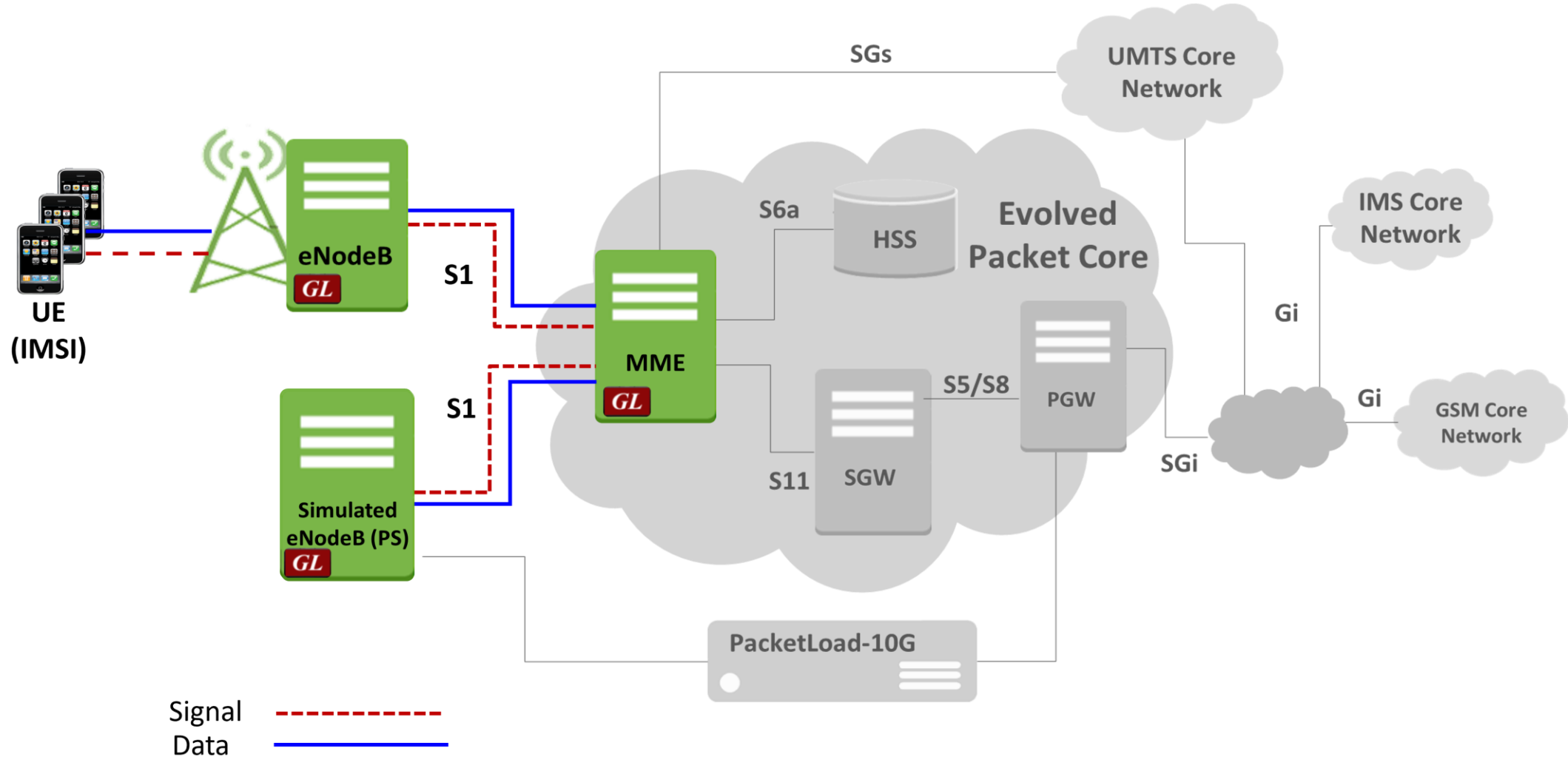

MAPS™ LTE S1 Interface and Conformance Emulator



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MAPS™ LTE S1 Architecture



MAPS™ LTE S1 Interface and Conformance Emulator

Emulate elements in LTE network

Main Features

- Setup a virtual real-time network simulating 4G-LTE network elements using 'MAPS™ 4G Wireless Lab Suite'
- Emulates eNodeB and MME
- Supports LTE Control plane
- Generates hundreds of UE signaling (Load Testing)
- Generates and process S1/NAS (valid and invalid) messages
- Supports GTP Traffic (GTP User Plane Data) which includes: verification like BERT testing, HTTP traffic generation capability, GGSN/PGW can actually be connected to real IP network to simulate Gateway testing
- Supports large number of subscribers with CSV based profiles for bulk call generation
- Handover S1 support including Intra/Inter MME
- UE initiated signaling for CSFB
- Supports LTE S1 interface conformance test suite with 50+ test cases

Applications

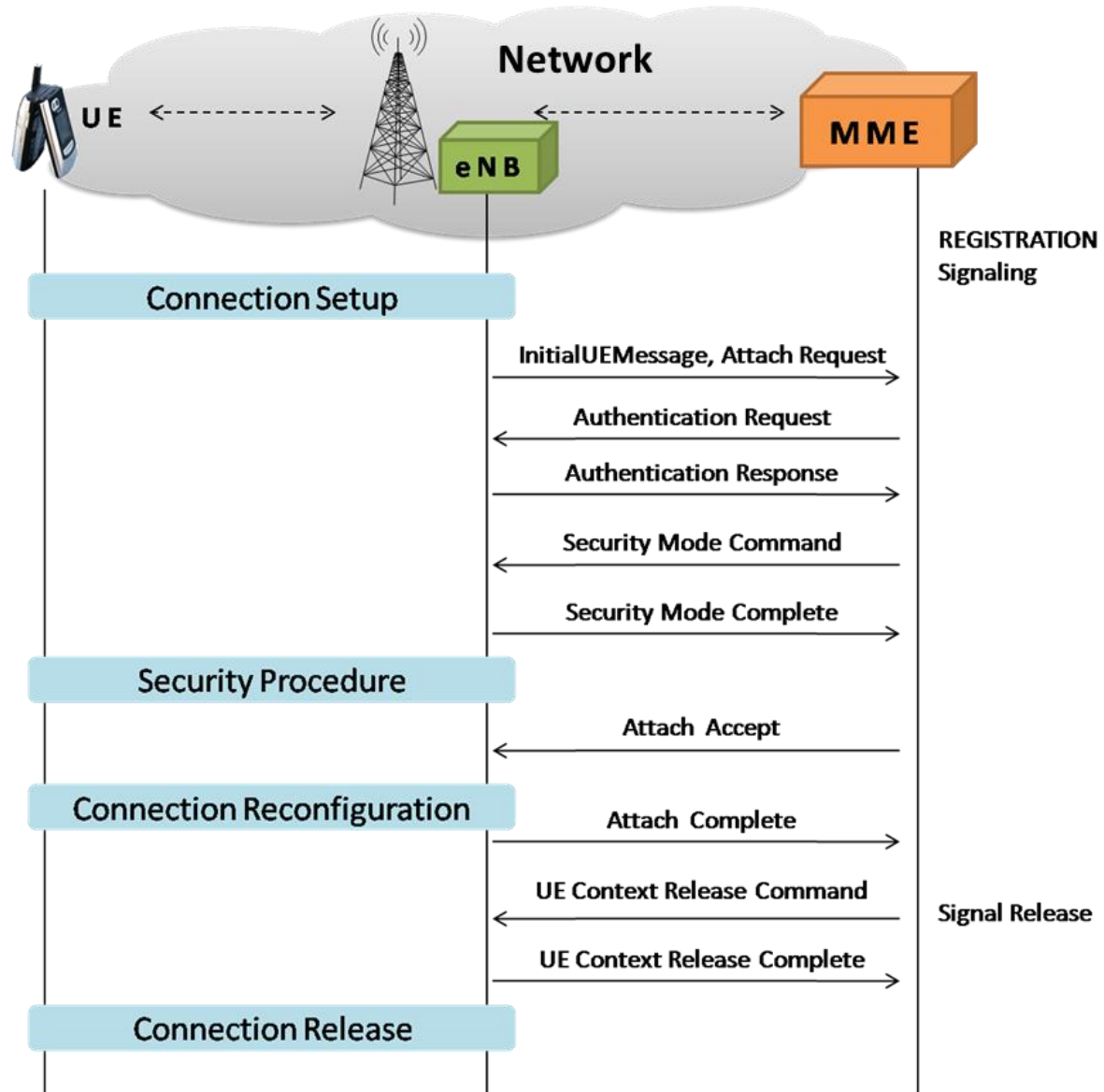
- Provides fault insertion, and erroneous call flows testing capability
- Performance testing, Load testing, Functional testing, Regression testing and Conformance testing of network elements
- Ready scripts makes testing procedure simpler, less time consuming and hence time to market products
- Emulate up to 500 Smartphones (UEs) powering up and down
- Authenticate and confirm security procedures
- QoS requests for greater or lesser bandwidth
- Temporary addressing management for mobility and security

Supported Protocol Stack & Standards



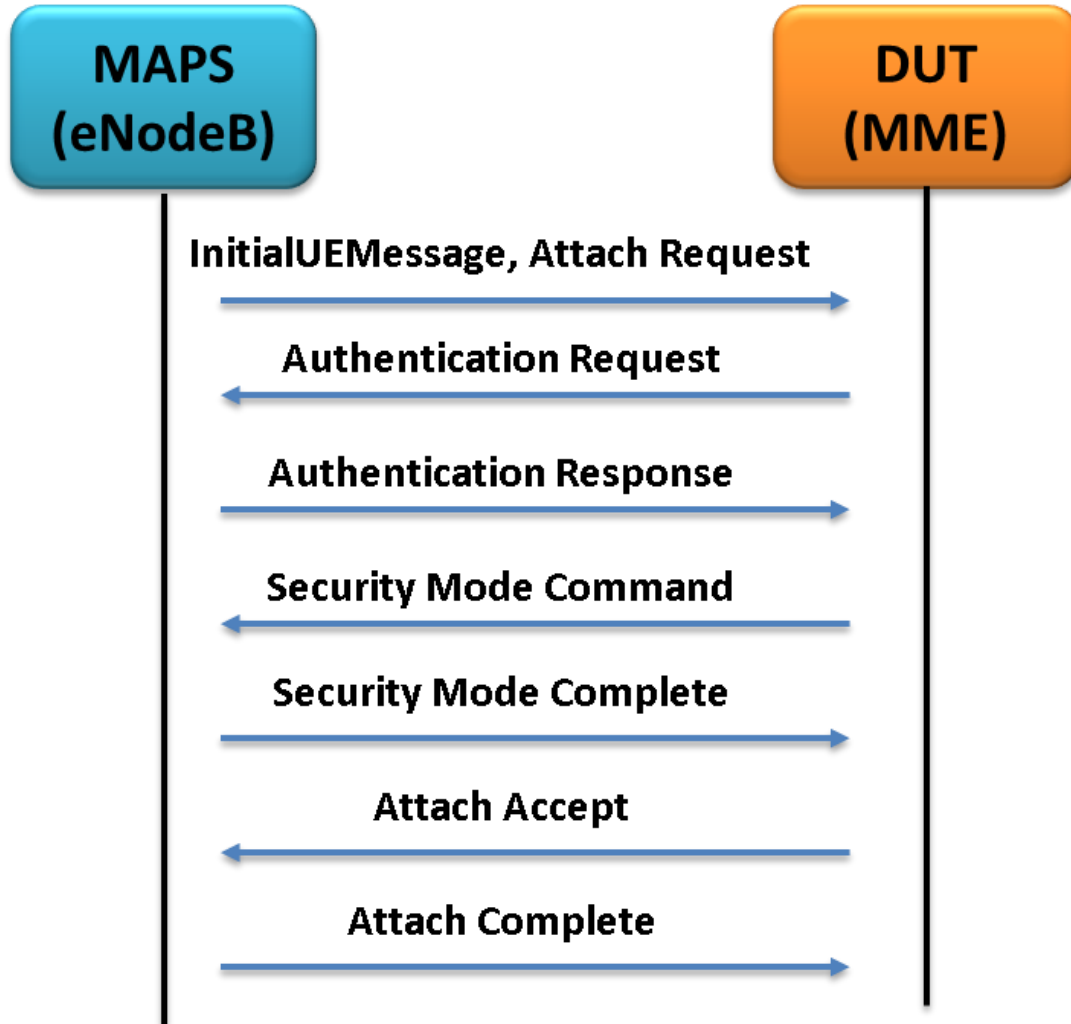
Supported Protocols	Standard / Specification Used
S1 Application Protocol (S1-AP)	3GPP 36.413 9.0.0 (2009-09)
SCTP	RFC 4960
Non-Access-Stratum (NAS)	3GPP TS 24.301 V9.0.0 (2009-09)

MAPS™ LTE S1 Signaling Scenario

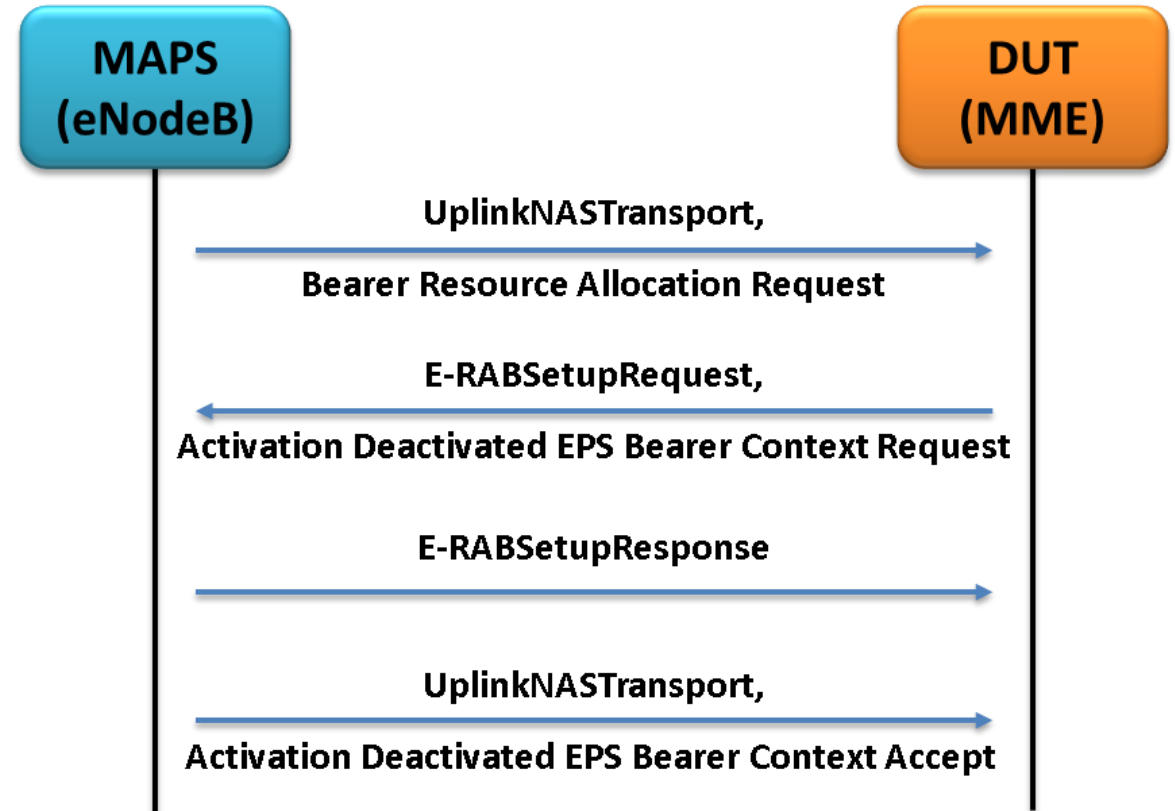


S1AP/NAS Procedures

UE Registration Signaling



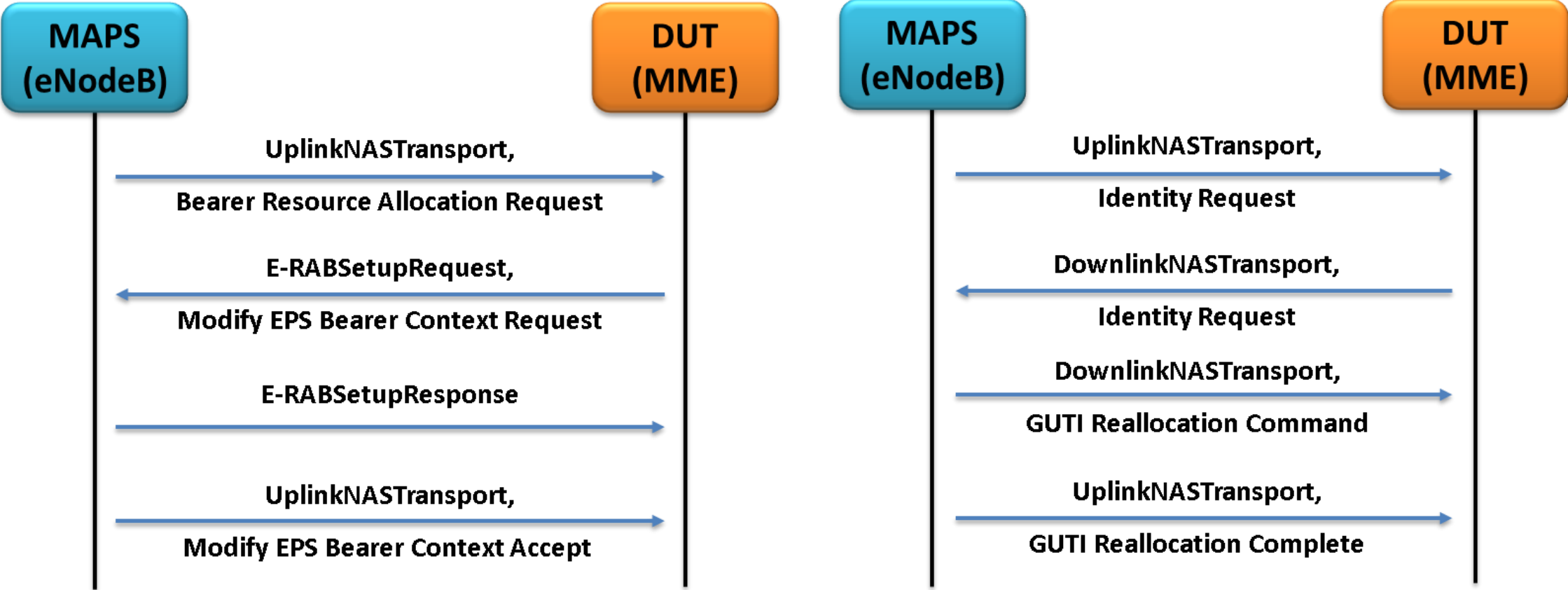
Dedicated Bearer Context



S1AP/NAS Procedures (Contd.)

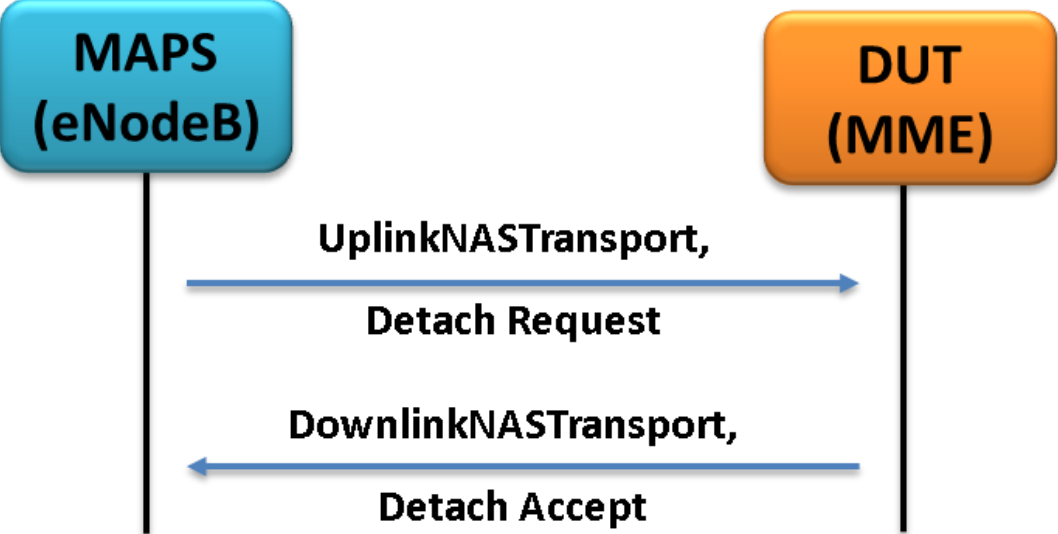
Modify EP Bearer Context Procedure

Identification & GUTI Reallocation Procedure

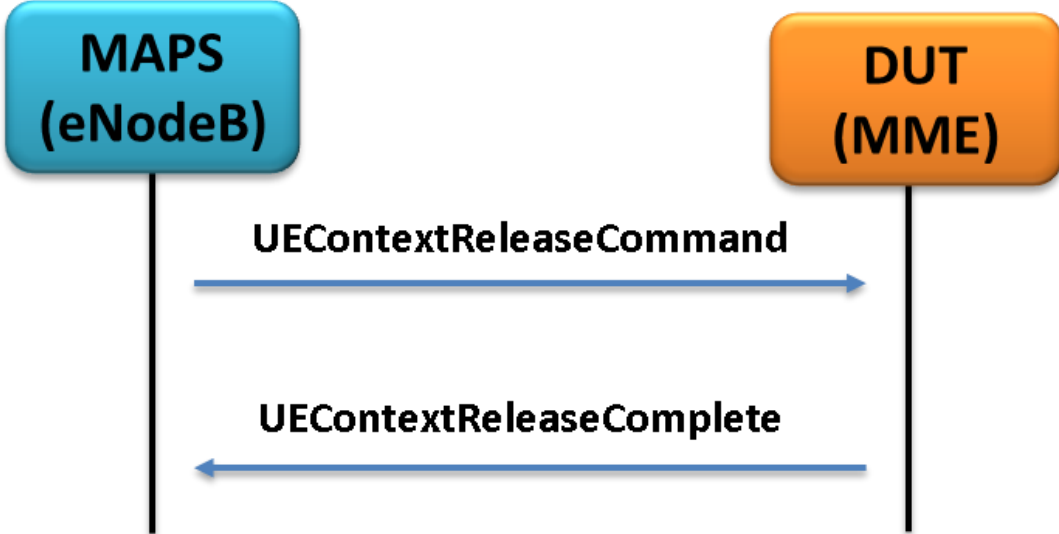


S1AP/NAS Procedures (Contd.)

Detach Procedure



UE Context Release Procedure



MAPS™ LTE S1 Call Generation

Active Calls Call Status Call Events

Loading Scripts and Profiles

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Result	Total Iterations	Completed It
1	S1SessionControl.gls	UEProfile0001	MSI..00101301204..	Start	UE-Deregistered	None		Pass	1	1
2	S1SessionControl.gls	UEProfile0002		Start		None		Unknown	1	0
3	S1SessionControl.gls	UEProfile0003		Start		None		Unknown	1	0

Message Sequence

Decode Message

MAPS™ LTE S1 Call Reception

The screenshot displays the MAPS MME (LTE S1 RELEASE15) - [Call Reception] interface. At the top, there is a menu bar with options: Configurations, Emulator, Reports, Editor, Debug Tools, Windows, Help. Below the menu is a toolbar with various icons. The main area is divided into two sections: a table of call results and a detailed message sequence.

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Results
1	S1APManagementHandler.gls		MMEName:MME01,MMEGroupID:...	Stop	S1-LINK-UP	Update MME Configuration		Pass
2	S1SessionControl.gls	UEProfile001	IMSI.001013012041631	Completed	UE-CONTEXT-RELEASED	None		Pass

Below the table, there are buttons: Stop, Stop All, Abort, Abort All, Show Records, Select Active Call, Auto Trash, Trash, Show Hidden Calls. There are also options for Save, Column Width, and Show Latest.

The message sequence section shows a list of messages between eNodeB and MME. The messages are as follows:

- InitialUEMessage, Attach Request, PDN Connectivity Request, 12:33:51.412000
- DownlinkNASTransport, Authentication Request, 12:33:51.414000
- UplinkNASTransport, Authentication Response, 12:33:51.433000
- DownlinkNASTransport, Security Mode Command, 12:33:51.434000
- UplinkNASTransport, Security Mode Complete, 12:33:51.457000
- DownlinkNASTransport, ESM Information Request, 12:33:51.457000
- UplinkNASTransport, ESM Information Response, 12:33:51.476000
- InitialContextSetupRequest, Attach Accept, Activate Default EPS Bearer Context Request, 12:33:51.481000
- InitialContextSetupResponse, 12:33:51.508000
- UplinkNASTransport, Attach Complete, Activate Default EPS Bearer Context Accept, 12:33:51.509000
- UplinkNASTransport, PDN Connectivity Request, 12:33:51.509000
- E-RABSetupRequest, Activate Default EPS Bearer Context Request, 12:33:51.511000
- E-RABSetupResponse, 12:33:51.533000
- UplinkNASTransport, Activate Default EPS Bearer Context Accept, 12:33:51.534000
- UplinkNASTransport, PDN Disconnect Request, 12:34:51.539000
- E-RABReleaseCommand, Deactivate EPS Bearer Context Request, 12:34:51.540000
- E-RABReleaseResponse, 12:34:51.557000
- UplinkNASTransport, Deactivate EPS Bearer Context Accept, 12:34:51.558000
- UplinkNASTransport, Detach request, 12:34:51.558000
- DownlinkNASTransport, Detach Accept, 12:34:51.559000
- UEContextReleaseCommand, 12:34:51.559000
- UEContextReleaseComplete, 12:34:51.580000

The decoded message section shows the following details:

```

===== S1AP Layer =====
S1AP-PDU = CHOICE
Extensibility Marker = 0
Choice Index = 0
InitiatingMessage = SEQUENCE
ProcedureCode = INTEGER
Contents = 12 id-initialUEMessage
Criticality = ENUMERATOR
Contents = 1 ignore(1)
Value = Open Type
Length = 146
InitialUEMessage = SEQUENCE
Extensibility Marker = 0
ProtocolIE-Container = SEQUENCE OF
Iteration Count = 6
ProtocolIE-Container = Instance 0
ProtocolIE-Field = SEQUENCE
ProtocolIE-ID = INTEGER
Contents = 9 id-eNB-UE-S1AP-ID
Criticality = ENUMERATOR
Contents = 0 reject(0)
value = Open Type
Length = 3
eNB-UE-S1AP-ID = INTEGER
Length Determinant = 2
Contents = 10001
ProtocolIE-Container = Instance 1
ProtocolIE-Field = SEQUENCE
ProtocolIE-ID = INTEGER
Contents = 26 id-NAS-PDU
Criticality = ENUMERATOR
Contents = 0 reject(0)
value = Open Type
Length = 94
NAS-PDU = OCTET STRING
NAS-PDU = x07417108091010032140611304E060
ProtocolIE-Container = Instance 2
ProtocolIE-Field = SEQUENCE
ProtocolIE-ID = INTEGER
Contents = 67 id-TAI
Criticality = ENUMERATOR
Contents = 0 reject(0)
value = Open Type
Length = 6
TAI = SEQUENCE
Extensibility Marker = 0
Preamble = 0
PLMNIdentity = OCTET STRING
MCC = 001
MNC = 01
    
```

Call Results

Message Sequence

Decode Message

Testbed Configuration

The screenshot displays the MAPS MME (LTE S1 RELEASE9) configuration interface. The window title is "[Testbed Setup - TestBedDefault]". The menu bar includes Configurations, Emulator, Reports, Editor, Debug Tools, Windows, and Help. The toolbar contains icons for file operations and system functions. The main area is divided into a tree view on the left and a configuration table on the right.

Config	Value
MMEConfiguration	1
MME	1
MME1	
MME IP Address	192.168.12.26
PLMN Id	
Mobile Country Co...	001
Mobile Network Co...	01
MME Group Id	032B
MME Code	52
MME Name	MME01
Tracking Area Identity L...	
Type of List	Non-Consecutive ...
TAC List	0001
Number of Consec...	4
Supported eNBs	
eNodeBs	1
eNodeBs 1	
eNodeB IP ...	192.168.12.27
eNodeB Port	36412
MME Port	36412
eNodeB Id	197094
eNodeB Na...	eNB02
Source SCT...	Server
TAC	0002
APN Configuration	3
APN Configuration 1	
APN Name	default
IPv4 Range	
Start IP	192.168.121.1
End IP	192.168.140.250
IPv6 Range	
APN Configuration 2	
APN Configuration 3	
Traffic	Disable
GTP Gateway Function	Disable
Gateway Hardware Interface Ty...	PC NIC
GTP Gateway	1
GTP Gateway 1	
NIC SGW Traffic IP Add...	192.168.12.26
HD Card Parameters	
Gateway Address	192.168.12.1
Gateway Address IPv6	fe80::1
GTP Port for Traffic	2152

At the bottom right of the configuration table, there are "Start" and "Edit" buttons. The status bar at the bottom of the window shows "Initialisation Errors".

Profile Configuration

The screenshot displays the 'Profile Editor - UE_Profiles' window in the MAPS MME (LTE S1 RELEASE9) application. The interface is divided into several sections:

- Profiles List (Left):** A table listing profiles from UEProfile0001 to UEProfile0027. UEProfile0001 is selected.
- Config Table (Center):** A tree view showing the configuration for UEProfile0001. The parameters and their values are as follows:

Category	Parameter	Value
Mobile Identity Parameters	Paging IMSI	45234001
	IMSI	001013012041631
	IMEI	359877068325248
	MSISDN	3012041631
GUTI	M TMSI	12345001
	E RAB Context	
E RAB Context	E RAB ID	5
	Default Bearer Id	5
	Dedicated Bearer Id	10
Network Detach Parameters	EMM Cause for Detach	Network failure
	Type Of Detach	IMSI detach:Re-Atta...
Authentication Parameters	Authentication Algorithm Type	Milenage
	RES Length	8 bytes
	Key	00112233445566778...
	Operator Variant Parameter Ty...	OPc
	OP	01020304050607080...
	OPc	01020304050607080...
	AMF	8000
	SQN	000000000079
Integrity and Encryption Algor...	EPS Integrity Algorithm Ty...	EPS Integrity Algorit...
	Encryption Algorithm Type	EPS Encryption Algor...
	NAS Key Set Identifier	1
UE Context	PCSCF IP Address	192.168.12.20
	PCSCF IP Address IPv6	fe80::192:168:13:67
Required QoS	Remote IP Address	192.168.10.68
	Maximum Requested Bandwi...	1000000
	Maximum Requested Bandwi...	1500000
	QoS Class Identifier	9
- Enable Column (Right):** A column with a checked 'Enable' checkbox for the selected profile.
- Buttons (Bottom):** 'Add', 'Insert', 'Delete', 'Properties', 'Insert', 'Delete', 'Clear'.

Incoming Call Handler Configuration

The screenshot displays the 'Incoming Call Handlers Configuration' window in the MAPS MME (LTE S1 RELEASE9) software. The window title is 'MAPS MME (LTE S1 RELEASE9) - [Incoming Call Handlers Configuration - default]'. The interface includes a menu bar with 'Configurations', 'Emulator', 'Reports', 'Editor', 'Debug Tools', 'Windows', and 'Help'. Below the menu is a toolbar with various icons. The main area contains a table with two columns: 'Message Name' and 'Script Name'. The 'S1SetupRequest' message is highlighted, and its script is 'S1APManagementHandler.gls'. Other messages include 'Reset', 'PDN Connectivity Request', 'Tracking Area Update Request', and 'SERVICE REQUEST', all using 'S1SessionControl.gls'. To the right of the table is a 'Scripts' list containing 'S1APManagementHandler.gls'. Below the scripts list are radio buttons for 'Sequence' (selected) and 'Random', along with 'Up' and 'Down' buttons. At the bottom of the window are buttons for 'Add', 'Delete', 'Apply Scripts', and 'Clear Scripts'.

Message Name	Script Name
S1SetupRequest	S1APManagementHandler.gls
Reset	Reset.gls
PDN Connectivity Request	S1SessionControl.gls
Tracking Area Update Request	S1SessionControl.gls
SERVICE REQUEST	S1SessionControl.gls

Scripts
S1APManagementHandler.gls

Sequence
 Random

Up
Down

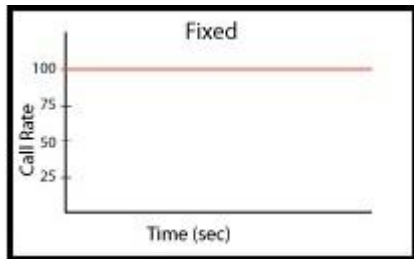
Add Delete

Add Delete Apply Scripts Clear Scripts

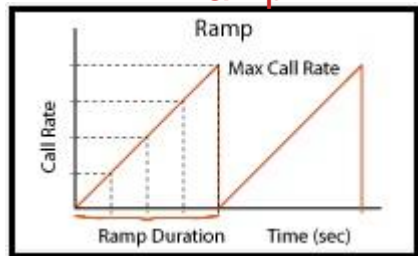
Load Generation

- Stability/Stress and Performance testing using Load Generation
- Different types of Load patterns to distribute load
- User can load multiple patterns for selected script
- User configurable Test Duration, CPS, Maximum and Minimum Call Rate etc.

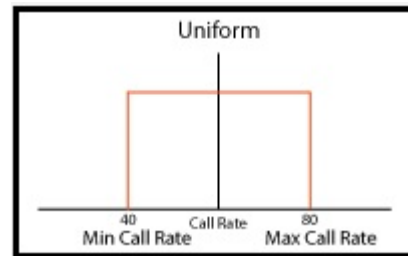
Fixed



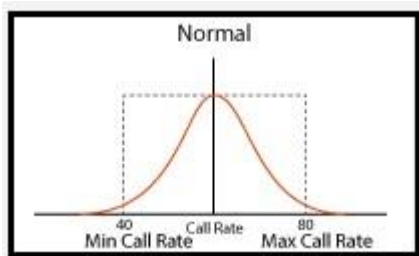
Ramp



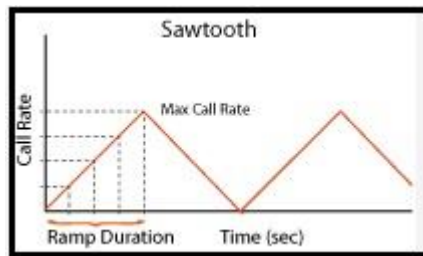
Uniform



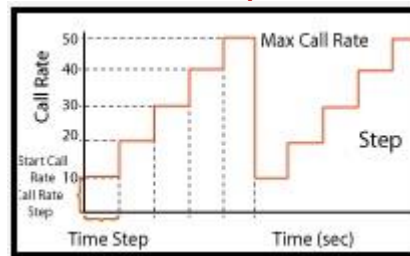
Normal



Saw-tooth



Step



GL MAPS eNodeB (LTE S1 RELEASE9) - [Load Generation - LoadGendefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Total Calls To Generate * (* indicates no limit)
 Max Active Calls 100 Unique Distributions Per Script

Multi Distributions Iteration * (* indicates no limit)

Distributions	Description	Add
Uniform	MinCR=40, MaxCR=80, Duration=10.00	Remove
Fixed	Call Rate=20, Duration=10.00	Remove All
Normal	MinCR=40, MaxCR=80, Duration=10.00	Edit

Scripts Exclusive Profiles

Scripts	Profile
S1SessionControl	UEProfile0001
	UEProfile0002
	UEProfile0003
	UEProfile0004
	UEProfile0005
	UEProfile0006
	UEProfile0007
	UEProfile0008
	UEProfile0009
	UEProfile0010

Add Delete Add Delete

Stop Time Days 0 Hours 0 Minutes 0 Start Time - 00:00:00.000 Pause
 End Time - 00:00:00.000 Start

MAPS™ LTE S1 Bulk Call Generation

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Result	Total Iterations	Completed...
1	S1SessionControl.gls	UEProfile0001	IMSI: 001013012041631.MTMSI: 0x...	Stop	UE-REGISTERED	Detach	Pass	10	1
2	S1SessionControl.gls	UEProfile0002		Start		None	Unknown	10	0
3	S1SessionControl.gls	UEProfile0003		Start		None	Unknown	10	0
4	S1SessionControl.gls	UEProfile0004		Start		None	Unknown	10	0
5	S1SessionControl.gls	UEProfile0005		Start		None	Unknown	10	0
6	S1SessionControl.gls	UEProfile0006		Start		None	Unknown	10	0
7	S1SessionControl.gls	UEProfile0007		Start		None	Unknown	10	0
8	S1SessionControl.gls	UEProfile0008		Start		None	Unknown	10	0
9	S1SessionControl.gls	UEProfile0009		Start		None	Unknown	10	0

```
Script Contents
//*****Initialization Section*****

if(_S1CONNECTION=="Successful")
    goto "CONTINUE";
else
    ErrorLog("S1-SETUP FAILED");
    exit;
endif

"CONTINUE":
    ReportEvent(Script = "Running");
    //ReportEvent(IsTransportUp = "Down");
    LTES1ScriptId = "Null" ;
    MTPagingInitiated="False";
    AuthenticationLogs=0; //To display Authentication Parameters
    BearerLogs=0; //To display slap signalling(bearers) Parameters
    GTPSessionLogs=0; //To display GTP Command Parameters
    IsCallReception = 0;
    TxCount=0;
    RxCount=0;
    nFileCount=0;
    File_TxCount=0;
    File_RxCount=0;
    MMECodeInt=$_MMECode;
    MMEGrpIDInt=$_MMEGrpID;
    MMECodeHex=$_MMECodeHex;
```


MAPS™ LTE S1 Events Log

GL MAPS eNodeB (LTE S1 RELEASE15) - [Events]

Configurations Emulator Reports Editor Debug Tools Windows Help

Event Log | Error Events | Captured Errors

Date/Time	Captured Events	Call Trace Id	Script Name	Script Id
2022-5-10 12:43:06.799000	SCTP Up On ConnectionId = 1		Check_SCTP_Status.gls	ProtScriptId-19-596206848-7515-4612
2022-5-10 12:43:06.886000	S1-LINK-UP	eNodeBName:,eNB02,eN...	S1APManagementHandler.gls	ProtScriptId-12-596206874-7516-14136
2022-5-10 12:43:14.977000	RTP Tunnel IP : 192.168.1.20, AdaptorIndex : 0, RtpCoreId : 1, RTPsoc...		MapsInit.gls	
2022-5-10 12:43:17.545000	MobilePCoreTrafficEnabled = 1, MobilePCore IPAddress = 192.168.1.20...		MapsInit.gls	
2022-5-10 12:43:19.997000	CreateGTP Tunnel : 0. RTP GTP Tunnel Added for Src IP = 192.168.1.20		InitiateAddRTPTunnelpHandler.gls	ProtScriptId-5-596215051-7517-11760
2022-5-10 12:43:20.267000	CreateGLTransport : eNB SIP Tunnel IP = 192.168.1.20, AdaptorIndex = ...		MapsInit.gls	
2022-5-10 12:43:20.267000	0. SIP GTP Tunnel Added for Src IP = 192.168.1.20		MapsInit.gls	
2022-5-10 12:43:25.118000	GTP User Traffic Session Started on Task Id : 0	5000	GTPSessionInit.gls	ProtScriptId-13-596217620-7518-7624
2022-5-10 12:43:27.649000	RTP Stats Query Script started		RTP_Stats_Display.gls	ProtScriptId-12-596220348-7519-12096
2022-5-10 12:43:27.935000	Task Started			ProtScriptId-13-596217620-7518-7624
2022-5-10 12:44:39.147000	Loaded Profile: UEProfile0001		S1SessionControl.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:44:39.147000	Loaded Profile: UEProfile0001	IMSI:,001013012041631	S1SessionControl.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:44:39.896000	Selected SIP GTP IPAddress[Gtupl0] = 192.168.1.20		S1_eNodeBHandler.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:44:39.897000	APNName = ims	IMSI:,001013012041631	S1SessionControl.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:44:39.954000	Send:AttachRequest		S1_eNodeBHandler.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:44:42.082000	Security Context Created	IMSI:,001013012041631	S1SessionControl.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:44:42.177000	Attach Accept:APNName=ims		S1_eNodeBHandler.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:44:42.178000	Recv: Attach Accept PDNIPAddress=192.168.15.200 , SGWTRaffiIPAd...		S1_eNodeBHandler.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:44:42.276000	Activate Default EPS Bearer Context Request : APNName=internet		S1_eNodeBHandler.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:44:42.276000	Recv: Activate Default EPS Bearer Context Request PDNIPAddress=19...		S1_eNodeBHandler.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:44:42.300000	UE Registered		S1_eNodeBHandler.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:44:42.421000	FileName = www.gl.com	IMSI:,001013012041631	S1SessionControl.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:44:42.422000	GTP-U Mobile-Traffic Started : 192.168.141.1	IMSI:,001013012041631	S1SessionControl.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:45:42.311000	CallDuration Timer Expired:Call Released	IMSI:,001013012041631	S1SessionControl.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:45:42.323000	Send:PDN Disconnect Request		S1_eNodeBHandler.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:45:42.379000	Traffic Not Sent Completely	IMSI:,001013012041631	S1SessionControl.gls	CGProtScriptId-9-596299227-7521-3860
2022-5-10 12:45:42.439000	UE Deregistered		S1_eNodeBHandler.gls	CGProtScriptId-9-596299227-7521-3860

Clear Save Events Capture Events to file

● Initialisation Errors ● Error Events ● Captured Errors ●

Customizations - Call Flow (Scripts)

```
ScriptEditor - [C:\Program Files\GL Communications Inc\MAPS-LTES1\MAPS\LTE S1\RELEASE9\MME\Scripts\S1SessionControl.gls]
File View Edit Shortcuts Tools Help
Command Window
S1SessionControl
1 //*****Initialization Section *****
2
3
4 LTES1ScriptId = "Null" ;
5 PagingScriptId = "Null" ;
6 HSSScriptId = "Null" ;
7 GTPScriptId = "Null" ;
8 KIdDispStr1="IMSI";
9 KIdDispStr2="MTMSI";
10 SIAPState = "Null";
11 State = "Null";
12 DistributionType = $_DistributionType;
13 SessionDurationTimeOut=$_SessionDurationTimeOut;
14 GUTIReallocationComplete = "false";
15 TAUpdateTimer=$_TAUpdateTimer;
16 SGWRTPTrafficIPAddress="";
17 IMSListener_IPAddress="";
18 Unit=$_Unit;
19 RNCID=0;
20 apnid=0;
21 HandoverCounter = 0;
22 ScriptIdCounter = 0;
23 HOState="Null";
24 ImportUnit=1;
25 ERABIDCount=0;
26 PDNIPAddressIPv6="";
27 TrafficState="Null";
28 ImportTAUUpdateTimer=1;
29 GTPServerIdentified=0;
30 GetCurrentTime(CurrentTime);
31 StartTime = $CurrentTime;
32 FailureCause="-";
33 LocalPortRL=0;//[Prakash : added for dedicated bearer UDP port update]
34 ProfileIPv4Id=0;
35 ProfileIPv6Id=0;
36 HDTrafficStarted="False";
37 PostSend=1;//[Nagara].VK]: It is required in case of multithreading as p
38 //*****Initialization Section *****
Ready
Line Count - 1652 | Line: 1 Col: 1
```

Customizations - Protocol Messages

The screenshot shows the 'Message Editor - AttachRequest' window. The interface includes a menu bar (File, View, Direction, Tools, Help) and a toolbar with icons for file operations and help. The main area is divided into three sections:

- Left Panel (Tree View):** Shows a hierarchical structure of protocol elements. The 'Message Type' field is selected and highlighted in blue.
- Right Panel (List View):** Displays a list of message types with their corresponding values. The 'Attach Request = 65' entry is selected and highlighted in blue.
- Bottom Panel (Hex Dump):** Shows the raw data of the message in hexadecimal and ASCII format. The data is organized into fields with their respective values.

The list of message types in the right panel is as follows:

- Attach Request = 65
- Attach Accept = 66
- Attach Complete = 67
- Attach Reject = 68
- Detach Request = 69
- Detach Accept = 70
- Tracking Area Update Request = 72
- Tracking Area Update Accept = 73
- Tracking Area Update Complete = 74
- Tracking Area Update Reject = 75
- Extended Service Request = 76

The hex dump in the bottom panel shows the following fields and values:

```
***** SIAP Layer *****  
SIAP-PDU = CHOICE  
Extensibility Marker = 0  
Choice Index = 0  
ProcedureCode = INTEGER  
Contents = 12 id-initialUEMessage  
Criticality = ENUMERATOR  
Contents = 1 ignore(1)  
Value = Open Type  
Length = 112  
Extensibility Marker = 0  
ProtocolIE-Container = SEQUENCE OF  
Iteration Count = 5  
ProtocolIE-Container = Instance 0  
ProtocolIE-ID = INTEGER  
Contents = 8 id-eNB-UE-SIAP-ID  
Criticality = ENUMERATOR  
Contents = 0 reject(0)  
value = Open Type  
Length = 2  
eNB-UE-SIAP-ID = INTEGER  
Length Determinant = 1
```

Customizations - Statistics and Reports

MOS, R-Factor

Packet Loss

Packets

Discarded

Duplicate Packets

Out-Of-Sequence

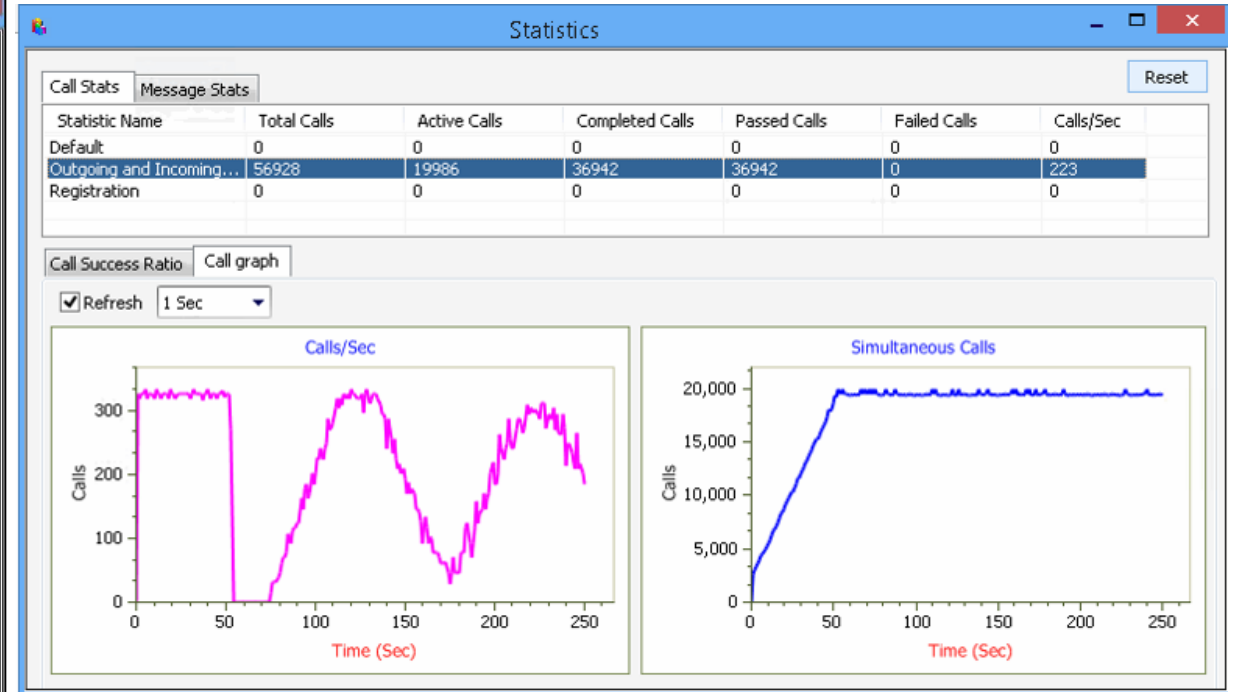
Packets

Jitter Statistics

User Defined Statistics - VoiceQualityStats

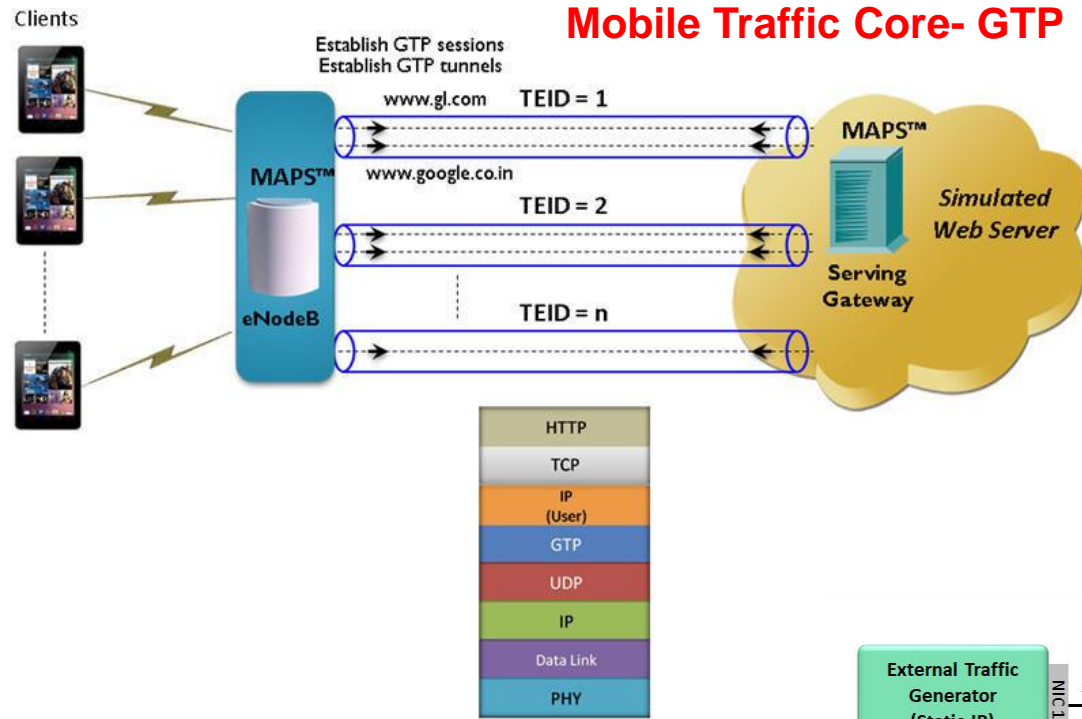
Packet Stats

Name	Values
Active RTP Sessions	1987
Completed RTP Sessions	1548093
Sessions With Zero Receive Traffic	0
MOS Score Stats	0
Sessions with Mos (5.0 - 4.0)	612618 [39%]
Sessions with Mos (4.0 - 3.0)	852971 [55%]
Sessions with Mos (3.0 - 2.0)	73446 [4%]
Sessions with Mos (< 2.0)	9058 [0%]
Total RTP Packet Sent	4485008797
Total RTP Packet Received	4481760883
Packet-Loss Stats	0
Total PacketLoss	4072 [0%]
Sessions with Zero Packet-Loss	1534967 [99%]
Sessions with Packet-Loss(<1%)	13126 [0%]
Sessions with Packet-Loss(1% - 5%)	0 [0%]
Sessions with Packet-Loss(5% - 10%)	0 [0%]
Sessions with Packet-Loss(>10%)	0 [0%]
Packet-Discarded Stats	0
Total PacketDiscarded	3738934 [0%]
Sessions with Zero Packet-Discard	1464299 [94%]
Sessions with Packet-Discard(<1%)	41479 [2%]
Sessions with Packet-Discard(1% - 5%)	37232 [2%]
Sessions with Packet-Discard(5% - 10%)	4843 [0%]
Sessions with Packet-Discard(>10%)	240 [0%]
Packet-Duplicate Stats	0
Total Duplicate Packet	0 [0%]
Sessions with Zero Duplicate Packets	1539942 [99%]
Sessions with Duplicate Packets(<1%)	0 [0%]
Sessions with Duplicate Packets(1% - 5%)	0 [0%]
Sessions with Duplicate Packets(5% - 10%)	0 [0%]
Sessions with Duplicate Packets(>10%)	0 [0%]
Packet-Out Of Sequence Stats	0 [0%]
Total Out Of Sequence Packet	0 [0%]
Sessions with Zero OOS Packets	1539942 [99%]
Sessions with OOS Packets(<1%)	0 [0%]
Sessions with OOS Packets(1% - 5%)	0 [0%]
Sessions with OOS Packets(5% - 10%)	0 [0%]



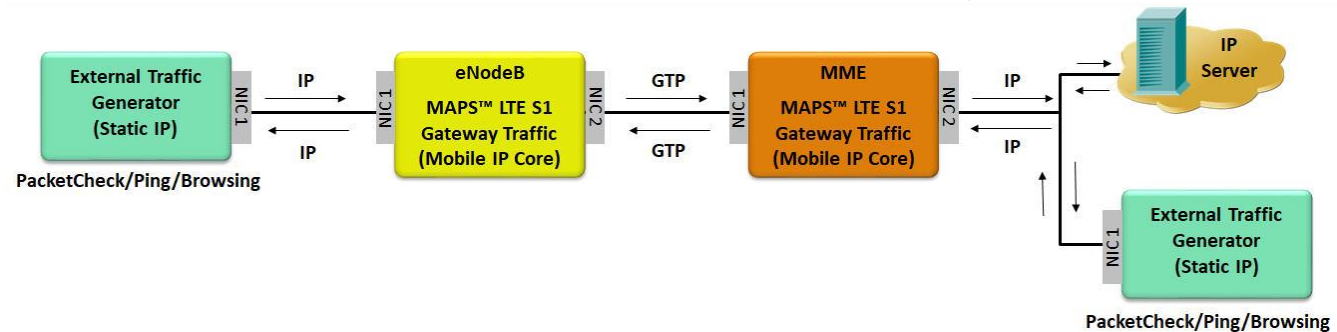
Call Stats provide a running tabular log of system level stats, tracked stats include Total Calls, Active Calls, Completed Calls, Passed Calls, Failed Calls, Instantaneous Calls/Sec

Mobile Traffic Core – GTP and Gateway



- Mobile Traffic Core - GTP (ETH101) – module supports simulation for user-plane packet transmission and reception, generation and verification of data traffic and services between any two nodes in LTE and UMTS networks.

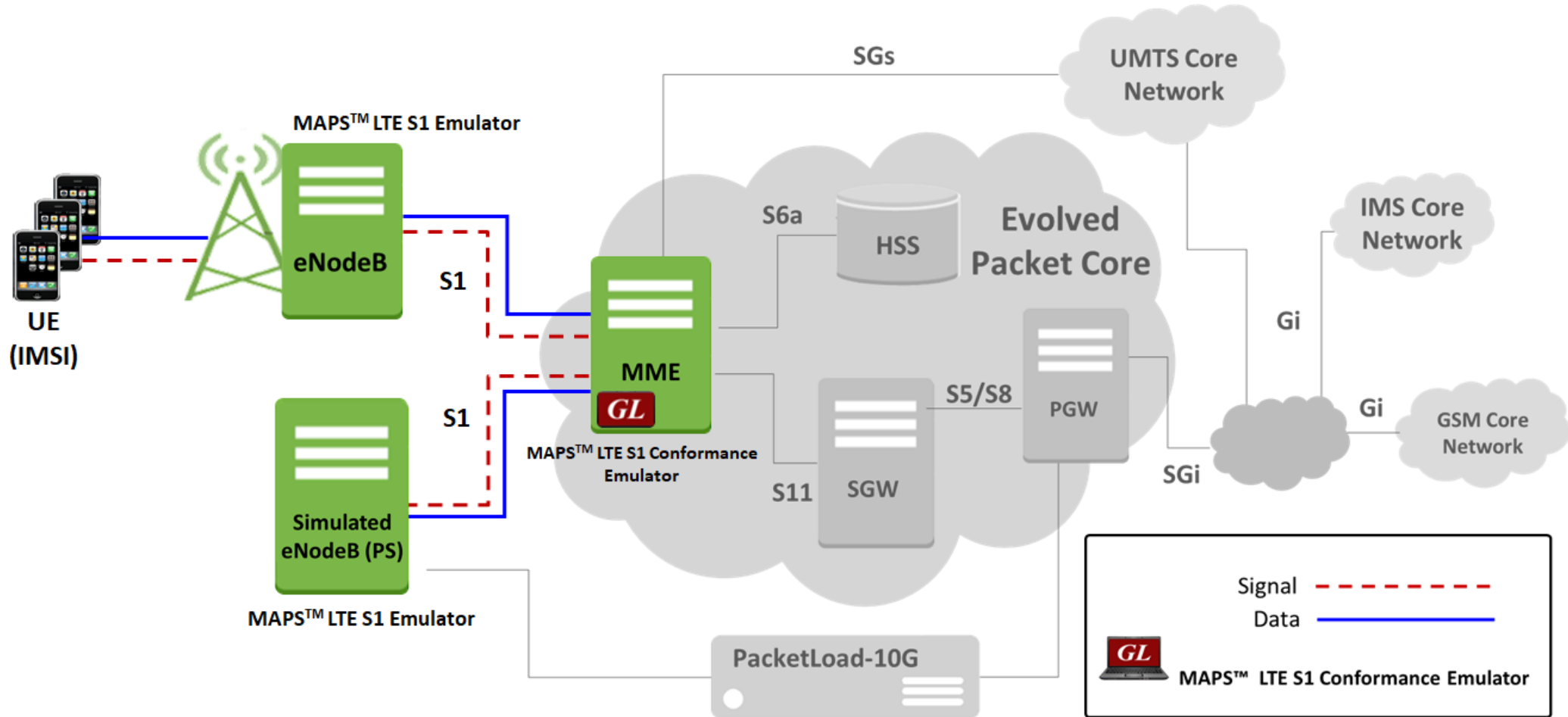
Mobile Traffic Core - Gateway



- Mobile Traffic Core – (ETH102) Gateway module allows simulation of Gateway Traffic to test media gateway telephony interfaces over IP and generate, verify the data traffic like Email, FTP, Web (HTTP), Video, and more.

MAPS™ LTE S1 Conformance Emulator

MAPS™ LTE S1 Conformance Emulator



Overview

- GL's MAPS™ LTE Conformance Test Suite is designed with 50+ test cases, as per 3GPP TS 36.413 (LTE S1) specifications
- Includes inbuilt conformance scripts (*.gls) for MME conformance in S1 interface as per 3GPP standards
- Supports LTE Control plane
- Simulates MME Node
- Generates and process S1/NAS (valid and invalid) messages
- Insertion of impairments to create invalid messages
- Supports customization of call flow and message templates using Script and Message Editor
- Ready-to-use scripts for quick testing
- Supports scripted call generation and automated call reception
- Provides Call Statistics and Events Status

Supported Test Cases

Following are the supported test cases -

- Paging success/failure
- Paging via IMSI success/failure
- UE attach success, UE detach, UE tracking area update
- Periodic updating
- Service Request
- E-RAB Setup procedures
- Setup context – Fail, Success
- UE Context Release, Modification
- Handover success, failure S1 interface
- S1 Setup success, failure and resend setup
- Reset all resource, partial resource
- Error Indication
- Location report

Testbed Setup and Profile Editor

Testbed Setup

The screenshot shows the MAPS (Message Automation Protocol Simulation) MME configuration window. The main area displays a tree view of configuration parameters under 'MMEConfiguration'. The 'MME' section is expanded, showing 'MME1' with various parameters like IP Address, PLMN Id, and eNodeBs. The 'eNodeBs' section is also expanded, showing 'eNodeBs 1' with parameters like IP Address, Port, and Name. The 'Value' column shows the current settings, and the 'Enable' column has a checked box. At the bottom, there are 'Start' and 'Edit' buttons.

Config	Value	Enable
MMEConfiguration		<input checked="" type="checkbox"/>
Adapter Index	0	
MME	1	
MME1		
MME IP Address	192.168.12.26	
PLMN Id		
Mobile Country Code	001	
Mobile Network Code	01	
MME Group Id	032B	
MME Code	52	
MME Name	MME01	
SupportedNBs		
eNodeBs	1	
eNodeBs 1		
eNodeB IP Address	192.168.12.110	
eNodeB Port	36412	
MME Port	36412	
eNodeB Id	197094	
eNodeB Name	eNB01	
Source SCTP Mode	Server	
TAC	0001	
Gateway IP Address	123.124.124.2	
SGW IP Address Traffic	123.124.124.2	
GTP Port for Traffic	2152	
Protocol Configuration Options		
Primary DNS Address	8.8.8.8	
Secondary DNS Address	8.8.8.8	
Subnet Mask	255.255.255.0	

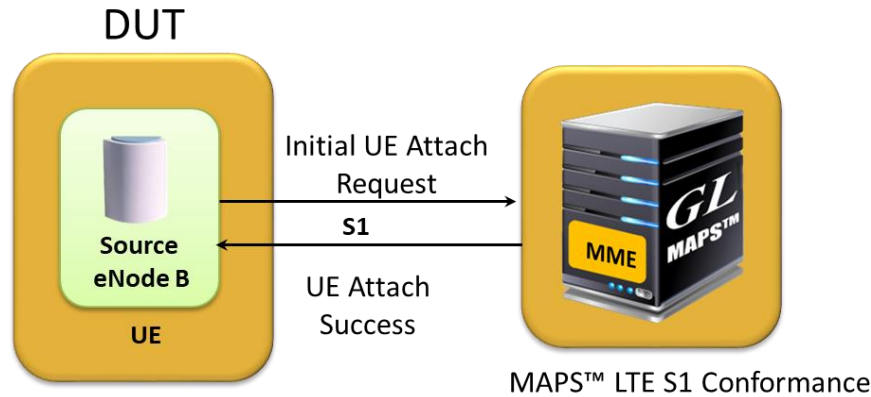
UE Profile

The screenshot shows the MAPS (Message Automation Protocol Simulation) MME Profile Editor window. The main area displays a list of profiles on the left and a detailed configuration for 'UEProfile0001' on the right. The 'UEProfile0001' configuration includes sections for Mobile Identity Parameters, GUTI, Network Detach Parameters, Authentication Parameters, Integrity and Encryption Algorithms, UE Context, and Required QoS. The 'Profile for TestCase Number' is set to 'TestCase5.1.1.1'. At the bottom, there are 'Insert', 'Delete', and 'Clear' buttons.

#	Profiles (Edit-F2)	Config	Value
1	UEProfile0001	UEProfile0001	
2	UEProfile0002		
3	UEProfile0003		
4	UEProfile0004		
5	UEProfile0005		
6	UEProfile0006		
7	UEProfile0007		
8	UEProfile0008		
9	UEProfile0009		
10	UEProfile0010		
11	UEProfile0011		
12	UEProfile0012		
13	UEProfile0013		
14	UEProfile0014		
15	UEProfile0015		
16	UEProfile0016		
17	UEProfile0017		
18	UEProfile0018		
19	UEProfile0019		
20	UEProfile0020		
21	UEProfile0021		

Config	Value
UEProfile0001	
Mobile Identity Parameters	
Paging IMSI	45234001
IMSI	001013012041631
IMEI	359877068325248
Paging DRX	v32
Profile for TestCase Number	TestCase5.1.1.1
GUTI	
M TMSI	12345001
Network Detach Parameters	
EMM Cause for Detach	Network failure
Type Of Detach	IMSI detach:Re-Att...
Authentication Parameters	
Authentication Algorithm Type Milenage	
RES Length	16 bytes
Key	00112233445566778...
Operator Variant Parameter T...	OPc
OP	01020304050607080...
OPc	01020304050607080...
AMF	8000
SQN	000000000079
Integrity and Encryption Alg...	
EPS Integrity Algorithm T...	EPS Integrity Algori...
Encryption Algorithm Type	EPS Encryption Algo...
NAS Key Set Identifier	1
UE Context	
PCSCF IP Address	192.168.13.131
Required QoS	

UE Attach Success Conformance Emulation



MAPS (Message Automation Protocol Simulation) MME (LTE S1 RELEASE9) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Results
1	Check_SCTP_Status.gls			Stop	Monitoring SCTP Status	None		Pass
2	S1APManagementHandler.gls		MMEName:MME01_MMEGroupID:0x032B	Stop	S1-LINK-UP	ResetAll		Pass
3	S1SessionControl.gls	UEProfile0001	IMSI:001013012041631	Stop	Activate-Default-EPS-Bearer-Context-Ac...	Create Context		Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash

Save Column Width Show Latest

Find

```

===== S1AP Layer =====
S1AP-PDU
Extensibility Marker = CHOICE
Choice Index = 0
InitiatingMessage = SEQUENCE
ProcedureCode = INTEGER
Contents = 12 id-initialUEMessage
Criticality = ENUMERATOR
Contents = 1 ignore(1)
Value = Open Type
Length = 120
InitialUEMessage = SEQUENCE
Extensibility Marker = 0
ProtocolIE-Container = SEQUENCE OF
Iteration Count = 5
ProtocolIE-Container = Instance 0
ProtocolIE-Field = SEQUENCE
ProtocolIE-ID = INTEGER
Contents = 8 id-eNB-UE-S1AP-ID
Criticality = ENUMERATOR
Contents = 0 reject(0)
Value = Open Type
    
```

Scripts Message Sequence Event Config Script Flow LTE-S1 Conformance Report Test Case Detailed Report

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

Reports

LTE S1 Conformance Report

MAPS (Message Automation Protocol Simulation) MME (LTE S1 RELEASE9) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Results
1	Check_SCTP_Status.gls			Stop	Monitoring SCTP Status	None		Pass
2	S1APManagementHandler.gls		MMEName:MME01,MMEGroupID:0x032B	Stop	S1-LINK-UP	ResetAll		Pass
3	S1SessionControl.gls	UEProfile0001	IMSI,001013012041631	Completed	UE-CONTEXT-RELEASED	None		Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash

Date/Time	Test Case No	Test Case Name	Test Description	Test Result
2020-06-01 15:24:18.996000	TestCase5111	UE attach success	The MME performs the successful UE attach procedure after receiving I...	Pass

Scripts Message Sequence Event Config Script Flow **LTE-S1 Conformance Report** Test Case Detailed Report

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

Test Case Detailed Report

MAPS (Message Automation Protocol Simulation) MME (LTE S1 RELEASE9) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Results
1	Check_SCTP_Status.gls			Stop	Monitoring SCTP Status	None		Pass
2	S1APManagementHandler.gls		MMEName:MME01,MMEGroupID:0x032B	Stop	S1-LINK-UP	ResetAll		Pass
3	S1SessionControl.gls	UEProfile0001	IMSI,001013012041631	Completed	UE-CONTEXT-RELEASED	None		Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash

Date/Time	Test Case Name	Message	MessageDirection	InformationElement	ExpectedValues	ActualValues
TestCase5111	UE attach success	Initial UE-Attach Request	Rx	eNB UE S1AP ID	Y	10001
				NAS-PDU	Y	Initial UE-Attach Request
				TAI-MCC	Y	001
				TAI-MNC	Y	01
				TAI-TAC	Y	0x0001
				CGL-MCC	Y	001
				CGL-MNC	Y	01
				CGL-CellIdentity	Y	0x0301E602
				S-TMSI	Y	0x12345001
				RRC Establishment cause	mo-signaling	mo-Signalling

Scripts Message Sequence Event Config Script Flow **LTE-S1 Conformance Report** **Test Case Detailed Report**

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

Thank you