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Technology Series

Introduction to Signaling System No. 7

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1 INTRODUCTION

Signaling refers to a protocol or language used by the Network Elements (NEs) to exchange information, thus providing and maintaining services. The name "signaling" derives from former systems that used actual signals (pulses, DTMF, or MF tones) as a means of communication. Today's modern signaling systems exchange complex digital messages between Network Elements. Out-of-band signaling refers to systems that carry the signaling messages in a different (dedicated) path than that of the voice and data traffic.

Signaling System No. 7 (SS7) is a common channel signaling system developed by ITU-T (formerly CCITT) in response to a demand for more features and integrated data services. It is a high-speed, out-of-band signaling system based on ITU-T recommendation Q.700 series that has become a global standard for telecommunications. SS7 defines the architecture, procedures, and protocols for information exchange over digital channels. It is designed to support call setups, routing, billing, database information, and special service functions for PSTNs. The ITU-T definition of SS7 allows for national variants such as ANSI, Bellcore (North America), ETSI (used in Europe), and several country-dependant variants.

One timeslot on the signaling T1 (or E1) link is used for transmission of SS7 messages. Applications have the flexibility to define any of the 24 (or 31) timeslots as a signaling channel. This means one channel is assigned solely for sending the signaling information, whether

the system has one bearer channel or multiple bearer channels. In order to support this architecture, a new protocol was developed which is a variation of data packet switching. The signaling channel packets contain framing words, checksums, addresses, and information. The order of these packets is well defined and flexible in terms of user requirements.

Examples of some applications supported by SS7 are:

- PSTN
- ISDN (Voice and Data)
- Interaction with Network Databases and Service Control Points for service control
- Mobile Services
- Operations Administration and Maintenance of Networks

SS7 networks provide the following functionality:

- Basic call setup, management, billing, and release
- Enhanced call features such as call waiting, call forwarding, calling party name/number display/restriction/rejection, and three-way calling
- Handling congestion and priorities
- Wireless services such as PCS, wireless roaming, and mobile subscriber authentication
- Local number portability (LNP)
- Toll-free and toll services
- Exchange of database information between NEs
- Network management for efficient and secure worldwide telecommunications

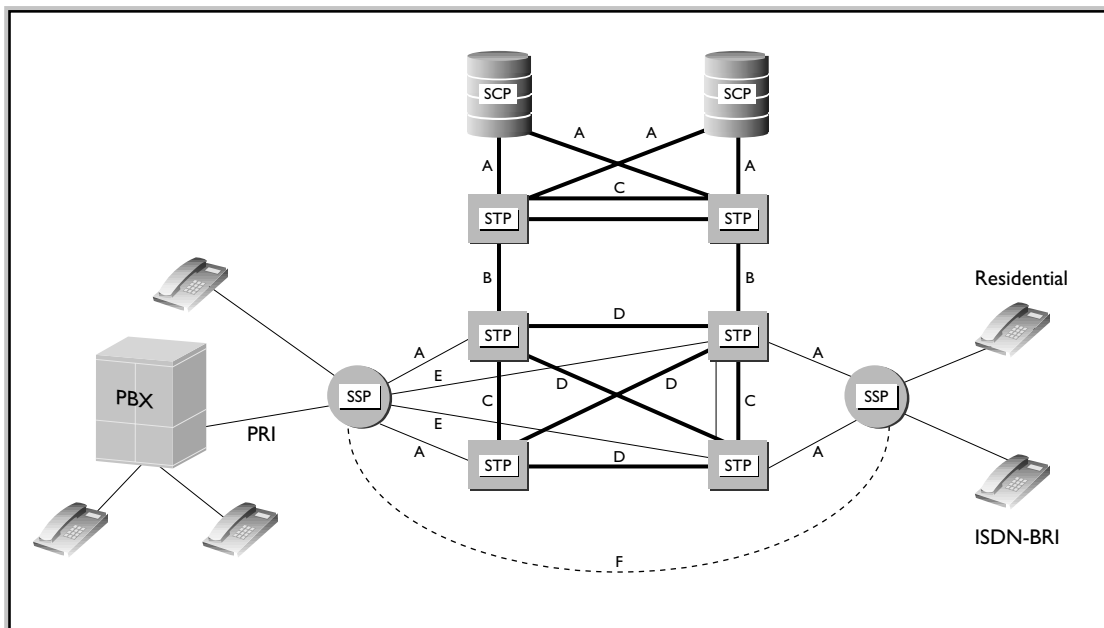


Figure 1 SS7 Network Structure

2 SIGNALING NETWORK ARCHITECTURE

2.1 Signaling Links

SS7 messages are exchanged between Network Elements over one or more signaling links. Signaling occurs out-of-band on dedicated channels rather than in-band on voice channels. Advantages of out-of-band over in-band signaling include:

- Speed: Faster call setup times (compared to in-band signaling using MF signaling tones)
- Efficiency: More efficient use of voice circuits, especially on international or long distance calls, where the voice channel is only occupied when the called party is available
- Flexibility: Complex messages, instead of simple signals, allow SS7 to offer more services
- Management: Support signaling between NEs without voice trunks (database systems, for example).
- Control: Improved control over fraudulent network usage.

Types of Signaling Links

The SS7 network structure allows different types of connections between SPs. These links are logically organized by types (A to F), according to their use in the network. All links are identical (56 or 64 kbps bi-directional data links) and support the same lower layer of the protocol.

A Link: An Access link connects a signaling end point or source point (for example, SCPs or SSPs) to an STP.

Only messages originating from or destined to the signaling end point are transmitted on an "A" link.

B Link: A Bridge link connects STPs. Typically, quads of B links interconnect primary STPs of one network to primary STPs of another network. The distinction between B and D links is rather arbitrary. For this reason, such links may be referred to as B/D links.

C Link: A Cross link connects STPs performing identical functions into a mated pair; they are used to enhance the reliability of the signaling network. A C link is used only when an STP has no other route available to a destination signaling point due to link failures. Note that SCPs may also be deployed in pairs to improve reliability, unlike STPs. However, signaling links do not interconnect mated SCPs.

D Link: A Diagonal link connects pairs of STPs at different hierarchical levels (for example, a secondary [local or regional] STP pair to a primary [inter-network gateway] STP pair in a quad-link configuration). Secondary STPs within the same network are connected via a quad of D links.

E Link: An Extended link connects an SSP to an alternate STP to provide an alternate signaling path. E links are not usually provisioned unless the benefit of a marginally higher degree of reliability justifies the added expense.

F Link: A Fully associated link connects two signaling end points (for example, SSPs and SCPs). F links are not usually deployed in networks with STPs, because they bypass the security features provided by the STPs. In networks without STPs, F links directly connect signaling points.

2.2 Signaling Points (SP)

Each signaling point in the SS7 network is uniquely identified by a numeric point code (PC). Point codes are carried in signaling messages exchanged between signaling points to identify the origination (OPC) and destination (DPC) of each message. Each signaling point uses a routing table to select the appropriate signaling path for each message.

Types of Signaling Points

Service Switching Points (SSP) are switches (exchanges or central offices) with SS7 software that originate, terminate, or tandem calls. An SSP sends signaling messages to other SSPs to setup, manage, and release voice circuits required to complete a call. An SSP may also send a query message to a centralized database (SCP) to determine how to route a call (for example, toll-free calls).

Signaling Transfer Points (STP) are packet switches that route network traffic between signaling points. An STP routes each incoming message to an outgoing signaling link based on routing information contained in the SS7 message. Since STPs act as network hubs, they improve the utilization of the SS7 network by eliminating the need for direct links between signaling points. STPs also offer specialized routing functions for toll-free 800 numbers, calling card numbers, or mobile subscriber identification numbers. An STP may also be used to screen the messages exchanged with other networks.

Service Control Points (SCP) are databases that provide information necessary for advanced call-processing capabilities. STPs are usually deployed in mated pair configurations in separate physical locations as a backup system. Traffic is shared across all links, so if one of the links fails, the signaling traffic is rerouted over another link. The SS7 protocol provides both error correction and retransmission capabilities to allow continued service in the event of signaling point or link failures.

3 SS7 PROTOCOL LAYERS (ARCHITECTURE)

Like the OSI reference model, the hardware and software functions of the SS7 protocol are also divided into functional layers. Initial SS7 architecture was based on circuit-related control telephony, but as new requirements have emerged, SS7 keeps evolving. It now allows non-circuit related information transfer, for example.

3.1 Message Transfer Part (MTP)

The MTP is divided into three levels:

- Signaling Data Link functions: Define the physical, electrical, and functional characteristics of the digital signaling link. Defined physical interfaces include, DS1 (1.544 Mbps), E1 (2.048 Mbps), V.35 (64 kbps), DS0 (64 kbps), and DS0A (56 kbps).
- Signaling Link functions: Define the functions and procedures to ensure that messages are reliably transmitted across a signaling link. They implement flow control, message sequence validation, and error checking. When an error occurs on a signaling link, the messages are retransmitted.
- Signaling Network functions: Define those transport functions and procedures that are common to and independent of individual signaling links. They provide message routing between signaling points in the SS7 network. They also re-route traffic away from failed links and signaling points, and control traffic when congestion occurs.

3.2 Signaling Connection Control Part (SCCP)

Provide additional functions to the MTP, to support connectionless and connection-oriented network services and Global Title Translation (GTT). SCCP provides subsystem numbers to allow messages to be addressed to specific applications or subsystems at specified signaling points. SCCP is used as the transport layer for TCAP-based services.

GTT: Adds the ability to perform incremental routing and frees the originating signaling point of having to know every possible destination. A global title is an address (an 800 number, calling card number, or mobile subscriber identification number) which is translated by SCCP into a destination point code and subsystem number. A subsystem number uniquely identifies an application at the destination signaling point. SCCP is used as the transport layer for TCAP-based services.

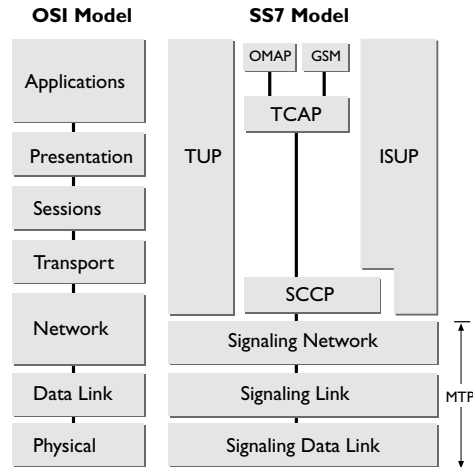


Figure 2 OSI and SS7 layers

3.3 Telephone User Part (TUP)

Defines the international telephone call control signaling functions for basic call setup and release. TUP was an earlier implementation of SS7 and does not allow for data type applications.

3.4 ISDN User Part (ISUP)

Defines the protocol used to setup, manage, and release trunk circuits that carry voice and data between SSPs. ISUP is used for both ISDN and non-ISDN calls. However, calls that originate and terminate at the same switch do not use ISUP signaling.

3.5 Transaction Capabilities (TC)

Provides the means to establish non-circuit related communications between two SPs.

Transaction Capabilities Applications Part (TCAP):

Supports the exchange of non-circuit related data between applications across the SS7 network using the SCCP connectionless service as a transport. Queries and responses sent between SSPs and SCPs are carried in TCAP messages. In mobile networks (IS-41 and GSM), TCAP carries Mobile Application Part (MAP) messages sent between mobile switches and databases to support user authentication, equipment identification, and roaming.

3.6 Operations, Maintenance and Administration Part (OMAP) and ASE

OMAP defines messages and protocols that assist the administration of SS7 networks. OMAP services may be used to verify network routing databases and to diagnose link problems. Application Service Element (ASE) is a module or portion of a protocol in the application layer 7 of the OSI (Open Systems Interconnection) protocol stack. Several ASEs are usually combined to form a complete protocol.

4 MESSAGE TRANSFER PART (MTP)

4.1 Signaling Link Messages

There are three types of signal units (SUs): Fill-In Signal Units (FISUs), Link Status Signal Units (LSSUs), and Message Signal Units (MSUs).

Fill-In Signal Units (FISU) operate when there is no other SU traffic present. FISUs are transmitted continuously on a signaling link in both directions to keep the link alive and aligned. They carry a checksum (CK) so that signaling link quality is continually checked by the SPs at each end of the link (see Figure 3).

Link Status Signal Units (LSSU) are used to exchange link status information between the SPs at each end of a link. They are used to control link alignment and to give status of a signaling point to the remote signaling point (see Figure 4).

Message Signal Units (MSU) are the containers that carry TUP, ISUP, and SCCP protocol messages (within the SIF). They carry all call control, database query and response, network management, and network maintenance data; there are additional specialized functions pertaining to mobile cellular applications. MSUs have a routing label that allows an originating signaling point to send information to a destination signaling point across the network (see Figure 5).

Flag (0111 1110) indicates the beginning of a new signal unit and implies the end of the previous signal unit (if any). False flags are removed before transmitting the message by adding a zero after any sequence of five ones (bit stuffing).

BSN (Backward Sequence Number) acknowledges the receipt of signal units by the remote signaling point. The BSN contains the sequence number of the signal unit being acknowledged. Every single message needs to be acknowledged by means of BSN.

BIB (Backward Indicator Bit) is used for error recovery and indicates a negative acknowledgment by the remote signaling point when inverted.

FSN (Forward Sequence Number) contains the sequence number of the signal unit.

FIB (Forward Indicator Bit) is used in error recovery; it also transmits when the originating signaling point receives a negative acknowledgment. It retransmits all forward messages, beginning with the corrupted message; in this instance, the FIB is inverted.

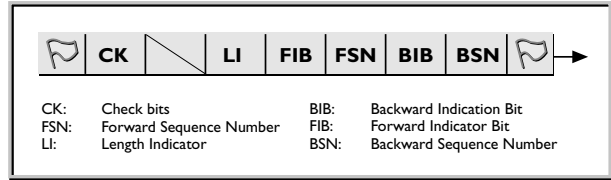


Figure 3 FISU message structure

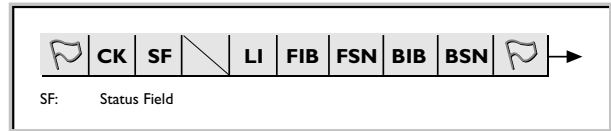


Figure 4 LSSU message structure

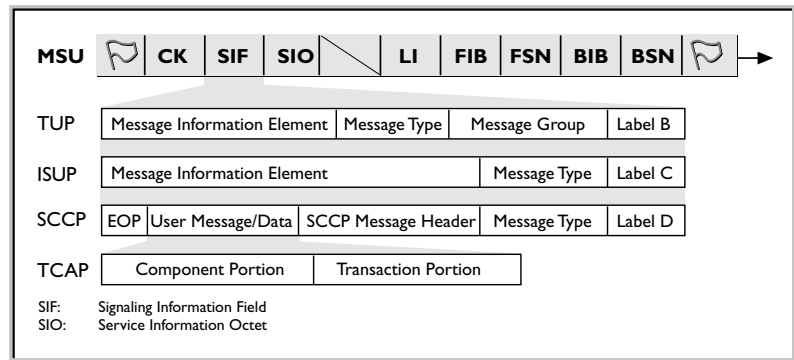


Figure 5 MSU message structure

SIO (Service Information Octet) contains the subservice field and service indicator.

- Subservice Field contains the network indicator (national or international) and the message priority. Message priority is considered only under congestion conditions. Low priority messages may be discarded during periods of congestion. Signaling link test messages receive a higher priority than call setup messages.
- Service Indicator specifies the MTP user (TUP, ISUP, DUP, SCCP, SNM, MTNE).

SIF (Signaling Information Field) contains the routing label and signaling information (i.e., SCCP, TCAP, and ISUP message data). LSSUs and FISUs contain neither a routing label nor an SIO as they are sent between two directly connected signaling points. See Figure 6 on next page.

CK (Check bits) is a CRC value used to detect and correct data transmission errors.

4.2 Signaling Network

The signaling network provides message routing between SPs based on the routing label in the SIF. It re-routes traffic away from failed links and signaling points and controls traffic when congestion occurs.

Point codes (OPC and DPC) are hierarchical numeric addresses that identify each signaling point in the SS7 network. Addresses are required so that a node can exchange messages with other SPs that are not connected via a physical link. A PC address can be 14-bits or 24-bits long, depending on the standard, and contains three identifiers (Network, Cluster, and Node addresses). ITU-T point codes are pure binary numbers that identify the zone, area/network, and SP identification numbers.

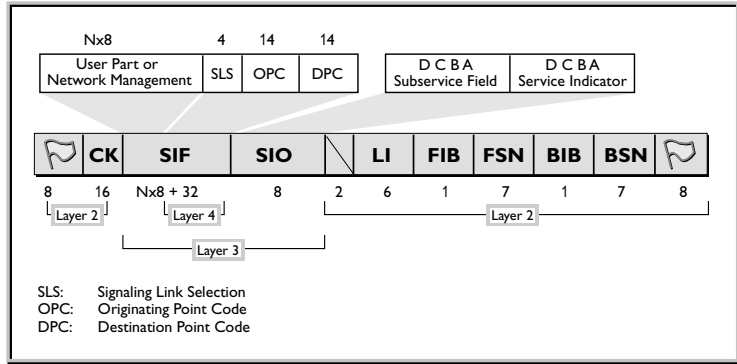


Figure 6 SIF and SIO field structure

5 ISDN USER PART (ISUP)

ISUP defines the protocol and procedures used to set up, manage, and release trunk circuits that carry voice and data calls over the public switched telephone network. It is used for both ISDN and non-ISDN calls. Calls that originate and terminate at the same switch do not use ISUP signaling.

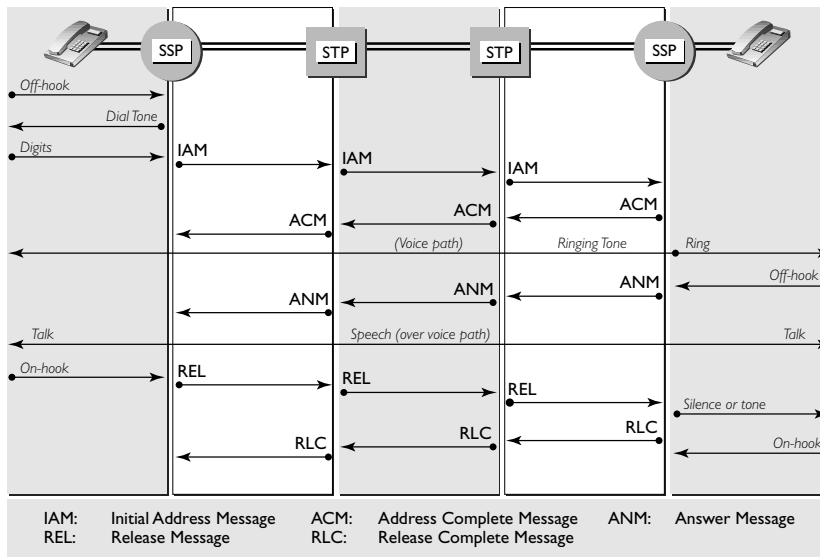


Figure 7 Sample of basic ISUP call

5.1 ISUP Message Structure

In an ISUP message, the SIF contains the routing label followed by a 14-bit (ANSI) or 12-bit (ITU) circuit identification code (CIC). The CIC indicates the trunk circuit reserved by the originating switch to carry the call. The message type field (IAM, ACM, ANM, REL, and RLC), which defines the contents of the remainder of the message, follows the CIC. See Figure 8.

5.2 Initial Address Message (IAM)

This contains call setup information and is sent when the switch needs to complete the circuit between the calling party and called party. An IAM contains the called party number in the mandatory variable part and may contain the calling party name and number in the optional part.

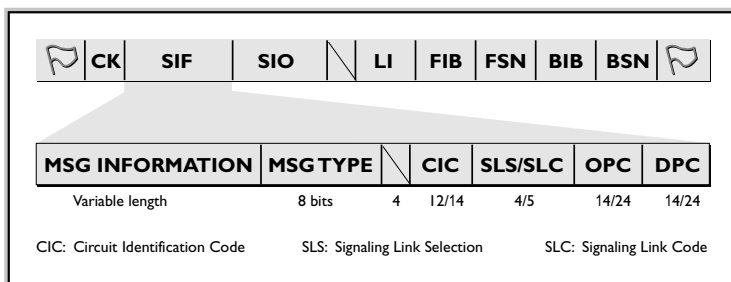


Figure 8 ISUP message structure

5.3 Address Complete Message (ACM)

ACM indicates that the called party is available and a remote end of a trunk circuit has been reserved. The originating switch responds to an ACM message by connecting the calling party's line to the trunk; this completes the voice circuit from the calling party to the called party. The calling party hears the ringing tone on the voice trunk generated by the destination switch.

5.4 Answer Message (ANM)

When the called party answers, the destination switch terminates the ringing tone and sends an Answer Message (ANM) to the originating switch. The originating switch initiates billing after verifying that the calling party's line is connected to the reserved trunk.

5.5 Release Message (REL)

This indicates that the circuit is being released and specifies a release cause. A REL is sent when either the calling or called party "hangs up" the call (cause=16). A REL is also sent in the backward direction if the called party line is busy (cause=17) or if no channel is available (cause=34).

5.6 Release Complete Message (RLC)

Acknowledges the reception of REL from the remote end of a trunk circuit and ends the call and billing cycle.

6 TRANSACTION CAPABILITIES APPLICATION PART (TCAP)

Enables the deployment of advanced intelligent network services by supporting non-circuit related information exchange between signaling points using the SCCP connectionless service. An SSP uses TCAP to query an SCP to determine the routing numbers associated with a dialed 800, 877, 888, or 900 numbers. The SCP uses TCAP to return a response containing the routing numbers, plus any error/reject messages, back to the SSP. Calling card calls are also validated using TCAP. When a mobile subscriber roams into a new mobile switching center (MSC) area, the integrated visitor location register requests service profile information from the subscriber's home location register (HLR). This is accomplished using mobile application part (MAP) information carried within TCAP messages.

A TCAP message is comprised of a transaction portion and a component portion, described in detail in the following section.

6.1 Transaction Portion

Contains the package type identifier. There are seven package types:

- Unidirectional: Transfers components in one direction and no reply is expected.
- Query with Permission: Initiates a transaction. The destination node may end the transaction.
- Query without Permission: Initiates a transaction. The destination node cannot end the transaction.
- Response: Ends the transaction. A response to a query with permission may contain the routing numbers associated with an 800 number.
- Conversation with Permission: Continues a transaction. The destination node may end the transaction.
- Conversation without Permission: Continues a transaction. The destination node cannot end the transaction.
- Abort: Terminates a transaction due to an abnormal situation.

The transaction portion also contains the Originating Transaction ID and Responding Transaction ID fields. These associate the transaction with a specific application at the originating and destination SPs.

6.2 Component Portion

There are six kinds of components:

- Invoke (Last): Invokes an operation. For example, a Query with Permission transaction may include an Invoke (Last) component to request SCP translation of a dialed 800 number. The component is the last component in the query.
- Invoke (Not last): Similar to the Invoke (Last) component, except that the component is followed by one or more components.
- Return Result (Last): Returns the result of an invoked operation. The component is the last component in the response.
- Return Result (Not last): Similar to the Return Result (Last) component, except that the component is followed by one or more components.
- Return Error: Reports the unsuccessful completion of an invoked operation.
- Reject: Indicates that an incorrect package type or component was received.

Components include parameters which contain application-specific data unexamined by TCAP.

7 LIST OF SS7 RECOMMENDATIONS

Topic	No.
Message Transfer Part (MTP)	Q.701-Q.704, Q.706, Q.707 ANSI T1.111.2-7 (USA) JT-Q.701-JT-Q.707 (Japan)
Telephone User Part (TUP) including some supplementary services	Q.721-Q.725
Supplementary Services	Q.730 Series
Data User Part (DUP)	Q.741, X.61
ISDN User Part (ISUP)	Q.761-Q.764, Q.766 ANSI T1.113 JT-Q.761 - JT-Q.764
Signaling Connection Control Part (SCCP)	Q.711-Q.714, Q.716 ANSI T1.112 JT-Q.711 - JT-Q.714
Transaction Capabilities (TC)	Q.771-Q.775 ANSI T1.114 JT-Q.771 - JT-Q.775
Operations Maintenance and Administration Part (OMAP)	Q.750-Q.755

Other Related ITU-T Recommendations

G.705	Signaling Network Structure
G.708	Numbering of International Signaling Point Codes
G.709	Hypothetical signaling reference connection
G.710	PABX application
G.780	SS No. 7 Test Specification (General)
G.781	MTP Level 2 Test Specification
G.782	MTP Level 3 Test Specification
G.783	TUP Test Specification
G.784	ISUP Test Specification
G.785	ISUP Supplementary Service Test Specification
G.786	SCCP Test Specification
G.787	TCAP Test Specification
X.61	Data User Part (DUP)

8 GLOSSARY

A

A link	Access Link
ACB	Access Barring Signal (TUP)
ACC	Automatic Congestion Control Information Message (TUP)
ACM	Address Complete Message (ISUP, TUP)
ADI	Address Incomplete Signal (TUP)
AK	Data Acknowledgement (SCCP Message)
ANC	Answer Signal, Charge (TUP)

ANN	Answer Signal, No Charge (TUP)
ANM	Answer Message (ISUP)
ANSI	American National Standards Institute
ANU	Answer Signal Unqualified (TUP)
ASE	Application Service Element

B

B link	Bridge Link
BELLCORE	Bell Communication Research. Now
BIB	Backward Indicator Bit
BLA	Blocking Acknowledgement Signal (ISUP, TUP)
BLO	Blocking Signal (ISUP, TUP)
BSM	Backward Set-up Message (TUP)
BSN	Backward Sequence Number

C

C links	Cross Links
C7	Signaling System No.7. This is another refer to SS7
CBA	Changeback Acknowledgement Signal (SNM/
CBD	Changeback Declaration Signal (SNM/SNT)
CBK	Clear-Back Signal (TUP)
CC	Connection Confirm (SCCP Message)
CCF	Continuity Failure Signal (TUP)
CCITT	International Telegraph & Telephone Consulta- (now ITU-T)
CCL	Calling Party Clear Signal (TUP)
CCM	Circuit Supervision Message (TUP)
CCR	Continuity-Check Request Message (ISUP, TUP)
CCS	Common Channel Signaling
CCSS7	Common Channel Signaling System No.7. This way to refer to SS7
CFL	Call Failure Signal (TUP)
CFN	Confusion Message (ISUP)
CGB	Circuit Group Blocking Message (ISUP)
CGBA	CGB Acknowledgement Message (ISUP)
CGC	Circuit Group Congestion Signal (TUP)
CGU	Circuit Group Unblocking Message (ISUP)
CGUA	CGU Acknowledgement Message (ISUP)
CHG	Charging Message (TUP)
CHM	Changeover and Changeback Messages (SNM/
CIC	Circuit Identification Code
CK	Check bits
CLEC	Competitive Local Exchange Carrier
CLF	Clear Forward Signal (TUP)
CMC	Call Modification Completed Message (ISUP)
CMR	Call Modification Request Message (ISUP ITU)
CMRJ	Call Modification Reject Message (ISUP ITU)
CNM	Circuit Network Management Message Group
CNP	Connection Not Possible Signal (SNM/SNT)
CNS	Connection Not Successful Signal (SNM/SNT)
COA	Changeover Acknowledgement Signal (SNM/
CON	Connect Message (ISUP ITU)
COO	Changeover Order Signal (SNM/SNT)
COT	Continuity Check Message (ISUP, TUP)

CPG	Call Progress Message (ISUP)	FISU	fill in signal unit
CQM	Circuit Query Message (ISUP)	FOT	Forward Transfer Message (ISUP, TUP)
CQR	Circuit Query Response Message (ISUP)	FRJ	Facility Rejected Message (ISUP ITU)
CR	Connection Request (SCCP Message)	FSM	Forward Set-up Message (TUP)
CRA	Circuit Reservation Acknowledgement Message (ISUP ANSI)	FSN	Forward sequence number
CREF	Connection Refused (SCCP Message)	G	
CRG	Charge Information Message (ISUP ITU)	GRA	Circuit Group Reset Acknowledgement Message (ISUP, TUP)
CRM	Circuit Reservation Message (ISUP)	GRM	Circuit Group Supervision Message (TUP)
CSM	Call Supervision Message (TUP)	GRQ	General Request Message (TUP)
CSS	Connection Successful Signal (SNM/SNT)	GRS	Circuit Group Reset Message (ISUP, TUP)
CVR	Circuit Validation Response Message (ISUP ANSI)	GSM	General Forward Set-up Information Message (TUP)
CVT	Circuit Validation Test Message (ISUP ANSI)	GSM	Global Service Mobile
D		GTT	Global Title Translation
D links	Diagonal Links	H	
DLC	Signaling Data Link Connection Order Signal (SNM/SNT)	HBS	Hardware Failure Oriented Group Blocking Acknowledgment Message (TUP)
DLP	Signaling Data Link Connection Order Message (SNM/SNT)	HGH	Hardware Failure Oriented Group Blocking Message (TUP)
DPC	Destination point code	HGU	Hardware Failure Oriented Group Unblocking Message (TUP)
DPN	Digital Path Not Provided Signal (TUP)	HLR	Home Location Register
DRS	Delayed Release Message (ISUP ITU)	HUA	Hardware Failure Oriented Group Unblocking Acknowledgment Message (TUP)
DT1	Data Form 1 (SCCP Message)	I	
DT2	Data Form 2 (SCCP Message)	IAI	Initial Address Message with Additional Information (TUP)
DTMF	Dual Tone Multi-Frequency code	IAM	Initial Address Message (ISUP, TUP)
E		ILEC	Incumbent Local Exchange Carrier
E link	Extended Link	IN	Intelligent Network
EA	Expedited Data Acknowledgement (SCCP Message)	INF	Information Message (ISUP)
ECA	Emergency Changeover Acknowledgement Signal (SNM/SNT)	INR	Information Request Message (ISUP)
ECM	Emergency Changeover Message (SNM/SNT)	ISDN	Integrated services digital network
ECO	Emergency Changeover Order Signal (SNM/SNT)	ISO	International Standards Organization
ED	Expedited Data (SCCP Message)	ISP	Intermediate Service Part
ERR	Error (SCCP Message)	ISPC	International Signaling Point Code
ETSI	European Telecommunication Standards Institute	ISUP	ISDN User Part
EUM	Extended Unsuccessful Backward Set-up Information Message (TUP)	IT	Inactivity Test (SCCP Message)
EXM	Exit Message (ISUP ANSI)	ITU	International Telecommunication Union
F		ITU-T	International Telecommunication Union, Telecommunication Standardization Sector (formerly CCITT)
F	Flag	K	
F link	Fully Associated Link	kbits	Kilobits per second (kbit/s, kb/s)
FAA	Facility Accepted Message (ISUP ITU)	L	
FAM	Forward Address Message (TUP)	LFU	Link Forced Unhibit Message (SNM/SNT)
FAR	Facility Request Message (ISUP ITU)	LI	Length Indicator
FCM	Signaling Traffic Flow Control Message (SNM/SNT)	LIA	Link Inhibit Acknowledgement Message (SNM/SNT)
FCS	Frame Check Sequence		
FIB	Forward indicator bit		

LID	Link Inhibit Denied Message (SNM/SNT)	RLG	Release Guard Signal (TUP)
LIN	Link Inhibit Message (SNM/SNT)	RLSD	Released (SCCP Message)
LLI	Link Local Inhibit Test Signal (SNM/SNT)	RSC	Reset Circuit Message (ISUP, TUP)
LOS	Line Out-of-Service Signal (TUP)	RSC	Reset Confirm (SCCP Message)
LPA	Loopback Acknowledgement Message (ISUP)	RSM	Route Set Test Messages (SNM/SNT)
LPN	Local Number Portability	RSP	Route Set Test Prohibited Message (SNM/SNT)
LRI	Link Remote Inhibit Test Signal (SNM/SNT)	RSR	Route Set Test Restricted Signal (SNM/SNT)
LSSU	Link Status Signal Unit	RSR	Reset Request (SCCP Message)
LUA	Link Uninhibit Acknowledgement (SNM/SNT)		
LUN	Link Uninhibit Message (SNM/SNT)		
M		S	
MAP	Mobile Application Part	SAM	Subsequent Address Message (ISUP ITU, TUP)
MBA	Maintenance Oriented Group Blocking Acknowledgment Message (TUP)	SANC	Signaling Area Network Code
MF	Multi-Frequency code (tone)	SAO	Subsequent Address Message with One Signal (TUP)
MGB	Maintenance Oriented Group Blocking Message (TUP)	SBA	Software Generated Group Blocking Acknowledgement Message (TUP)
MGU	Maintenance Oriented Group Unblocking Message (TUP)	SBM	Successful Backward Set-up Information Message (TUP)
MIM	Management Inhibiting Message (SNM/SNT)	SCCP	Signaling Connection Control Part
MPR	Misdialed Trunk Prefix (TUP)	SCP	Service Control Point
MSC	Mobile Switching Center	SEC	Switching Equipment Congestion Signal (TUP)
MSG	Message Group (SNM/SNT)	SEP	Signaling End Point
MSU	Message Signal Unit	SF	Status Field
MTP	Message transfer part	SGB	Software Generated Group Blocking Message (TUP)
MUA	Maintenance Oriented Group Unblocking Acknowledgment Message (TUP)	SGU	Software Generated Group Unblocking Message (TUP)
N		SI	Service Indicator
NNC	National Network Congestion Signal (TUP)	SIF	Signaling Information Field
O		SIO	Service Indicator Octet
OLM	Overload Message (ISUP ITU)	SLC	Signaling Link Code
OMAP	Operations, Maintenance, and Administration Part	SLS	Signaling Link Selection
OPC	Originating Point Code	SLTA	Signaling Link Test Acknowledgement (SNM/SNT)
OSI	Open Systems Interconnect	SLTM	Signaling Link Test Message (SNM/SNT)
P		SNM	Signaling Network Management
PCS	Personal Communications Services	SNT	Signaling Network Testing
PSTN	Public Switched Telephone Network	SP	Signaling Point
R		SPC	Signaling Point Code
RAN	Re-answer Signal (TUP)	SPR	Signaling Point with SCCP Relay Function
RBOC	Regional Bell Operating Company	SS7	Signaling System 7
RCL	Release Complete Message	SSB	Subscriber Busy Signal
RCP	Route Set Test Cluster Prohibited Signal (SNM/SNT)	SSF	Sub-Service Field
RCR	Route Set Test Cluster Restricted Signal (SNM/SNT)	SSP	Service Switching Point
RCT	Route Set Congestion Test Signal (SNM/SNT)	SST	Send Special Information Tone Signal (TUP)
RES	Resume Message (ISUP)	STP	Signal Transfer Point
REL	Release Message (ISUP)	SU	Signal Unit
RLC	Release Complete Message (ISUP, SCCP)	SUA	Software Generated Group Unblocking Acknowledgement Message (TUP)
		SUS	Suspend Message (ISUP)
		T	
		TC	Transaction Capabilities
		TCA	Transfer Cluster Allowed Signal (SNM/SNT)
		TCAP	Transaction capabilities application part

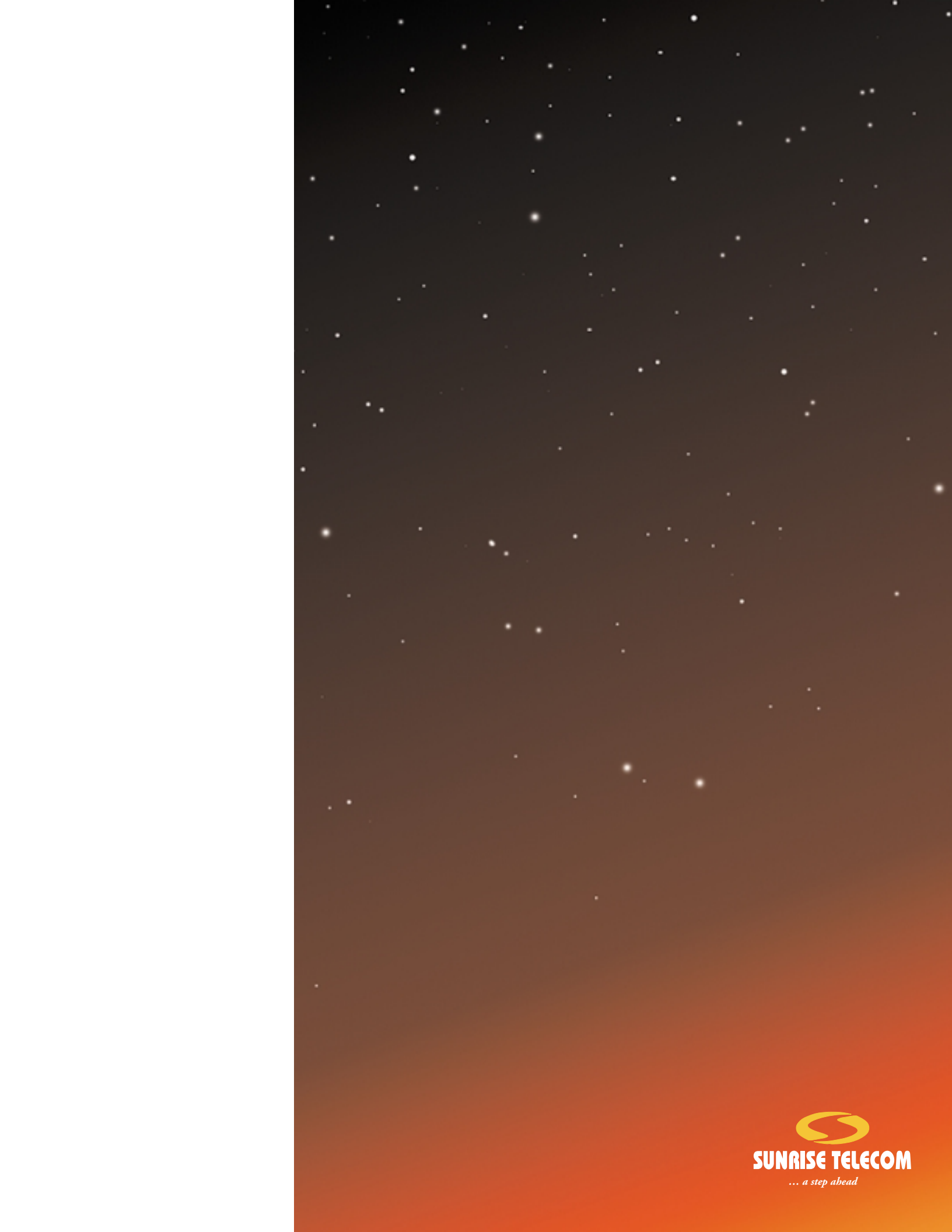
TCP	Transfer Cluster Prohibited Signal (SNM/SNT)
TCR	Transfer Cluster Restricted Signal (SNM/SNT)
TFA	Transfer Allowed Signal (SNM/SNT)
TFC	Transfer Controlled Signal (SNM/SNT)
TFM	Transfer Prohibited, Allowed, Restricted Messages (SNM/SNT)
TFP	Transfer Prohibited Signal (SNM/SNT)
TFR	Transfer Restricted Signal (SNM/SNT)
TRA	Traffic Restart Allowed Signal (SNM/SNT)
TRM	Traffic Restart Message (SNM/SNT)
TRW	Traffic Restart Waiting Signal (SNM/SNT)
TUP	Telephone User Part

U

UBA	Unblocking Acknowledgment Message (ISUP, TUP)
UBL	Unblocking Message (ISUP, TUP)
UBM	Unsuccessful Backward Set-up Information Message (TUP)
UDT	Unidata (SCCP Message)
UDTS	Unidata Service (SCCP Message)
UFC	MTP User Flow Control Messages (SNM/SNT)
UPU	User Part Unavailable Signal (SNM/SNT)
UNN	Unallocated Number Signal (TUP)
USIS	Unequipped Circuit Identification Code Message (ISUP)
USR	User-to-user Information Message (ISUP ITU)

X

XUDT	Extended Unidata (SCCP Message, ANSI)
XUDTS	Extended Unidata Service (SCCP Message, ANSI)



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