
SIGTRAN Protocol Analysis and Simulation



818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878
Phone: (301) 670-4784 Fax: (301) 670-9187 Email: info@gl.com
Website: <https://www.gl.com>

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 - Need for new IP Protocol
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 - Media Gateway Controller

User Adaption layers

- M2UA (MTP Level 2 User Adaption)
- M3UA (MTP Level 3 User Adaption)
- SCCP User Adaption (SUA)
- ISDN User Adaption (IUA)

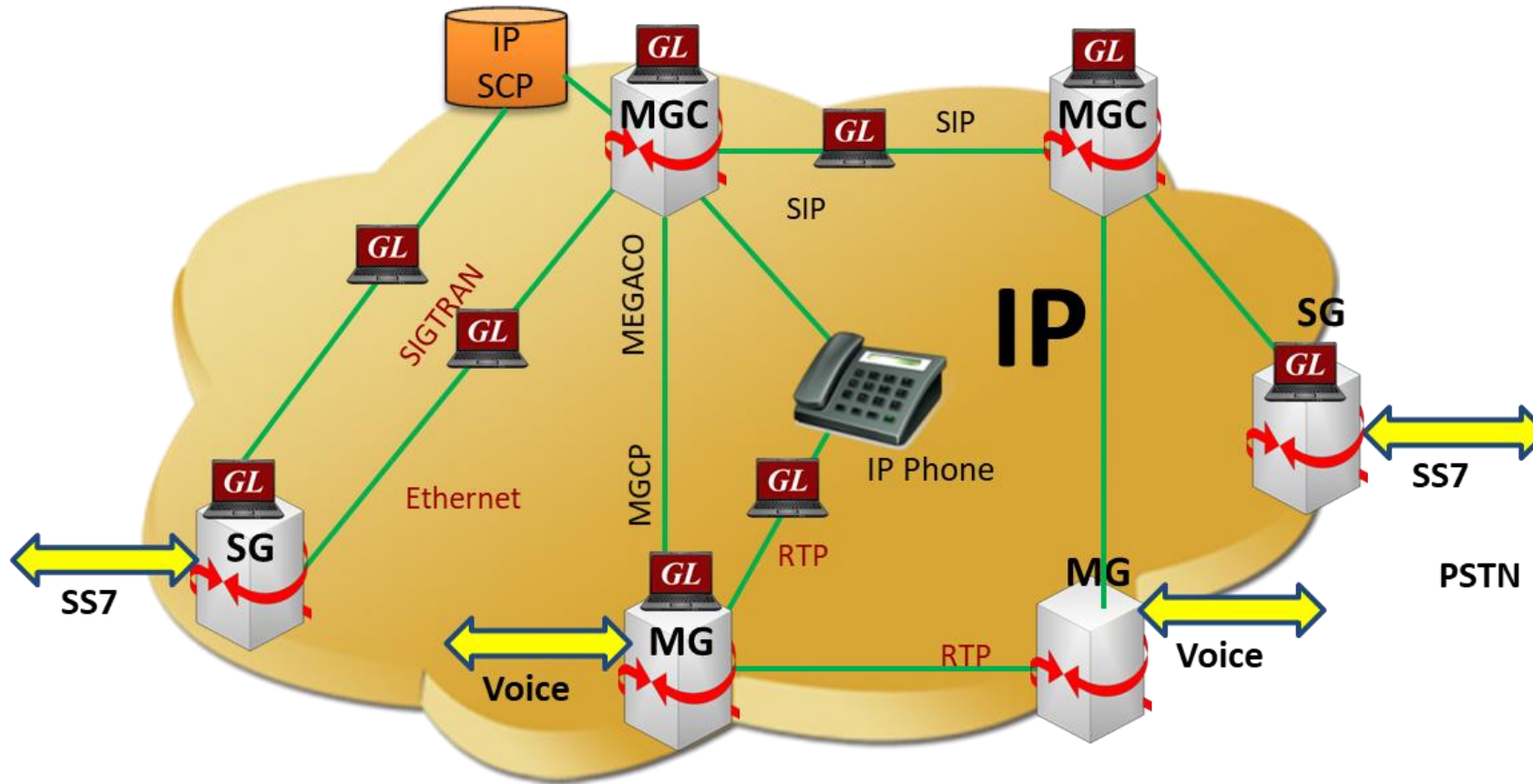
What is SIGTRAN ?


- SIGTRAN – Its a protocol suite used to carry PSTN signalling (SS7, ISDN, TUP and SCCP etc.) over SCTP as a Transport protocol in an IP network developed by IETF group called SIGTRAN Working Group
- Sigtran working group purpose is to address the transport of packet-based PSTN signaling over IP Networks by considering functional and performance requirements of the PSTN signaling

History of SIGTRAN

- The main difference between these two schemes (i.e. PSTN and IP) is that the long-distance carrier is replaced by an IP network. So we convert a long-distance call into two local calls plus long-distance IP transport. Thus the IP Telephony Service Provider (ITSP) can offer a cheaper price to its customers
- The costs of transporting the speech using an IP network are lower than those of a long-distance carrier, as the whole facilities are shared among all the users and there is no dedicated channels
- If we have a dedicated full-duplex circuit to transmit a telephone conversation we make poor use of it, as most of the time at least one of the parties will be silent (at least that is the idea) and its channels unused

Architecture View of SIGTRAN

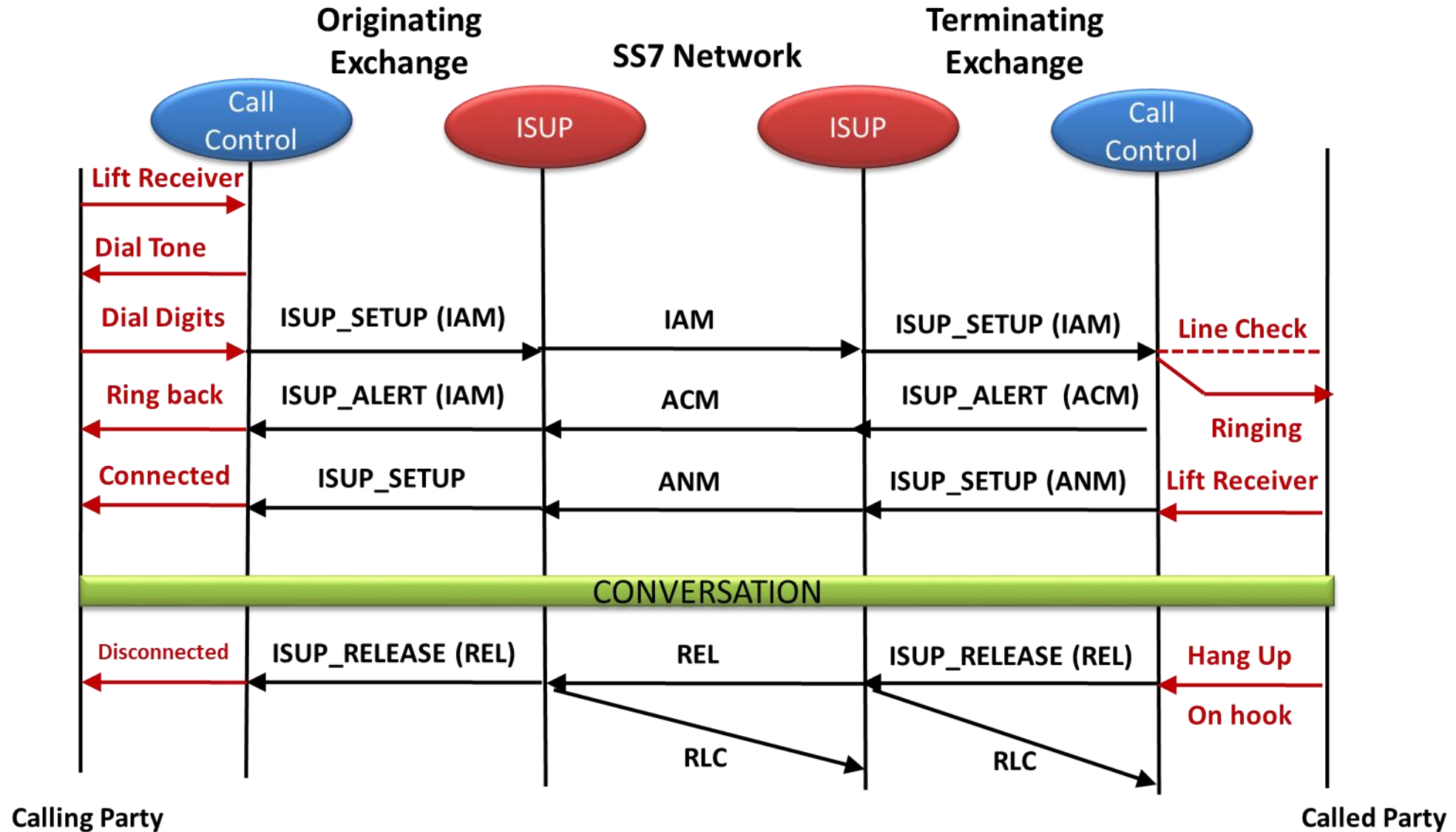


 **SS7 over IP (SIGTRAN) Analysis and Simulation**

SIGTRAN

- In the SIGTRAN architecture view, gateways connect the SS7 and IP networks. We can identify the three elements carrying PSTN signalling over IP network i.e. MG, SG and MGC. The SS7-IP gateways translates and transport the SS7 signaling through the IP network, Both the media data and the signaling can traverse the IP network and reach the destination, providing the same kind of services that the PSTN offers while making a better use of the network that carries the voice stream
- Media Gateway (MG) - The media gateway converts media provided PSTN network to the format required in IP network . For example, Media Gateway terminates PSTN media streams, packetizes the voice and delivers the packets to the IP network. At the receiver side, it performs the reverse function
- Signaling Gateway (SG) - The Signalling gateway receives and translates signalling from Pstn network and send accross IP network and vice-versa
- Media Gateway Controller (MGC) - Controls the parts of the call state that pertain to connection
- control for media channels in a MG i.e registration and resource management at MG
- IP SCP (IP enabled Service Control Point) - This exists wholly within the IP network, but is addressable from the SS7 network

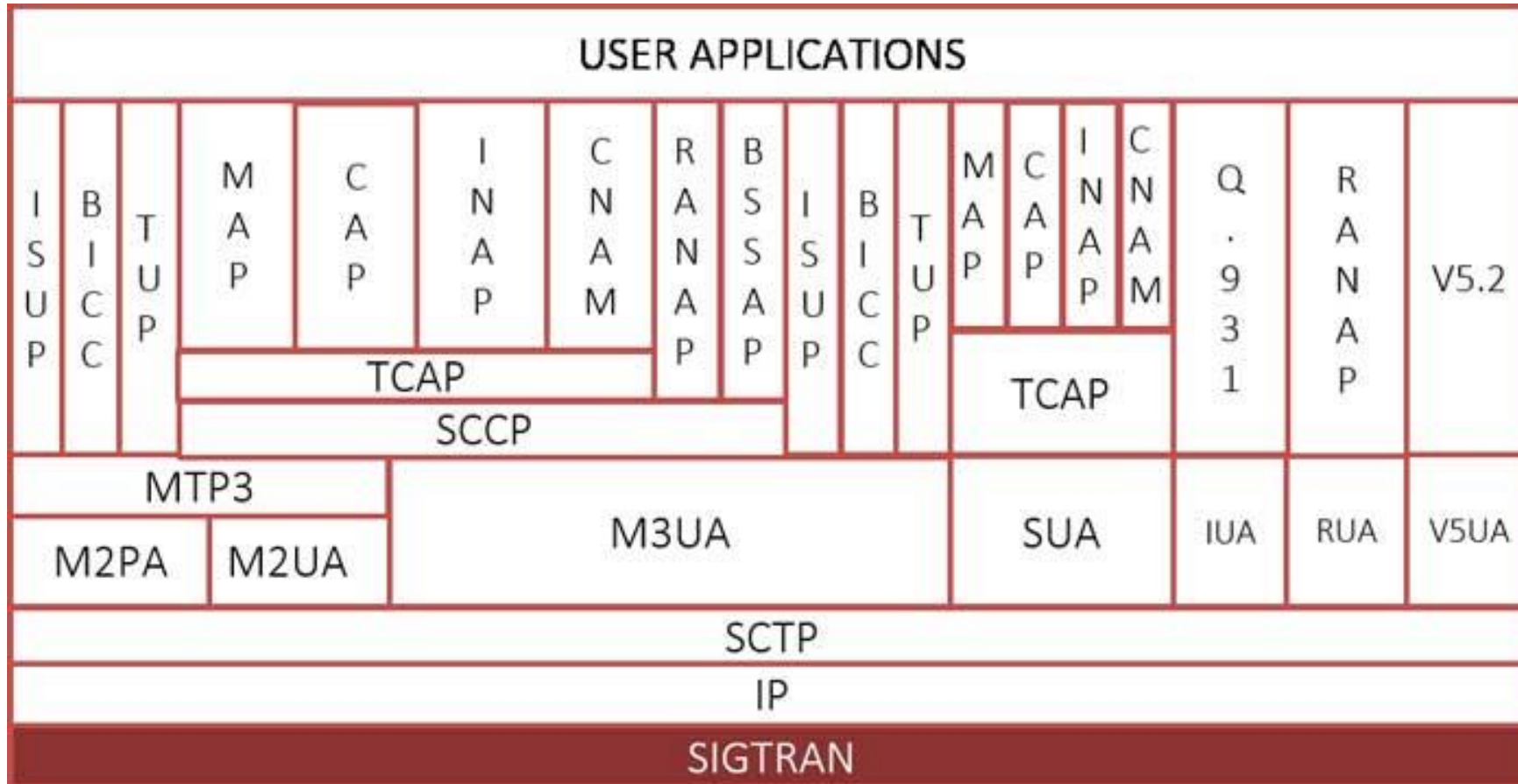
SS7 SIGTRAN Call Scenario



SIGTRAN Protocol Stack

The protocol stack includes protocols such as:-

- SCTP (Stream Control Transmission Protocol)
- M3UA, M2UA, SUA, IUA, M2PA, DUA, V5UA (All User Adaptation Protocols)



User Adaption Layers

- To make SS7 or ISDN or TCAP signaling transport over IP networks possible, an SS7-IP gateway must provide the means for translating SS7 messages into IP datagrams, and vice-versa
- However, that translation can be done at several layers. Even though there is no need to provide translation at all levels in the SS7 stack, adaptation modules (Layers) are developed and can translate SS7 signaling at the SCCP level, as well as MTP3 and MTP2 (there are even two proposals for MTP2)

Each UA has applicability -

- SUA provides services of SCCP to its users like TCAP
- V5UA provides services of V.5.2
- M2UA, M2PA provides services of MTP2 to MTP3
- IUA provides services of LAPD to Q.931
- M3UA provides services of MTP3 to ISUP, SCCP
- DUA provides services of LAPD to DPNSS/DASS2

User Adaption Layers

M3UA (MTP3-User Adaptation Layer)

The MTP3-User Adaptation Layer (M3UA) works at a lower layer than SUA. It directly replaces MTP3, and it provides support for the transfer of all SS7 MTP3-User Part messages, such as ISUP or SCCP over IP using SCTP.

M2UA (MTP2-User Adaptation Layer)

MTP2 level we have two different protocols that translates SS7 into IP. One of them is the MTP2-User Adaptation Layer (M2UA) and the other is MTP2-User Peer-to-Peer Adaptation Layer (M2PA). They both replace the MTP2 protocol, adapting the MTP3 protocol to the SCTP/IP stack.

IUA (ISDN Q.921-User Adaptation Layer)

The ISDN Q.921-User Adaptation Layer (IUA). The ITU-T recommendation Q.921 defines the data link level protocol used in ISDN signaling, also known as the Link Access Procedures on the D-channel (LAPD). IUA replaces Q.921 and uses SCTP as the transport layer, and provides transparent adaptation to Q.921 users, such as Q.931.

User Adaption Layers

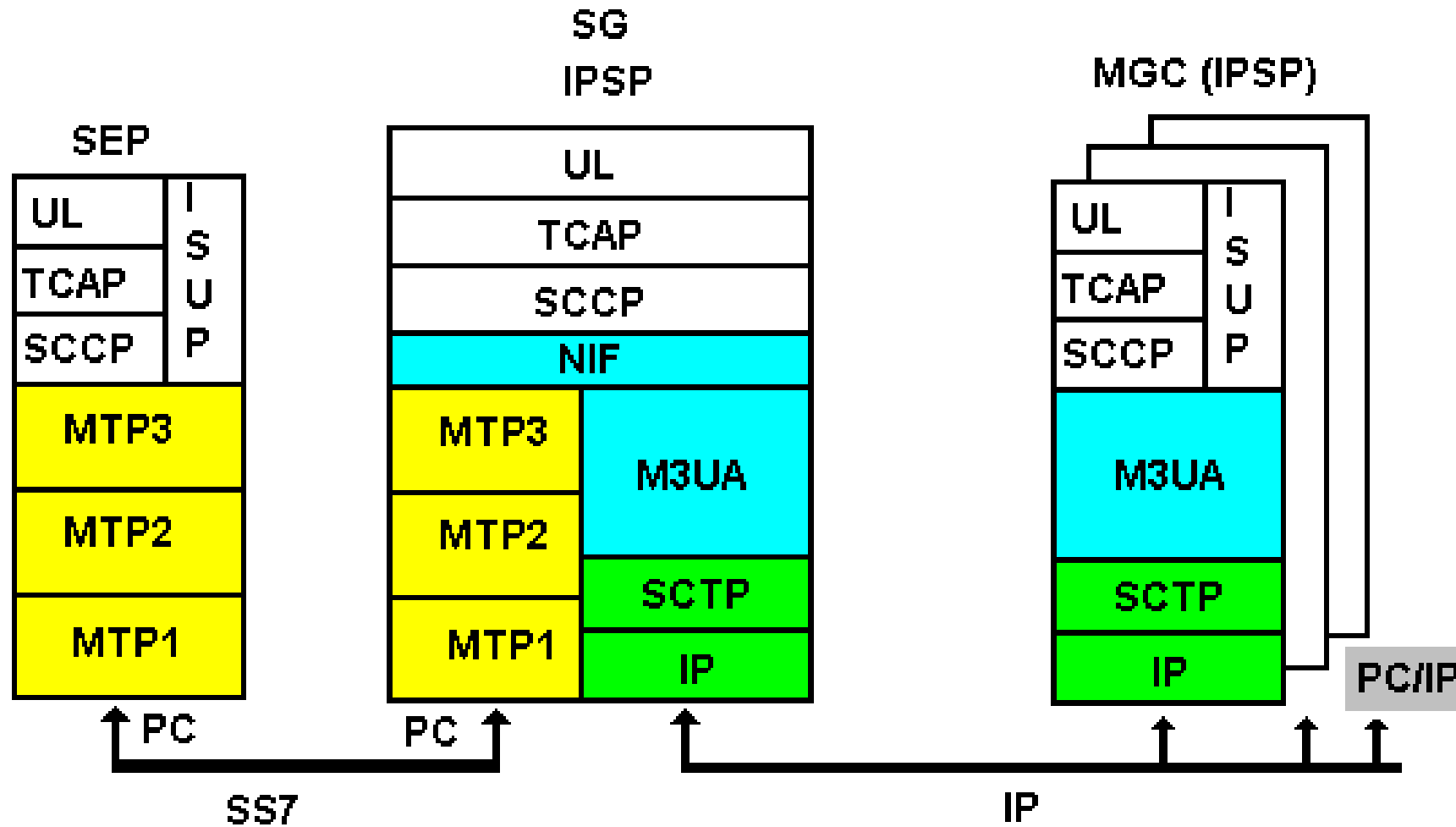
SUA (SCCP-User Adaptation Layer)

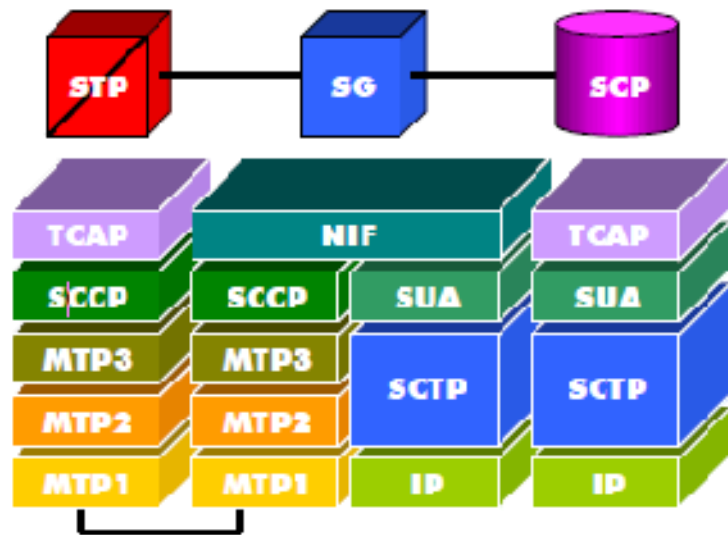
- The SCCP-User Adaptation Layer (SUA) is a protocol designed to transport any SCCP-User signaling (such as TCAP) over IP using SCTP, in a seamless way
- SUA can be used between a Signaling Gateway (SG) and an IP signaling endpoint (a Service Switching Point (SSP) or Service Control Point (SCP)), but can also provide transport of SCCP user information directly between IP endpoints rather than through a SG
- The SG is needed only to assure interoperability with SS7 signaling in the switchedcircuit network. It also supports all the features SCCP protocol supports in the IP network

Nodal Interworking Function (NIF)

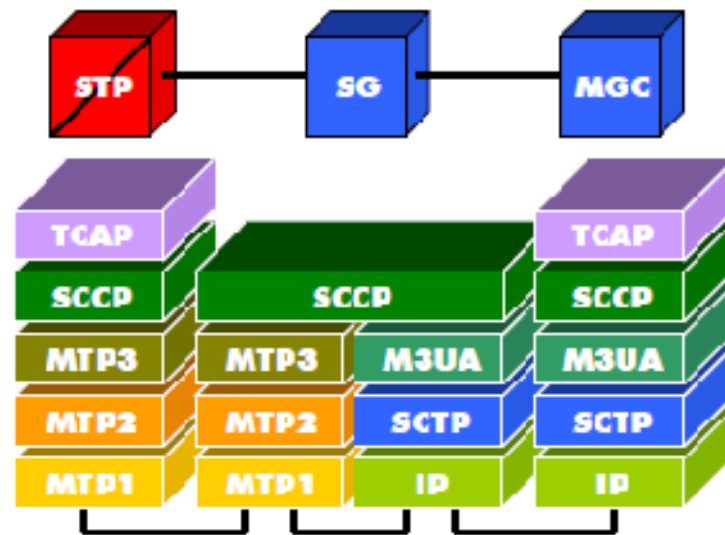
- Basically, the NIF serves as an interface between PSTN stack layers and Adoption layers within the SG

Conversion at Signaling Gateway

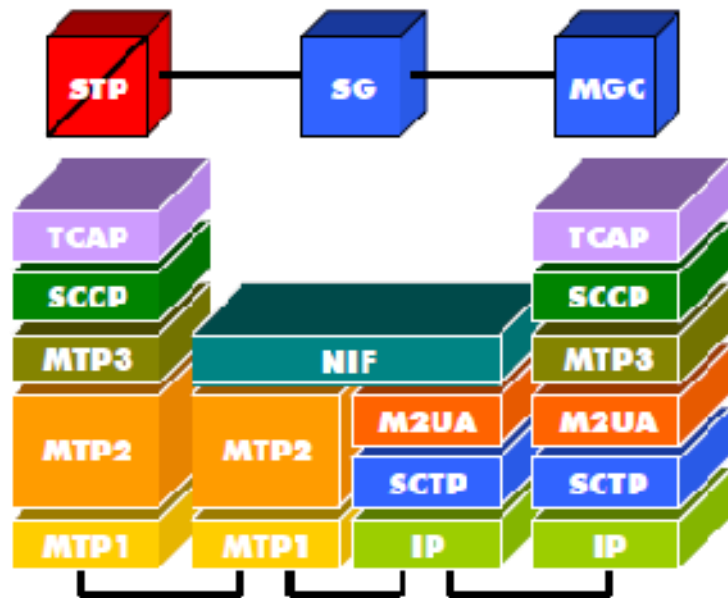




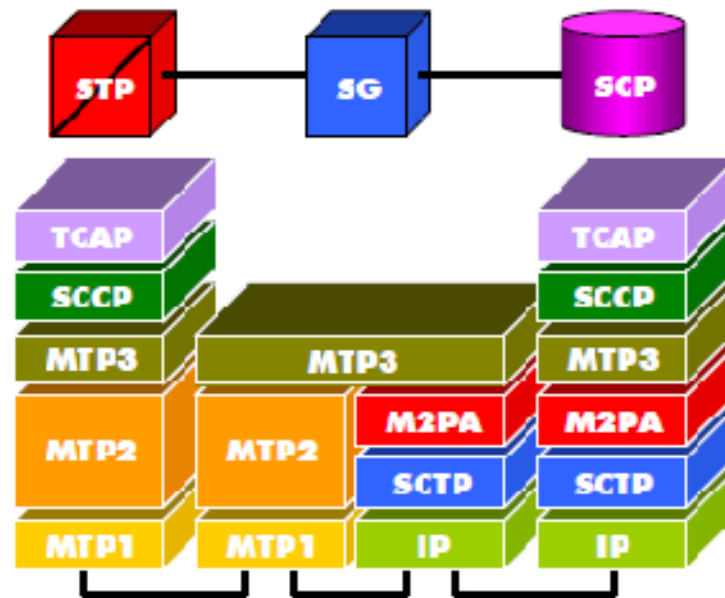
(a) Adaptation with SUA



(b) Adaptation with M3UA



(c) Adaptation with M2UA



(d) Adaptation with M2PA

SCTP vs TCP vs UDP

Services/Features	SCTP	TCP	UDP
Connection-oriented	yes	yes	no
Full duplex	yes	yes	yes
Reliable data transfer	yes	yes	no
Partial-reliable data transfer	optional	no	no
Ordered data delivery	yes	yes	no
Unordered data delivery	yes	no	yes
Flow control	yes	yes	no
Congestion control	yes	yes	no
ECN capable	yes	yes	no
Selective ACKs	yes	optional	no
Preservation of message boundaries	yes	no	yes
Path MTU discovery	yes	yes	no
Application PDU fragmentation	yes	yes	no
Application PDU bundling	yes	yes	no
Multistreaming	yes	no	no
Multihoming	yes	no	no
Protection against SYN flooding attacks	yes	no	n/a
Allows half-closed connections	no	yes	n/a
Reachability check	yes	yes	no
Pseudo-header for checksum	no (uses vtags)	yes	yes
Time wait state	for vtags	for 4-tuple	n/a

Applications

- Replaces high cost traditional circuit-switched network with the cheaper IP network
- Sigtran associations are capable of delivering high bandwidth in a single connection
- Using SIGTRAN protocols the application vendor like SMSC, HLR, ASG, can support heavy SS7 traffic
- Stack can be used between SG-SG, SG-MGC, SG-IP SCP etc.

Hardware and Software

- Hardware
 - Signaling Gateway
 - Media Gateway
- Software
 - Media Gateway Controller/Softswitch
 - Signaling Gateway Simulator/Emulators

SIGTRAN Vendors

- Signalling Gateway – Performance Technologies
- SS7 C7 SG – Squire Technologies
- MACH7-SIGTRAN Stack that supports SUA, M3UA, M2UA, M2PA, IUA and SCTP - Telsys
- HP OpenCallInternet Protocol Signaling Transfer Gateway - HP
- OpenCall IP-STG) bridges the next-generation Internet Protocol (IP) and the SS7 networks, enabling service providers to connect present and future applications across multiple networks
- Essentra CX Media Gateway Controller – VoITec
- Essentra SG signaling gateway and a separate media gateway both controlled by the Essentra CX, this solution enables increased E1/T1 capacity and signaling links
- Sigtran Stack i.e. SCTP and User Adaptation called SIGTRAN-BRICKS - Netbricks
- SIGTRAN Software Protocol Stack – Team UP Telco Solutions
- SIGTRAN Testing Software - Simulation and conformance Testing - Valid8
- Stinga SS7 simulator - SS7 simulation over IP through SIGTRAN (SCTP/M3UA) – UTEL Systems
- Media Gateway – AudioCodes, Avaya, Cisco etc
- Sigtran protocol Analyzer - SAFIRE Tracer Plug-In for SIGTRAN Protocol Analysis - SAFIRE
- QOS Analyzer for SIGTRAN – JDSU
- Sigtran Analysys – LinkBIT
- The most comprehensive solutions for monitoring and troubleshooting new complex SIGTRAN networks - Agilent Technologies Inc.

SIGTRAN Products

GL provides comprehensive test tools to test integrated services such as carrying both PSTN signalling and Media Over IP Network and testing of PSTN Signaling carried over IP i.e. SIGTRAN using simulation tools (i.e. MAPS™ SS7 Over IP and MAPS™ ISDN Over IP) and Analysis (SigTran Analyzer). Media Conversion using MGC (i.e. MAPS™ Megaco or MAPS™ MGCP).

- SIGTRAN Analyzer (PKV105)
 - Supports Detailed analysis of Sigtran stack layer such as M2UA, M2PA, M3UA, IUA, SUA and SCTP for ITU, ANSI, ETSI standards
 - Displays the key fields of SS7 and ISDN Protocols in separate columns
- MAPS™ SS7 SIGTRAN Emulator (PKS130)
 - SS7 SIGTRAN simulates IP part of Signalling gateway or Softswitch (MGC) carrying ISUP message over IP network using SCTP as transport layer
 - Its supports ISUP -> M3UA -> SCTP-IP stack
 - Used to Test Signalling Gateway and Softswitch (MGC) or IP SSP
- MAPS™ ISDN SIGTRAN Emulator (PKS135)
 - ISDN SIGTRAN simulates IP part of Signaling gateway or Softswitch (MGC) carrying ISDN message over IP network using SCTP as transport layer
 - Its supports ISDN -> IUA -> SCTP-IP stack
 - Used to Test Signalling Gateway and Softswitch (MGC) or IP SSP

SIGTRAN ANALYZER (PKV105)

SIGTRAN Analyzer Includes

- Virtual Packet Analysis (VPA) view
- Default panes - summary, detail, and hex dump of the frame data views
- Optional panes – statistics and call trace views

Key Features

- Supports Real-time as well as Off-line analysis
- Summary View displays M2UA Class, M2UA Type, M3UA Type and SUA Class, SUA Type, Called and Calling number, SCCP message type, SSN, INAP information
- Detailed View displays easy to understand decodes of the user-selected frame
- Hex Dump View displays the frame information in HEX and ASCII format
- Statistics View displays call and MSU statistics at any link or entire link set
- Call Trace View isolates call specific information such as status of each call (active/ completed), duration of completed call, OPC, DPC, CIC, Called and Calling Party Numbers, and more
- Search and filtering capabilities for both real-time as well as offline analysis
- Provides the 'Capture Filter' option to filter M2UA, M2PA, M3UA and SUA frames on the specified ports

Real-Time Analysis

- Default panes - summary, detail, and hex dump of the frame data views

- Optional panes - statistics and call trace views

✓ 1	7	00:00:00.000611	78	Internet IP(IPv4)	164.164.109.111	216.148.237.99	
✓ 1	8	00:00:00.000805	110	Internet IP(IPv4)	164.164.109.111	216.148.237.99	▼

```
Device1 Frame=3 at 00:00:00.000314 OK Len=94
Ethernet Frame Data
***** MAC Layer *****
Destination Address          = x00005F7CCEA3
Source Address               = x0050BA8DB3CA
Higher Layer Protocol       = x0800 Internet IP(IPv4)
***** IP Layer *****
Version                     = 0100.... (4)
Internet Header Length (In 32 bit words) = ....0101 (5)
```

Define Summary Column

- TCP Connection Options
- Periodic Trace Saving Options
- Startup Options
- Data Link Groups
- View Font Size
- INI Decode Options
- Define Summary Columns

- VLAN ID
- IP
- Compartments
- Copied Flag
- DF
- Delay
- Destination IP Address
- Flag
- Fragment Offset
- Handling Restrictions
- Header Check Sum

Real-Time Capture Filter



- Layers
 - MAC
 - IP
 - TCP
 - UDP
 - SCTP
 - SIGTRAN



<input type="checkbox"/>	M2UA	Port	2904
<input type="checkbox"/>	M2PA	Port	3565
<input type="checkbox"/>	M3UA	Port	2905
<input checked="" type="checkbox"/>	SUA	Port	14001
<input type="button" value="Default"/>			

Display Filter (Offline)

- Time Format
- View Filter**
- View Search
- TCP connection options
- Periodic trace saving options
- Startup Options
- Data Link Groups

The screenshot shows the 'Display Filter (Offline)' window. On the left, a tree view lists protocol layers with expand/collapse icons and checkboxes. 'MTP2 User Adaptation' and its sub-item 'M2UA Class' are selected, indicated by green checkmarks. Below the tree, a status bar shows 'All Selected'. On the right, a list of filter values is displayed, including 'MTP2 User Adaptation (M2UA)', 'Management (MGMT)', 'Q.921/Q.931 Boundary Primitives Transport (BPT)', 'Routing Key Management (RKM)', 'SS7 Signalling Network Management (SSNM)', and 'Transfer'. At the bottom of this list are 'Activate' and 'Deactivate' buttons. Below the filter list, a table header is visible with columns for 'Layer', 'Field', and 'Filter Value'.

Layer	Field	Filter Value
-------	-------	--------------

Define/Edit Statistics

- + ICMP
- SCTP
 - N Advertised Receiver Window
 - Beginning/Ending bits
 - N Cause Code
 - N Cause Length
 - N Checksum
 - N Chunk Length

Byte Percent

Value Set

- ABORT Chunk
- COOKIE ACK Chunk
- COOKIE ECHO Chunk
- DATA Chunk**

Statistics View

✓ 1	4	00:00:00.000139	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999995	111
✓ 1	5	00:00:00.000168	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999996	111
✓ 1	6	00:00:00.000196	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999997	111
✓ 1	7	00:00:00.000225	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999998	111
✓ 1	8	00:00:00.050775	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999999	111
✓ 1	9	00:00:00.050920	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999999	111

Σ Device #	Σ Chunk Type	Σ Time Stamp	Frame Count(Device #)	Frame Count(Chunk Ty...)	Frame Count(Time Stamp)
1	DATA Chunk (0)	x003CBE07D613CC01	1	1	1
total 1	total DATA Chunk (0)	total x003CBE07D613CC01	1	1	1
1	DATA Chunk (0)	x00C27E07D613CC01	1	1	1
total 1	total DATA Chunk (0)	total x00C27E07D613CC01	1	1	1
1	DATA Chunk (0)	x029C140ED613CC01	1	1	1

Call Detail Records

✓ 1	1	00:00:00.000050	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999992
✓ 1	2	00:00:00.000080	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999993
✓ 1	3	00:00:00.000110	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999994
✓ 1	4	00:00:00.000139	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999995
✓ 1	5	00:00:00.000168	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999996
✓ 1	6	00:00:00.000196	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999997
✓ 1	7	00:00:00.000225	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999998
✓ 1	8	00:00:00.050775	114	Internet IP(IPv4)	192.168.1.96	192.168.1.160	DATA Chunk	Transfer	Payload Data	9999999

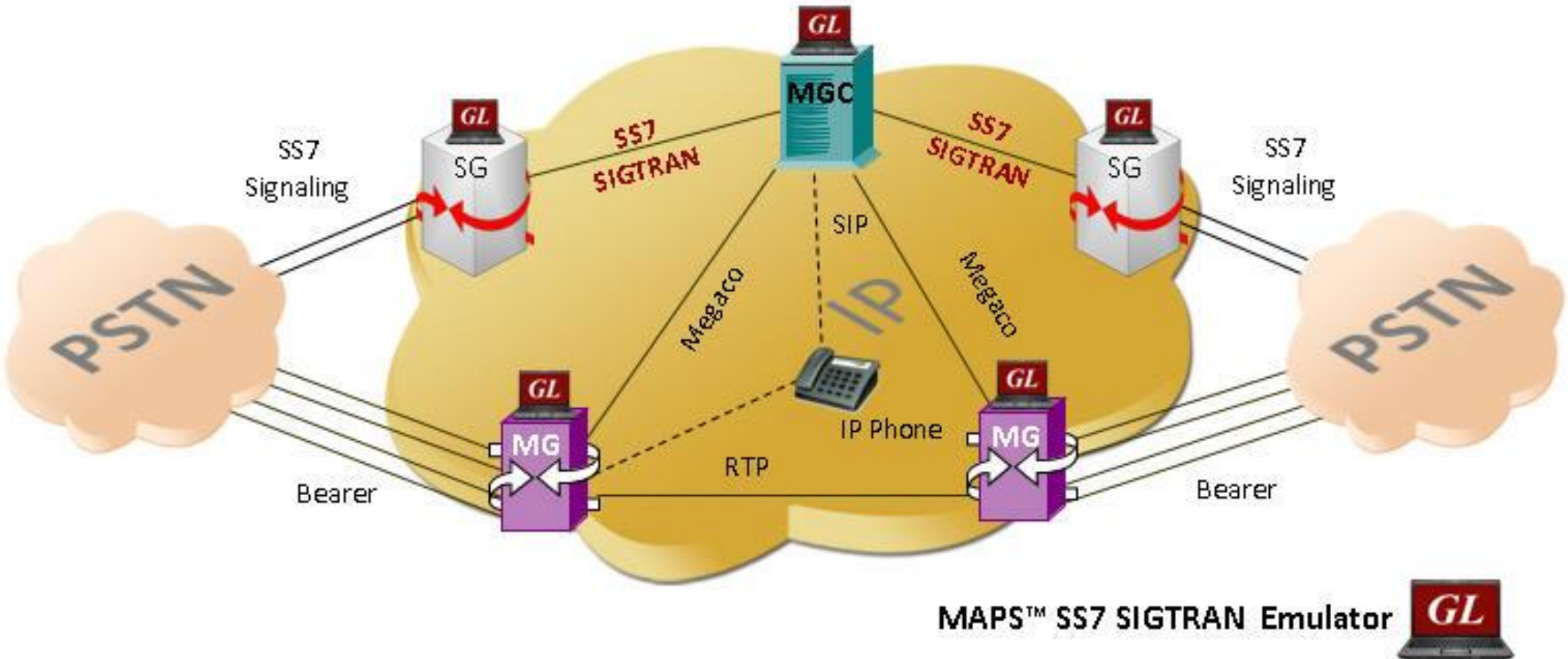
Call ID	Call Status	Call Start Date & Time	Call Duration	Call Type	Mob.ID1 (Calling#)	Mob.ID2 (Called#)	OPC	DPC	Release Cause
A 14	Active	2011-05-16 14:32:05.882877	62596:18:00.072284		1111115	9999995	1.1.1	2.2.0	SCCP failure
A 15	Active	2011-05-16 14:32:05.882906	62596:18:01.072255		1111116	9999996	1.1.1	2.2.0	SCCP failure
A 16	Active	2011-05-16 14:32:05.882934	62596:18:00.072207		1111117	9999997	1.1.1	2.2.0	SCCP failure

Select Call Trace Columns to Display ✕

- Call ID
- Call Status
- Call Start Date & Time
- Call Duration
- Call Type
- Mob.ID1(Calling#)
- Mob.ID2(Called#)
- OPC
- DPC
- Release Cause

MAPS™ SS7 SIGTRAN Emulator (PKS130)

MAPS™ - SIGTRAN (SS7 over IP)



MAPS™ - SIGTRAN Key Features

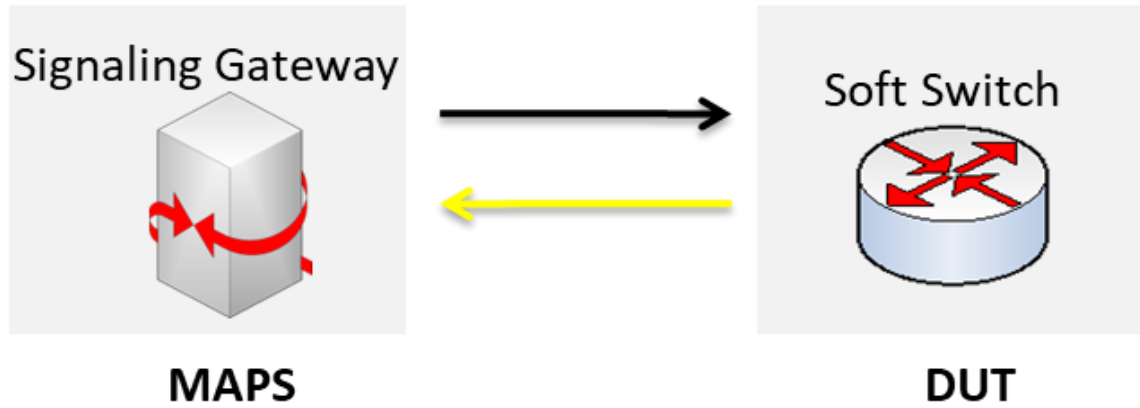
- SS7 simulation over IP
- User-friendly GUI for configuring the SS7 M3UA Layers
- User Configurable Signaling Links
- Supports M3UA and SCTP protocol machine
- Multiple M3UA links
- Access to all ISUP Message Parameters Initial Address, Subsequent Address, Release messages, and more
- User controlled 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

Supported Protocol Standards

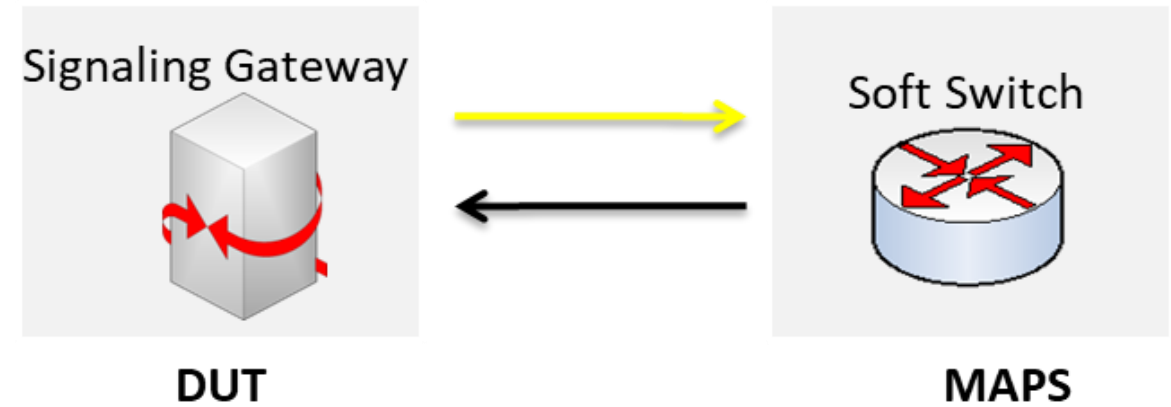
Supported Protocols	Standard / Specification Used
SS7 SIGTRAN	
ISUP ITU	ITU - Q.761, Q.762, Q.763 and Q.764
ISUP Conformance testing	ITU - Q.784.1
ISUP ANSI	ANSI - T1.113.1 to T1.113.4
ISUP UK	ND1007:2007/01 TSG/SPEC/007
M3UA ITU	RFC 3332
M3UA ANSI	RFC 3332
M2PA	RFC 4165
M2UA	RFC 3331

MAPS™ - SS7 SIGTRAN Configuration

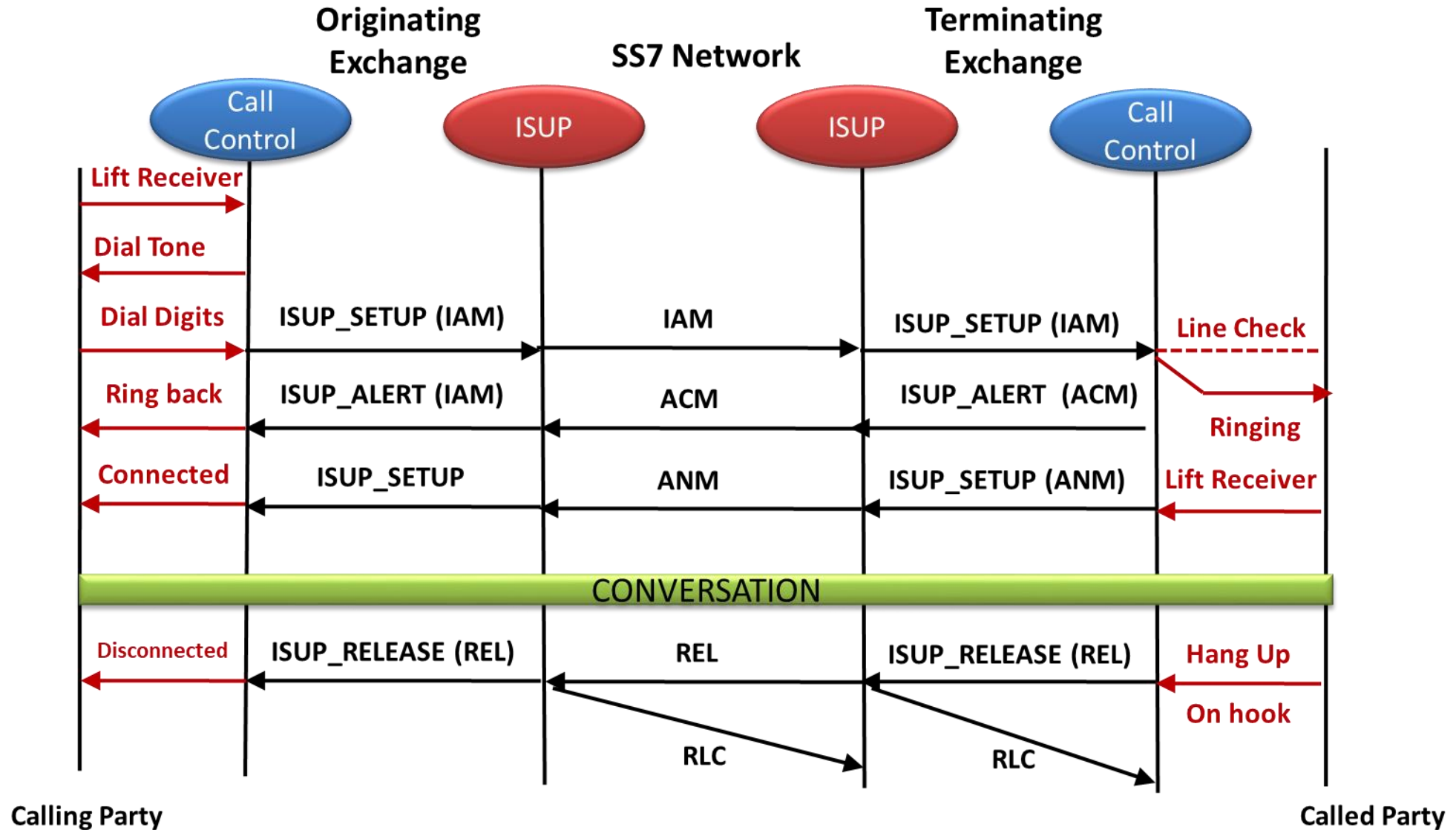
Scenario: MAPS™ acting as Signaling Gateway



Scenario: MAPS™ acting as Softswitch



SS7 SIGTRAN Call Scenario



MAPS™ SS7 SIGTRAN- Call Generation and Reception

Active Calls ← **Completed Calls**

Call Generation - Untitled

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Result	Total Iterations	Completed Iterations
1	PlaceCall.gls	SigPro1	1	Abort	Call Active	Terminate		Pass	1	1
2	PlaceCall.gls	SigPro2	2	Abort	Call Active	Terminate		Pass	1	1
3	PlaceCall.gls	SigPro3	3	Abort	Call Active	Terminate		Pass	1	1
4	PlaceCall.gls	SigPro4	4	Abort	Call Proceeding	Terminate		Unkno...	1	1
5	PlaceCall.gls	SigPro5	5	Abort	Call Proceeding	Terminate		Unkno...	1	1
6	PlaceCall.gls	SigPro6	6	Abort	Call Proceeding	Terminate		Unkno...	1	1
7	PlaceCall.gls	SigPro7	7	Abort	Call Proceeding	Terminate		Unkno...	1	1
8	PlaceCall.gls	SigPro8	8	Abort	Call Proceeding	Terminate		Unkno...	1	1
9	PlaceCall.gls	SigPro9	9	Abort	Call Proceeding	Terminate		Unkno...	1	1
10	PlaceCall.gls	SigPro10	10	Start	Call Released	None		Pass	1	1

Load Scripts and Profiles

Script Contents

```

send "InitialAddress" "InitialAddressImport" ;
KeyIdentific:ciic;
State="Call Initiated" ;
Status="Call Initiated";
Recvwaittime=$T7;

"mainloop":
recv msg wait Recvwaittime
    
```

Commands already executed

Call Reception

Sr No	Script Name	Call Info	Script Execution	Status	Events	Events Profile	Results
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	Completed	Call Released	None		Pass
5	RecvCall.gls	5	Completed	Call Released	None		Pass
6	RecvCall.gls	6	Abort	Call Active	Terminate		Pass
7	RecvCall.gls	7	Abort	Call Active	Terminate		Pass
8	RecvCall.gls	8	Abort	Call Active	Terminate		Pass
9	RecvCall.gls	9	Abort	Call Active	Terminate		Pass
10	RecvCall.gls	10	Abort	Call Active	Terminate		Pass

Receiving Scripts

Message Sequence of a selected call

MAPS	DUT	Time
Initial address	→	18:04:27.578000
Address complete	→	18:04:27.578000
Answer	→	18:04:31.578000
Release	→	18:05:11.609000
Release complete	→	18:05:11.609000

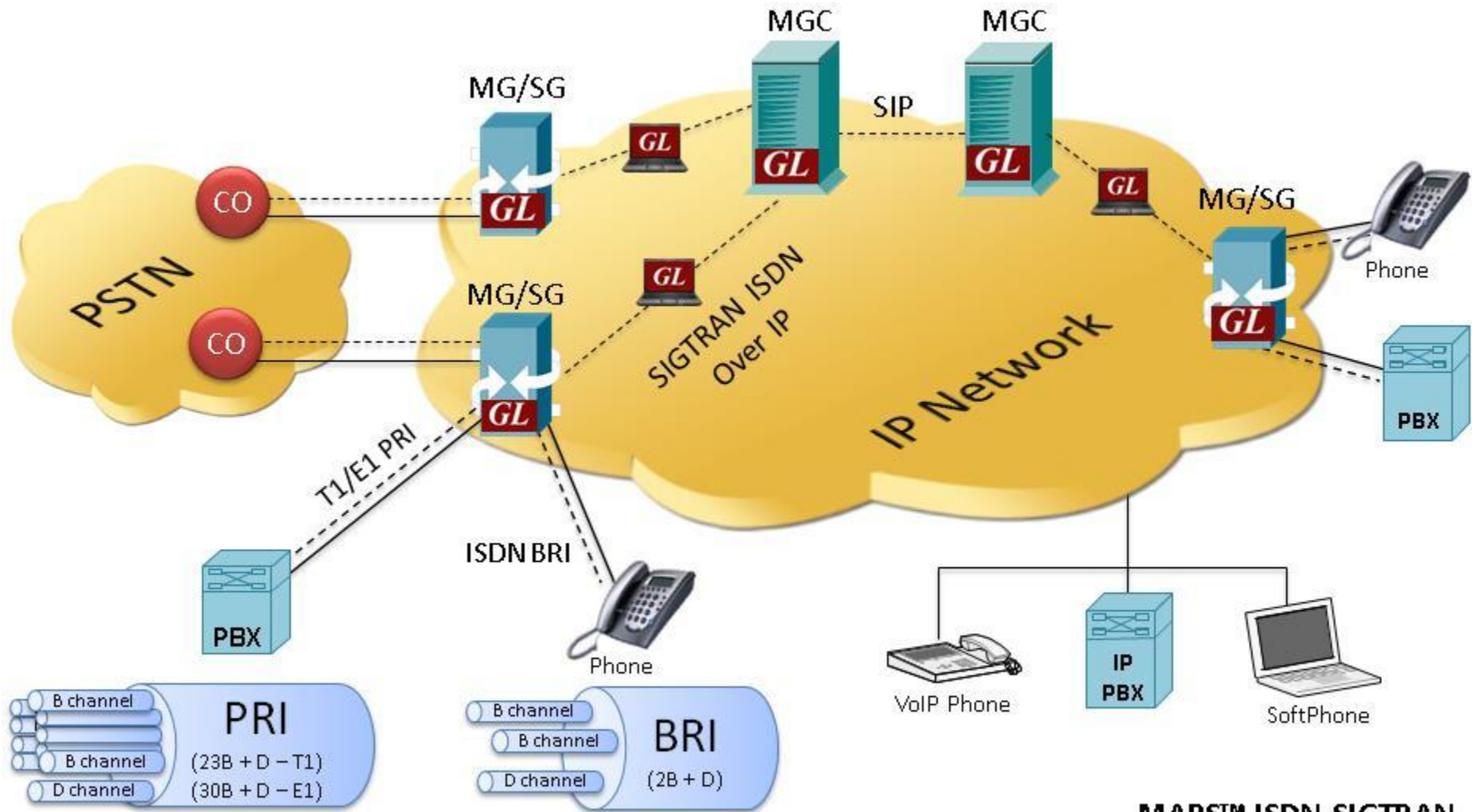
Message Decodes of the selected ISDN message

```

===== HTP3 User Adaptation Layer =====
Version = 00000001 Release 1.0
Message Class = 00000001 Transfer
Transfer Message Type = 00000001 Payload Data
Message Length = 50 (x00000032)
Protocol Data =
Tag = x0210 Transfer Protocol
Length = 42 (x002A)
Originating Point Code = 4114 (x00001012)
Destination Point Code = 2057 (x00000809)
Service Indicator = ...0101 ISDN User Part
Network Indicator = 00 International
    
```

MAPS™ ISDN SIGTRAN Emulator (PKS135)

MAPS™ ISDN - SIGTRAN



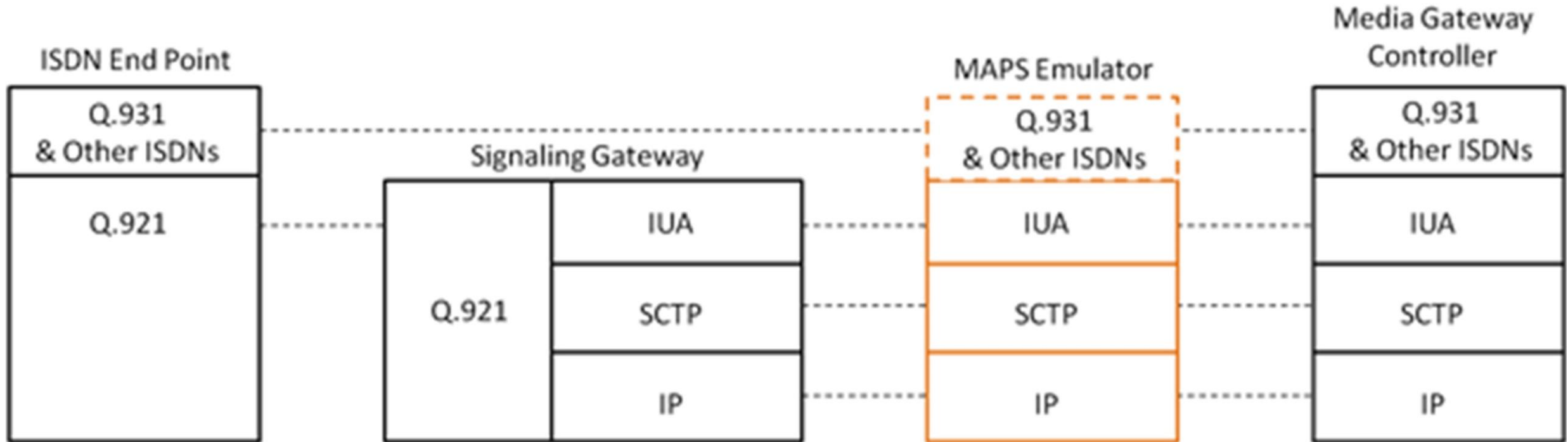
MAPS™ ISDN-SIGTRAN
 Simulate Elements in ISDN Network over IP



MAPS™ ISDN SIGTRAN Key Features

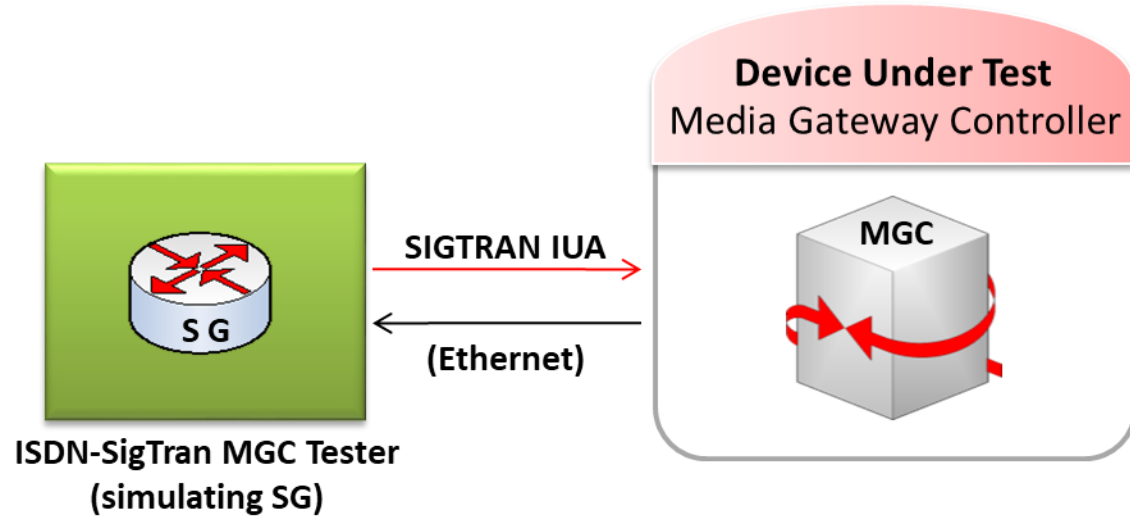
- Simulates ISDN signaling over IP (ISDN-SIGTRAN)
- Generates and process all ISDN messages such as Setup, Connect, Release messages, and more
- Switch and Subscriber Emulation
- User controlled access to optional ISDN parameters such as timers
- Provides various release cause codes such as rejected, no user response, user busy, congested, and so on to troubleshoot the problems in ISDN
- Impairments can be applied to messages to simulate error conditions
- Supports scripted call generation and automated call reception

Supported Protocol Standards

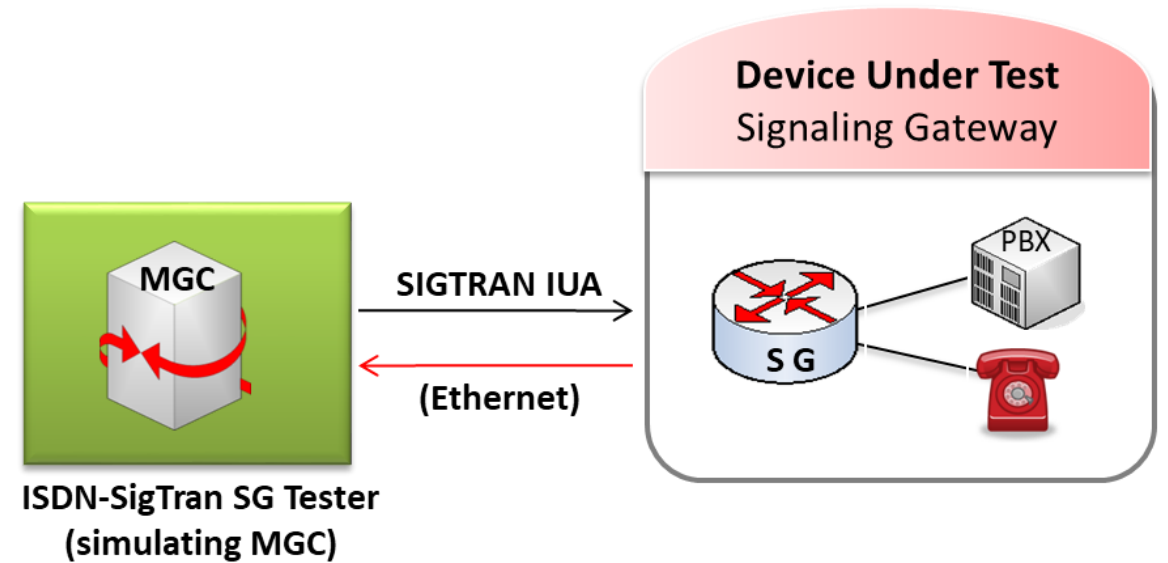


MAPS™ ISDN SIGTRAN Configuration

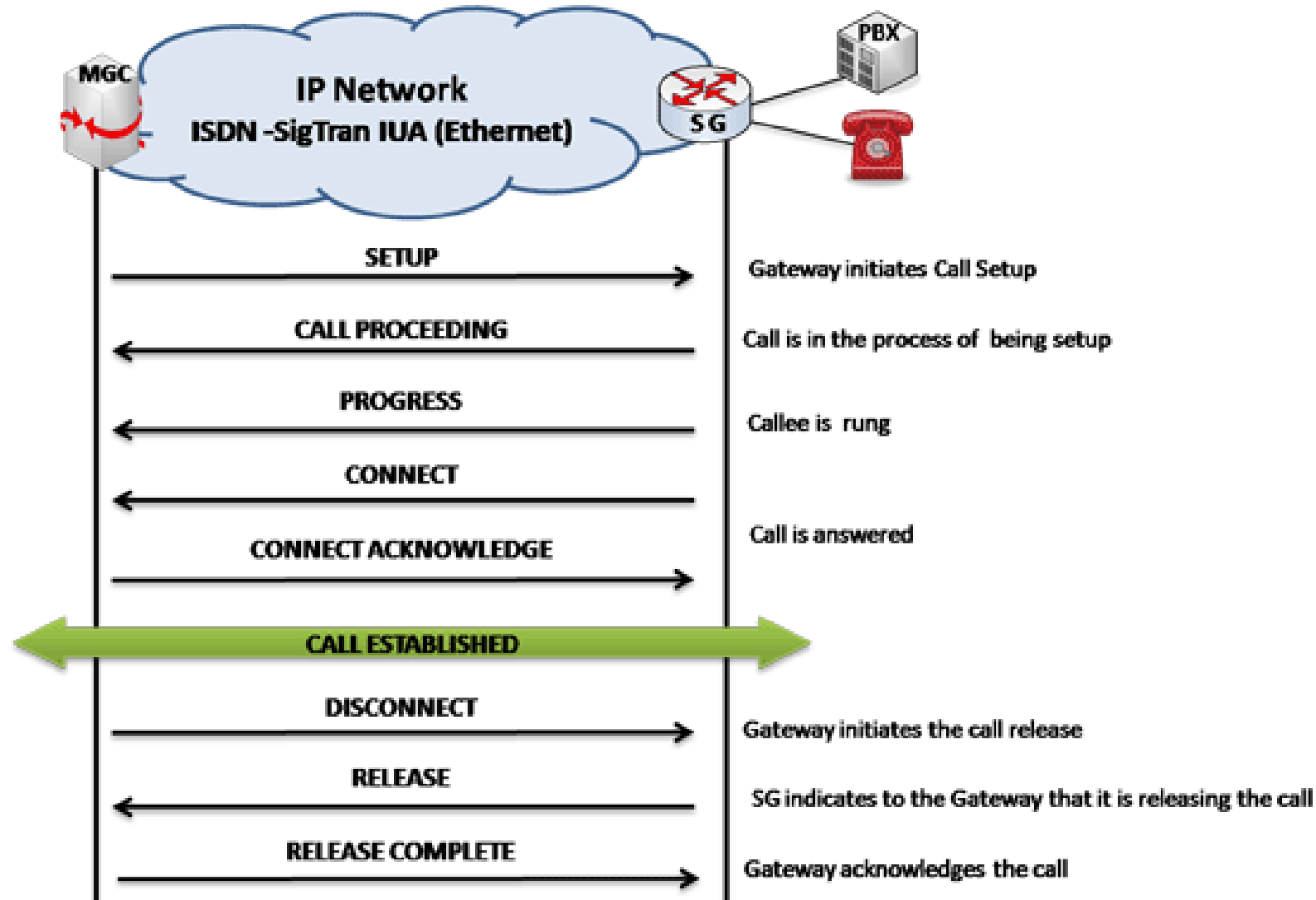
Scenario: MAPS™ acting as MGC



Scenario: MAPS™ acting as Signaling GW



ISDN SIGTRAN Call Scenario



MAPS™ - ISDN SIGTRAN Call Generation & Reception

Active Calls

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Result	Total Iterations	Completed Iterations
1	PlaceCall.gls	SigPro1	1	Abort	Call Connected	Disconn...		Pass	Infinite	93

Completed Calls

Sr No	Script Name	Call Info	Script Execution	Status	Events	Events Profile	Results
1	RecvCall.gls	1	Completed	Call Released	None		Pass
2	RecvCall.gls	1	Abort	Call Active	Disconnec...		Pass

Commands already executed

```

KeyIdentifier:CN;

send "SETUP" "SETUPImport" retxmit T303 (2,T303 msec);
State="Call Initiated";
EventLog ("Call Initiated");
Recvwaittime=8000;

"mainloop":
recv_msg wait Recvwa
    
```

Receiving Scripts

Message Sequence of a selected call

Direction	Message	Time
MAPS → DUT	SETUP	4:49:26.500000
DUT → MAPS	CALL PROCEEDING	4:49:26.515000
DUT → MAPS	ALERTING	4:49:26.515000
DUT → MAPS	CONNECT	4:49:34.078000
MAPS → DUT	CONNECT ACKNOWLEDGE	4:49:34.078000

Message Decodes of the selected ISDN message

```

===== ISDN Q.921-User Adaptation Layer Layer =====
Version = 00000001 R
Message Class = 00000101 Q
QPM Message Type = 00000010 D
Message Length = 68 (x00000)
Interface-Identifier Tag Length = x0001 Inte
Length = 8 (x0008)
Interface Identifier (integer) = 0 (x000000)
DLCI Tag Length = x0005 DLCI
Length = 8 (x0008)
SAPI (Service Access Point Identifier) = 000000.. (
TEI (Terminal Endpoint Identifier) = 00000000.. (
Protocol Data =
Protocol Data Tag = x000F Dprot
    
```

Buyer's Guide

Item No.	Item Description
PKV100	PacketScan™ Software (required)
PKV105	SIGTRAN Analyzer Software (optional)
PKS130	MAPS™ SIGTRAN (SS7 simulation over IP)
PKS135	MAPS™ ISDN SIGTRAN (ISDN over IP)
XX120	SS7 Analyzer Software (T1 or E1)
XX100	ISDN Analysis Software (T1 or E1)
XX649	MAPS™ SS7 (requires xx600)
XX648	MAPS™ ISDN (requires xx600)

Thank You