780
MTP Level 2 Test Specification	Q.781
MTP Level 3 Test Specification	Q.782
TUP Test Specification	Q.783
Monitoring and measurements for the CCITT S.S. No.7 network	Q.791

§ 3 of Q.700 describes the relationship between these components.

1.4 *Description techniques in the Q.700 to Q.795 series of Recommendations*

The CCITT S.S. No. 7 Recommendation series define the signalling system using prose description which is complemented by SDL diagrams and state transition diagrams. Should any conflict arise between the text and the SDL definition, the textual description is taken as definitive.

Message sequence charts or arrow diagrams are used to illustrate examples of signalling procedures, but are not considered definitive.

2 CCITT S.S. No. 7 signalling network

2.1 *Basic concepts*

A telecommunications network served by common channel signalling is composed of a number of switching and processing nodes inter-connected by transmission links. To communicate using CCITT No. 7, each of these nodes requires to implement the necessary “within node” features of CCITT S.S. No. 7 making that node a signalling point within the CCITT S.S. No. 7 network. In addition, there will be a need to interconnect these signalling points such that CCITT S.S. No. 7 signalling information (data) may be conveyed between them. These data links are the signalling links of CCITT S.S. No. 7 signalling network.

The combination of signalling points and their interconnecting signalling links form the CCITT S.S. No. 7 signalling network.

2.2 *Signalling network components*

2.2.1 *Signalling points*

In specific cases there may be a need to partition the common channel signalling functions at such a (physical) node into logically separate entities from a signalling network point of view; i.e., a given (physical) node may be defined as more than one signalling point. One example is an exchange at the boundary between international and national signalling networks.

Any two signalling points, for which the possibility of communication between their corresponding User Part function exists, are said to have a signalling relation.

The corresponding concept for a given User Part is called a user signalling relation.

An example is when two telephone exchanges are directly connected by a bundle of speech circuits. The exchange of telephone signalling relating to these circuits then constitutes a user signalling relation between the Telephone User Part functions in those exchanges in their role as signalling points.

Another example is when administration of customer and routing data in a telephone exchange is remotely controlled from an operation and maintenance centre by means of communication through a common channel signalling system.

Examples of nodes in a signalling network that constitutes signalling points are:

– exchanges (switching centres),

– operation, administration and maintenance centres,

– service control points,

– signalling transfer points.

All signalling points in a CCITT S.S. No. 7 network are identified by a unique code known as a point code (Recommendation Q.704 refers).

2.2.2 *Signalling links*

The common channel signalling system uses signalling links to convey the signalling messages between two signalling points. A number of signalling links that directly interconnect two signalling points which are used as a module constitute a signalling link-set. Although a link set typically includes all parallel signalling links, it is possible to use more than one link set in parallel between two signalling points. A group of links within a link set that have identical characteristics (e.g., the same data link bearer rate) is called a link group.

Two signalling points that are directly interconnected by a signalling link are, from a signalling network structure point of view, referred to as adjacent signalling points. Correspondingly, two signalling points that are not directly interconnected are non-adjacent signalling points.

2.2.3 *Signalling modes*

The term “signalling mode” refers to the association between the path taken by a signalling message and the signalling relation to which the message refers.

In the associated mode of signalling, the messages relating to a particular signalling relation between two adjacent points are conveyed over a link set, directly interconnecting those signalling points.

In the non-associated mode of signalling, the messages relating to a particular signalling relation are conveyed over two or more linksets in tandem passing through one or more signalling points other than those which are the origin and the destination of the messages.

The quasi-associated mode of signalling is a limited case of the non-associated mode where the path taken by the message through the signalling network is pre-determined and, at a given point in time, fixed.

Signalling System No. 7 is specified for use in the associated and quasi-associated modes. The Message Transfer Part does not include features to avoid out-of-sequence arrival of messages or other problems that would typically arise in a fully non-associated mode of signalling with dynamic message routing.

Examples of signalling modes are illustrated in Figure 1/Q.700.

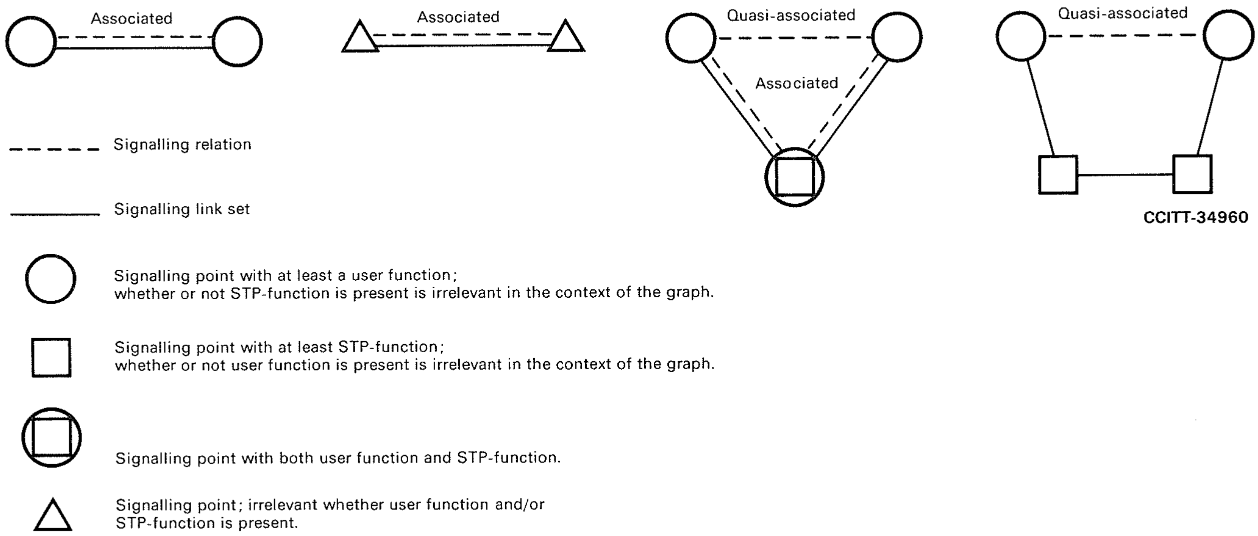


FIGURE 1/Q.700
Examples of associated and quasi-associated signalling modes and definition of signalling network graph symbols

2.3 *Signalling point modes*

A signalling point at which a message is generated, i.e., the location of the source User Part function, is the originating point of that message.

A signalling point to which a message is destined, i.e., the location of the receiving User Part function, is the destination point of that message.

A signalling point at which a message is received on a signalling link is transferred to another link, i.e., neither the location of the source nor the receiving User part function, is a Signal Transfer Point (STP).

For a particular signalling relation, the two signalling points thus function as originating and destination points for the messages exchanged in the two directions between them.

In the quasi-associated mode, the function of a signalling transfer point is typically located in a few signalling points which may be dedicated to this function, or may combine this function with some other (e.g., switching) function. A signalling point serving as a signalling transfer point functions as an originating and destination point for the messages generated and received by the level 3 function of the Message Transfer Point also in cases when no user functions are present.

2.4 *Signalling routes*

The pre-determined path, consisting of a succession of signalling points/signalling transfer points and the interconnecting signalling links, that a message takes through the signalling network between the origination point and the destination point is the signalling route for that signalling relation.

All the signalling routes that may be used between an originating point and a destination point by a message traversing the signalling network is the signalling route set for that signalling relation.

2.5 *Signalling network structure*

The signalling system may be used with different types of signalling network structures. The choice between different types of signalling network structures may be influenced by factors such as the structure of the telecommunication network to be served by the signalling system and administrative aspects.

In the case when the provision of the signalling system is planned purely on a per signalling relation basis, the likely result is a signalling network largely based on associated signalling, typically supplemented by a limited degree of quasi-associated signalling for low volume signalling relations. The structure of such a signalling network is mainly determined by the patterns of the signalling relations.

Another approach is to consider the signalling network as a common resource that should be planned according to the total needs for common channel signalling. The high capacity of digital signalling links in combination with the needs for redundancy for reliability then typically leads to a signalling network based on a high degree of quasi-associated signalling with some provision for associated signalling for high volume signalling relations. The latter approach to signalling network planning is more likely to allow exploitation of the potential of common channel signalling to support network features that require communication for purposes other than the switching of connections.

The worldwide signalling network is structured into two functionally independent levels, namely the international and national levels. This structure makes possible a clear division of responsibility for signalling network management and allows numbering plans of signalling points of the international network and the different national networks to be independent of one another.

Further considerations about the structure of the signalling network are given in Recommendation Q.705, and the impact on the message transfer part in Recommendation Q.701.

3 CCITT S.S. No. 7 functional blocks

3.1 *Basic functional division*

The Blue Book CCITT Signalling System No. 7 comprises the following functional blocks:

– Message Transfer Part	(MTP)
– Telephone User Part	(TUP)
– ISDN User Part	(ISDN-UP)
– Signalling Connection Control Part	(SCCP)
– Transaction Capabilities	(TC)
– Application-Entity	(AE) *Note 1*
– Application-Service-Elements	(ASEs) *Note 1*

Note 1 – The glossary shows these as hyphenated terms but the usual convention used in this Recommendation will be unhyphenated.

The fundamental principle of the signalling system structure is the division of functions into a common Message Transfer Part (MTP) on one hand, and separate User Parts for different users on the other. This is illustrated in Figure 2/Q.700.

The overall function of the Message Transfer Part is to serve as a transport system providing reliable transfer of signalling messages between the locations of communicating user functions.

User functions in CCITT S.S. No. 7 MTP terms are:

– the ISDN User Part	(ISDN-UP)
– the Telephone User Part	(TUP)
– the Signalling Connection Control Part	(SCCP)

– the Data User Part (DUP)

The term “User” in this context refers to any functional entity that utilises the transport capability provided by the Message Transfer Part.

A User Part comprises those functions of, or related to, a particular type of user that are part of the common channel signalling system, typically because those functions need to be specified in a signalling context.

The SCCP also has Users. These are:

– the ISDN User Part (ISDN-UP)

– Transaction Capabilities (TC)

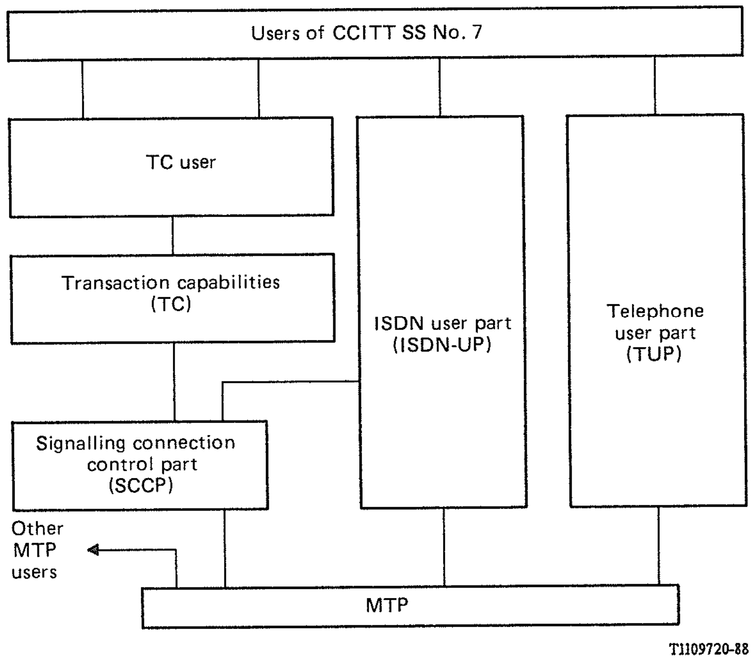


FIGURE 2/Q.700
Architecture of CCITT SS No. 7

3.2 *CCITT S.S. No. 7 architecture*

3.2.1 *General*

Figure 2/Q.700 shows the Architecture of CCITT S.S. No. 7 and illustrates the functional relationship between the various functional blocks of the Blue Book CCITT S.S. No. 7. Figure 5/Q.700 shows the relationship between CCITT No. 7 levels and the OSI Reference Model Layers. This level/layer relationship is described in the following sections.

The initial specification of CCITT No. 7 was based on circuit-related telephony control requirements. To meet these requirements, CCITT No. 7 was specified in four functional levels, the Message Transfer Part comprising levels 1-3, and the User Parts as level 4.

Figure 3/Q.700 shows the Functional Levels of CCITT S.S. No. 7. As new requirements have emerged, e.g., for non-circuit related information transfer, CCITT S.S. No. 7 has also evolved to meet these new requirements. There has been a need to align certain elements in CCITT No. 7 to the OSI 7 Layer Reference Model.

The result of this evolution is that Functional Levels and OSI layers co-exist in CCITT No. 7. For example, the SCCP is a level 4 User Part in MTP terms, but also provides an OSI Network layer 3 service. Subsequent sections describe the various functional elements of CCITT S.S. No. 7 in terms of levels and layers.

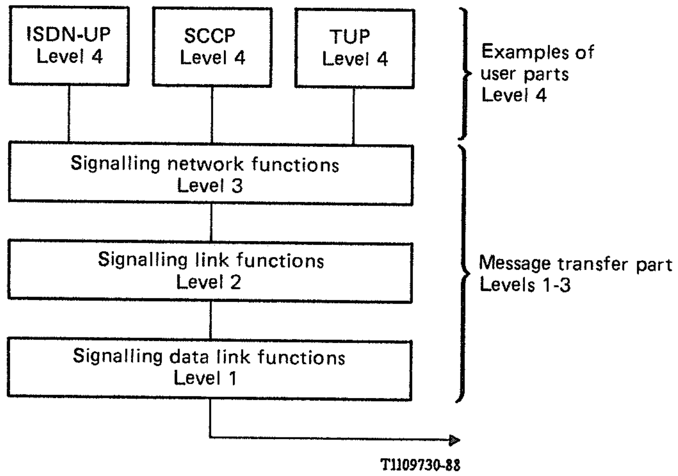


FIGURE 3/Q.700
CCITT No.7 funcional levels

It should be noted that the approach proposed for ISDN architecture is to define two orthogonal planes, User and Control, each of which has its own 7-layer protocol reference model.

From the perspective of an end user, the service provided by a telecommunications network may be regarded as a Network Layer Service (User Plane).

Within the telecommunications network, the techniques of the ISDN Protocol Reference Model are applied, and the 7-layer protocol structure of the OSI Model can also be used for inter-nodal communication to the end user.

3.2.2 *Message Transfer Part (MTP) levels 1-3*

An overview of the MTP is given in Recommendation Q.701. The MTP is defined in Recommendations Q.701-Q.704, Q.706 and Q.707.

3.2.2.1 *Signalling data link functions (level 1)*

Level 1 defines the physical, electrical and functional characteristics of a signalling data link and the means to access it. The level 1 element provides a bearer for a signalling link.

In a digital environment, 64-kbit/s digital paths will normally be used for the signalling data link. The signalling data link may be accessed via a switching function, providing a potential for automatic reconfiguration of signalling links. Other types of data links, such as analogue links with modems, can also be used.

The detailed requirements for signalling data links are specified in Recommendation Q.702.

3.2.2.2 *Signalling link functions (level 2)*

Level 2 defines the functions and procedures for and relating to the transfer of signalling messages over one individual signalling data link. The level 2 functions together with a level 1 signalling data link as a bearer, and provides a signalling link for reliable transfer of signalling messages between two points.

A signalling message delivered by the higher levels is transferred over the signalling link in variable length signal units. For proper operation of the signalling link, the signal unit comprises transfer control information in addition to the information content of the signalling message.

The detailed requirements for signalling functions are given in Recommendation Q.703.

3.2.2.3 *Signalling network functions (level 3)*

Level 3 in principle defines those transport functions and procedures that are common to and independent of the operation of individual signalling links. These functions fall into two major categories:

a) Signalling message handling functions - These are functions that, at the actual transfer of the message, direct the message to the proper signalling link or User Part.
b) Signalling network management functions - These are functions that, on the basis of predetermined data and information about the status of the signalling network, control the current message routing and configuration of the signalling network facilities. In the event of changes in the status, they also control the reconfigurations and other actions to preserve or restore the normal message transfer capability.

The detailed requirements for signalling network functions are given in Recommendation Q.704.

3.2.3 *Level 4: MTP User functions*

Level 4 consists of the different User Parts. Each User Part defines the functions and procedures of the signalling system that are particular to a certain type of user of the system. the following entities are defined as User Parts in CCITT S.S. No. 7.

3.2.3.1 *Signalling Connection Control Part (SCCP)*

The SCCP is defined in Recommendations Q.711-Q.716. This Recommendation series defines the SCCP capabilities, layer interfaces to MTP and SCCP users signalling messages, their encoding and signalling procedures, and cross-office performance. The SCCP provides additional functions to the Message Transfer Part to provide such connectionless and connection-oriented network services to transfer circuit-related, and non-circuit-related signalling information.

The SCCP provides the means to:

– control logical signalling connections in a CCITT No. 7 network;

– Transfer Signalling Data Units across the CCITT No. 7 network with or without the use of logical signalling connections.

SCCP provides a routing function which allows signalling messages to be routed to a signalling point based on, for example, dialled digits. This capability involves a translation function which translates the global title (e.g., dialled digits) into a signalling point code and a subsystem number.

SCCP also provides a management function, which controls the availability of the “subsystems”, and broadcasts this information to other nodes in the network which have a need to know the status of the “subsystem”.

The combination of the MTP and the SCCP is called “Network Service Part” (NSP). The Network Service Part meets the requirements for layer 3 services as defined in the OSI-Reference Model, CCITT Recommendation X.200.

3.2.3.2 *Telephone User Part (TUP)*

The CCITT S.S. No. 7 Telephone User Part is defined in Recommendations Q.721-725. The TUP Recommendations define the necessary telephone signalling functions for use of S.S. No. 7 for international telephone call control signalling. This Recommendation series defines the telephone signalling messages, their encoding and signalling procedures, and cross-office performance.

Supplementary Services handled by the CCITT S.S. No. 7 TUP applications are described in Recommendation Q.724, § 10. These supplementary services embody TUP signalling messages and procedures.

3.2.3.3 *Data User Part (DUP)*

The Data User Part is defined in Recommendation Q.741, and the functionality fully defined in Recommendation X.61. It defines the protocol to control interexchange circuits used on data calls, and data call facility registration and cancellation.

3.2.3.4 *ISDN User Part (ISDN-UP)*

The ISDN User Part is defined in Recommendations Q.761-Q.764 and Q.766. This Recommendation series defines the ISDN network signalling messages, their encoding and signalling procedures, and cross-office performance. This Recommendation series deals with the basic services only.

The ISDN-UP encompasses signalling functions required to provide switched services and user facilities for voice and non-voice applications in the ISDN.

The ISDN-UP is also suited for application in dedicated telephone and circuit-switched data networks and in analogue, and mixed analogue/digital networks.

The ISDN-UP has an interface to the SCCP (which is also a level 4 User Part) to allow the ISDN-UP to use the SCCP for end-to-end signalling.

Supplementary Services handled by the CCITT S.S. No. 7 ISDN application are described in Recommendation Q.730. These supplementary services embody ISDN-UP signalling messages and procedures. In some cases these services also include application protocol which uses TC and SCCP, as, for example, centralised Closed User Group (CUG).

3.2.3.5 *Transaction Capabilities*

Transaction Capabilities is defined in Recommendations Q.771-Q.775. This Recommendation series defines the Transaction Capabilities signalling messages, their encoding and signalling procedures.

Transaction Capabilities consists of two elements. These are:

– Transaction Capabilities Application Part (TCAP);

– Intermediate Service Part (ISP) [The ISP is for further study (see Note 1, Figure 5/Q.700)].

The TCAP entity is a functional block residing above the ISP in layer 7. TCAP consists of two sub-layers: the Transaction sub-layer, and the Component sub-layer. Further details are given in Recommendation Q.771.

TC, as currently specified, provides services based on a connectionless network service. In this case, no ISP layers 4-6 functions are involved. Connection-oriented TC services, and the layer functions of layers 4-6 are for further study.

TC provides the means to establish non-circuit-related communication between two nodes in the signalling network.

TC provides the means to exchange operations and replies via a dialogue. The X.229 Remote Operations protocol has been extended to provide added functionality in order to accommodate specific user needs. The operations and parameters are part of the Application protocol between TC users.

3.2.3.6 *Application Entities and Application Service Elements*

In an OSI environment, communication between application processes is modelled by communication between "Application Entities (AEs)". An Application Entity represents the communication functions of an Application process. There may be multiple sets of OSI communication functions in an application process, so a single application process may be represented by multiple AEs. However, each Application Entity is a set of communication capabilities whose components are "Application Service Elements". An Application Service Element (ASE) is a coherent set of integrated functions.

3.2.3.6.1 *Application Entities in a CCITT S.S. No. 7 environment*

Figure 4/Q.700 shows the relationship between Application Processes and Application Entities, and Application Service Elements.

An "Application Process" is considered to be a range of functions and features which support a particular network requirement. For example, an application process in the context of CCITT S.S. No. 7 provides the co-ordination across circuit-related protocols where required.

An Application Process can be considered as:

a) a co-ordinator of specific aspects of network operation (e.g., ISDN Call Control, Mobiles, OA&M);

b) an individual service or supplementary service control function (e.g., CUG).

In the CCITT S.S. No. 7 context, the various functional elements of the signalling system provide the signalling protocols (information elements, messages, and procedures) necessary to support the service between nodes.

In a CCITT No. 7 environment, Application Entities (AEs) are the elements representing the communication functions of the application process, which are pertinent to inter-nodal communication using layer 7 application protocols.

The options for the relationship between an application process, AEs and ASEs can take several forms at a CCITT No. 7 signalling point. Some examples are shown in Figure 4/Q.700.

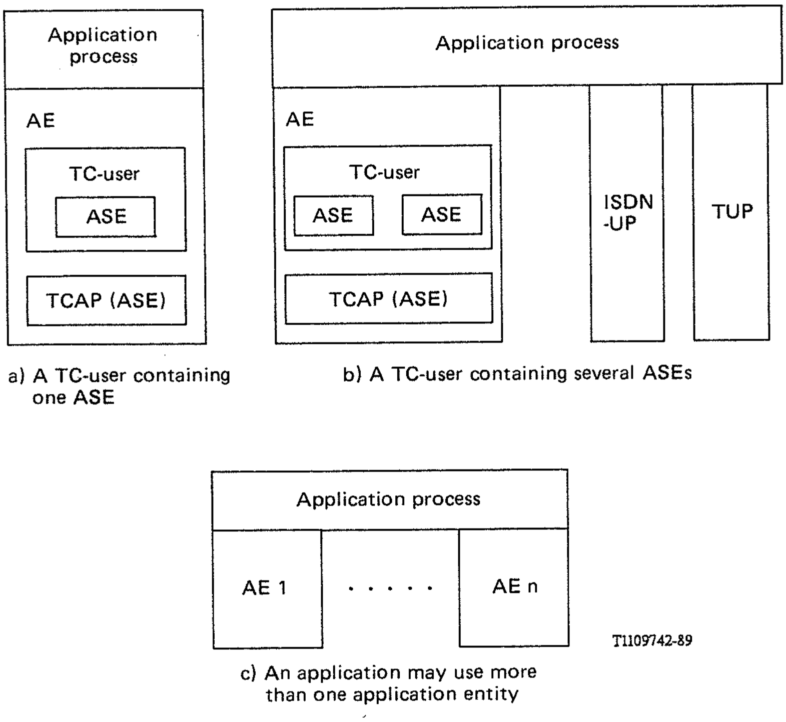


FIGURE 4/Q.700

Example of the relationship between the application process, AEs and ASEs

3.2.3.6.2 *Application Service Elements in a CCITT No. 7 environment*

Application Service Elements (ASEs) reside in the CCITT S.S. No. 7 Architecture Model within layer 7 above TCAP. In the context of OSI, TCAP could also be considered to be an ASE.

OMAP has an Application Entity currently containing the TCAP ASE and one other ASE. Other ASEs are under study. OMAP is described further in § 6.

The Mobile Application Part (MAP) is another example of an Application Entity (AE) (see Recommendation Q.1051).

An ASE can include a number of signalling procedures for a single service (e.g., Freephone), where this single service is the application.

Alternatively, an ASE can include a number of signalling procedures for any number of services or functions, encompassed by an application (e.g., MAP, OMAP).

Thus, an ASE can define an individual service protocol (e.g., CUG), or a complete application protocol (e.g., MAP).

An ASE can only communicate with a compatible peer ASE. The operations defined in an ASE may be either symmetrically invoked by each entity involved in the dialogue, or asymmetrically invoked by one entity only (i.e., on a “client/server” basis). An example of the former is a “look ahead if free” procedure; an example of the latter is a database enquiry.

3.2.3.6.3 *Addressing for Application Entities (AEs)*

The SCCP provides a mechanism for addressing “subsystems” using Subsystem Numbers (SSNs). The Application Entity is considered, in the connectionless mode, equivalent to an SCCP subsystem.

3.2.3.6.4 *Management of AEs*

The SCCP provides a mechanism for managing “subsystems” and signalling points and informing other nodes of relevant availability status.

4 OSI layering and CCITT S.S. No. 7

4.1 *General*

Evolution of the CCITT Signalling System No. 7 architecture has been based on the Open Systems Interconnection (OSI) Reference Model.

The purpose of the Reference Model of Open Systems Interconnection for CCITT Applications (Recommendation X.200) is to provide a well-defined structure for modelling the interconnection and exchange of information between users in a communications system. This approach allows standardised procedures to be defined not only to provide an open systems interconnection between users over a single network, but also to permit interworking between networks to allow communication between users over several networks in tandem.

At present, OSI only considers connection-oriented protocols, that is, protocols which establish a logical connection before transferring data. In CCITT S.S. No. 7, the ISDN-UP uses the SCCP connection-oriented protocol. The CCITT S.S. No. 7 Network Service Part (NSP) provides both connectionless and connection-oriented protocol.

The approach taken in the OSI reference model is to partition the model used to describe this interconnection and exchange information between users in a communications system into seven layers.

From the point of view of a particular layer, the lower layers provide a “transfer service” with specific features. The way in which the lower layers are realised is immaterial to the next higher layers. Correspondingly, the lower layers are not concerned with the meaning of the information coming from higher layers or the reasons for its transfer.

The characteristics of each layer are described below.

4.1.1 *Physical Layer*

The Physical Layer (layer 1) provides transparent transmission of a bit stream over a circuit built in some physical communications medium. It furnishes the interface to the physical media and is responsible for relaying bits (i.e., interconnects data-circuits). A 64 kbit/s link is assumed for the CCITT S.S. No. 7 Physical Layer.

4.1.2 *Data Link Layer*

The Data Link Layer (layer 2) overcomes the limitations inherent in the physical circuits and allows errors in transmission to be detected and recovered, thereby masking deficiencies in transmission quality.

4.1.3 *Network Layer*

The Network Layer (layer 3) transfers data transparently by performing routing and relaying of data between end users. One or more of the sub-networks may interwork at the Network Layer to provide an end user to end user network service. A connectionless network provides for the transfer of data between end users, making no attempt to guarantee a relationship between two or more data messages from the same user.

4.1.4 *Transport Layer*

The Transport Layer (layer 4) provides end user to end user transfer optimising the use of resources (i.e., network service) according to the type and character of the communication, and relieves the user of any concern for the details of transfer. The Transport Layer always operates end-to-end, enhancing the Network Layer when necessary to meet the quality of service objectives of the users.

4.1.5 *Session Layer*

The Session Layer (layer 5) co-ordinates the interaction within each association between communicating application processes. Full and half duplex dialogues are examples of possible Session Layer modes.

4.1.6 *Presentation Layer*

The Presentation Layer (layer 6) transforms the syntax of the data which is to be transferred into a form recognizable by the communicating application processes. For example, the Presentation Layer may convert a data stream from ASCII to EBCDIC.

4.1.7 *Application Layer*

The Application Layer (layer 7) specifies the nature of the communication required to satisfy the users' needs. This is the highest layer in the Model and so does not have a boundary with a higher layer. The Application Layer provides the sole means for the application processes to access the OSI environment.

4.2 *Relationship between CCITT S.S. No. 7 layering and the OSI model*

Layers 1-3 comprise functions for the transportation of information from one location to another, possibly via a number of communication links in tandem. These functions provide the basis on which a communication network can be built.

– The SCCP provides, with the MTP, OSI layer services 1-3.

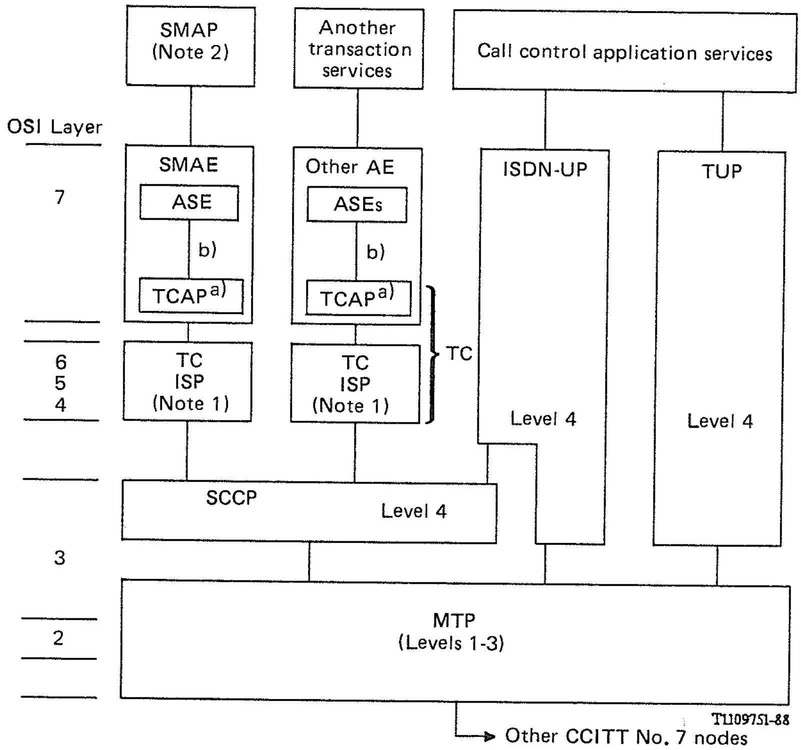
Layers 4-7 define functions relating to end-to-end communication. These layers are so defined that they are independent of the internal structure of the communication network.

– Transaction Capabilities provides layer 4-7 services.

Layer 7 represents the semantics of a communication, whereas layers 1-6 comprise the means by which the communication may be realised.

– Application Entities/Application Service Elements provide the appropriate Application Layer Protocols in layer 7.

Figure 5/Q.700 shows the relationship between SCCP, TC, and ASEs to the OSI 7 Layer Reference Model.



[a] TCAP is an ASE.
[b] CCITT SS No. 7 primitive interface.

Note 1 – The TC ISP is for further study. As no signalling procedures are presently specified for this function, the TCAP messages are presented directly to the SCCP. Specific requirements for this ISP function will be defined when needed for future ASEs.

Note 2 – The set of functions that collectively encompass systems management are known as the Systems Management Application process (SMAP).

FIGURE 5/Q.700
Relationship between CCITT No. 7 functional levels and OSI layering

The aspect of the SMAP which is then involved with communication is the Systems Management Application Entity (SMAE). The SMAE is also known as the OMAP AE.

4.3 *Primitive Interfaces between CCITT No. 7 Functions*

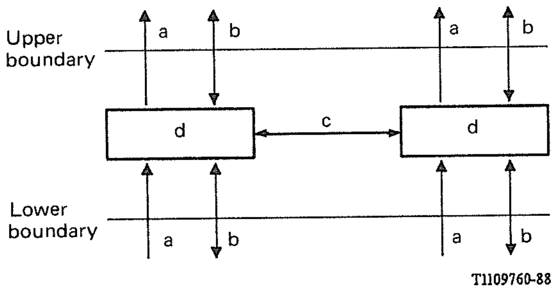
4.3.1 *General*

Interfaces between the functional elements of CCITT S.S. No. 7 are specified using interface primitives. Primitive interface definition does not assume any specific implementation of a service.

4.3.2 *OSI service primitives*

Where the functional element of CCITT No. 7 is modelled on the OSI 7 layer reference model, e.g., SCCP, TC, service primitives are defined in line with Recommendation X.210.

In line with Recommendation X.210, Figure 6/Q.700 illustrates the relationship between the terms "service", "boundary", "service primitives", "peer protocol" and "peer entities". The term "boundary" applies to boundaries between layers, as well as to boundaries between sub-layers.



a = service
b = service primitive
c = peer protocol
d = peer entities

FIGURE 6/Q.700
Types of service primitives

4.3.2.1 *Service primitives*

The user of primitives does not preclude any specific implementation of a service in terms of interface primitives.

A service primitive consists of a name and one or more parameters which are passed in the direction of service primitive.

The name of a service primitive contains three elements, as defined in Recommendation X.210:

a) a type indicating the direction of the primitive flow. Four types of service primitives are identified (Figure 7/Q.700):
   - request — a primitive issued by a service user to invoke a service element,
   - indication — a primitive issued by a service provider to advise that a service element has been invoked by the service user at the peer service access point or by the service provider,
   - response — a primitive issued by the service user to complete at a particular service access point some service element whose invocation has been previously indicated at that service access point,
   - confirmation — a primitive issued by a service provider to complete at a particular service access point some service element previously invoked by a request at that service access point.

   Not all four types can be associated with all service names.

b) a name which specifies the action to be performed;

c) An initial (or initials) which specifies the (sub-)layer providing the service:
   - OM for the Operations Management primitives associated with OMAP;
   - TC for the TCAP Component sub-layer,
   - TR for the TCAP Transaction sub-layer,
   - P, S, T, respectively for the Presentation, Session, and Transport layers in the ISP,
   - N for the Network Service Part (MTP + SCCP), as defined in Recommendation Q.711.

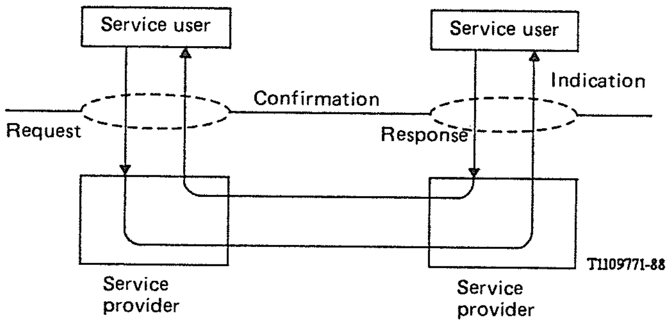


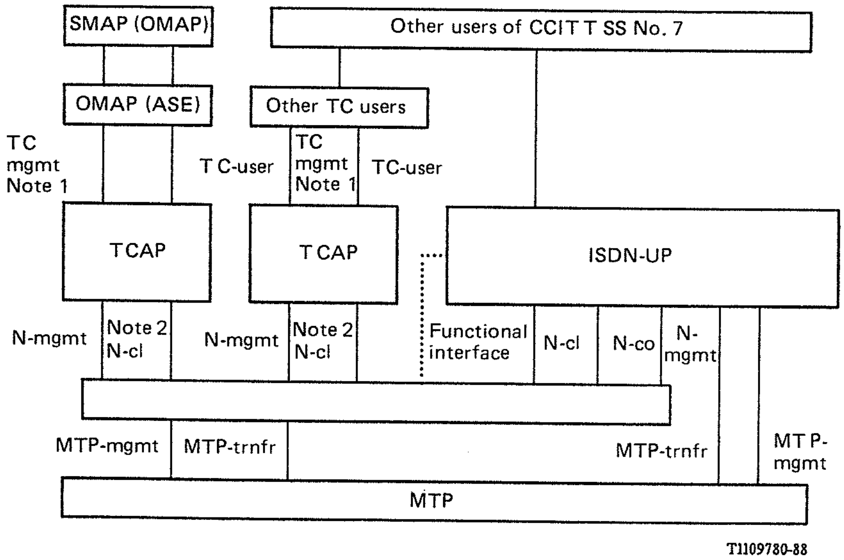
FIGURE 7/Q.700
Types of service primitives

Figure 8/Q.700 provides an overview of the primitives used between the various functional elements of CCITT No. 7.

The MTP primitives apply to all level 4 users of the MTP.

Similarly, the SCCP Management Primitives N-STATE, N-COORD, N-PCSTATE apply to all SCCP subsystems/AEs via TC.

The TC primitives between the ASE and TC provide control of connectionless TCAP transactions. Service primitives for connection-oriented TC transactions are for further study.



MTP-mgmt	MTP management primitives
MTP-trnfr	MTP primitives for message transfer
N-co	SCCP (network layer) connection oriented primitives
N-cl	SCCP (network layer) connectionless primitives
Functional interface	SCCP-ISUP interface for end to end signalling
TC-user	TC-user primitives for TCAP service
TC-mgmt	Management primitives for TC users

Note 1 – The handling of N-(management) primitives by TC is for further study.

Note 2 – The handling of N-co primitives by TC is for further study.

FIGURE 8/Q.700
Overview of the primitives used between the functional elements of CCITT No. 7

5 Addressing

Addressing of CCITT S.S. No. 7 messages has to be considered on a number of levels. For example, the message transfer part uses the destination point code to route the message to the appropriate signalling point. The called party address field in TUP, or ISUP called party number field, in the Initial Address Message is used to route the call to the appropriate called destination. The capabilities of the various CCITT S.S. No. 7 addressing mechanisms are illustrated by the signalling message structure.

5.1 *Signalling message structure*

A signalling message is an assembly of information, defined at level 3 or 4, pertaining to a call, management transaction, etc., that is transferred as an entity by the message transfer function.

Each message contains service information including a service indicator identifying the source User Part and possibly additional information such as an indication whether the message relates to international or national application of the User Part.

The signalling information of the message includes the actual user information, such as one or more telephone or data call control signals, management and maintenance information, etc., and information identifying the type and format of the message. It also includes a label that provides information enabling the message to be:

– routed by the level 3 functions and thorugh a signalling network to its destination; and (This part of the label is known as the Routing label. This is shown in Figure 9/Q.700.)
– directed at the receiving User Part to the particular circuit, call, management or other transaction to which the message is related.

Further details are given in Q.700, § 5.2.

SLS	Originating Point Code	Destination Point Code

FIGURE 9/Q.700
CCITT SS No. 7 Routing Label

There are four types of label:

– type A for MTP management messages;
– type B for TUP;
– type C for ISDN-UP (circuit related) messages;
– type D for SCCP messages.

These are shown in Figure 10/Q.700.

The circuit identification code is used as a label for circuit related signalling messages, e.g., TUP or ISDN-UP. The least significant 4 bits of this field (in the TUP) is the Signalling Link Selection (SLS) field, which is used, where appropriate, to perform load sharing (see Q.704). In the ISDN-UP, the SLS is a separate field to the circuit identification code.

The CCITT No. 7 MTP signalling messages at level 2, which carry user information, are called Message Signal Units (MSUs). Figure 11/Q.700 shows the basic format of the MSU (refer also to Q.703) and the breakdown of the MSU. Signalling Information Field (SIF) when transporting circuit-related (ISDN-UP, TUP) messages and non-circuit-related messages (SCCP, TC based). Further details are given on message formats in Recommendations Q.704, Q.713, Q.723, Q.763, Q.773.

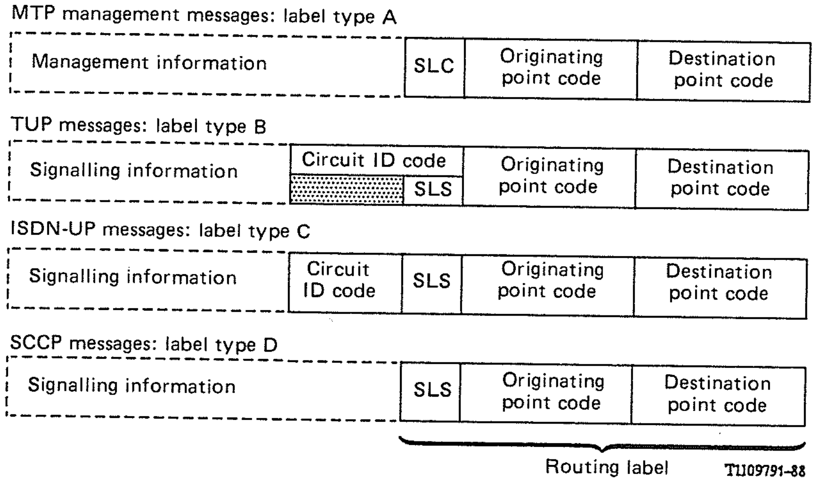


Figure 10/Q.700

CCITT SS No. 7 message label types

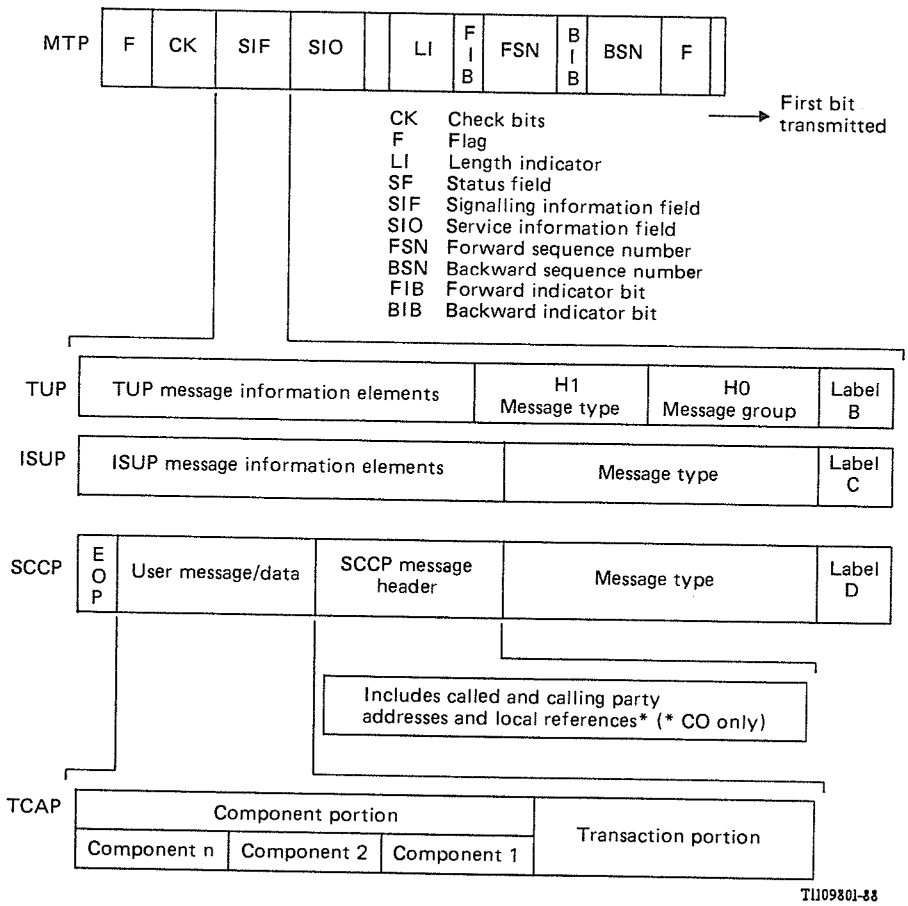


Figure 11/Q.700

CCITT No. 7 signalling message structure

5.2 *MTP addressing*

There is a two part addressing mechanism in the MTP, one part of the mechanism uses the point code which is incorporated in the routing label of every message signal unit, the other part of the mechanism makes use of the service indicator and network indicator within the service information octet. The point code is used for inter-node addressing and the SIO addresses signalling system users on an intra-node basis.

5.2.1 *Point codes*

Every signalling point (SP) and signalling transfer point (STP), when integrated in an SP, will be allocated its own unique point code. This is used by the MTP routing function to direct outgoing messages towards their destination in the network as indicated by the inclusion of the appropriate point code in the routing label. This point code is known as the destination point code (DPC). The routing label also contains the point code of the SP originating the message signal unit, therefore, the combination of this originating point code (OPC) and DPC will determine the signalling relation (i.e., the network points between which MTP "User" information is exchanged). The DPC is used by the receiving SP/STP discrimination function to determine whether the message is addressed to that SP or requires to be onward routed by means of the signal transfer capability of the STP.

The DPC will always be determined and inserted in the routing label by the level 4 MTP "User". This will also generally be the same for the OPC but it is possible that since the OPC might be constant it could be inserted by the MTP.

5.2.2 *Service indicator and network indicator*

The 4 bit service indicator (SI) and 2 bit network indicator (NI) are included in the service information octet (SIO) and are used within an SP's distribution function to determine the "User" the incoming message should be delivered to.

The SI will determine the "User", e.g., TUP, SCCP, ISUP and the NI will determine which network is concerned, e.g., international or national.

The NI will also in conjunction with the OPC/DPC determine whether a national or international signalling relation/routing is involved.

The NI, together with the standard 14 bit point code, allows for a max 16 384 point codes to be allocated in a signalling network.

5.3 *SCCP addressing*

Addressing within the SCCP of S.S. No. 7 makes use of three separate elements:

– DPC
– Global Title (GT)
– Sub-System Number (SSN)

One, two or all of the elements may be present in the Called and Calling Party Address, the main options are:

GT DPC + SSN	When transferring SCCP messages
SSN GT SSN + GT	When receiving messages from MTP
DPC DPC + (SSN or GT or both) GT GT + SSn	When receiving messages from connectionless or connection-orientated control for SCCP Routing.

The form of address used will depend on the service, application and underlying network.

5.3.1 *Global Title (GT)*

The Global Title (GT) may comprise of dialled digits or another form of address that will not be recognized in the S.S. No. 7 network, therefore, if the associated message requires to be routed over the S.S. No. 7 network, translation is required.

Translation of the GT will result in a DPC being produced and possibly also a new SSN and GT. A field is also included in the address indicator to identify the format of the global title.

5.3.2 *Destination Point Code (DPC)*

The DPC in an address requires no translation and will merely determine if the message is destined for that in SP (incoming message) or requires to be routed over the S.S. No. 7 signalling network via the MTP. For outgoing messages this DPC should be inserted in the MTP routing label. On an incoming message the DPC in the MTP routing label should correspond to the DPC in the called address.

5.3.3 *Subsystem Number (SSN)*

The SSN will identify a subsystem accessed via the SCCP within a node and may be a User Part, e.g., ISUP, SCCP management or an AE via TC. TC, however, will be invisible to the SCCP.

When examination of the DPC in an incoming message has determined that the message is for that SP, examination of the SSN will identify the concerned SCCP "User". The presence of an SSN without a DPC will also indicate a message which is addressed to that SP.

The SSN field has an initial capacity of 255 codes with an extension code for future requirements.

5.4 *User Part addressing*

5.4.1 *Telephone User Part addressing*

The Telephone User Part is capable of handling E.164 (incorporating E.163) addresses in the calling and called party address information elements.

5.4.2 *ISDN User Part addressing*

The ISDN User Part address structure is capable of handling E.164 addresses in the calling and called number, and re-directing address information elements.

5.4.3 *Signalling connection control part addresses*

The signalling connection control part is capable of handling E.164 (incorporating E.163), X.121, F.69, E.210, E.211, E.212, E.213, addresses, and the mobile hybrid E.214 address in the calling and called party address information elements.

The handling of OSI NSAP addresses in SCCP is for further study.

5.5 *Labelling*

A variety of methods to label signalling messages is used to allow the signalling system and users of the signalling system to relate a received message to a particular call or transaction.

For circuit-related messages, (e.g., on a simple telephone call), the TUP (and the ISUP) use the circuit identification code (CIC) to label the message.

For certain ISUP procedures, call reference are used to associate messages with calls.

SCCP also uses local references on connection oriented protocols.

Transaction capabilities use transaction and invoke identities to associate transaction messages and components respectively.

6 Operations administration and maintenance

6.1 *Management*

Management within S.S. No. 7 is partitioned into two main areas:

– Signalling network management;

– Signalling system management.

6.1.1 *Signalling network management*

These are functions contained within the MTP and SCCP which, by means of automatic procedures, maintain the required signalling network performance (e.g., changeover of faulty links, forced re-routing, subsystem availability, etc.).

6.1.2 *Signalling system management*

This may be considered as the actions taken by the operator (or by an external automatic mechanism) to maintain the signalling system performance when problems are identified.

6.1.3 *Signalling System No. 7 and TMN*

The TMN concept identifies CCITT S.S. No. 7 as a candidate to act as a data communications network (DCN) for some TMN functions. The protocols that will be needed for this purpose are intended to be defined as ASEs, as part of OMAP. This topic is for further study.

6.1.4 *Signalling System No. 7 and OSI management*

This subject is for further study.

6.2 *Maintenance and testing*

The maintenance administration and management functions of the signalling system themselves use the signalling system as a data carrying mechanism. When regarded in the data transport mode, however, any management or maintenance information is regarded as signalling traffic. Those functions having direct impact on S.S. No. 7 are included in OMAP Recommendation Q.795.

Testing within Signalling System No. 7 is:

– instigated automatically as a part of a signalling system management procedures (e.g., signalling route set test in MTP) or

– applied as a result of external activity, e.g., human-machine (MMI).

The first form is described in the appropriate Q.700 to Q.795 Recommendation dealing with MTP or SCCP, etc. The second form includes some MMI initiated procedures (initiation of MRVT (Q.795)), and also pre-in service testing using test cases specified in Recommendations for S.S. No. 7 tests (Q.780 to Q.783). A testing user part has been agreed to be necessary for pre-in service testing, this topic is for further study.

6.2.1 *Operations Maintenance and Administration Part (OMAP)*

Recommendation Q.795 provides procedures and protocols related to operations and maintenance information. These procedures and protocols use TCAP and are invoked by the system management application process (SMAP). Recommendation Q.795 includes the following:

– MTP Routing Verification Test (MRVT)

– SCCP Routing Verification Test (SRVT) - for further study

– Circuit Validation Test

The protocol for the MRVT contained in Q.795 forms part of the OMAP AE which in turn uses the services provided by transaction capabilities.

ASEs needed to support the TMN functions are for further study.

6.2.2 *Testing*

Test specifications for Signalling System No. 7 are contained in Recommendations Q.780-783 and cover MTP level 2, level 3 and the TUP together with an overview of testing.

A Testing User Part is for further study.

6.3 *CCITT S.S. No. 7 measurements*

Recommendation Q.791 specifies the monitoring and measurements appropriate to the MTP and SCCP.

7 Signalling system performance

The performance requirements of Signalling System No. 7 must take account of the performance requirements of the services that are being supported. Each functional component of Signalling System No. 7 has its performance criteria specified in a self-contained Recommendation. An overall performance target is specified in the form of a Hypothetical Signalling Reference Connection (HSRC).

7.1 *Hypothetical Signalling Reference Connection (HSRC)*

The HSRC for Signalling System No. 7 (Recommendation Q.709), identifies components that are used in a signalling relation between signalling end points, signalling points, signalling transfer points, and signalling points with SCCP relay functions, and gives the values for the signalling delays and unavailability parameters. The values used are derived from the figures contained in the individual performance Recommendations for MTP, TUP, SCCP and ISUP.

7.2 *MTP*

The MTP signalling performance requirements are specified in Recommendation Q.706. This Recommendation includes:

- the parameters route-set unavailability, MTP malfunction (loss of messages and mis-sequencing), and message transfer times;
- factors affecting performance, for example signalling traffic characteristics (e.g., loading potential, security, etc.) and parameters related to transmission characteristics (e.g., bit rates of signalling data links);
- those parameters which have greatest influence on the signalling network queueing delays for example, error control, security arrangements, failures and priorities.

It should be noted that management functions affect MTP performance.

7.3 *SCCP*

The SCCP signalling performance requirements are contained in Recommendation Q.716. Parameters identified are signal connection delays (establishment, unsolicited reset, reset and release signalling connection, reset and release failure probability, data message transmit delay, data message delay failure and error probability and SCCP unavailability).

It should be noted that management functions affect SCCP performance.

7.4 *TUP*

The TUP signalling performance requirements are contained in Recommendation Q.725. Parameters contained in this Recommendation are cross office performance for TUP supported circuit connection control application under normal and abnormal traffic loads. Also specified is the probability of failure of calls due to signalling malfunction.

7.5 *ISDN-UP*

The ISDN-UP signalling performance requirements are contained in Recommendation Q.766. Parameters contained in this Recommendation are cross office performance for ISDN-UP supported circuit connection control under normal and abnormal traffic loads. Also specified is the probability of failure of an ISDN call due to signalling function.

8 Flow control

Signalling System No. 7 in common with other transport mechanisms, needs to limit the input of data when congestion onset is detected. Failure to do so can create overload situations. The nature of CCITT S.S. No. 7 will lead to SP/STP overload congestion being spread through the signalling network if no action is taken. This will result in impaired signalling performance. In addition to signalling network congestion within a node, congestion will also require action to prevent signalling performance from deteriorating. There is thus a need for flow control within the signalling system to maintain the required signalling performance.

8.1 *Signalling network flow control*

This is achieved by incorporating a flow control mechanism in the MTP. On detection of congestion, MTP “Users” are informed by the means of a special primitive; the “User” should then reduce signalling traffic towards the congested part of the network. If the User is at a remote SP, the information is carried across the network in an appropriate signalling network management message.

8.2 *Signalling node (congestion) flow control*

In addition to network congestion, nodal congestion also requires the remedial action of flow control to prevent the signalling performance from being impaired. Nodal congestion can occur both within the MTP and the MTP “User”.

8.2.1 *MTP nodal flow control*

A similar activity to that to combat signalling network congestion is required, i.e., on detection, the “User” is informed so that traffic can be reduced.

8.2.2 *“User” flow control*

As well as taking action to reduce MTP congestion, mechanisms are also required within the User to detect the onset of congestion and to take appropriate action.

8.3 *Automatic congestion control*

The ISUP and TUP provide signalling procedures which aim to reduce the new calls offered to an exchange which is experiencing processor overload.

Automatic congestion control provides the means to inform adjacent exchanges of the current workload, and to request that only priority calls are offered to the exchange experiencing overload.

9 Compatibility mechanisms and rules in CCITT S.S. No. 7

9.1 *Modularity*

The wide scope of the signalling system requires that the total system include a large diversity of functions and that further functions can be added to cater for extended future applications. As a consequence only a subset of the total system may need to be used in an individual application.

A major characteristic of the signalling system is that it is specified with a functional structure to ensure flexibility and modularity for diverse applications within one system concept. This allows the system to be realized as a number of functional modules which could ease adaptation of the functional content of an operating Signalling System No. 7 to the requirements of its application.

The CCITT specifications of the signalling system specify functions and their use for international operation of the system. Many of those functions are also required in typical national applications. Furthermore, the system to some extent includes features that are particular to national applications. The CCITT specifications thus form an internationally standardized base for a wide range of national applications of common channel signalling.

CCITT S.S. No. 7 is one common channel signalling system. However, as a consequence of its modularity and its intended use as a standard base for national applications the system may be applied in many forms. In general, to define the use of the system in a given national application, a selection of the CCITT specified functions must be made and the necessary additional national functions must be specified depending on the nature of the application.

CCITT S.S. No. 7 is an evolutionary signalling system which has undergone a number of enhancements. To allow ease of evolution it has been necessary to incorporate a number of compatibility mechanisms in various functional elements of CCITT No. 7, and to apply a number of compatibility rules to protocol enhancement. Detailed specification of the compatibility mechanisms in each functional element of CCITT S.S. No. 7 are given in the appropriate Q.700 to Q.795 Recommendations. Hence an overview is given in this Recommendation.

Compatibility rules which apply to all functional elements of CCITT S.S. No. 7 are detailed in the following text.

9.2 *Evolutionary requirements*

In application protocols (e.g., ISDN-UP, ASEs), the main evolutionary requirement is the ability to add new subscriber services, new administration and network services to the protocol.

In the SCCP and MTP, the evolutionary requirements are different in that initial versions provide basic transport functions which are generally stable. The main enhancements have been in the management protocols.

Although the evolutionary requirements are different across the elements of CCITT S.S. No. 7, it is possible to incorporate certain common mechanisms in the various functional elements.

9.3 *Forward and backward compatibility*

Compatibility mechanisms can be considered as being either:

– Forward compatibility mechanisms

– Backward compatibility rules

Forward compatibility mechanisms are defined as a scheme to enable a version of a protocol to communicate effectively and interwork with future versions of the protocol.

Backward compatibility rules are defined as a scheme to ensure that future versions of the protocol will be able to send protocol messages to the previous version which will be understood and fully processed by the node supporting the previous version.

9.4 *Compatibility rules for CCITT S.S. No. 7*

The following compatibility rules are applied to each element of CCITT S.S. No. 7 (e.g., ISDN-UP) when protocols are enhanced.

9.4.1 *Addition of a new value to an existing field (e.g., a cause value)*

New values to an existing field can be added. The processing of these new values at nodes supporting an earlier version of the protocol will be defined in their version specifications.

9.4.2 *Addition of a new parameter to an existing message*

Any new parameters added to an existing message must not be added as mandatory parameters. If a new parameter, must be added, and it must be a mandatory parameter, then a new message type must be created.

9.4.3 *Handling of unrecognized information*

When a new protocol, message or information element is created, a rule is required on a per message and information element basis, to define the action on receipt of unrecognized information. This rule needs to be applied to both unrecognized messages, unrecognized information elements within messages, and unrecognized values within recognized information elements.

The actions defined for receipt of an unrecognized message/information element could be:

- Discard message/information element.
- Discard/ignore information element within a recognized message.
- Default to a known general value (e.g., on receipt of an ISDN-UP IAM with an unrecognized calling party category could be defaulted to “Unknown”).
- Send a “Confusion” message.
- Terminate the call/transaction.
- Information management.

9.4.4 *Increase in the length of optional parameters*

If a parameter is used as an optional parameter in all messages that it appears, the length of the parameter can be increased. The older version of the protocol would be able to function as it does today, assuming it ignores the extra bits or a suitable extension method has been defined. The newer version would have to check the length of the parameter to determine if the added information was present.

Protocols which use coding rules which are based on X.409 (e.g., TC) are not subject to this rule.

9.4.5 *Processing of messages with unrecognized SIO information*

To enable signalling points implemented to the Blue Book to interwork with signalling points implemented to earlier Recommendations when a message containing an unrecognized service information octet (see Q.704, § 14.2) is received, the message is discarded.

9.4.6 *Unacknowledged messages*

Where a function requires an acknowledgement to a message in order to continue, if no response is received the function sends the message for only a limited number of times. The sending signalling point should assume that the function is not available, and inform local management.

9.4.7 *Processing of spare fields*

For those CCITT S.S. No. 7 functions which define fields or sub-fields in signalling messages as spare or reserved, the following rules for processing of these fields apply.

At a node generating a signalling message, all spare and reserved fields are set to zero. At transit nodes, spare or reserved fields may be passed on transparently. At the destination node, the spare and reserved fields are not examined.

10 Glossary

A Glossary of terms in CCITT S.S. No. 7 is contained at the back of the Fascicles VI.7, VI.8 and VI.9.

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