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# SS7 – Signaling System Number 7

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# SS7 – A Brief Overview

- Defined by ITU-T in its Q.700-series, ANSI, and ETSI
- Out-of-band signaling system
- Designed for call control, remote network management, and maintenance
- Combines circuit-switched and packet-switched networks
- Suitable for use on point-to-point terrestrial and satellite links
- SS7 networks are flexible, reliable, with capacity up to 64 Kbps

# T1 E1 Analyzer Hardware Platforms



**tProbe™ - Portable USB based T1 E1 VF  
FXO FXS and Serial Datacom Analyzer**

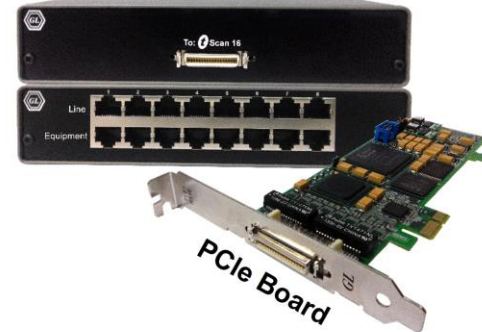


**Quad / Octal T1 E1 PCIe Card**



**Dual T1 E1 Express (PCIe) Board**

**tScan16™ with  
16-port T1 E1 Breakout Box**



**PCIe Board**

# TDM mTOP™ Solutions



**mTOP™ tProbe™ FXO FXS Dual UTA**

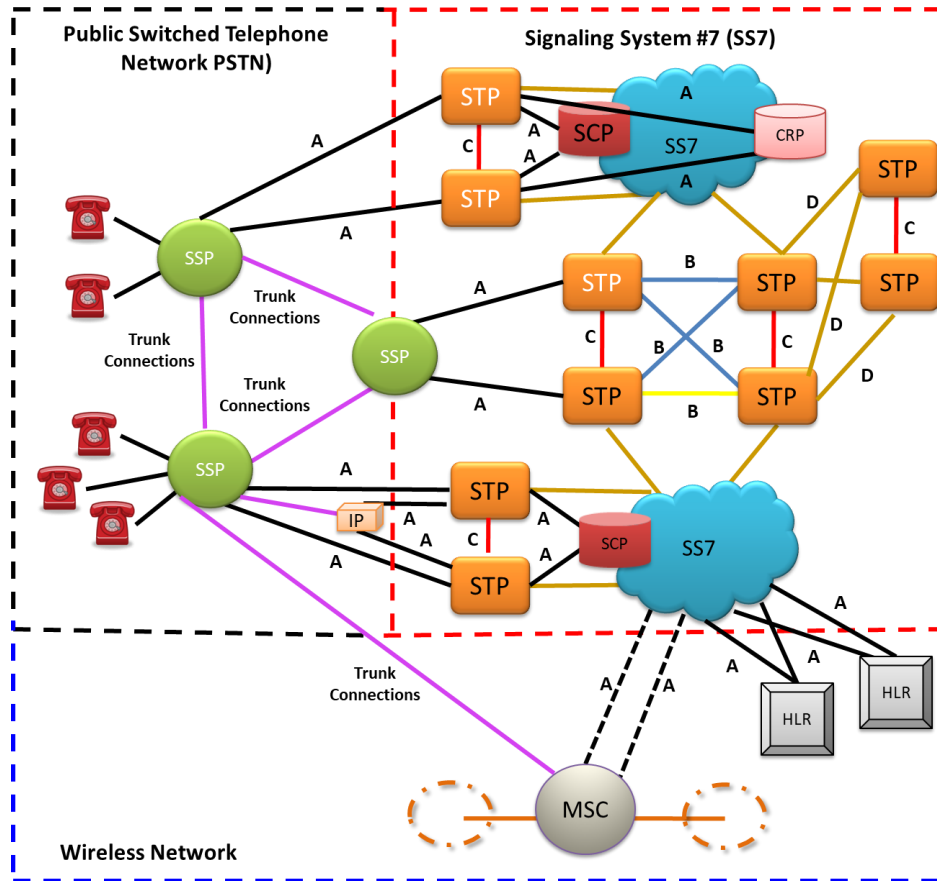


**1U tProbe™ w/ FXO FXS**

# Applications

- Allows telecommunications networks to offer wide ranges of services such as telephony, fax transmission, data transfer
- Setting up and tearing down circuit-switched connections
- Support for Intelligent Network (IN) services such as toll-free (800) calling, SMS, EMS
- Mobility management in cellular networks
- Local Number Portability (LNP) to allow subscribers to change their service, service provider, and location without needing to change their telephone number
- Support for ISDN

# SS7 Network Architecture

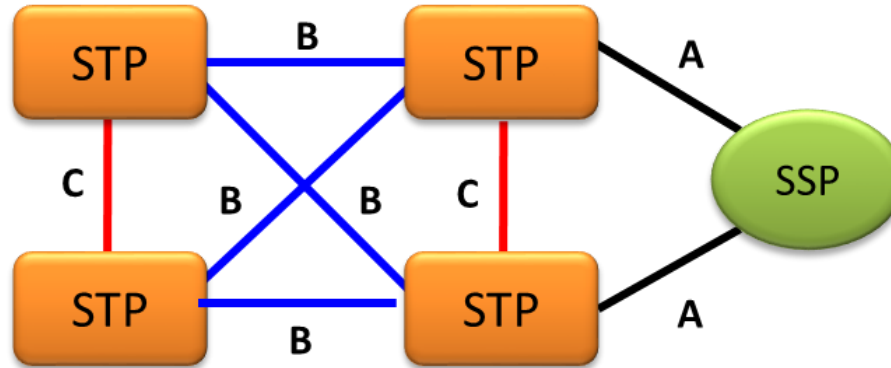


# Signaling Points

- SS7 constitutes three different types of Signaling Points (SP):
  - Signaling Transfer Point
  - Service Switching Point
  - Service Control Point

Signaling Transfer Points	Service Switching Points	Service Control Points
Transfers SS7 messages between other SS7 nodes	Capable of controlling voice circuits via a voice switch	Acts as an interface between telecommunications databases and the SS7 network
Acts as a router for SS7 messages	Converts signaling from voice switch into SS7 format	Provide the core functionality of cellular networks
Does not originate SS7 messages	Can originate and terminate messages, but cannot transfer them	Provides access to database

# Signaling Links

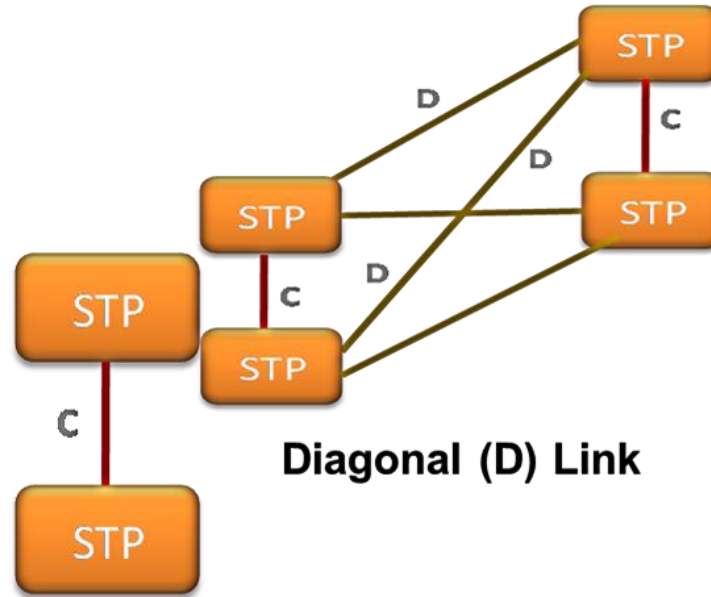


## Bridge (B) Link

- **Access Links** connects SCP or SSP to an STP. Only messages originating from or destined to the signaling end point are transmitted on an "A" link
- **Bridge Links** connect mated pairs of STPs to each other at the same hierarchical level

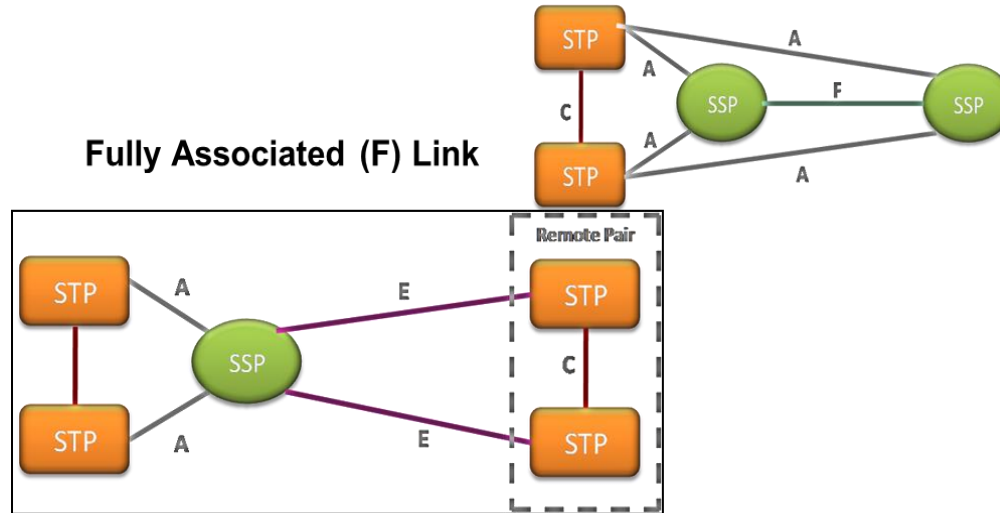


# Signaling Links (Contd.)



- **Cross Links** connect STP to its mate STP. Not used for routing
- **Diagonal Links** connect mated STP pairs from one hierarchical level to another mated STP pair at a higher level

# Signaling Links (Contd.)



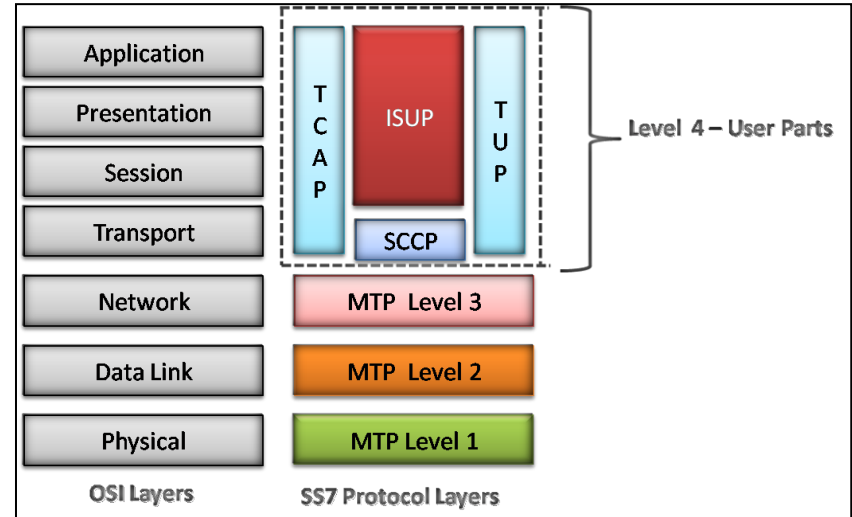
- **Extended Links** connect SSPs and SCPs to remote STP pairs
- **Fully Associated Links** route large amount of traffic between two SSPs. Connect network SSPs and/or SCPs directly to each other without using STPs

# SS7 Protocol Stack

SS7 is developed in a layered architecture like OSI model.

## OSI protocol stack implementation

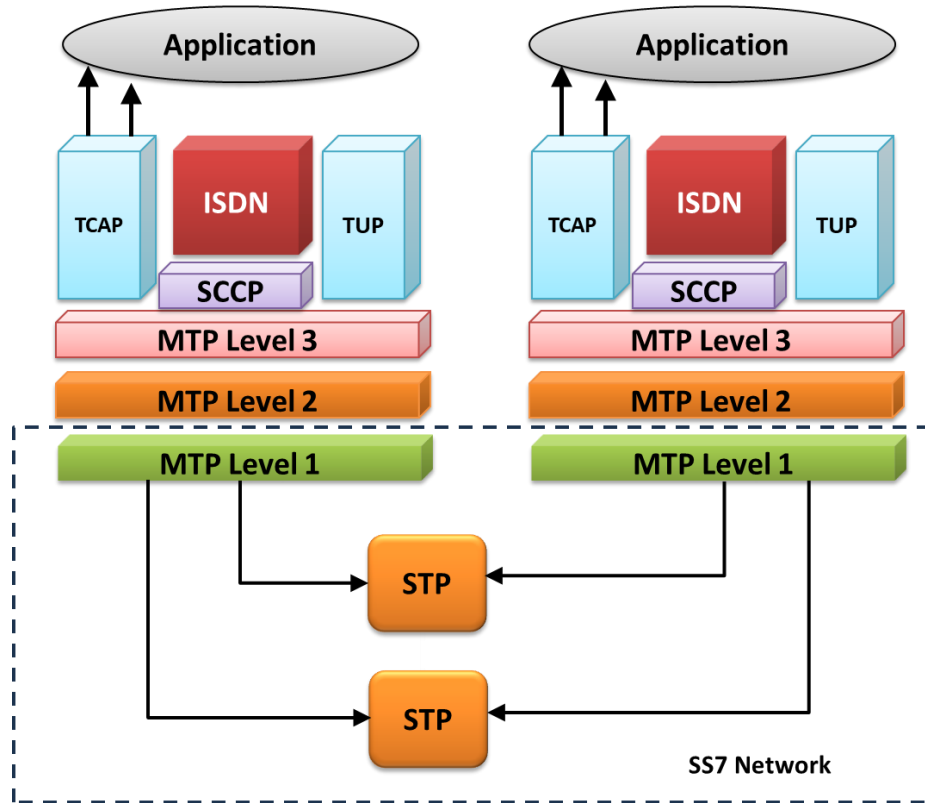
- Physical Layer (Level 1)- MTP Level 1
- Data link Layer (Level 2)- MTP Level 2
- Network Layer (Level 3)- MTP Level 3 + SCCP
- User Part (Level 4) - INAP, MAP, IS-41, TCAP, CAP, ISUP, etc.



# SS7 Layers (Contd.)

- Message Transfer Part (MTP) – divided into three levels
  - MTP Level 1 – defines the physical interfaces
  - MTP Level 2 – ensures reliable transfer of signaling messages
  - MTP Level 3 – provides message routing between signaling points in the SS7 network
- Signaling Connection Control Protocol (SCCP) –
  - Combination of MTP and SCCP forms the SS7 Network Services Part (NSP). Enhances the message carrying facilities of MTP
  - Provides some network layer protocol functions
- ISDN User Part (ISUP) and Telephone User Part (TUP) –
  - Defines the protocol used to set-up, manage, and release trunk circuits
- Transaction Capabilities Application Part (TCAP) –
  - Allow new applications to use SS7

# Application to Application Communication



# Signaling Link Level (MTP Level 2) and Signaling Units



Flag – 01111110

FCS - Frame Check Sequence

LI – Length Indicator

FIB – Forward Indicator Bit

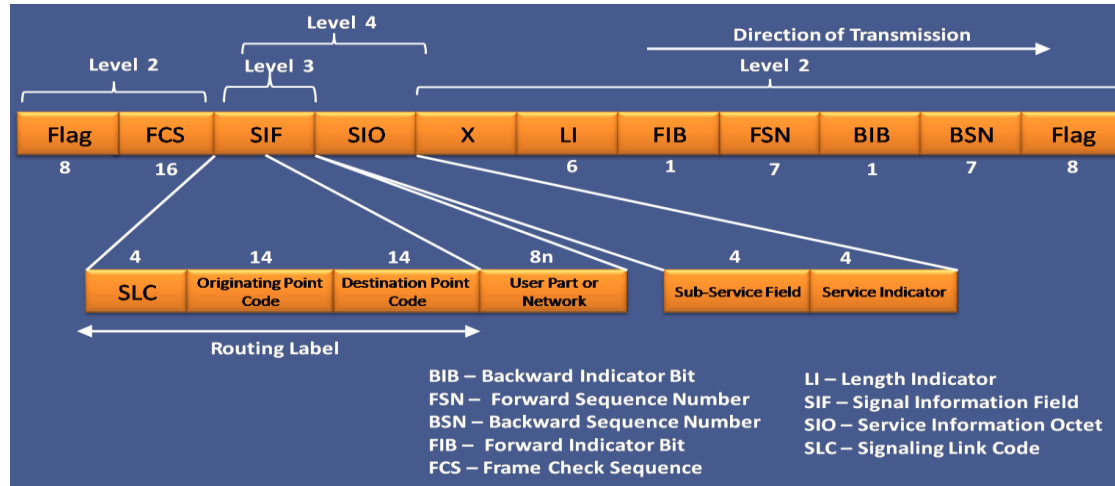
FSN – Forward Sequence Number

BIB – Backward Indicator Bit

BSN – Backward Sequence Number

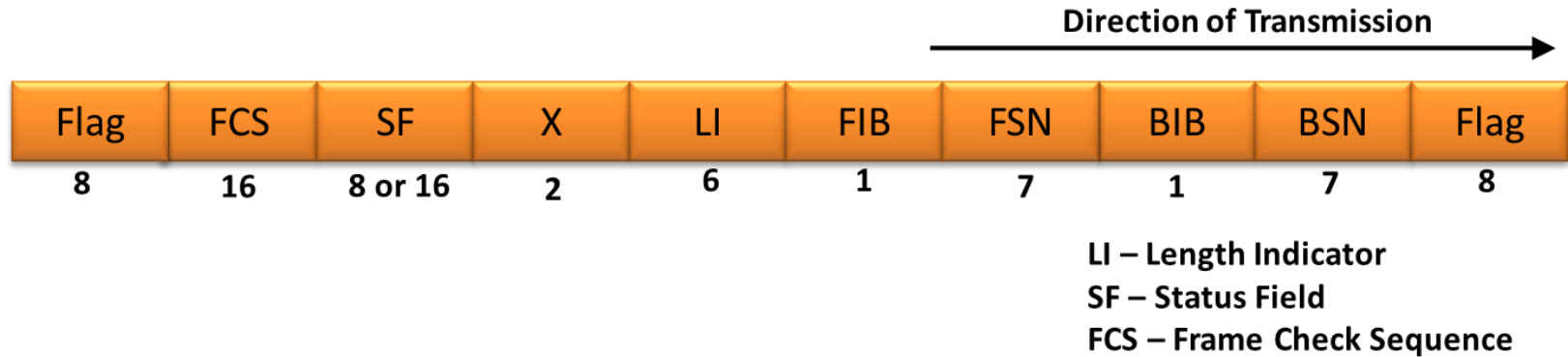
- Basic Frame Structure
- Frame with Error Correction (4 fields at the end and beginning of frame – BSN, BB, FSN, FB) and Length Indicator (contains info about bytes in information part, and message type)
- SS7 uses three types of signal units –
  - Message Signal Units (MSU)
  - Link Status Signal Unit (LSSU)
  - Fill-In Signal Unit (FISU)

# Message Signaling Unit



- Carries SS7 information
- Consists of MTP protocol fields and two additional fields
  - Service indicator octet (SIO) - indicates type of protocol at level 4, e.g., TUP, ISUP, and type of standard, e.g. national, international
  - Service information field (SIF) - used to carry control information as well as level 3 routing label. SIF can be up to 272 octets and is used by all level 4 protocols

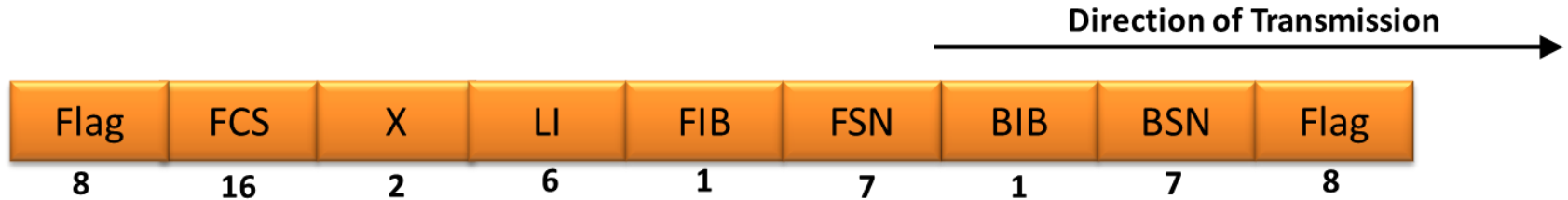
# Link Status Signaling Unit



- Carries link status information
- Used by level 3 at one node to transmit link status information to its adjacent node
- Used only on single point-to-point links, and never through the network
- Carries no information traffic on a link when LSSU are sent



# Fill-In Signaling Unit



- Used when no information needs be sent, and the network is idle
- Used to monitor error rates on links. This allows SS7 to be highly reliable as it can detect link quality even when idle
- Constantly monitors the link status

# Signaling in SS7 Network

## Signaling transfer point (STP):

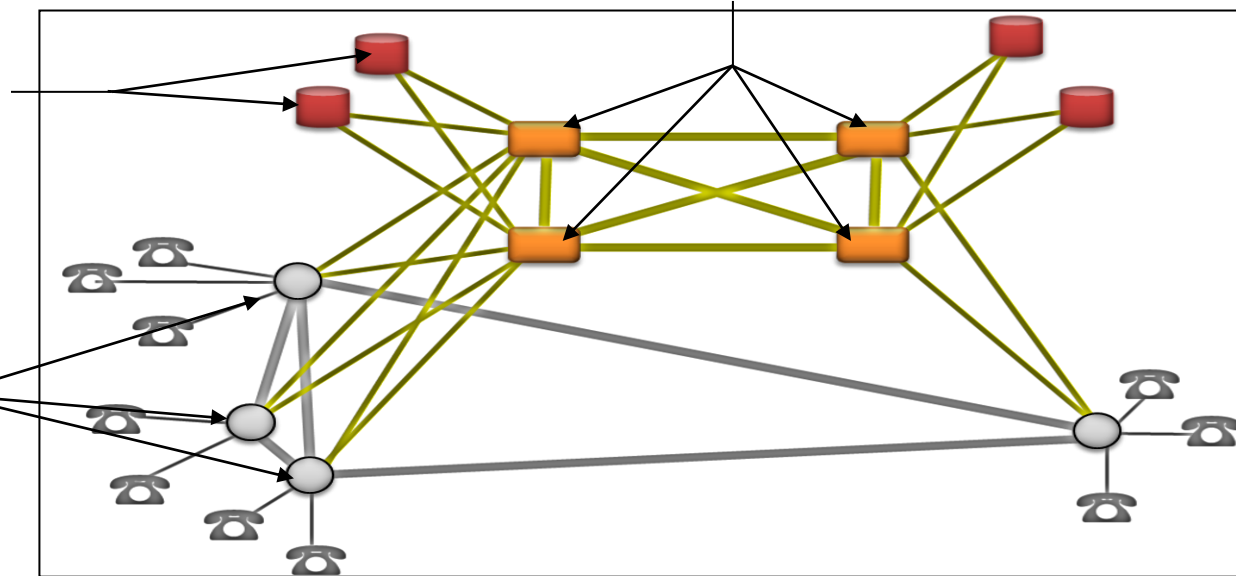
- Send/receive/route signaling messages
- Packet switches of SS7 network

## Signaling control point (SCP):

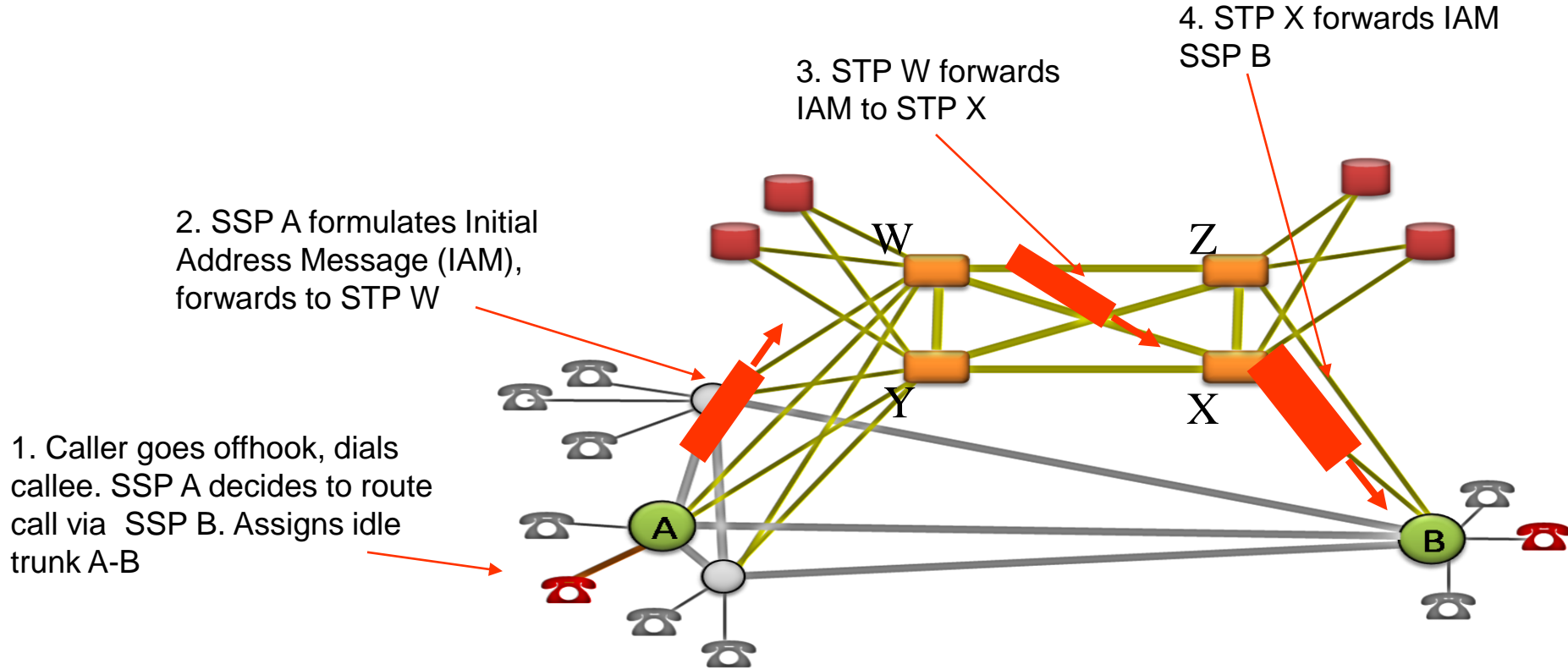
- “services” go here
- E.g., database functions

## Signaling switching point (SSP):

- attach directly to end user
- endpoints of SS7 network



# Signaling in SS7 Network (Contd.)

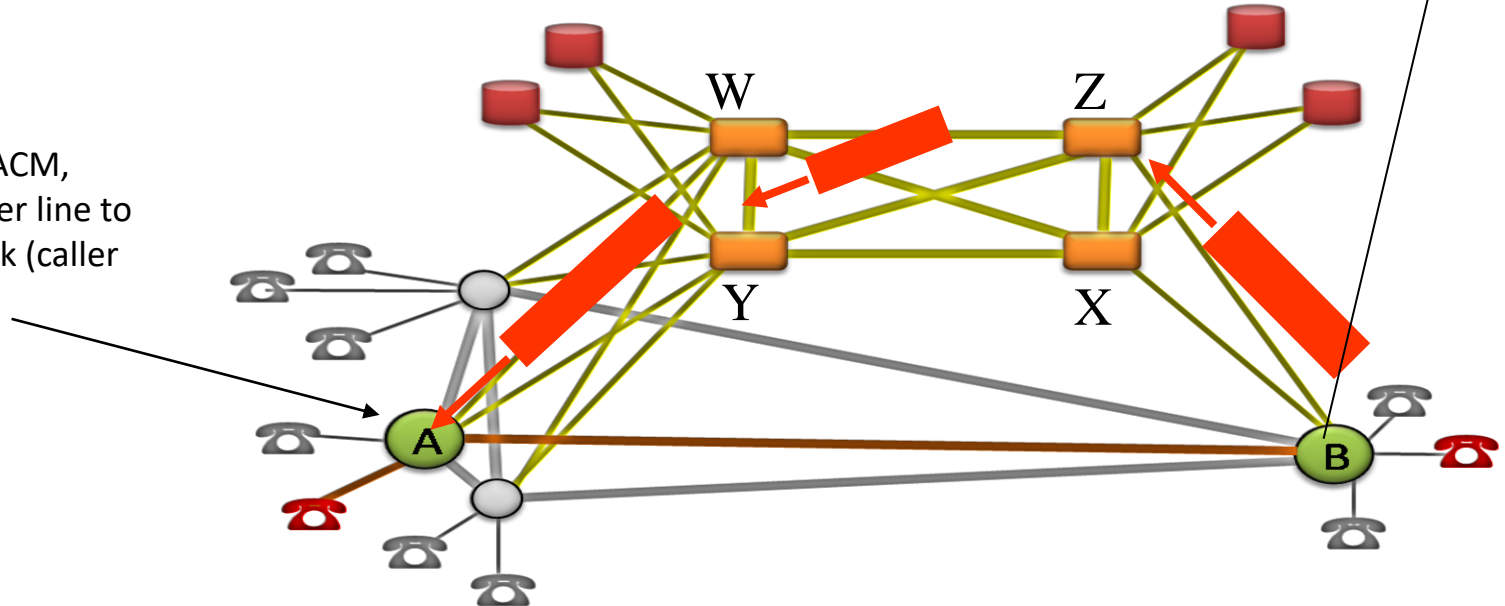


# Signaling in SS7 Network (Contd.)

5. SSP B determines it serves callee, creates address completion message (ACM[A, B, trunk]), rings callee phone, sends ringing sound on trunk to A

6. ACM routed to Z to Y to A

7. SSP A receives ACM, connects subscriber line to allocated A-B trunk (caller hears ringing)

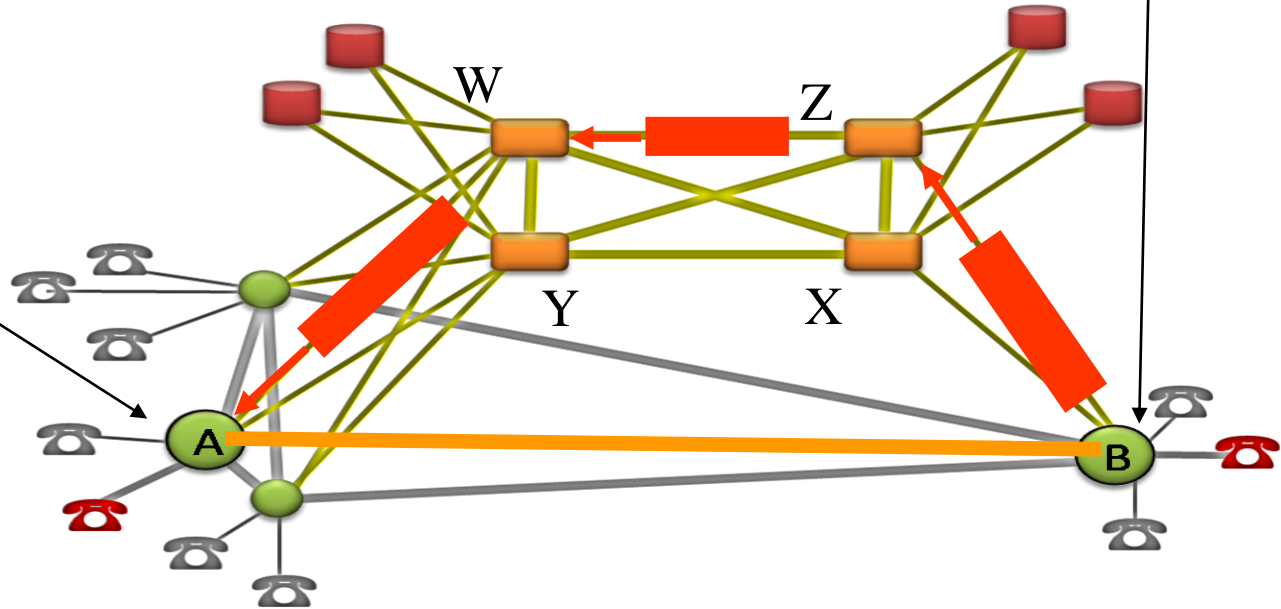


# Signaling in SS7 Network (Contd.)

8. Callee goes off hook, SSP B sends answer message to A (ANM[A,B,trunk])

9. ANM routed to A

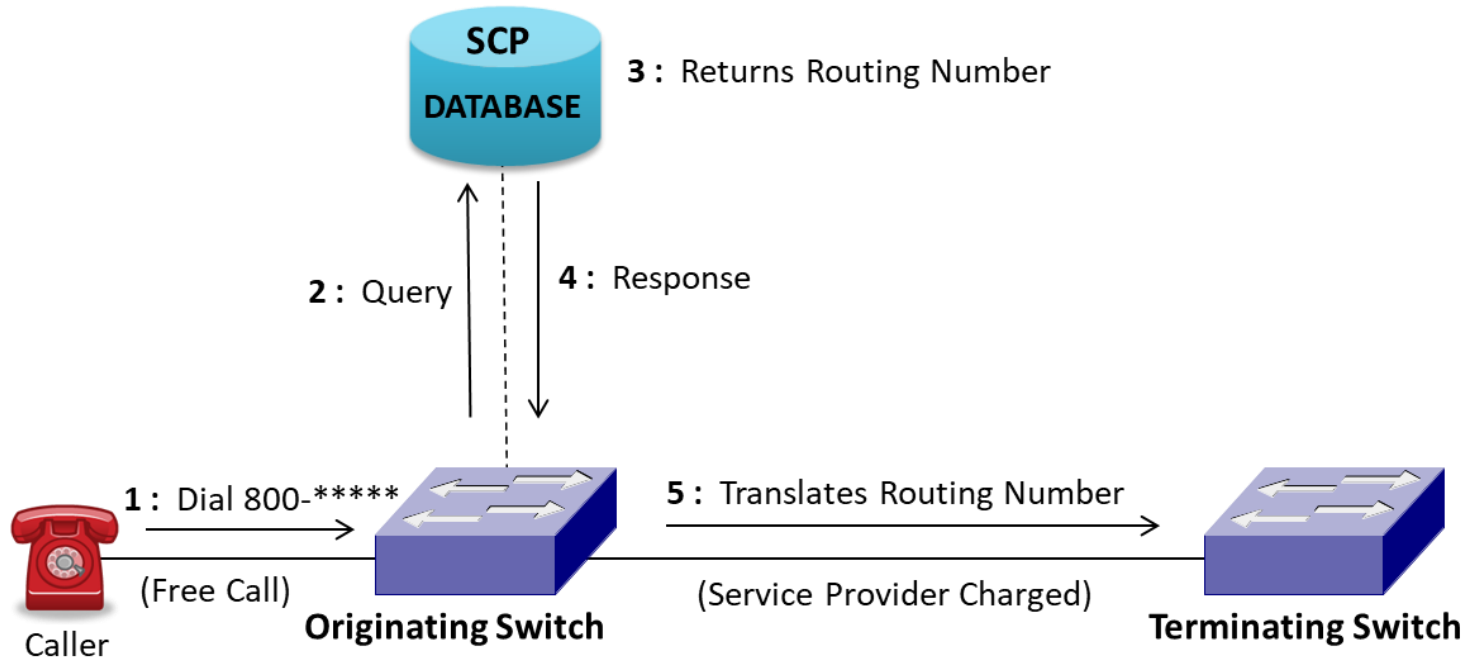
10. SSP A receives ANM, checks caller is connected in both directions to trunk. **Call is Connected!**



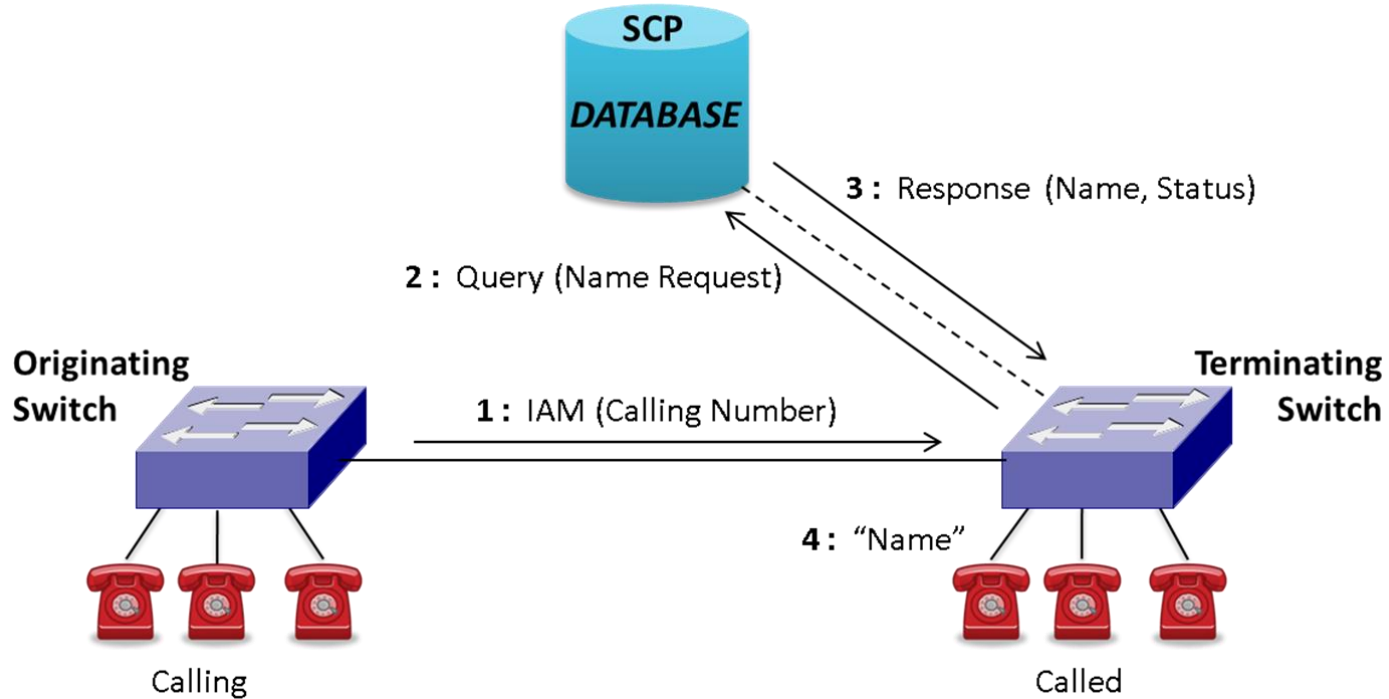
# Advanced Intelligent Network (AIN)

- It is a telephone network architecture which separates the service logic from switching equipment and allows new services to be added without redesigning switches to support added services
- Provides advanced services using distributed databases which provides additional information to call processing and routing requests
- AIN is a combination of the SS7 network, interactive database nodes, and development tools which allow the processing of signaling messages
- The supported services are CNAM (Calling Name Delivery), LNP (Local Number Portability), and Toll-free 800 Number over TCAP layer as per ANSI

# Example of AIN Toll-Free 800 Service

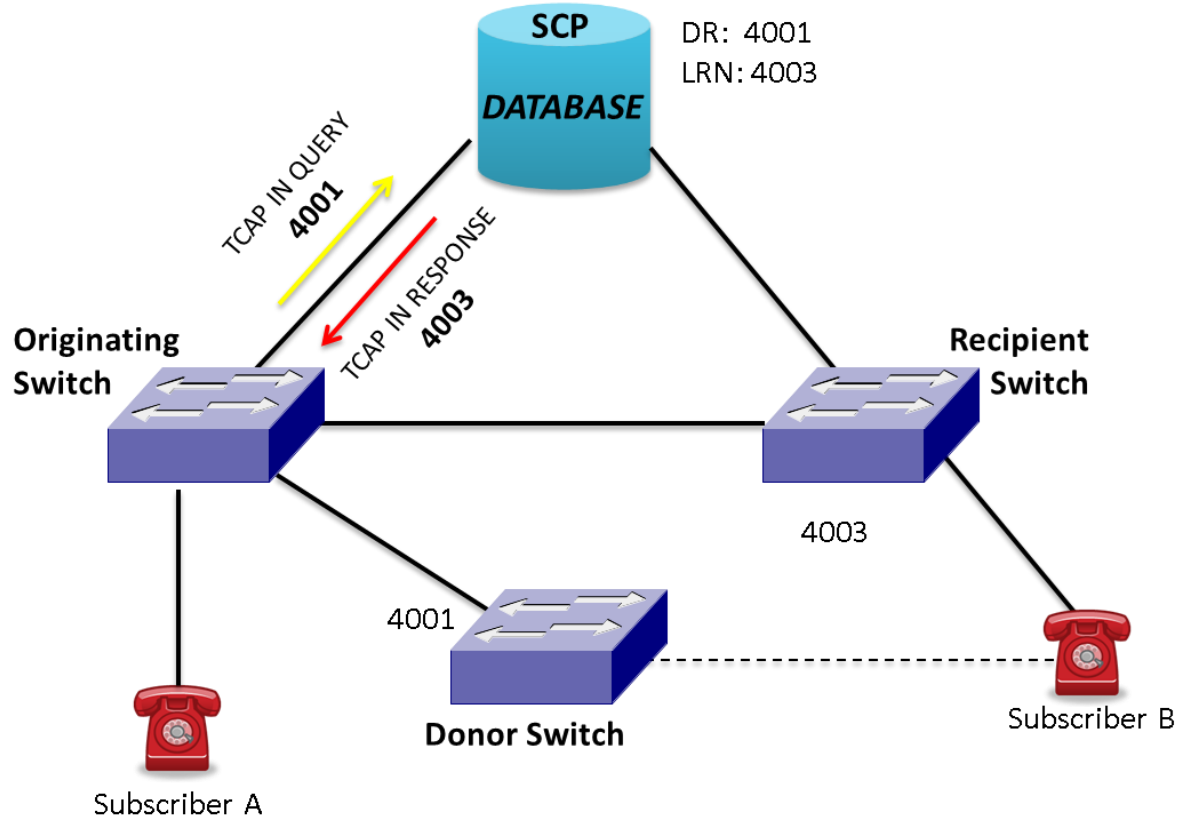


# Calling Name Delivery Service (CNAM)





# LNP (Local Number Portability) Service



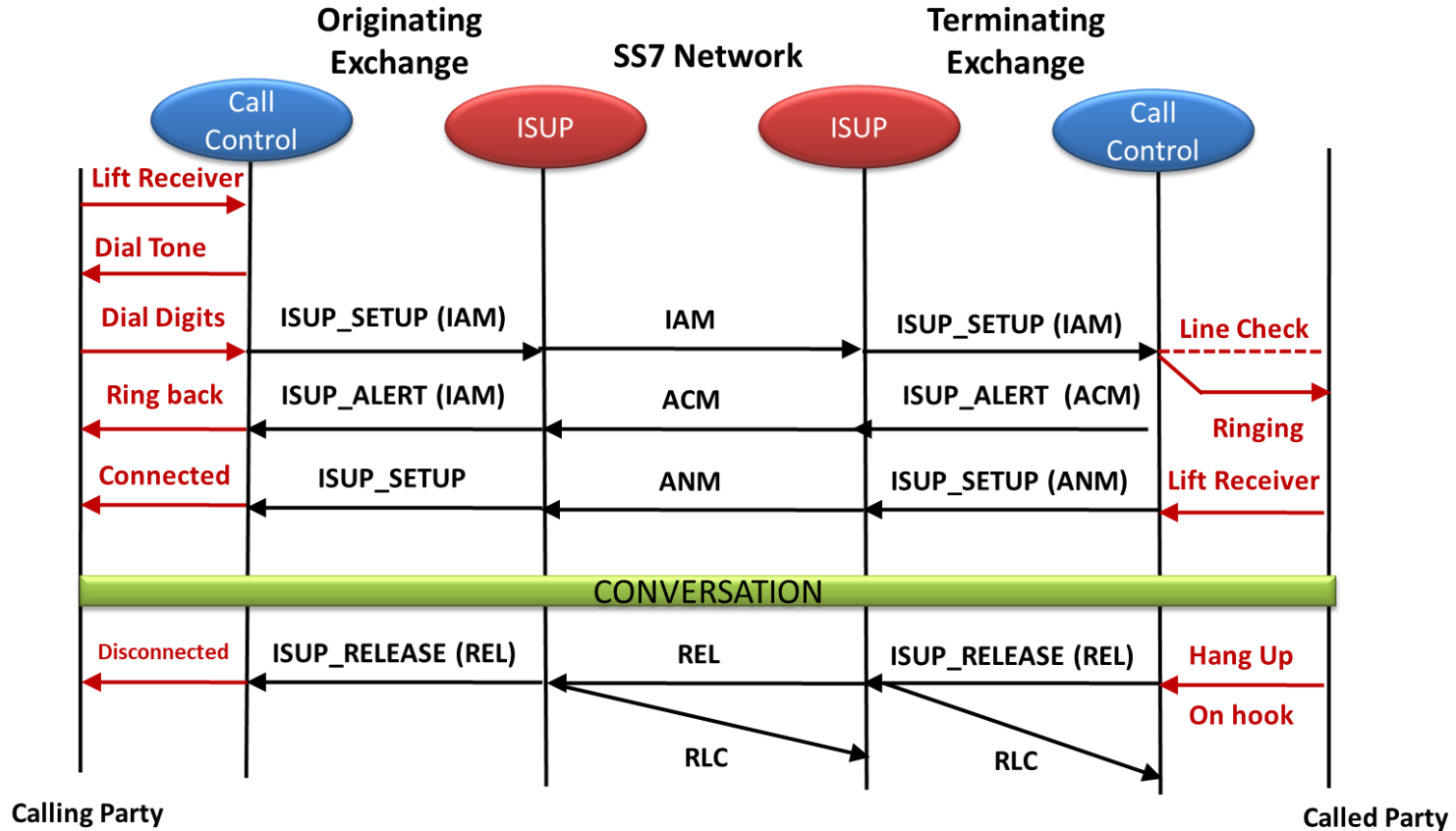
# User Parts Functionality in SS7 Network

- The User parts in SS7 protocol stack offers its services to user designed applications
- The Transaction Capabilities Application Parts (TCAPs) are employed when the application deals with Database query and response
  - Exchange of non-circuit related data
  - Queries and responses sent between SSPs and SCPs
  - Sends and receives database information
- The Integrated Services Digital Network User Parts (ISUPs) are meant for handling of telephone call related messaging which is sent from switch to switch
  - Sends and receives database information
  - Messages are sent from a switch, to the switch where the next circuit connection is required
  - Call circuits are identified using circuit identification code (CIC)

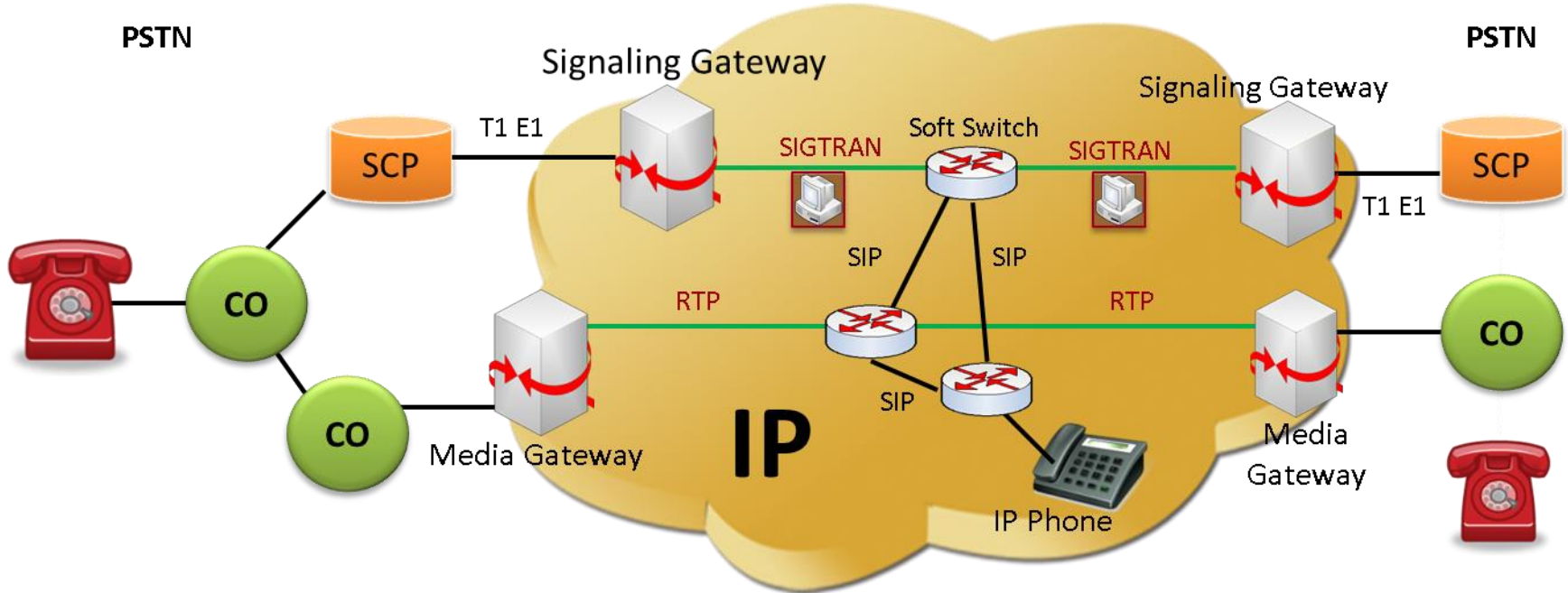
# ISUP Messages

- Initial address message (IAM): Contains all necessary information for a switch to establish a connection
- Address complete message (ACM): Acknowledge to IAM and reserve the required circuit
- Answer message (ANM): Occurs when the called party picks up the phone and actual connection is established
- Release (REL): Sent by the switch to clear the call
- Release complete (RLC): Acknowledges to the receipt of REL by each exchange that receives REL

# ISUP Normal Call Flow Scenario



# SS7 SIGTRAN

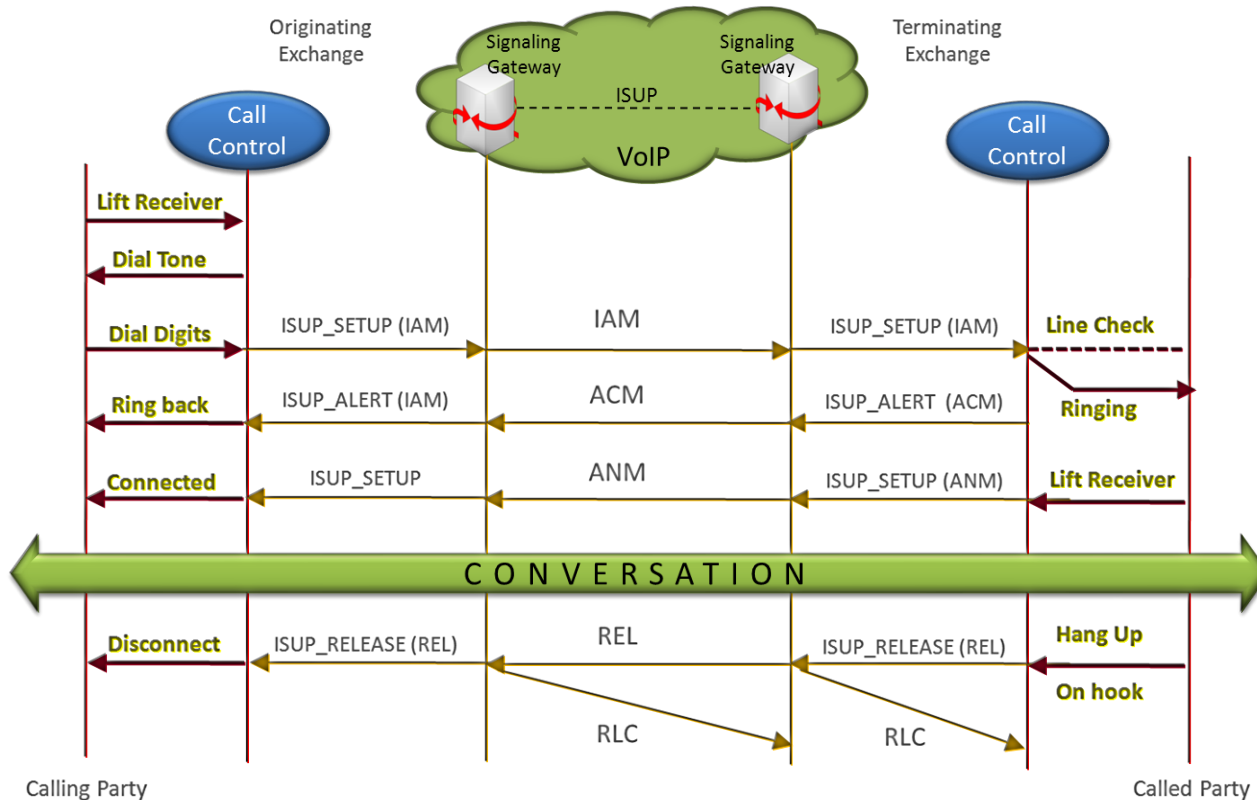


SIGTRAN (SS7 over IP)

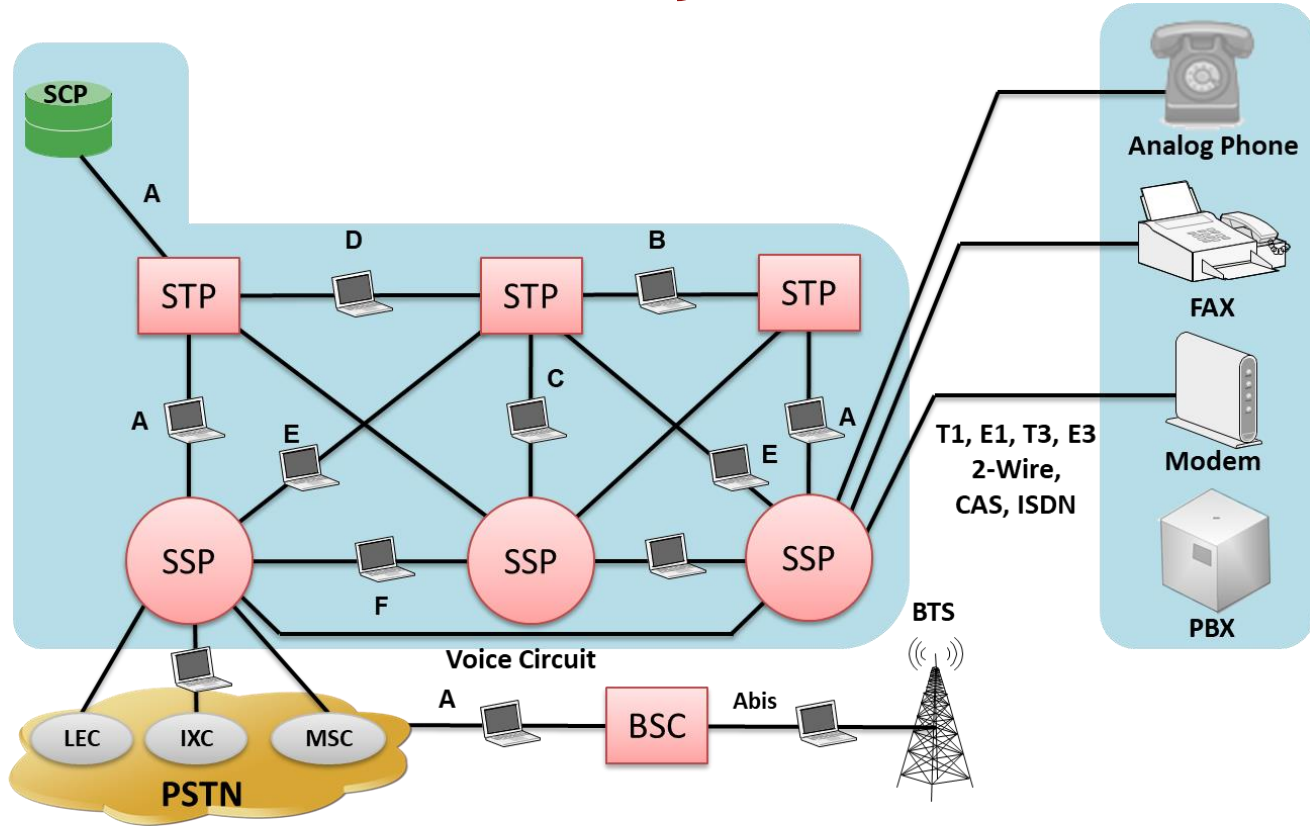
Message Automation & Protocol Simulation (MAPS) SIGTRAN



# SIGTRAN Call Flow Scenario



# SS7 Analyzer



GL's SS7, Protocol Analysis

# SS7 Analyzer View

SS7 Protocol Analysis SS7 ITU 64-bit

File View Capture Statistics Database Call Detail Records Configure Help

0 GoTo

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	OPC MTP3	DPC MTP3	Message Type ISUP	Circuit Identific ISUP
1	23		0	00:00:00.000000	13		3.4.6	5.5.5	Reset Circuit	1
2	23		1	00:00:00.728875	14		5.5.5	3.4.6	Release Complete	1
1	23		2	00:00:06.101875	13		3.4.6	5.5.5	Blocking	1
2	23		3	00:00:06.845500	13		5.5.5	3.4.6	Blocking acknowledgement	1
1	23		4	00:00:17.390000	13		3.4.6	5.5.5	Unblocking	1

Card1 TimeSlot=23 Frame=0 at 00:00:00.000000 OK Len=13 \*\*\* Right click to SHOW/HIDE layer d

HDLc Frame Data + FCS

===== MTP2 Layer =====

```

0000 BSN = 0000001 (1)
0000 BIB = 1..... (1)
0001 FSN = 0000010 (2)

```

Hex Dump of the Frame Data

```

81 82 08 85 2D A8 09 16 01 00 12 E9 4D

```

Device #	Frame Count(Device #)
1	10
total 1	10
2	9
total 2	9

Call ID	Call Status	Disp	Calling Num	Called Num	Call Start Date & Time	Call Duration	Release Complete Cause	DevNo	TS	OPC	DPC
0	ClArR	1	9987095800	8978675400	2013-03-15 18:32:21.805000	00:00:06.843000	Normal call clearing	1	23	3.4.6	5.5.5
1	ClA	3	9987095821	8978675421	2013-03-15 18:36:23.475375	00:00:24.091750	x00	2	23	5.5.5	3.4.6

C:\Program Files\GL Communications Inc\Ust\19 Frames

Summary View

Detail View

Hex Dump View

Statistics View

CDR View



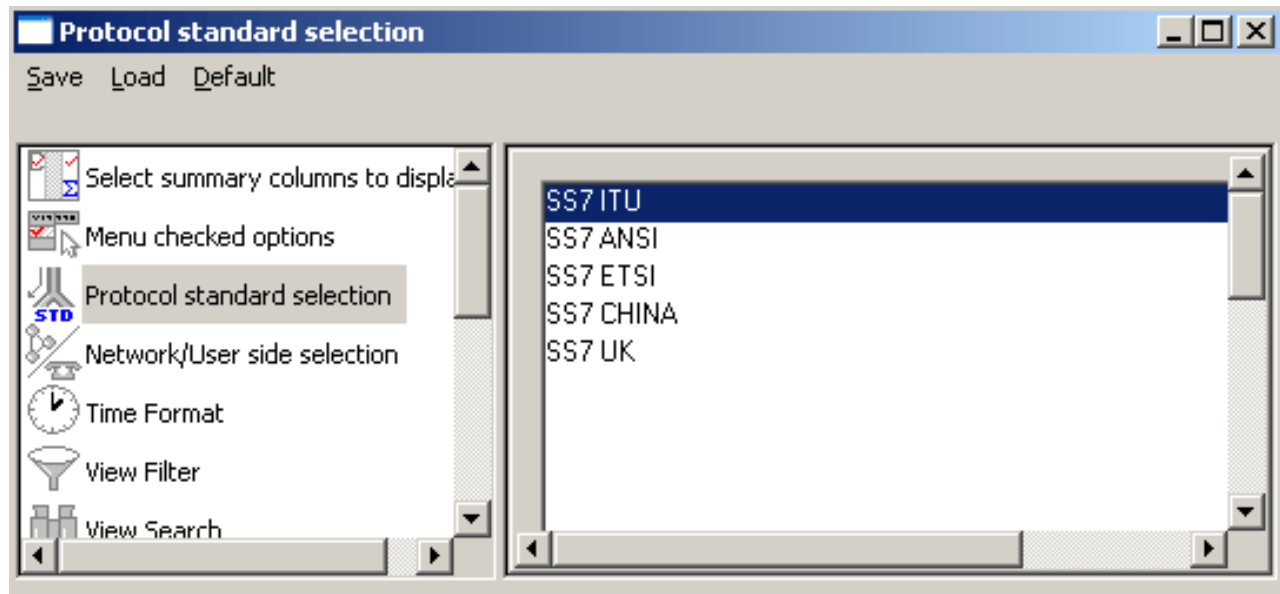
# Key Features

- Perform real-time / offline / remote analysis
- Consolidated GUI – Summary of all decodes, detail and hex-dump views of each frame, statistics view, and call detail record views
- Supports various protocol standards for proper decode
- Capture options - Channel selection, CRC, bit reversion, bit inversion, scrambler and more
- Any protocol field can be added to the summary view, filtering, and search features providing users more flexibility to monitor required protocol fields
- Call Detail Recording feature includes data link groups that help in defining the direction of the calls in a given network and form logical groups comprised of unidirectional (either 'Forward' or 'Backward') data links
- Option to create multiple aggregate column groups and prioritize the groups as per the requirement to display the summary results efficiently
- Allows the user to create search/filter criteria automatically from the current screen selection

# Key Features (Contd.)

- Call trace defining important call specific parameters such as call ID, status (active or completed), duration, calling number, called number, and more are displayed
- Fine tune results with filtering and search capability based on OPC, DPC, ISUP message types, SCCP message types, CIC, and more
- Extensive statistics measurement ability
- Exports Summary View information to a comma delimited file for subsequent import into a database or spreadsheet
- Capability to export detail decodes information to an ASCII file
- Trace File Saving Options
- Remote-access capability

# Protocol Standards



# Filter and Search

Space Delimited Length List to Exclude

Exclude FISU   Exclude LSSU   Clear ALL

Filter Selection

- SS7 ITU
  - Data Link
    - Frame Length(s)
    - Error Frames Only
    - OK Frames Only
    - Frame Number(s)
    - Card.Timeslot.Subchan
  - MTP2
  - MTP3
  - SCCP
  - MAP R99
  - MAP R4

Frame Length N or Range Min-Max

Activate   Deactivate

All Selected

Layer	Field	Filter Value
Data Link	Frame Length(s)	6

Conditions for all selections

AND  OR    Include  Exclude   Deactivate Sel   Deactivate All

# Statistics View

The screenshot displays the 'SS7 Protocol Analysis' software interface. The main window shows a list of frames with columns for Device (Dev), TS, Subchannel (Su...), Frame#, Time (Relative), Length (Len), Error, BSN, BIB, FSN, FIB, SLC, DPC, OPC, CIC, and ISUP Message. A red arrow points from the 'ISUP Message' column to the text 'Summary View'. Below the frame list is a summary table with columns for Device #, Message Type, and Frame Count. A red arrow points from this table to the text 'Statistics View'. The status bar at the bottom indicates the file path and total frame count.

Dev	TS...	Su...	Frame#	TIME (Relative)	Len	Error	BSN	BIB	FSN	FIB	SLC	DPC	OPC	CIC	ISUP Message
✓ 1	0		3	00:00:00.062746	15		4	1	5	1	0	4.4.4	3.3.3		
✓ 1	0		4	00:00:00.862505	36		5	1	6	1	0	3.3.3	4.4.4	4	Initial address
✓ 1	0		5	00:00:00.870377	16		6	1	6	1	0	4.4.4	3.3.3	4	Address compl
✓ 1	0		6	00:00:02.019163	14		6	1	7	1	0	4.4.4	3.3.3	4	Answer
✓ 1	0		7	00:00:14.108362	36		6	1	8	1	1	4.4.4	3.3.3	5	Initial address
✓ 1	0		8	00:00:14.117334	16		8	1	7	1	1	3.3.3	4.4.4	5	Address compl
✓ 1	0		9	00:00:16.020708	14		8	1	8	1	1	3.3.3	4.4.4	5	Answer
✓ 1	0		10	00:00:17.724446	15		8	1	9	1	0	4.4.4	3.3.3		

Device #	Message Ty...	Frame Count(Device #)
1	Initial address (1)	10
1	Address complete ...	10
1	Answer (9)	4
1	Release (12)	10
1	Release Complete ...	10
total 1	Total	44

C:\Program Files\GL Communications Ir 68 Frames

Summary View

Statistics View

# Call Detail Records View

SS7 Protocol Analysis SS7 ITU Standard

File View Capture Statistics Database Call Detail Records Configure Help

Dev	TS...	Su...	Frame#	TIME (Relative)	Len	Error	BSN	BIB	FSN	FIB	SLC	DPC	DPC	CIC	ISUP Message
✓ 1	0		3	00:00:00.062746	15		4	1	5	1	0	4.4.4	3.3.3		
✓ 1	0		4	00:00:00.862505	36		5	1	6	1	0	3.3.3	4.4.4	4	Initial address
✓ 1	0		5	00:00:00.870377	16		6	1	6	1	0	4.4.4	3.3.3	4	Address compl
✓ 1	0		6	00:00:02.019163	14		6	1	7	1	0	4.4.4	3.3.3	4	Answer
✓ 1	0		7	00:00:14.108362	36		6	1	8	1	1	4.4.4	3.3.3	5	Initial address
✓ 1	0		8	00:00:14.117334	16		8	1	7	1	1	3.3.3	4.4.4	5	Address compl
✓ 1	0		9	00:00:16.020708	14		8	1	8	1	1	3.3.3	4.4.4	5	Answer
✓ 1	0		10	00:00:17.724446	15		8	1	9	1	0	4.4.4	3.3.3		
✓ 1	0		11	00:00:17.725230	15		8	1	9	1	0	3.3.3	4.4.4		

Summary View

Call ID	Call Status	Disp	Calling Num	Called Num	Call Start Date & Time	Call Duration	Release Corr
0	completed	0	5554000	5551234	1601-01-01 00:00:08.625079	00:01:06.636420	
1	completed	4	5555000	5551234	1601-01-01 00:00:21.870936	00:00:31.974504	
2	completed	0	5555000	5551234	1601-01-01 00:00:48.268243	00:00:03.411017	
3	active	4	5555000	5551234	1601-01-01 00:00:53.008978	00:00:36.767436	
4	active	4	5556000	5551234	1601-01-01 00:01:00.500672	00:00:29.275741	
5	active	4	5557000	5551234	1601-01-01 00:01:07.142719	00:00:22.633694	
6	active	4	5553000	5551234	1601-01-01 00:01:17.659679	00:00:12.116735	

Call Detail Records View

C:\Program Files\Gl Communications Ir 68 Frames

- Call trace defining important call specific parameters such as call ID, status (active or completed), duration, calling number, called number, release complete cause etc are displayed

# Applications

- Can be used as independent standalone units as "probes" integrated in a network surveillance systems
- Triggering, collecting, and filtering for unique subscriber information and relaying such information to a back end processor
- Collecting Call Detail Records (CDR) information for billing

# Filtering Criteria From Screen Selection

- Allows the user to create filter criteria automatically from the current screen selection

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	DPC MTP3	DPC MTP3	Message Type ISUP	Identification ISUP	led Address ISUP	ling Address Sic ISUP
✓1	23		0	00:00:00.0...	13		3.4.6	5.5.5	Reset Circuit	1		
✓2	23		1	00:00:00.7...	14		5.5.5	3.4.6	Release C...			
✓1	23		2	00:00:06.1...	13		3.4.6	5.5.5	Blocking			
✓2	23		3	00:00:06.8...	13		5.5.5	3.4.6	Blocking a			
✓1	23		4	00:00:17.3...	13		3.4.6	5.5.5	Unblocking			
✓2	23		5	00:00:18.1...	13		5.5.5	3.4.6	Unblocking			

Use Ctrl, Shift for Extended Selection

MTP3::DPC  
MTP3::OPC  
ISUP::Circuit Identification Code  
ISUP::Message Type

OK Select All Cancel

Analyzer GUI and Protocol Configuration

Save Load Default

Select summary columns to di...  
Menu checked options  
Protocol standard selection  
Network/User side selection  
Time Format  
View Filter  
View Search  
TCP Connection Options  
Periodic Trace Saving Options  
Startup Options  
Data Link Groups  
View Font Size  
INI Decode Options  
Define Summary Columns  
Aggregate Summary Columns  
Capture Options

Filter Selection

- PPP
  - Data Link
  - MLPPP Error
  - PPP Link
    - ML PPP(Level 1)
    - PPP Link(Level 1)
    - Bridging PDU
    - ML PPP(Level 2)
    - PPP Link(Level 2)
    - Link Control
    - Password Authentication
    - Link Quality Report

Value Selection

Activate Deactivate

All Selected

Layer	Field	Filter Value
PPP Link	Protocol	ML PPP
PPP Link(Level 1)	Protocol	Internet Protocol (IPv4)

Conditions for all selections

AND  OR  Include  Exclude

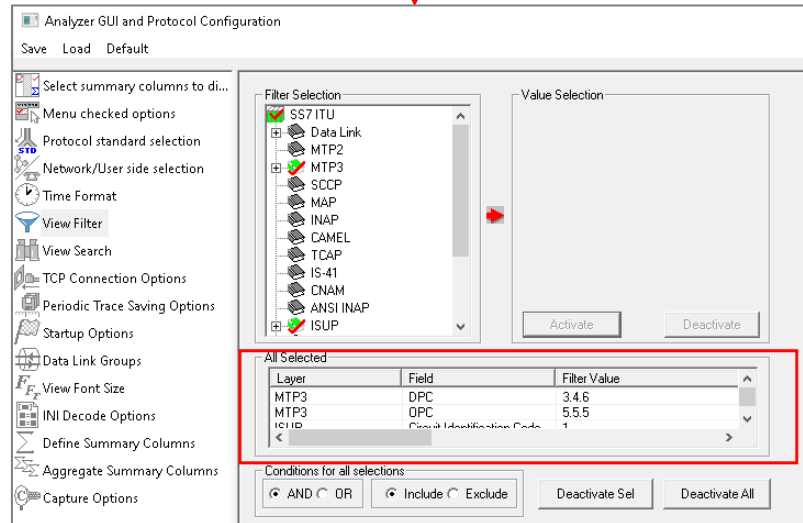
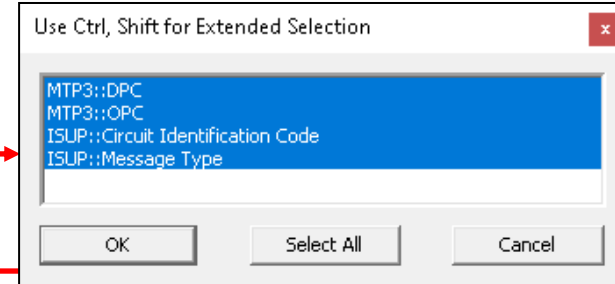
Deactivate Sel Deactivate All



# Search Criteria From Screen Selection

- Allows the user to create search criteria automatically from the current screen selection

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	OPC MTP3	DPC MTP3	Message ISUP
✓ 1	23		9	00:01:20.966625	18		3.4.6	5.5.5	Release
✓ 2	23		10	00:01:21.633000	14		5.5.5		
✓ 2	23		11	00:05:16.460375	38		5.5.5		
✓ 1	23		12	00:05:17.189375	16		3.4.6		
✓ 1	23		13	00:05:19.208250	14		3.4.6		



# Define Summary Columns

- Required protocol fields can be added through Define summary column option
- User can remove the protocol field which is not required

The screenshot displays the 'Define Summary Columns' dialog box in the SS7 Protocol Analysis software. The dialog has two panes: 'DISPLAYED summary columns' and 'HIDDEN summary columns'. The 'DISPLAYED' pane contains a list of protocol fields such as 'Dev', 'TSlot', 'SubCh', 'Frame#', 'TIME', 'Len', 'Error', 'Called Number', 'DPC\_MTP3', 'MTP3', 'Message\_Type\_ISUP', and 'Initial address\_ISUP'. The 'HIDDEN' pane is currently empty. Below the panes are buttons for 'Set Only', 'All Columns', 'Undo Delete', and 'Restore'. The main window shows a table of protocol data with a red box highlighting the 'Called Number' column.

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	Called Number	DPC MTP3	MTP3	Message_Type ISUP	Initial address_ISUP
✓1	23		6	00:01:14.7...	38		9987095800 -> 8978675400	3.4.6	5.5.5	Initial address	1
✓2	23		7	00:01:15.6...	16			5.5.5	3.4.6	Address complete	1
✓2	23		8	00:01:17.6...	14			5.5.5	3.4.6	Answer	1
✓1	23		9	00:01:20.9...	18			3.4.6	5.5.5	Release	1
✓2	23		10	00:01:21.6...	14			5.5.5	3.4.6	Release Complete	1
✓2	23		11	00:05:16.4...	38		9987095821 -> 8978675421	5.5.5	3.4.6	Initial address	22
✓1	23		12	00:05:17.1...	16			3.4.6	5.5.5	Address complete	22
✓1	23		13	00:05:19.2...	14			3.4.6	5.5.5	Answer	22
✓2	23		14	00:05:40.5...	13			5.5.5	3.4.6	Reset Circuit	22
✓1	23		15	00:05:41.2...	14			3.4.6	5.5.5	Release Complete	22
✓2	23		16	00:06:04.9...	38		9987095804 -> 8978675404	3.4.6	5.5.5	Initial address	5
✓1	23		17	00:06:24.9...	18			3.4.6	5.5.5	Release	5
✓2	23		18	00:06:25.6...	14			5.5.5	3.4.6	Release Complete	5

Below the table, the software shows a detailed view of a frame: 'Card1 TimeSlot=23 Frame=6 at 00:01:14.790000 OK Len=38'. The frame data is displayed in a hex dump format with corresponding protocol layer names: HDLC Frame Data + FCS, MTP3 Layer, MTP3 Layer, ISDN User Part, Priority Code, Sub-service field, DPC, OPC, Signalling Link Code, ISUP Layer, and Circuit Identification Code.

# Aggregate Group Column

- The user can create multiple aggregate column groups and prioritize the groups as per the requirement to display the summary results efficiently

The screenshot displays the 'Aggregate Summary Columns' dialog box and a network analysis tool interface. The dialog box is titled 'Aggregate Summary Columns' and has a menu bar with 'Save', 'Load', and 'Default'. It contains a table with the following columns: Name, Display Format, Summary Columns, and Separator. The table has three rows: Group-0, Group-1, and Group-2. The 'Summary Columns' column for Group-0 contains 'Calling Address Signal\_ISUP' and 'Called Address Signal\_ISUP'. The 'Summary Columns' column for Group-1 contains 'Cause Value\_ISUP'. The 'Summary Columns' column for Group-2 contains 'Message Type\_ISUP'. The 'Separator' column for Group-0 contains '--->'. The 'Display Format' column for Group-0 and Group-2 contains 'Concat'. The 'Display Format' column for Group-1 contains '<Col\_Alias>Value'. The main interface shows a table of network data with columns for Dev, TSlot, SubCh, Frame#, TIME (Relative), Len, Error, Called Number, DPC MTP3, DPC MTP3, Message Type ISUP, and iIdentical ISUP. A red box highlights the 'Called Number' column in the main table. Below the table is a detailed view of a frame, showing the HDLC Frame Data + FCS and the MTP2 and MTP3 layers.

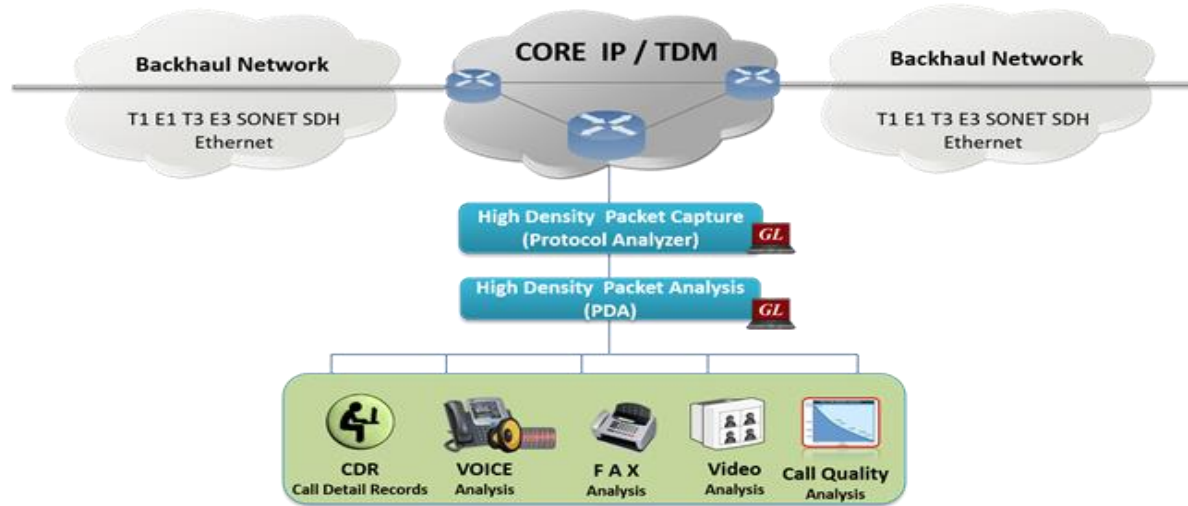
Name	Display Format	Summary Columns	Separator
Group-0	Concat	Calling Address Signal_ISUP Called Address Signal_ISUP	--->
Group-1	<Col_Alias>Value	Cause Value_ISUP	
Group-2	Concat	Message Type_ISUP	


Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	Called Number	DPC MTP3	DPC MTP3	Message Type ISUP	iIdentical ISUP
✓1	23		6	00:01:14.7...	38		9387095800 -> 9378675400	3.4.6	5.5.5	Initial address	1
✓2	23		7	00:01:15.6...	16			5.5.5	3.4.6	Address complete	1
✓2	23		8	00:01:17.6...	14			5.5.5	3.4.6	Answer	1
✓1	23		9	00:01:20.9...	18			3.4.6	5.5.5	Release	1
✓2	23		10	00:01:21.6...	14			5.5.5	3.4.6	Release Complete	1
✓2	23		11	00:05:16.4...	38		9387095821 -> 9378675421	5.5.5	3.4.6	Initial address	22
✓1	23		12	00:05:17.1...	16			3.4.6	5.5.5	Address complete	22
✓1	23		13	00:05:19.2...	14			3.4.6	5.5.5	Answer	22
✓2	23		14	00:05:40.5...	13			5.5.5	3.4.6	Reset Circuit	22
✓1	23		15	00:05:41.2...	14			3.4.6	5.5.5	Release Complete	22
✓1	23		16	00:06:04.9...	38		9387095804 -> 9378675404	3.4.6	5.5.5	Initial address	5
✓1	23		17	00:06:24.9...	18			3.4.6	5.5.5	Release	5
✓2	23		18	00:06:25.6...	14			5.5.5	3.4.6	Release Complete	5

```
Card1 TimeSlot=23 Frame=6 at 00:01:14.790000 OK Len=38
HDLC Frame Data + FCS
***** MTP2 Layer *****
0000 BSN = 0000100 (4)
0000 BIB = 1..... (1)
0001 FEN = 0000101 (5)
0001 FIB = 1..... (1)
0002 LI = 1100001 NSU Format
***** MTP3 Layer *****
0003 Service Indicator = ...0101 ISDN User Part
0003 Priority Code = 000... Priority Code 0
0003 Sub-service field = 10..... National Network
0004 DPC = 5.5.5(00101101...101000)
0005 OPC = 3.4.6(10.....00001001...0110)
0007 Signalling Link Code = 0001.... (1)
***** ISUP Layer *****
0008 Circuit Identification Code = 00000001...0000 (1)
```

# SS7 Packet Data Analysis (PDA)

# Packet Data Analyzer over TDM



 **GL's Packet Capture Module**  
PacketScan, LightSpeed1000, T1 E1 T3 E3 Analyzer Pods

 **GL's Packet Analysis Module**  
H.323, LTE, IMS, SIP, MGCP, MEGACO, UMTS, GPRS, GSM A, BICC, CAP, MAP, SIGTRAN

- Monitors live TDM networks including capture, analysis, and reporting of every call-in detail. Supported protocols include CAS, ISDN, ISUP, CAMEL, MAP, INAP, and GSM

# Main Features

CDR, Call Flow, Statistics, and Report Generation	<ul style="list-style-type: none"><li>• Isolates call specific information for each individual call from the captured data and displays the information in an organized fashion</li><li>• A host of call and message counters gives the user an instantaneous snapshot of the traffic on the network</li><li>• Pictorial representation of the statistics including ladder diagrams for the calls of various protocols</li><li>• Ability to export and analyze call detail records of completed calls in CSV file format</li><li>• These reports can be further fed to DB and accessed using GL's NetSurveyorWeb™ Lite for analysis.</li><li>• Isolates calls, a graphical call flow diagram can be created from a call trace</li><li>• Filters on CDR information feature is used to search required calls by using "key" as CDR parameters</li><li>• Event counters on CDR information provides over all count of completed events such as total calls, active calls, completed calls, purged calls, failed calls, calls per second, remaining calls and more</li><li>• Flexible options are provided to interchange/hide the columns as required</li></ul>
Traffic Recording	<ul style="list-style-type: none"><li>• Supports capturing of voice, digits, tones and FAX etc to *.PCM file format</li></ul>
Triggers and Actions	<ul style="list-style-type: none"><li>• Filter captures based on protocol parameters such as OPC, DPC or CIC in case of ISUP followed by a set of actions such as save call, send mail, trigger alarm notification etc for the completed calls</li></ul>
Exporting Calls	<ul style="list-style-type: none"><li>• Supports saving the selected calls from traffic analyzer into *.HDL, *.PCAP, or *.PCAPNG formats</li></ul>

# Traffic Recording Configurations

Traffic Recording Configuration

File

Traffic Recording

Recording (Non Segmented)

Directory

Record Duration  sec {0 to Record Entire Call Duration}

Include Absolute Path in CDR

Segmented Recording

Directory

No. of Segments  Segment Length  sec

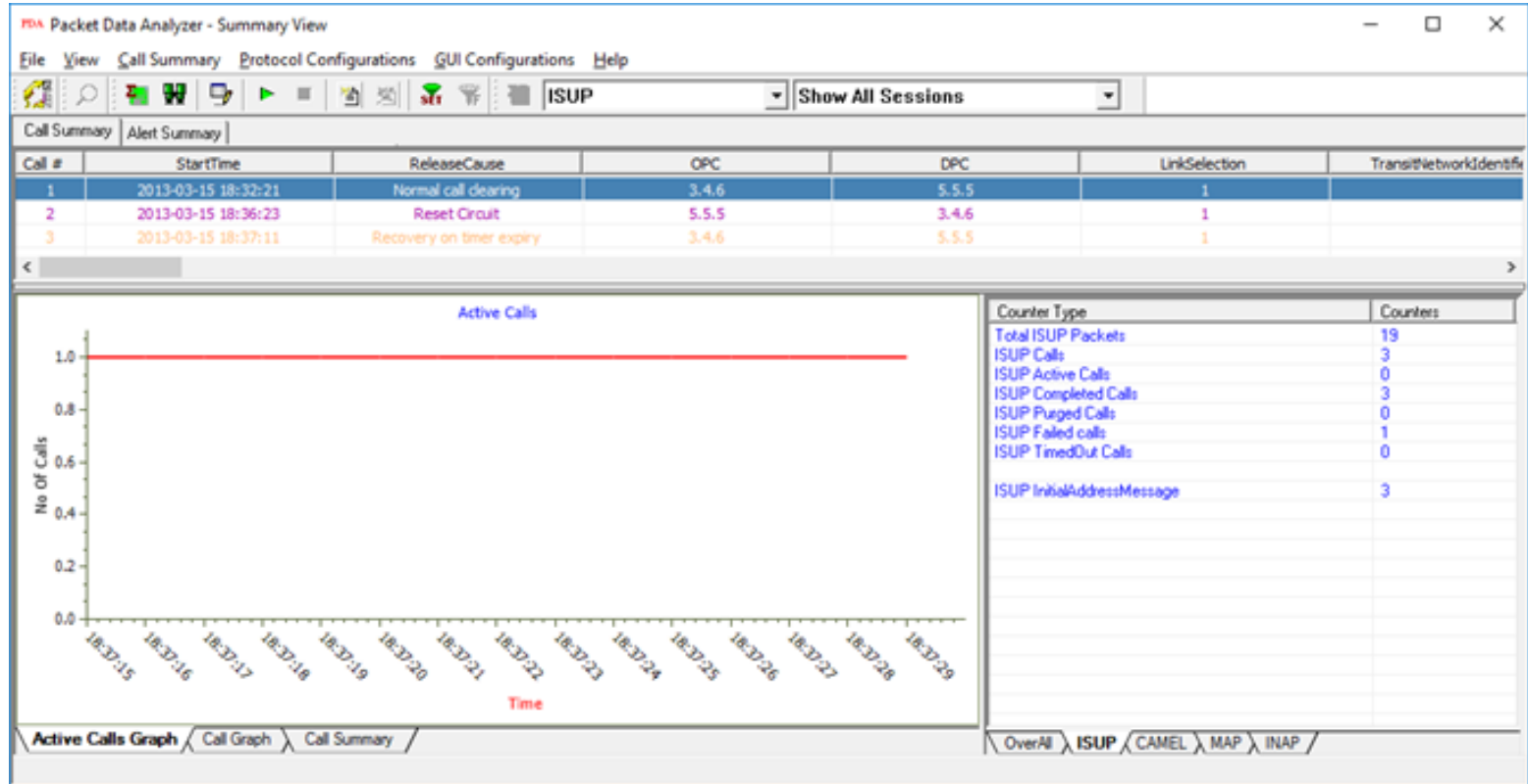
Max Simultaneous Recordings

Create Subfolder Every  min

# SS7 Call Summary



# Active Call Graph



# Summary View

Packet Data Analyzer - Summary View

File View Call Summary QoS Configurations Help

ISUP Show All Calls

Call Summary | Alert Summary

Call #	StartTime	Caller	Callee	OPC	DPC	CIC	LinkSelection	TimeSlot	SourcePort	DestinationPort	SetupTime(msec)	Result	ReleaseCause	CauseLocation	Duration	EndTime
1	2019-03-04 16:40:32.936	5674532002	4265379002	1.1.1	2.2.2	1	1	31	1	2	60215	Successful	Normal call clearing	User50	00:01:03.270	2019-03-04 16:41:36.172
2	2019-03-04 16:40:32.922	5674532003	4265379003	1.1.1	2.2.2	2	1	31	1	2	60214	Successful	Normal call clearing	User50	00:01:03.270	2019-03-04 16:41:36.193
3	2019-03-04 16:40:32.927	5674532004	4265379004	1.1.1	2.2.2	3	1	31	1	2	60299	Successful	Normal call clearing	User50	00:01:03.267	2019-03-04 16:41:36.194
4	2019-03-04 16:40:32.933	5674532005	4265379005	1.1.1	2.2.2	4	1	31	1	2	60297	Successful	Normal call clearing	User50	00:01:03.263	2019-03-04 16:41:36.196
5	2019-03-04 16:40:32.937	5674532006	4265379006	1.1.1	2.2.2	5	1	31	1	2	60294	Successful	Normal call clearing	User50	00:01:03.260	2019-03-04 16:41:36.198
6	2019-03-04 16:40:32.942	5674532007	4265379007	1.1.1	2.2.2	6	1	31	1	2	60292	Successful	Normal call clearing	User50	00:01:03.260	2019-03-04 16:41:36.202

Column Width

TimeStamp Frame Number 1.1.1 2.2.2

00:00:000 4 1.31 Initial Address → 2.21

00:02:662 10 1.31 ← Address Complete 2.21

00:02:685 11 1.31 ← Answer 2.21

01:02:900 22 1.31 → Release 2.21

01:03:255 28 1.31 ← Release Complete 2.21

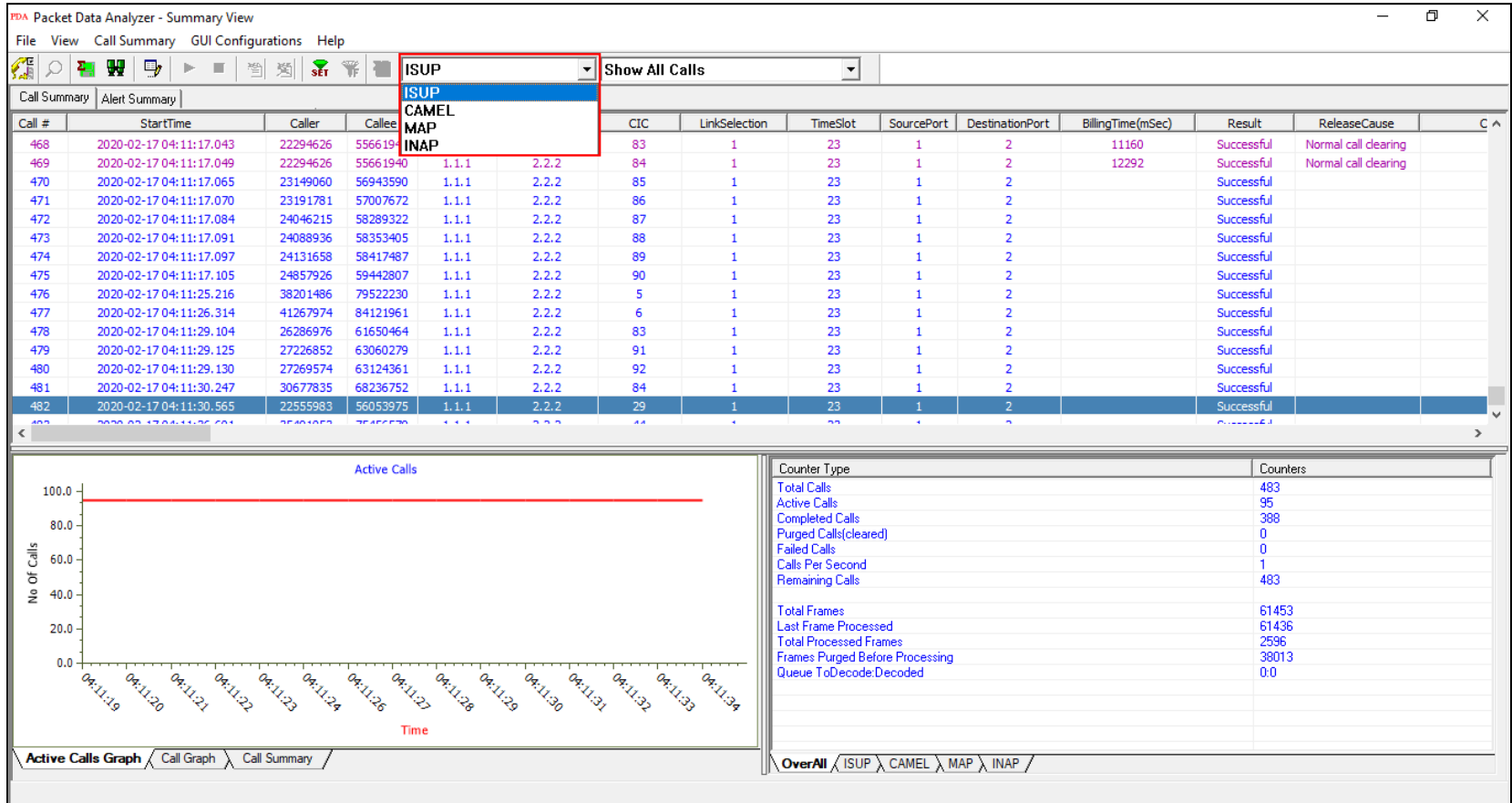
Find

```

===== MDCP Layer =====
=
= .0000001 (1)
= 1..... (1)
= .0000010 (1)
= 1..... (1)
= ..100001 MDT Format
=
===== MDCB Layer =====
=
= ....0101 IEEM User Part
= ..00.... Priority Code 0
= 10..... National Network
= 2.2.200010010 ..010000
= 1.1.1001..... 00000010 ....0010
= Signalling Link Code
= 0001.... (1)
===== ISUP Layer =====
=
= 00000001 ....0000 (1)
= 00000001 Initial address
=
= Mandatory Fixed Parameters
=
= Nature Of Connection Indicators Parameter
=
= Satellite Indicator
= .....10 two satellite circuits in the net
= ....90.. continuity check not required
= ...8.... outgoing echo control device not
=
= Forward Call Indicators Parameter
=
= National/international call ind
= .....0 treated as a national call
= .....00. No end-to-end method available
    
```

Active Calls Graph | Call Graph | Call Summary

# Supported Protocols



# Triggers and Action Settings

# Alert Summary

Action

<input checked="" type="checkbox"/> Save Call	Alarm Type	Warning
<input type="checkbox"/> Audio Recording		
<input type="checkbox"/> User Defined	Alarm Message	Triggers at the specified value
<input type="checkbox"/> Send e-mail		
<input checked="" type="checkbox"/> Alert Summary		
<input type="checkbox"/> Call Detail Record		
<input type="checkbox"/> Extract Fax Image		

- With this option, the user can set the alarm type and alarm message for the selected triggering type

# Alert Summary (Contd.)

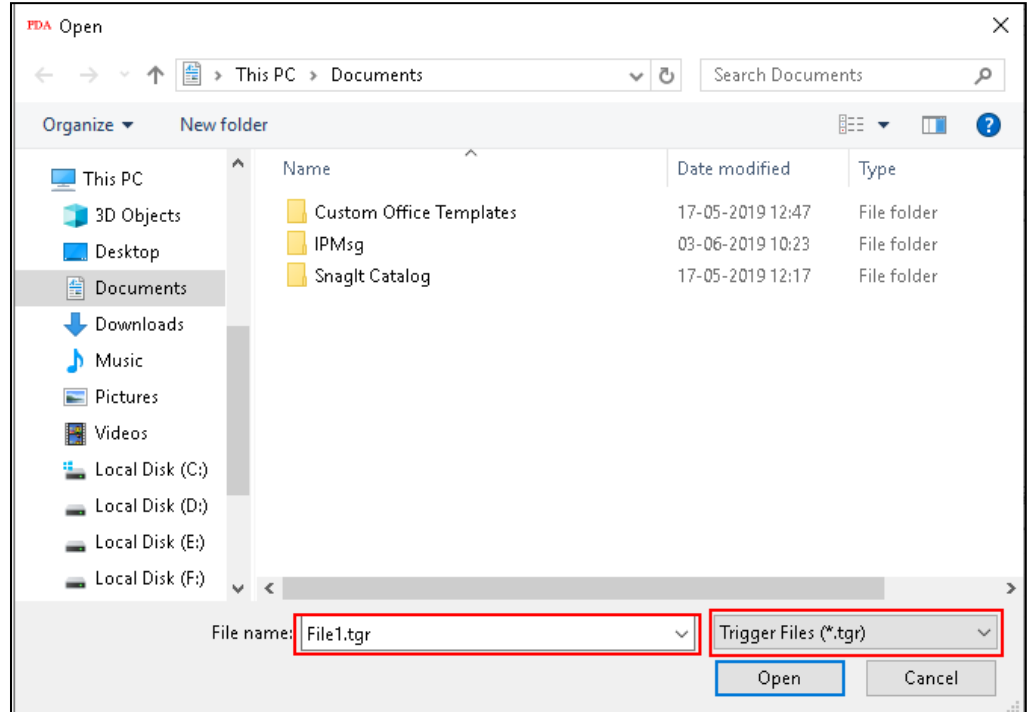
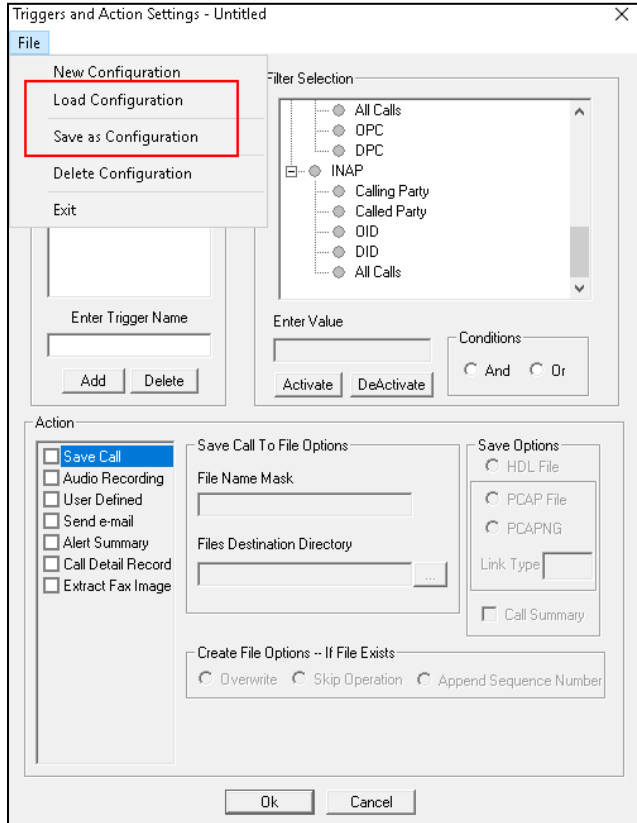
PDA Packet Data Analyzer - Summary View

File View Help

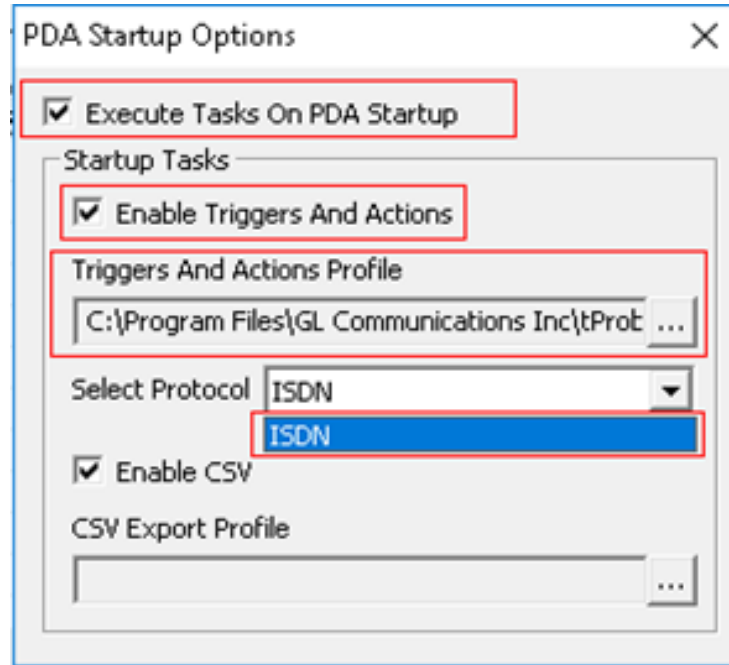
Call Summary Alert Summary

Call#	Protocol	Message	Type	Threshold	Value	Caller	Callee	CallId
26	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	4713318	26
56	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	3524936	56
86	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	6613093	86
116	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	7630644	116
146	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	9949501	146
176	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	8216780	176
206	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	5242990	206
236	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	4315996	236
266	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	9284515	266
297	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	1089521	297
322	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	4011142	322
373	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	1176208	373
403	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	2285801	403
433	ISDN	Triggers at the specified value.	Warning	5552525	5552525	5552525	5723954	433

# Load or Save Configurations



# PDA Startup Options



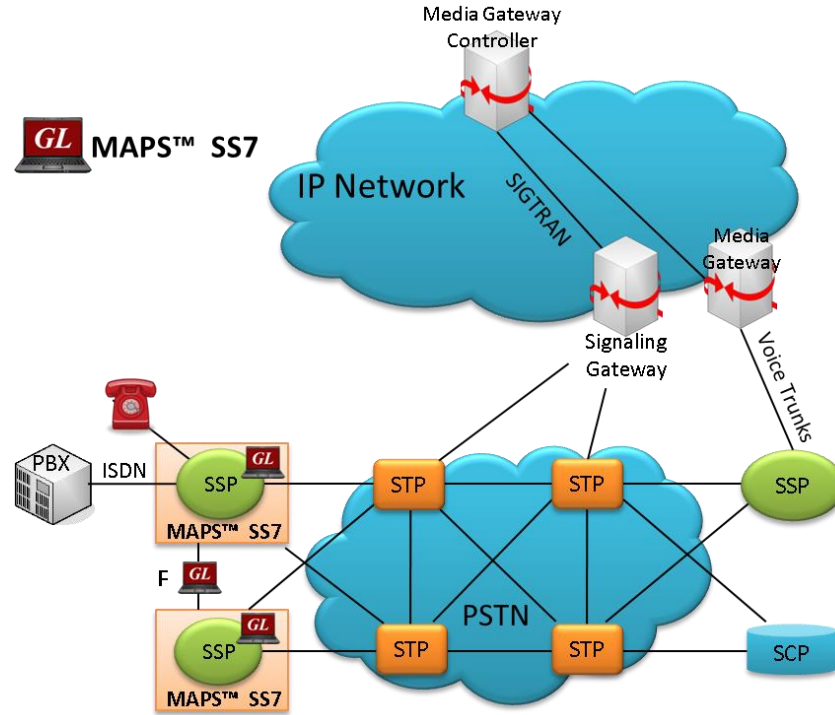
- Allows user to configure start-up tasks which will be started automatically whenever PDA is launched
- Loads the selected Triggers and Actions profile while invoking PDA



# MAPS™ ISUP

# Scripted ISUP Simulation - MAPS™ SS7 (XX649)

## MAPS SS7 Simulation



# Key Features

- ISUP (SSP) simulation over TDM (T1 E1)
- Supports transmission and detection of TDM traffic - digits, voice file, single /dual tones
- User-friendly GUI for configuring the SS7 MTP Layers
- User Configurable Signaling Links
- User-configured Circuit Mapping, i.e., defines Circuit Identification Codes (CIC) and map these CICs to Timeslots/Trunks in order to enable Voice / Data traffic
- Supports MTP2 and MTP3 protocol machine
- Multiple MTP links
- Access to all ISUP Message Parameters CIC, calling number, called number, and more
- User controlled access to optional ISUP parameters such as timers
- Subsequent Address Message (SAM) configurations available
- Fully Supported Continuity Testing (COT) that includes COT messages

# Call Generation and Reception

**Call Generation - BulkCall**

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Result	Total Iterations	Completed Iterations
3	PlaceCall.gls	TS3.xm	3	Abort	TX-File	Terminate		Pass	Infinite	1
4	PlaceCall.gls	TS4.xm	4	Start	TX-File	None		Pass	Infinite	0
5	PlaceCall.gls	TS5.xm	5	Abort	TX-File	Terminate		Pass	Infinite	1
6	PlaceCall.gls	TS6.xm	6	Abort	TX-File	Terminate		Pass	Infinite	0
7	PlaceCall.gls	TS7.xm	7	Start	TX-File	None		Pass	Infinite	1
8	PlaceCall.gls	TS8.xm	8	Abort	TX-File	Terminate		Pass	Infinite	0
9	PlaceCall.gls	TS9.xm	9	Start	TX-File	None		Pass	Infinite	1
10	PlaceCall.gls	TS10.xm	10	Abort	TX-File	Terminate		Pass	Infinite	0
11	PlaceCall.gls	TS11.xm	11	Abort	TX-File	Terminate		Pass	Infinite	0
12	PlaceCall.gls	TS12.xm	12	Abort	TX-File	Terminate		Pass	Infinite	1
13	PlaceCall.gls	TS13.xm	13	Abort	TX-File	Terminate		Pass	Infinite	0
14	PlaceCall.gls	TS14.xm	14	Start	TX-File	None		Pass	Infinite	0

Buttons: Add, Delete, Insert, Start, Abort, Refresh, Start All, Abort All

MAPS      DUT

```

===== MTP3 Layer =====
Service Indicator
Priority Code
Sub-service field
DPC
OPC
Signalling Link Code
Higher Layer Data
===== ISUP Layer =====
Circuit Identification Code
Message Type
Mandatory Fixed Parameters
Nature Of Connection Indicators Paramet
Satellite indicator
Continuity check indicator
Echo ctrl dev.ind (Nat. Comm. Ind)
    
```

Scripts | **Message Sequence** | Event Config | Script Flow | Profile

**Call Reception**

Sr No	Script Name	Call Info	Script Execution	Status	Events	Events Profile	Result
1	RecvCall.gls	1	Completed	Call Released	None		Pass
2	RecvCall.gls	2	Completed	Call Released	None		Pass
3	RecvCall.gls	3	Completed	Call Released	None		Pass
4	RecvCall.gls	4	Abort	TX-File	Terminate		Pass
5	RecvCall.gls	5	Completed	Call Released	None		Pass
6	RecvCall.gls	6	Abort	TX-File	Terminate		Pass
7	RecvCall.gls	7	Completed	Call Released	None		Pass
8	RecvCall.gls	8	Abort	TX-File	Terminate		Pass
9	RecvCall.gls	9	Completed	Call Released	None		Pass
10	RecvCall.gls	10	Abort	TX-File	Terminate		Pass
11	RecvCall.gls	11	Completed	Call Released	None		Pass
12	RecvCall.gls	12	Completed	Call Released	None		Pass
13	RecvCall.gls	13	Completed	Call Released	None		Pass
14	RecvCall.gls	14	Abort	TX-File	Terminate		Pass

Buttons: Abort, Auto Trash, Trash

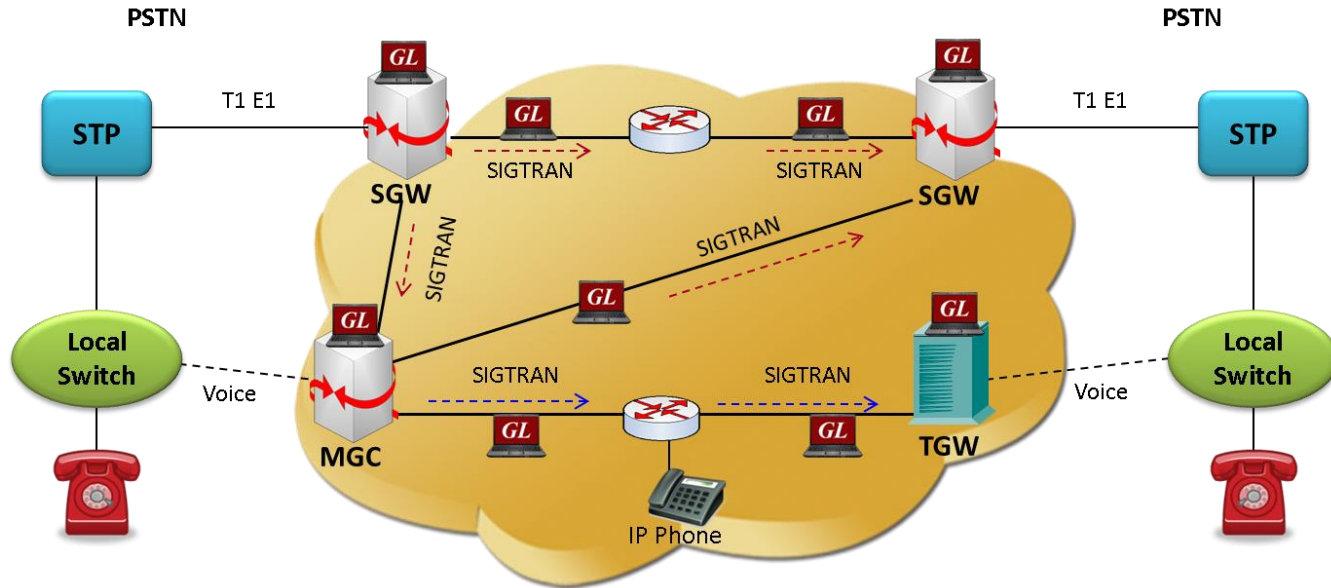
MAPS      DUT

```

===== MTP3 Layer =====
Service Indicator
Priority Code
Sub-service field
DPC
OPC
Signalling Link Code
Higher Layer Data
===== ISUP Layer =====
Circuit Identification Code
Message Type
Mandatory Fixed Parameters
Nature Of Connection Indicators Parameter
Satellite indicator
    
```

Scripts | **Message Sequence** | Event Config | Script Flow | Profile

# MAPS™ - SIGTRAN (SS7 over IP)



 **MAPS™ SIGTRAN**  
Simulate Elements in SS7 Network over IP

-----> TRAFFIC

-----> SIGNALING

# Key Features

- SS7 simulation over IP
- User-friendly GUI for configuring the SS7 M3UA Layers
- User Configurable Signaling Links
- Supports M3UA and SCTP protocol machine
- Multiple M3UA links
- Access to all ISUP Message Parameters Initial Address, Subsequent Address, Release messages, and more
- User controlled access to optional ISUP parameters such as timers
- Subsequent Address Message (SAM) configurations available
- Fully Supported Continuity Testing (COT) that includes both COT messages
- Logging of all SS7 Messages in real-time. Each SS7 message displays CIC values defined within the message

# Call Generation and Reception

MAPS (Message Automation Protocol Simulation) (Isup-Sigtran ITU M3UA) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Ev...	Result	Total Iterations	Completed Iterations
1	Isup_Call.gls	Card1TS01	1.1.1.2.2.2.1	Stop	Transmitting File	Terminate Call		Pass	1	0

Add Delete Insert Refresh Start Start All Stop Stop All Abort Abort All

Save Column Width

MAPS DUT

```

0000 Version
0002 Message Class
0003 Transfer Message
0004 Message Length
0008 Tag
000A Length
000E Originating Point Code
0012 Destination Point Code
0014 Service Indicator
0015 Network Indicator
0016 Message Priority
0017 Signalling Link
0018 Pdu
0018 Circuit Identification Code
001A Message Type
001B Mandatory Fixed Parameters
001C Nature Of Connection Indicators Parameter
001D Satellite indicator
001E Continuity check indicator
001F Echo ctrl dev.ind(Mat.Conn.Ind)
0020 Forward Call Indicators Parameter
0021 National/international call ind
0022 End-to-end method indicator
                    
```

Scripts Message Sequence Event Config Script Flow

MAPS (Message Automation Protocol Simulation) (Isup-Sigtran ITU M3UA) - [Call Reception]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Call Info	Script Execution	Status	Events	E...	Results
1	Check_SCTP_Status.gls		Stop		None		Unknown
2	M3UA.gls	1	Stop	ASP Active	Send-ASPDn		Pass
3	Isup_Call.gls	2.2.2.1.1.1	Stop	Transmitting File	Terminate Call		Pass

Abort Abort All Show Records Auto Trash Trash

Save Column Width

DUT MAPS

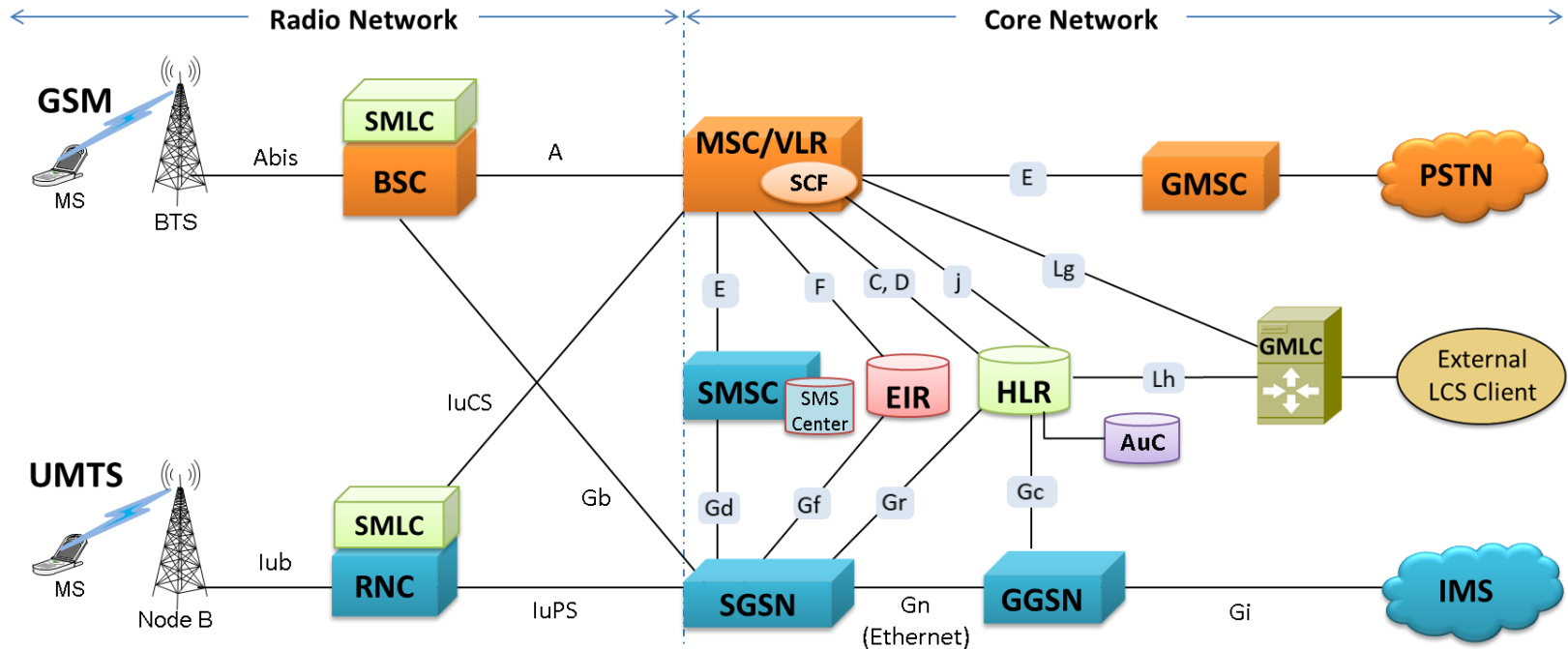
```


===== MTP3 User Adaptation Layer =====
0000 Version = 00000001 Release 1.0
0002 Message Class = 00000001 Transfer
0003 Transfer Message Type = 00000001 Payload Data
0004 Message Length = 52 (x00000034)
0008 Tag =
000A Length = 44 (x002C)
000E Originating Point Code =
0012 Destination Point Code = 1.1.1.(...001000 00001001)
0014 Service Indicator = 2.2.2.(...010000 00010010)
0015 Network Indicator = ...0101 TSMN User Part
0016 Message Priority = .....00 International network
0017 Signalling Link Selection = .....0 Priority Code 0
0018 Pdu = x01000100000000000020907041024567305200A07011165
===== ISUP Layer =====
0018 Circuit Identification Code = 00000001 (...0000 1)
001A Message Type = 00000001 Initial address
001B Mandatory Fixed Parameters =
001C Nature Of Connection Indicators Parameter = .....00 no satellite circuit in the connection
001D Satellite indicator = .....00 continuity check not required
001E Continuity check indicator = .....00 outgoing echo control device not inclu
001F Echo ctrl dev.ind(Mat.Conn.Ind) = .....0 treated as a national call
0020 Forward Call Indicators Parameter = .....00. No end-to-end method available
0021 National/international call ind =
0022 End-to-end method indicator =
                    
```

Scripts Message Sequence Event Config Script Flow

Error Events Captured Errors Link Status Up=1 Down=0

# Scripted MAP Simulation - MAPS™ MAP



 C, D, E, F, J  
Gc, Gd, Gf, Gr  
Lg, Lh

**MAPS™ MAP over IP & TDM Emulator**  
MAP (Mobile Application Part)



# Features

- MAP protocol simulation over TDM (T1 E1)
- Emulator can be configured as MSC (VLR), HLR, GMSC, EIR, AuC, SMSC, SGSN and GGSN entities and emulate the respective interfaces
- User-friendly GUI for configuring the MAP signaling links
- Access to all MTP3, SCCP, and MAP R4 protocol fields such as TMSI, IMSI, MCC, MNC, MSIN, CCBS and more
- Ready scripts for monitoring other end, set reporting state for the requested service, report an event or call outcome, report remote subscriber status procedures

# Call Generation and Reception

The screenshot displays the 'Call Generation - Untitled' application window. At the top, a table lists 10 scripts (HLR1.gls to HLR9.gls) with columns for Script Name, Profile, Call ID, Script Execution status, Status, Events, Result, Total Iterations, and Completed Iterations. Below the table are buttons for 'Add', 'Delete', 'Insert', 'Start', 'Abort', 'Refresh', 'Start All', and 'Abort All'. A 'View Executing Line' section shows script code, including 'MsgHandler: "HLRMessageHandler"', 'Hlr0id=#gHlr0id;', and 'KeyIdentifier: Hlr0id;'. A 'Call Reception' window is open below, showing a table of received calls (VLR\_Msc.gls) with columns for Sr No, Script Name, Call Info, Script Execution, Status, Events, Events Profile, and Results. Below this is a 'Message Sequence' diagram showing a sequence of messages between MAPS and DUT, such as 'selfReportingStateArg' and 'statusReportRes'. A 'CM Service Request Message Decode' window is also visible, showing protocol details for the MTP3 and SCCP layers.

**Loaded Scripts & Profiles** (points to the top table)

**Script Execution** (points to the 'View Executing Line' code area)

**Received Calls** (points to the 'Call Reception' table)

**Message Sequence** (points to the 'Message Sequence' diagram)

**CM Service Request Message Decode** (points to the 'CM Service Request Message Decode' window)

**Thank you**