

# Signalling System 7 Technology and Applications Overview

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## About This Document

This document is intended to be used by those who want to understand how the Common Channel Signalling System 7 (CCSS7 or SS7) network works. The goal is to bring voice and data communication personnel who are unfamiliar with SS7 up to speed rapidly. Exposing the reader to the terminology of SS7 is an explicit goal of this document. This document views SS7 at a functional block definition and concentrates at the service definition level without getting into the protocol specification details. Reference to standards, vendor product literature and other relevant sources are made throughout this document. This document is broken into four parts.

The first part (See Chapter 1, page 3) describes at a high level what the relevant standards, implementations and products are and how they fit together. 1.4, for a list of good introductory and tutorial documents on SS7 standards.

The second part (See Chapter 2, page 5) provides a summary of the SS7 standards. It is not as dry as the standard itself and while it is serious, it is intended to be understandable by the uninitiated.

The third part (See Chapter 3, page 15) is intended to be the place where all the common questions and answers are maintained.

The fourth part of this document (See Appendix A, page 17) is intended to be used as reference material. The terminology of SS7 is summarized in this section. It is indexed in two ways. First, since it is alphabetically sorted the table of contents can be used to quickly locate terms of interest. The Concept Index in the back of the document can also be used to locate information about concepts.

## How to best use this document

This manual is written in  $\LaTeX$ info.  $\LaTeX$ info is a documentation system that uses a single source file for both on-line documentation and a printed manual.

The printed manual is probably better suited for cover-to-cover reading. While the table of contents and index of this document make it easy for reference use, the on-line documentation is probably better suited for that purpose.

The on-line documentation is in the form of an Info file. An on-line Info file is a file formatted so that the Info documentation reading program can operate on it. Info files are divided into pieces called *nodes*, each of which contains the discussion of one topic. M-x info in emacs and xinfo under X11 are two Info documentation reading programs that can be used for on-line manipulation of this manual.

## Caveats

Clearly, no one individual may address the entire scope of this document. For this to be complete, many need to be involved. This manual is intended to function as a starting point.

While even in its present form this document can be very usefull, it is not flawless and it is not complete. This is intended to be a live document. As we learn more about the SS7 network, we will update this document.

I have made every possible effort to provide accurate information in this revision of the manual, yet I claim no responsibility for the fitness, applicability or accuracy of what is in this document.

## Comments

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# Chapter 1

## Overview of the SS7 Network

This section provides an overview of the Signalling System 7 network by providing a high level description of existing standards, products and implementations.

Common Channel Signalling System 7 Network (CCSS7 Network) is used for the exchange of information that are related to call setup, supervision, tear down, information needed for distributed application processing and network management information.

For pedagogical purposes one may view the SS7 Network as a *Voice Network* and *Data Network* is used to establish connection in the *Voice Network*. The SS7 protocol defines the rules of communication for the *Data Network*.

While the SS7 network may evolve into a general purpose *Data Network*, it is important to always remember the original purpose (call setup, tear down, supervision, ...) for which it was designed.

SS7 protocols are many and inter-related. Furthermore, they have been designed to be extensible. Some areas for these standards are complete and others are not. Because of this, many questions about SS7 Networks can not be answered without specifics of the products that are being used and the manner in which they have been deployed. Given this perspective, it is necessary to understand the models and services defined in the SS7 standards, before dealing with the specifics of existing implementations (See Chapter 2, page 5).

The remainder of this section contains additional information on existing standards, products and implementations relating to SS7.

### 1.1 Standards

The first CCITT recommendations on CCSS7 signalling protocol were published in 1980, followed by an expanded set of specifications in 1984, and again in 1988 by even more expansions. Although the development of the CCSS7 protocol has in many respects been tailored to the special needs of telephone signalling (in contrast with general data communication needs), its evolution has been influenced by the need to encompass a broader role and become more aligned, where appropriate, with the seven-layer OSI reference model.

In North America AT&T has filled in ambiguities of CCITT standards through its own standards and those documents are often the real authority.

## 1.2 Products

Most vendors have software and hardware modules for their switches that conform to SS7.

Test and monitoring equipment for SS7 protocols is also available through a number of sources. Tekelec in particular is one that I am familiar with. <sup>1</sup>.

Tekelec  
26580 W. Agoura Road  
Calabasas, CA 91302  
(818) 880-5656  
(800) TEKELEC

## 1.3 Implementations

I have been told that the North American and European implementations are different in some aspects. Addressing and topology are two areas where many variations are possible.

## 1.4 Good Additional Information Sources

July 1990 Issue of IEEE Communications Magazine was *entirely* devoted to Signalling System No. 7. One article in particular, *Signalling System No 7: A Tutorial* is very good.

The Q.700 CCITT books are authoritative and complete but very difficult to read. 1.1, for information on how to obtain these.

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<sup>1</sup>I have some of their product information and some contact names inside Tekelec

## Chapter 2

# Summary of SS7 Standards

The first CCITT recommendations on CCSS7 signalling protocol were published in 1980, followed by an expanded set of specifications in 1984, and again in 1988 by even more expansions. Although the development of the CCSS7 protocol has in many respects been tailored to the special needs of telephone signalling (in contrast with general data communication needs), its evolution has been influenced by the need to encompass a broader role and become more aligned, where appropriate, with the seven-layer OSI reference model.

The 1984 series were published in red covers and are often referred to as the *red books*. The 1988 series were published in blue covers and are often referred to as the *blue books*.

Blue books and Red books can be ordered through:

OMNICOM, Inc  
115 Park Street, SE  
Vienna, VA 22180  
Tel: (703) 281-1135 or (800) 666-4266

Q.700 series of standards are in Volume 6, Fascicle 7, 8 and 9.

Electronic copies of 1988 and pre-releases of 1992 blue books are available on an FTP server. <sup>1</sup>

In North America AT&T has filled in ambiguities of CCITT standards through its own standards and those documents are often the real authority.

This section provides a summary of aspects of CCITT Recommendation Q.700 that are relevant to management aspects of the Signalling Network.

An overview of the Signalling System 7 as defined in the standards is provided by describing the various functional elements of CCITT Signalling System 7 and the relationships between these elements.

The remainder of this section is structured as follows.

- CCSS7 Signalling Network
- Signalling Points
- Functional Blocks of a Signaling Point
  - MTP Level 1

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<sup>1</sup>I also have copies of this on *neda* drop me a note and I can send them to you through UUCP as well.

- MTP Level 2
- MTP Level 3
  - \* Routing
- ISDN-UP
- OMAP
- Addressing

## 2.1 CCSS7 Signalling Network

Common Channel Signalling System 7 network (CCSS7 Network) is used for the exchange of information that are related to call setup, supervision, tear down, information needed for distributed application processing and network management information.

CCSS7 Network is composed of Signalling Points (SP) that cooperate in the activities of the network.

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

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 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 link sets in tandem passing through one or more signalling points other than those which are the origin and 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.

A brief description of Signalling Point follows.

## 2.2 Signalling Points

A signalling point (SP) is a node in a signalling network which either originates or receives signalling messages from one signalling link to another, or both. A Signalling Point comprises the Message Transfer Part (MTP) functional block and possibly user part functional blocks.

There are three types of signalling points:

**SEP:** Signalling End Point, this SP contains MTP and user parts

**STP:** Signalling Transfer Point, this SP contains only MTP

**STEP:** Signalling Transfer and End Point, this SP type combines both the SEP and the STP function

The following section describes the structure of signalling points from a "Functional Blocks" perspective.

## 2.3 Functional Blocks of a Signalling Point

Evolution of the CCITT signalling System No. 7 architecture has been based on the Open Systems Interconnection (OSI) Reference Model. Figure 2.1 illustrates the relationship between CCITT S.S. No. 7 functional levels and OSI layering.

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.

The CCSS7 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)
- Application-Service-Elements (ASEs)

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

The term "User" refers to any functional entity that utilizes the transport capability provided by the message transfer part.

The Message Transfer Part provides the functions that enable User Part significant information passed to the MTP to be transferred across the Signalling System No. 7 network to the required destination. In addition, functions are included in the MTP to enable network and system failures that would affect the transfer of signalling information to be overcome. This constitutes a sequenced connection-less service for the MTP user.

The Message Transfer Part together with one of its "Users", the Signalling Connection Control Part (SCCP), forms the Network Service Part (NSP). The Network Service Part meets the requirement of layer 3 services as defined in the OSI Reference Model.

Transaction Capabilities provides layer 4-7 services.

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

Message Transfer Part is comprised of MTP level 1-3. MTP levels 1-3 may be mapped to OSI service definitions for layers 1-3. An overview of MTP level 1-3 is provided in the following sections.

### 2.3.1 MTP Level 1 - Signalling Data Link Functions

Figure 2.2 illustrates relationships of key MTP level 1 entities.

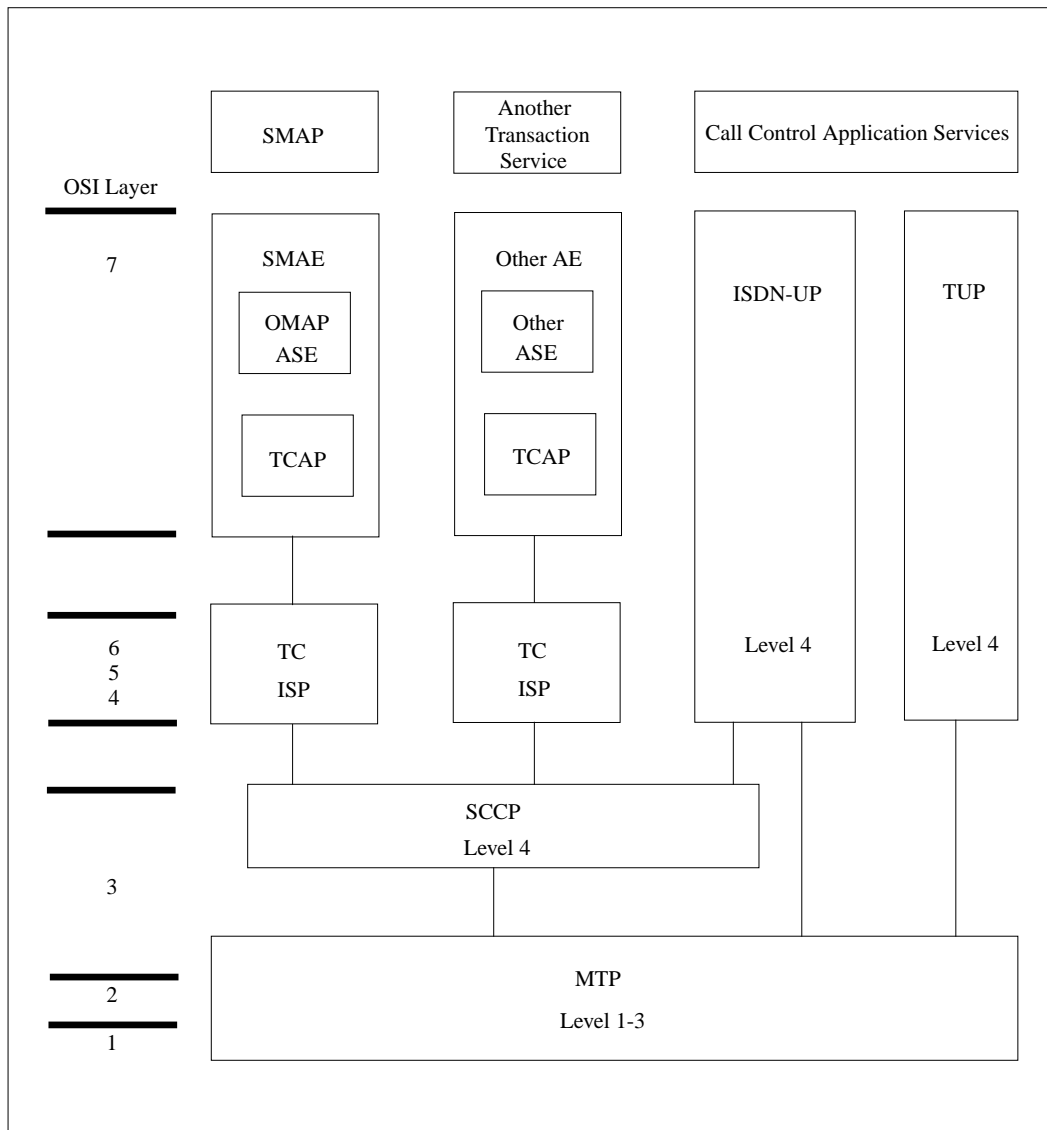


Figure 2.1: Functional Blocks of a Signalling Point

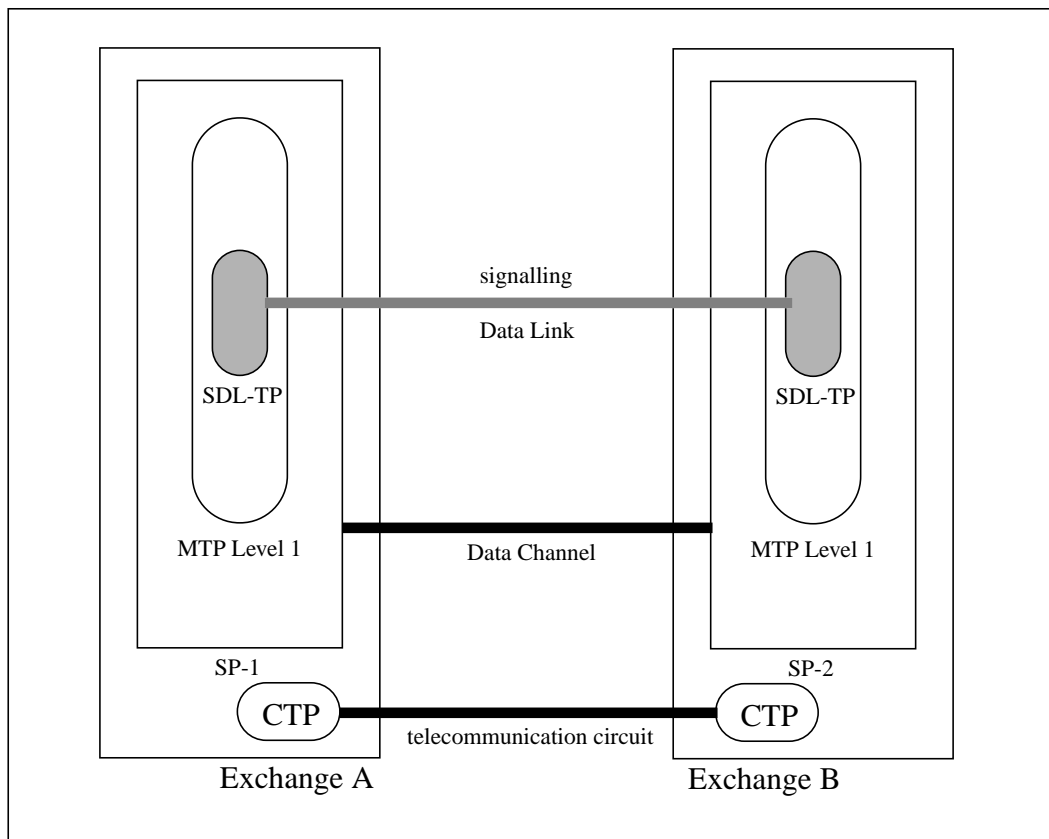


Figure 2.2: MTP Level 1 Entities

MTP level 1, Signalling Data Link Functions, defines the physical, electrical and functional characteristics of a signalling data link (SDL) and the means to access it. Signalling Data Link provides a bearer for a signalling link, (MTP level 2).

Each signalling data link has a signalling Data Link Termination Point (SDL-TP) at each of the signalling points that it is linking.

The detailed requirements for signalling data link functions are given in Recommendation Q.702.

### 2.3.2 MTP Level 2 - Signalling Link Functions

Figure 2.3 illustrates relationships of key MTP level 2 and MTP level 1 entities.

MTP Level 2, Signalling Link Functions, 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 signalling points.

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

A signalling link consists of a signalling data link with signalling terminal attached at both ends. A group of signalling links between two adjacent SP's forms a signalling link set.

Combinations of allocating the signalling terminal and signalling data link termination point to the signalling link are possible.

### 2.3.3 MTP Level 3 - signalling Network Functions

MTP Level 3 defines many of the services assigned to the Network Layer, Layer 3, of OSI Reference Model. MTP Level 3, uses MTP Level 2 services that provide for point-to-point communications and accomplishes end-to-end connection-less services. The main function of MTP level 3 is routing of signalling messages.

MTP Level 3 defines the functions and procedures that are common to, and independent of, the operation of individual signalling links.

The functions performed by MTP Level 3 fall into two major categories:

**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.

**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.

### Routing

Message routing is the process of selecting, for each signalling message to be sent, the signalling link to be used. In general, message routing is based on analysis of the routing label of the message in combination with predetermined routing data at the signalling point concerned.

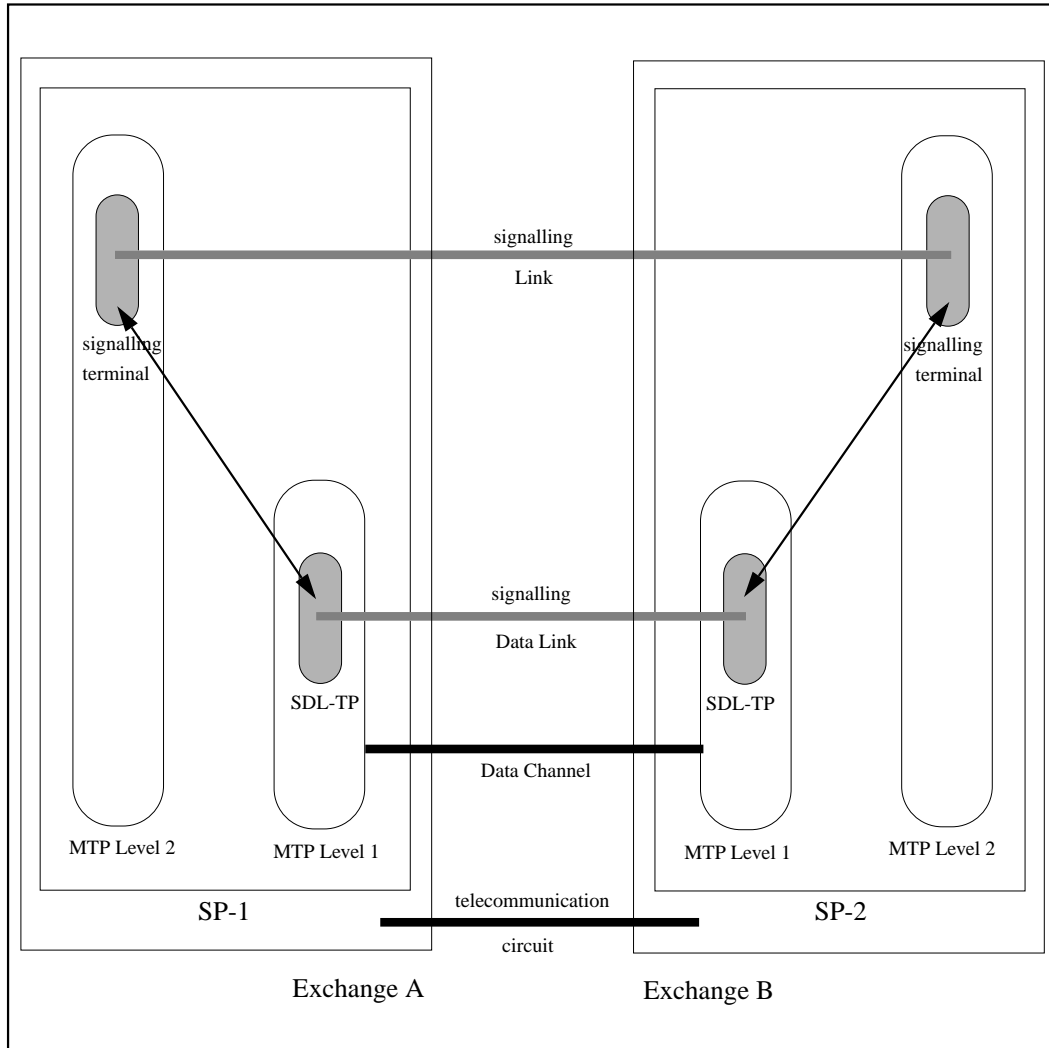


Figure 2.3: MTP Level 2 Entities

Each succession of signalling links that may be used to convey a message from the originating point to the destination point constitutes a "message route". A signalling route is the corresponding concept for a possible path referring to a succession of link sets and signalling transfer points, between a given signalling point and the destination point.

In Signalling System No. 7, message routing is made in a manner by which the message route taken by a message with a particular routing label is predetermined and, at a given point in time, fixed. Typically, however, in the event of failures in the message network, the routing of messages, previously using the failed message route, is modified in a predetermined manner under control of the signalling traffic management function at level 3.

Signalling route management is a function that relates to the quasi-associated mode of signalling only. Its task is to transfer information about changes in the availability of signalling routes in the signalling network to enable remote signalling points to take appropriate signalling traffic management actions. Thus a signalling transfer point may, for example, send messages indicating inaccessibility of a particular signalling point via that signalling transfer point, thus enabling other signalling points to stop routing messages to an incomplete route.

In the routing method described here, the network nodes only need to examine parts of the address, the Destination Point Code (DPC), instead of the entire point code. This is repeated until there is sufficient information to route the message in the direction of its final destination. Examining the whole address is not needed in the majority of cases. If a node does not maintain the complete status for an entire point code, it is sometimes said that the point code is "unknown" to the node. But a signalling message may still be routed to an unknown point code from a node if the node has a default route associated with either the unknown point code's network or cluster.

### **2.3.4 ISDN User Part**

ISDN User Part (ISDN-UP), or ISUP, encompasses signalling functions required to provide switched services and user facilities for both voice and non-voice applications in the ISDN.

The ISDN-UP is also suited for applications 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 to allow the ISDN-UP to use the SCCP for end-to-end signalling.

## **2.4 Addressing**

Addressing of CCSS7 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.

### **2.4.1 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 CCSS7 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.

### **2.4.2 Global Title (IT)**

The Global Title (AT) may comprise of dialled digits or another form of address that will not be recognized in the CCSS7 signalling network. Therefore, if the associated message requires to be rerouted over the CCSS7 signalling network, translation is required.

Translation of the GUT will result in a DPC being produced.

### **2.4.3 Subsystem Number (SSN)**

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

When examination of 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.

## **2.5 Systems Management**

Management within CCSS7 is partitioned into two main areas:

- Signalling network management
- Signalling system management

### **2.5.1 Signalling Network Management**

Signalling network management is the set of functions within the CCSS7 protocol which, by means of automatic procedures, maintain the required signalling network performance (e.g. changeover of faulty links, forced rerouting, subsystem availability).

### **2.5.2 Signalling System Management**

Signalling system management may be considered as actions taken by the operator or by an external management system to maintain the signalling system performance when problems are identified.



## Chapter 3

# Frequently Asked Questions

This section contains the answers to some Frequently Asked Questions (FAQ) about SS7. These are organized in no particular order.

### 3.1 What does “Common Channel” in CCSS7 mean?

When in addition to signalling information relating to circuit manipulation (set up, tear down, ...) other information such as that used for network management, is conveyed over a single channel, the term *Common Channel Signalling* is used.

### 3.2 Why the quasi-associated mode?

The route that a message will go through in normal operation is fixed in quasi-associated mode. This provides for predictability of traffic. This in turn makes planning and conformance to reliability and performance requirements easier.

### 3.3 What is 5ESS in relation to SS7?

5ESS is a switch that when equipped with the proper modules can conform to SS7 standards.

### 3.4 Is billing information available on the SS7 network?

It may be. Network Management and accounting parts of the standards were not complete in 1988 and 1992 version is not much more complete in those areas.

Because of the *Common Channel* nature of SS7, it is possible to access billing information through the network. I have not been able to collect relevant information about specific SS7 implementations.

### **3.5 How can the traffic on the SS7 be monitored?**

A number of vendors have SS7 network monitoring products that can monitor network traffic at various layers. 1.2, for more information.

# Appendix A

## GLOSSARY OF TERMS

- A -

acknowledgement			A service of the SCCP by which the receiver of the message informs the sender of the correct receipt.
available signalling link			A signalling link which has successfully completed the initial alignment procedures and carries (or is ready to carry) signalling traffic.
adjacent signalling points			Two signalling points that are directly interconnected by (a) signalling link(s).
alignment monitoring	error rate		A procedure by which the error rate of signalling link is measured during the initial alignment.
alternative signalling)	routing (of		The routing of a given signalling traffic flow in case of failures affecting the signalling links, or routes, involved in the normal routing of that signalling traffic flow.
analogue link	signalling data		The data link that provides an interface to signalling terminals and is made up of voice-frequency analogue transmission channels and modems.
application			The set of user's requirements.
application entity (AE)			A set of Application Service Elements which together perform all or part of the communications aspects of an application process. The Application Entity is addressed through an SCCP subsystem number.
application process			An element which performs the information processing for a particular application.

application service element (ASE) A coherent set of integrated functions within an application entity which provides an OSI environment capability, using underlying services where appropriate.

associated mode (of signalling) The mode where messages for a signalling relation involving two adjacent signalling points are conveyed over a directly interconnecting signalling link.

**– B –**

backward indicator bit (BIB) A bit in a signal unit requesting, by its status change, retransmission at the remote end when a signal unit is received out of sequence.

backward sequence number (BSN) A field in a signal unit sent which contains the forward sequence number of a correctly received signal unit being acknowledged.

basic (error correction) method A non-compelled, positive/negative acknowledgement, retransmission error control system.

**– C –**

called/calling party address An address within an SCCP message, consisting of any combination of signalling point code, global title and subsystem number.

changeback The procedure of transferring signalling traffic from one or more alternative signalling links to a signalling link which has become available.

changeback code A field in the signalling network management messages used in the changeback procedure; it is used to discriminate messages relating to different changeback procedures performed at the same time towards the same signalling link.

changeover The procedure of transferring signalling traffic from one signalling link to one or more different signalling links, when the link in use fails or is required to be cleared of traffic.

check bit (CK) A bit associated with a character or block for the purpose of checking the absence of error within the character or block.

check loop A device which is attached to interconnect the Go and Return paths of a circuit at the incoming end of a circuit to permit the outgoing end to make a continuity check on a loop basis.

circuit identification code (CIC)	Information identifying a circuit between a pair of exchanges, for which signalling is being performed (14 bits in the international ISDN User Part).
circuit validation test (CVT)	A procedure used to ensure that two exchanges have sufficient and consistent translation data for placing a call on a specific circuit.
class of operation	A number indicating whether an operation reports success or failure, failure only, success only or neither.
class of SCCP service	A number chosen by the user of the SCCP to select 1 out of 4 network services provided by the SCCP.
combined link set	A load sharing collection of one or more link sets.
common channel signalling	A signalling technique in which signalling information relating to a multiplicity of circuits, and other information such as that used for network management, is conveyed over a single channel by addressed messages.
component	A protocol data unit exchanged between TC-users, via the Component sublayer of Transaction Capabilities.
component correlation	The association of operation invocations and replies.
component portion	The part of a TC message containing the Components.
connection end-point	A signalling point which may be either originating or destination.
connection identification	A number which identifies unambiguously a certain connection at the interface between the SCCP and a user function.
connection-oriented network service	A network service that establishes logical connections between end users before transferring information.
connection section	A section of an SCCP connection between endpoints or between an endpoint and an intermediate point or between intermediate points.
connectionless network service	A network service that transfers information between end users without establishing a logical connection or virtual circuits.
continuity check	A check made to a circuit or circuits in a connection to verify that an acceptable path (for transmission of data, speech, etc.) exists.

continuity transponder	check	A device which is used to interconnect the Go and Return paths of a circuit at the incoming end which on detection of a check tone, returns another check tone to the originating end to permit a continuity checking of a 2-wire circuit.
controlled rerouting		A procedure of transferring in a controlled way, signalling traffic from an alternative signalling route to the normal signalling route, when this has become available.
coupling		An SCCP function which provides an association between connection sections at a relay point.
cross-office (transit) delay		The time a message will take to pass through an exchange.
cross-office check		A check made of a circuit across the exchange to verify that a transmission path exists.
<b>- D -</b>		
data channel propagation time (Tp)		The period which starts when the last bit of the signal unit has entered the data channel at the sending side and ends when the last bit of the signal unit leaves the data channel at the receiving end, irrespective of whether the signal unit is disturbed or not.
Data User Part (DUP)		The User Part specified for data services.
destination (signalling-)	point	The signalling point to which a message is destined.
destination (DPC)	point code	A part of the label in a signalling message which uniquely identifies, in a signalling network, the (signalling) destination point of the message.
dialogue		An association established between two TC users exchanging components.
digital signalling data link		The data link that provides an interface to signalling terminals and is made up of digital transmission channels and digital switches or their terminating equipment.
dual seizure		The condition which occurs when in bothway operation two exchanges attempt to seize the same circuit at approximately the same time.

– E –

emergency changeover	A modified changeover procedure to be used whenever the normal one cannot be accomplished, i.e. in case of some failures in the signalling terminal equipment or in case of inaccessibility between the two involved signalling points.
end-to-end signalling	The capability to transfer signalling information of end point significance directly between signalling end points in order to provide a requesting user with a basic or supplementary service.
end-user (SCCP)	A functional entity above the SCCP upper layer boundary indirectly using the services of the SCCP.
entity or (N) entity	A set of functions invoked by a given layer for an instance of intersystems communications in which that system is involved. An entity may be partitioned into several sub-entities. For each instance of intersystems communications, the set of functions invoked will be a part of all the functional capability of the given system within the layer in accordance with the functionality required for that instance of inter-system communication.
expedited data	Data transferred with priority which bypasses the normal data flow control.

– F –

failure response time	The elapsed time from the instant a signalling point recognises that a signalling link is unavailable, until the instant when the signalling point completes sending a changeover (or emergency changeover) order to the remote signalling point.
fill-in signal unit (FISU)	A signal unit containing only error control and delimitation information, which is transmitted when there are no message signal units or link status signal units to be transmitted.
flag (F)	The unique pattern on the signalling data link used to delimit a signal unit.
flow control	A function in a protocol used to control the flow of signalling messages between adjacent layers of a protocol, and/or between peer entities. The function permits, for example, a receiving entity to control signalling message flow from the sending entity.
forced rerouting	A procedure of transferring signalling traffic from one signalling route to another, when the signalling route in use fails or is required to be cleared of traffic.

forced retransmission (procedure)	An error correction procedure used to complement the preventive cyclic retransmission procedure.
forward indicator bit (FIB)	A bit in a signal unit which indicates the start of a retransmission cycle.
forward sequence number (FSN)	A signal unit used to identify the transmitted message signal units.
function	A logical object which accepts one or more inputs (arguments) and produces a single output (value) uniquely determined by the combination of the input and the formal specification of the function.
<b>– G –</b>	
global title (GT)	An address used by the SCCP, such as customer dialled digits which does not explicitly contain information that would allow routing in the signalling network, i.e., the SCCP translation function is required.
<b>– H –</b>	
hypothetical signalling reference connection (HSRC)	(CFRS) A hypothetical reference model of a connection in a signalling network.
<b>– I –</b>	
identifier (ID)	A character, or group of characters, used to identify or name an item of data and possibly to indicate certain properties of that data.
information element	The basic unit of a TCAP message.
initial alignment (procedure)	A procedure by which a signalling link becomes able to carry signalling traffic either for the first time or after a failure has occurred.
integrated digital network (IDN)	A network in which connections established by digital switching are used for the transmission of digital signals.
integrated services digital network (ISDN)	An integrated digital network in which the same digital switches and digital paths are used to establish connections for different services, for example, telephony, data.
Intermediate Service Part	An element of Transaction Capabilities which supports TCAP for connection-oriented messages. It represents OSI layers 4 to 6.

international network	signalling	A network used for signalling, consisting of international signalling points and common channel signalling links connecting them.
international point	signalling	A signalling point which belongs to the international signalling network.
international point code	signalling	A part of the label in a signalling message that uniquely identifies each signalling point which belongs to the international signalling network. It consists of a sub-field for the signalling area/network code (11-bit) and a sub-field which identifies a signalling point in a specific area or network (3-bit).
interruption control		A system which monitors a pilot for interruptions on FDM systems and which transmits an indication to the switching equipment.
ISDN user part (ISDN-UP)		A protocol of Signalling System No. 7 which provides the signalling functions necessary to basic bearer services and supplementary services for voice and non-voice applications in the ISDN.
<b>- J -</b>		
<b>- K -</b>		
<b>- L -</b>		
label		Information within a signalling message used to identify typically the particular circuit, call or management transaction to which the message is related.
layer		A group of one or more entities contained within an upper and lower logical boundary. Layer (N) has boundaries to the layer (N + 1) and to the layer (N - 1).
layer interface		The boundary between two adjacent layers of the model.
layer service		A capability of the (N) layer and the layers beneath it, which is provided to (N + 1) entities, at the boundary between the (N) layer and the (N + 1) layer.
layer service elements		An indivisible component of the layer service made visible to the service user via layer primitives.
layer service primitives		A means for specifying in detail the adjacent layer interactions.

length indicator (LI)	A six-bit field which differentiates between message signal units, link status signal units and fill-in signal units and in the case that its binary value is less than 63 indicates the length of a signal unit.
link-by-link signalling	A procedure for the exchange of signalling information directly between two signalling points that are either directly connected or via signalling transfer points.
link state control (LSC)	Coordinates functions of the signalling link including signal unit delimitation, signal unit alignment, error detection, error correction, initial alignment, signalling link error monitoring and flow control.
link status signal unit (LSSU)	A signal unit which contains status information about the signalling link in which it is transmitted.
linked operation	An operation invoked from one end of a dialogue that is linked to another operation previously invoked by the other end.
load sharing (general)	A process by which signalling traffic is distributed over two or more signalling or message routes, to provide for traffic equalization or security.
local reference	A local number, unambiguously identifying an SCCP connection within one SCCP entity.
<b>– M –</b>	
management inhibiting	se/alizaci)n A procedure included in signalling traffic management used to keep a signalling link unavailable to User Part generated signalling traffic, except for test and maintenance traffic.
mandatory fixed part	Part of a message that contains those parameters that are mandatory and of fixed length.
mandatory variable part	Part of a message that contains mandatory parameters of variable length.
message discrimination	The process which decides, for each incoming message, whether the signalling point is a destination point or if it should act as a signalling transfer point for that message and accordingly, whether the message should be handed to (signalling) message distribution or to (signalling) message routing functions.

message distribution		The process of determining, upon receipt of a signalling message at its destination point, to which User Part the signalling message is to be delivered.
message route (signalling-)		The signalling link or consecutive links connected in tandem that are used to convey a signalling message from an originating point to its destination point.
message routing (signalling-)		The process for selecting, for each signalling message to be sent, the signalling link to be used.
message signal unit (MSU)		A signal unit containing a service information octet and a signalling information field which is retransmitted by the signalling link control if it is received in error.
Message Transfer Part (MTP)		The functional part of a common channel signalling system which transfers signalling messages as required by all the users, and which performs the necessary subsidiary functions, for example error control and signalling security (levels 1, 2 and 3 of Signalling System No. 7).
message transfer part receiving time (Tmr)		The period which starts when the last bit of the signal unit leaves the signalling data link and ends when the last bit of the message has entered the User Part. It includes the handling time at level 2, the transfer time from level 2 to level 3, the handling time at level 3, the transfer time from level 3 to level 4.
message transfer part sending time (Tms)		The period which starts when the last bit of the message has left the User Part and ends when the last bit of the signal unit enters the data link for the first time. It includes the queueing delay in the absence of disturbances, the transfer time from level 4 to level 3, the handling time at level 3, the transfer time from level 3 to level 2, and handling time in level 2.
message transfer time at signalling transfer points (Tcs)	(Tcs) de se/alizacin (Tcs)	The period which starts when the last bit of the signal unit leaves the incoming signalling data link and ends when the last bit of the signal unit enters the outgoing signalling data link for the first time. It includes the queueing delay in the absence of disturbances, but not the additional queueing delay caused by retransmission.
Mobile Application Part (MAP)		The Application Entity dedicated to the communication aspects of the mobile application.
MTP routing verification test (MRVT)		A procedure used to determine if the data of the MTP routing tables in the signalling network are consistent.

## – N –

national signalling network	A network used for signalling, consisting of national signalling points and the connecting common channel signalling links, including the national signalling point of the gateway exchange connected to the international signalling network.
national signalling point (NSP)	A signalling point which belongs to the national signalling network.
negative acknowledgement (NACK)	An explicit request for retransmission of signal units, received in a corrupt form.
network indicator	The part of the subservice field within the service information octet that may be used to discriminate between national and international signalling messages.
Network Service Part (NSP)	The combination of the Message Transfer Part and the Signalling Connection Control Part.
nonassociated mode (of signalling)	The mode where messages for a signalling relation involving two (nonadjacent) signalling points are conveyed, between those signalling points, over two or more signalling links in tandem passing through one or more signalling transfer points.
nonadjacent signalling points	Two signalling points that are not directly connected by any signalling links.
normal routing of (signalling)	The routing of a given signalling traffic flow in normal conditions (i.e. in the absence of failures).
NSAP address (OSI-NSAP)	A global address as defined for OSI which is understandable over any network and can be used to address between networks.

## – O –

operation (TC-)	The action being requested of the remote end.
Operation, Maintenance and Administration Part (OMAP)	(SSEM) The Application Entity dedicated to the communications aspects of the Operation, Administration and Maintenance of the Signalling System No. 7 network and which may have an application for the Telecommunications Management Network (TMN).
optional part	Part of a message that contains parameters that may or may not occur in any particular message type.

originating (signalling-)	point	The signalling point in which a message is generated.
originating (OPC)	point code	A part of the label in a signalling message which uniquely identifies, in a signalling network, the (signalling) originating point of the message.

**– P –**

peer entities	Entities in the same layer but in different systems (nodes) which must exchange information to achieve a common objective.
peer protocol	A formal language used by peer entities to exchange information.
pilot	Sinusoidal signal transmitted over analogue FDM links for regulation and supervision purposes.
pointer	A single octet indicating the beginning of each mandatory variable parameter and optional part.
positive acknowledgement	A way to indicate correct transfer of message signal units.
preventive cyclic retransmission (error control) method	prŽventive preventiva A noncompelled, positive acknowledgement, cyclic retransmission forward error correction system.
processor outage	A situation in which a signalling link becomes unavailable, due to factors at a functional level higher than level 2. This may be because of, for example, a central processor failure.
Public Land Mobile Network (PLMN)	A public network dedicated to the operation of mobile radio communications.

**– Q –**

quasi-associated mode (of signalling)	A nonassociated mode (of signalling) in which the (signalling) message route is determined basically, for each signalling message, by information contained in this message (namely in its routing label) and is fixed in normal operation.
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**– R –**

reply	Any component sent back as the consequence of an operation invocation.
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reset (SCCP)	A service of the SCCP to return a connection to a predefined state, or to recover from loss of synchronization between two SCCP users.
restart (SCCP)	A recovery mechanism for signalling connection sections in the event of a node failure.
result	The component indicating the outcome (success or failure) of an operation.
retransmission buffer (RTB)	Storage in the signalling link control for signal units transmitted but not yet positively acknowledged.
retrieval	The process of transferring all those messages in the retransmission buffer of a signalling link (A), which have not yet been positively acknowledged, to the transmission buffers of alternative signalling links.
route set congestion control	A procedure included in the signalling route management which is used to update the congestion status of a signalling route in a given signalling point.
routing label	The part of the message label that is used for message routing in the signalling network. It includes the destination point code, the originating point code and the signalling link selection field.
<b>– S –</b>	
SCCP relation	A relationship between two SCCP users which allows them to exchange data over it. An SCCP relation can consist of one or several routes.
SCCP relay function	A function which provides an address translation to route an SCCP message to its destination, and may include coupling of connection sections for connection-oriented protocol classes.
SCCP route	A route 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 routing	A function based on the called party address information, which evaluates and translates the information, checks the addressee availability, and the need for coupling of connection sections.

SCCP routing verification test (SRVT)	A procedure used to determine if the data of the SCCP routing tables in the signalling network are consistent.
SCCP user	Functional entity which uses directly the services of the SCCP.
segmenting/reassembling	If the size of the user data is too big to be transferred within one message, user data are segmented into a number of portions, and reassembled at the receiving end.
sequence numbering	Each signal unit carries two sequence numbers for error correcting purpose.
sequencing	A service of the SCCP that preserves the sequence of Network Service Data Units.
service indicator (SI)	Information within a signalling message identifying the user to which the message belongs.
service information (octet) (SIO)	Eight bits, contained in a message signal unit, comprising the service indicator and the sub-service field.
signal unit (SU)	A group of bits forming a separately transferable entity used to convey information on a signalling link.
signal unit alignment	Signal unit alignment exists when flags are received at intervals which correspond to integral numbers of octets and which fall within certain upper and lower limits.
signal unit error rate monitoring	A procedure by which the error rate of an active signalling link is measured on the basis of a count of correctly checking and erroneous signal units.
signal unit sequence control	Procedures used at level 2 to ensure that message signal units are transported in sequence, without loss or duplication, over a particular signalling link.
signalling area/network code (SANC)	The field in the international signalling point code that identifies the zone and national signalling area or network. It consists of a code for the world geographical zone (3-bit) and a code for the area or network in a specific zone (8-bit).
Signalling Connection Control Part (SCCP)	Additional functions to the MTP to cater for both connectionless as well as connection-oriented network service and to achieve an OSI compatible network service.

signalling information	The information content of a signal or a signalling message.
signalling information (field) (SIF)	The bits of a message signal unit which carry information particular to a certain user transaction and always contain a label.
signalling link	A transmission means which consists of a signalling data link and its transfer control functions, used for reliable transfer of a signalling message.
signalling link activation	The process of making a signalling link ready to carry signalling traffic.
signalling link blocking	An event causing the unavailability of a signalling link, typically consisting in a "processor outage" condition at one end of that signalling link.
signalling link code (SLC)	A field of the label in the signalling network management messages, which indicates the particular signalling link to which the message refers among those interconnecting the two involved signalling points.
signalling link deactivation	The procedure by which a signalling link is taken out of service.
signalling link error monitoring	signal unit error rate monitoring.
signalling link failure	An event causing the unavailability of a signalling link, typically consisting in a failure in signalling terminal equipment or in the signalling data link.
signalling link group	A set of signalling links directly connecting two signalling points and having the same physical characteristics (bit rate, propagation delay, etc.).
signalling link management functions	Functions that control and take actions, when required, to preserve integrity of locally connected signalling links, e.g. by reconfiguration of the signalling link sets.
signalling link restoration	An event consisting in the initial alignment procedure on a signalling link following the removal of the previous causes of failure; if no other causes of unavailability exist (i.e. a signalling link blocked condition) then the signalling link becomes available.
signalling link selection field	A field of the routing label which is typically used by the message routing function to perform load sharing among different signalling links/link sets.

signalling link set		A set of one or more signalling links directly connecting two signalling points.
signalling link unblocking		An event consisting in the removal of the previous causes of signalling link blocking; if no other causes of unavailability exist (i.e. a signalling link failed condition), then the signalling link becomes available.
Signalling Management Application Process (SMAP)	Man-	The application process associated with the operation, administration, and management of the Signalling System No. 7.
signalling message		An assembly of signalling information pertaining to a call, management transaction, etc., that is transferred as an entity.
signalling message handling functions	han-	Functions that, at the actual transfer of a message, direct the message to the proper signalling link or User Part.
signalling network		A network used for signalling by one or more users and consisting of signalling points and connecting signalling links.
signalling components	network	Components which make up the signalling network, such as signalling points and common channel signalling links.
signalling functions	network	The functions which are performed by the Message Transfer Part at level 3 and are common to, and independent of, the operation of individual signalling links. They include the signalling message handling functions and the signalling network management functions.
signalling end point		A node in a signalling network associated with a call originating local exchange, terminating local exchange, or gateway exchange.
signalling network management functions		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 signalling network facilities.
signalling point		A node in a signalling network which either originates and receives signalling messages, or transfers signalling messages from one signalling link to another, or both.
signalling point code		A binary code uniquely identifying a signalling point in a signalling network. This code is used, according to its position in the label, either as destination point code or as originating point code.

signalling point numbering plan	A formal description of the method of translating end-user provided address information into an address understandable by the signalling network.
signalling point restart	A procedure that allows a graceful increase of traffic to a restarting node.
signalling point with SCCP relay function (SPR)	A node in a signalling network with SCCP relay functions.
signalling relation	A relation between two signalling points involving the possibility of information interchange between corresponding User Part functions.
signalling route	A predetermined path described by a succession of signalling points that may be traversed by signalling messages directed by a signalling point towards a specific destination point.
signalling route management functions	Functions that transfer information about changes in the availability of signalling routes in the signalling network.
signalling route-set-test procedure	A procedure, included in the signalling route management which is used to test the availability of a given signalling route, previously declared unavailable.
signalling traffic management functions	Functions that control and, when required, modify routing information used by the Message routing function and control the transfer of signalling traffic in a manner that avoids irregularities in the message flow.
signalling message transfer delay	The time a message will take to pass through the signalling network.
signalling transfer point (STP)	A signalling point with the function of transferring signalling messages from one signalling link to another and considered exclusively from the viewpoint of the transfer.
status field (SF)	The bits of a link status signal unit which indicate one of the major signalling link states.
subservice field (SSF)	The level 3 field containing the network indicator and two spare bits.
subsystem	A direct user of the Signalling Connection Control Part (SCCP) of Signalling System No. 7.

subsystem number (SSN)	A number to identify a subsystem using the SCCP either directly, like the ISDN User Part, or indirectly (via the Transaction Capabilities) like the OMAP.
system management application entity (SMAE)	The aspect of system Management Application Process involved with communication.
system management application process	The set of functions which collectively encompass system management.
<b>– T –</b>	
tag (key) (label)	The tag distinguishes one information element from another, and governs the interpretation of the contents.
Telephone User Part (TUP)	The User Part specified for telephone services.
traffic flow control (signalling-)	Actions and procedures intended to limit signalling traffic at its source in the case when the signalling network is not capable of transferring all signalling traffic offered by the User Parts, because of network failures or overload situations.
transaction	An association between two TC providers.
Transaction Capabilities (TC)	Functions which control information transfer between two or more nodes via a signalling network.
Transaction Capabilities Application Part (TCAP)	The part of the Transaction Capabilities that resides in the application layer of the OSI protocol references model.
transaction portion	The portion of the TCAP message that identifies whether the transaction is expected to consist of single or multiple messages and provides a means to associate these messages with a specific transaction and to terminate a transaction. The part of TCAP messages dealing with the control of transactions.
transceiver	A tone device inserted in the outgoing end of a circuit which performs the transmitter and receiver check test through a check loop.
transfer-allowed (procedure)	A procedure, included in the signalling route management, which is used to inform a signalling point that a signalling route has become available.

transfer (procedure)	controlled	A procedure, included in signalling route management, which does inform a signalling point of the congestion status of a signalling route.
transfer-prohibited (procedure)		A procedure, included in the signalling route management, which is used to inform a signalling point of the unavailability of a signalling route.
transfer (procedure)	restricted	A procedure, included in signalling route management, which does inform a signalling point of the restriction of a signalling route.
transmission buffer (TB)		Storage in the signalling link control for message signal units not yet transmitted.

– U –

unavailable signalling link		A signalling link which has been deactivated and cannot therefore carry signalling traffic.
user (of the signalling system)		A functional entity, typically a telecommunication service, which uses a signalling network to transfer information.
User Part (UP)		A functional part of the common channel signalling system which transfers signalling messages via the Message Transfer Part. Different types of User Parts exist (e.g. for telephone and data services), each of which is specified to a particular use of the signalling system.

– V-Z –

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