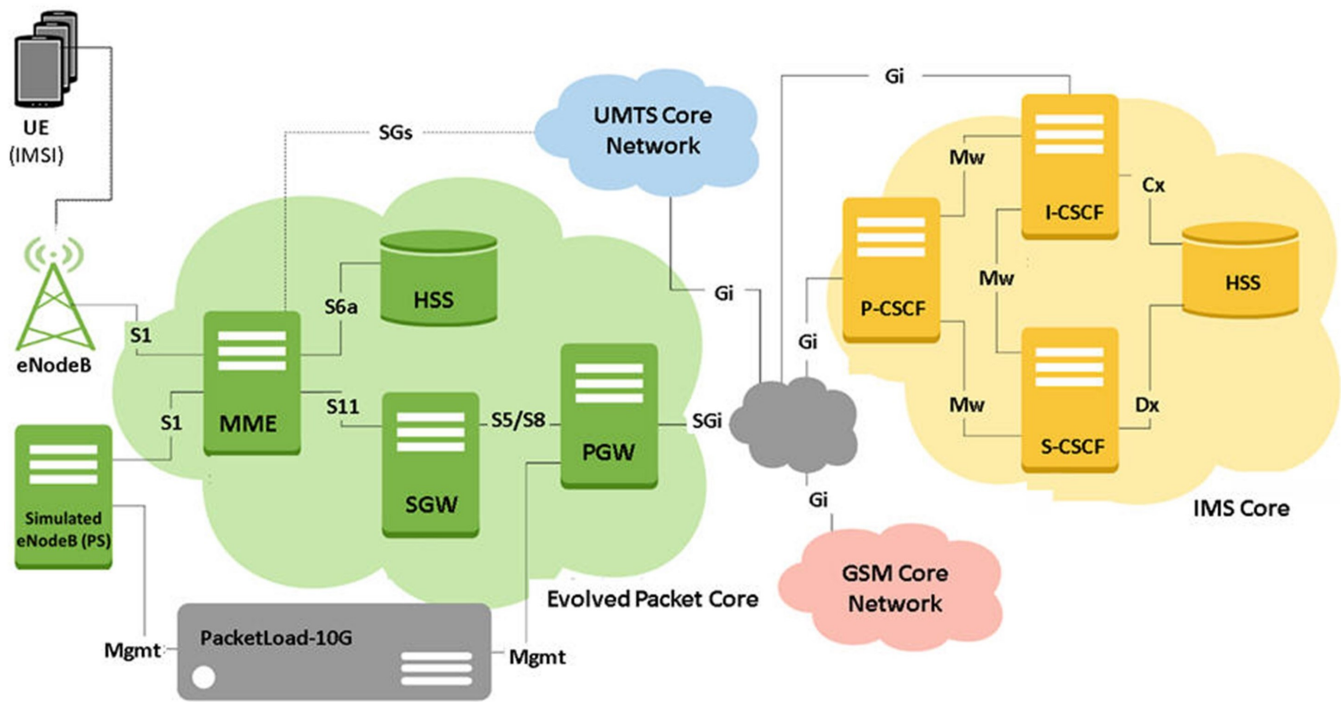


# 4G LTE IMS Wireless Network Lab Simulation



## Overview

GL Communications has enhanced MAPS™ protocol emulation tool to simulate multi-protocol and multi-interface offering a complete range of test solutions, covering the entire 2G, 3G, and 4G network.

The “MAPS™ 4G Wireless Lab Suite” supports simulation of S1-MME, S11, S5/S8, and other required eGTP interfaces and also supports Circuit switched fallback (CSFB) technology allowing voice and SMS services to travel over LTE (packet-based all-IP) networks. The SGs Application Part (SGsAP) protocol is used over SGs interface interconnecting MME in the EPS and the Visitor Location Register (VLR) in UMTS network.

MAPS™ test suite also allows interworking with IMS network simulating multiple UEs and the core elements such as P-CSCF, I-CSCF, S-CSCF, PCRF, MGCF. With the help of mobile phones, and other simulated wireless networks, the VoLTE Lab setup can be operated in real-time for making VoLTE calls and also for interworking with PSTN and VoIP networks.

MAPS™ supports automated stress/load testing capabilities through Load Generation and Bulk Call Simulation features. To perform Bulk Call Generation, several UE/Subscriber configuration files are required. The UE/Subscriber configuration files can be created using regular Profile Editors (XML Based), using CSV based profiles, or using Auto Generation feature for simulating inter-networking calls, roaming calls, data sessions, and bulk GTP traffic generation.

Complete 4G LTE lab simulation can be realized using GL's Remote MAPS™ feature, a client server module, designed for multi-node multi-interface simulation from a single GUI. The application has the ability to remotely control multiple MAPS™ Servers running on different PCs from a single remote client application.

For more details on 4G LTE IMS Wireless Lab Network Simulation, refer to [4G LTE Communication Network Lab](#).



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## Features

### Supported Procedures

- Registration
- Authentication information procedures
- VoLTE Calls using IMS
- Mobile to mobile voice call
- 4G user calling 3G/2G user via CSFB
- Mobile Web Browsing and Simulated UE Web Browsing

### Web Browsing Procedure

- Attach procedure
- UE context setup procedures
- Web browsing sessions
- Detach procedures
- Authentication information procedures

### CSFB SGsAP procedures

- Paging for non-EPS Services
- Location Update for Non-EPS Services
- Non-EPS Alert
- Explicit IMSI Detach from EPS Services
- Explicit IMSI Detach from Non-EPS Services
- Implicit IMSI Detach from Non-EPS services
- Tunnelling of NAS Messages

### Traffic Generation

- High Density packet (data sessions) traffic simulation using MAPS™ PacketLoad Server
- Voice, Fax, Video
- SMS, MMS, Email, FTP
- Supplementary IN Services
- Internet connectivity
- Multiple PDP contexts

### Supported Call Scenarios

#### Voice, SMS

- Real-mobile <-> Real-mobile
- Simulated UE <-> Real-mobile
- Simulated UE <-> Simulated UE
- Real-mobile <-> Real-Mobile
- Voice/SMS Circuit-Switched Fall Back (CSFB)
- Voice/SMS over IMS

#### Web Browsing

- Real-mobile
- Simulated UE
- Bulk mobile traffic simulation using [PacketLoad](#)

### Inter-network Calls and Roaming Calls

- 4G user calling 2G user
- 4G user calling 3G user
- 4G user calling 3G roaming user
- 4G user calling 2G roaming user
- 2G user calling 4G roaming user

### Interfaces

#### LTE Interfaces:

- S1, X2, eGTP, S3, S4, S5/S8, S10, S11, S16, SGs
- User-plane traffic (GTPv2-U)
- User-plane Gateway traffic

**Diameter Interfaces:** Cx/Dx, Gx, Rx, Gy/Ro, Gm, Sh, SGI, S6a, S6d, S13 and S13'

**Location Services** - SLs, SLg, SLh

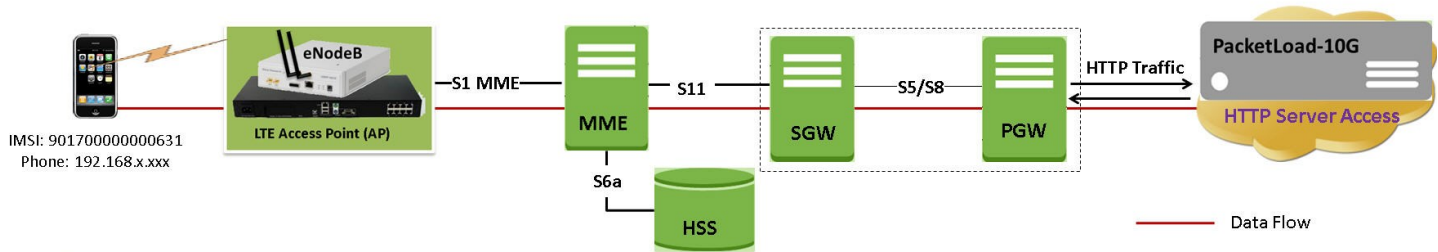
**IMS Interfaces** - Mw, Mi, Mj, Mg, ISC

### Nodes

**LTE Nodes** - eNodeB, MME, SGW, PGW, HSS, EIR, PCRF, AS, OCS & OFCS

**IMS Nodes** - CSCFs, HSS, MGCF, MGW, AS, OCS & OFCS

## 4G CNL SYSTEM w/ Real eNodeB



**Figure: Complete 4G LTE + IMS Network Simulation Test Suite with Real eNodeB**

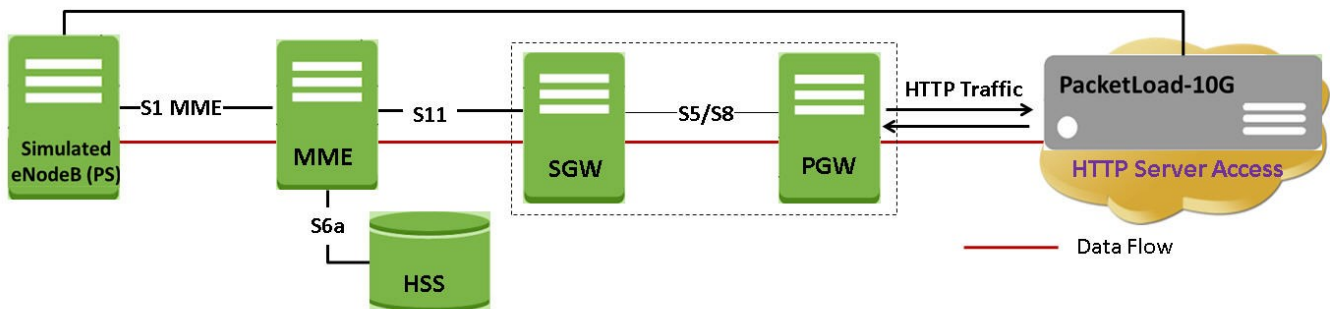
The above lab setup is realized using the real-time User Equipment (with 2 registered SIMs) and the real eNodeB (IP Access Point) to generate the HTTP traffic.

The fall-back procedures are simulated when the associations between the MME and MSC/VLR are established. MAPS™ multi-interface testbed configuration includes option to enable or disable the VLR Node as per the test requirement.

Supported procedures in LTE IMS network -

- VoLTE Calls using IMS
- Mobile to mobile Voice and SMS call
- 4G user calling 3G/2G user via CSFB
- Mobile Traffic and Web Access procedures

## 4G CNL SYSTEM w/ Simulated eNodeB



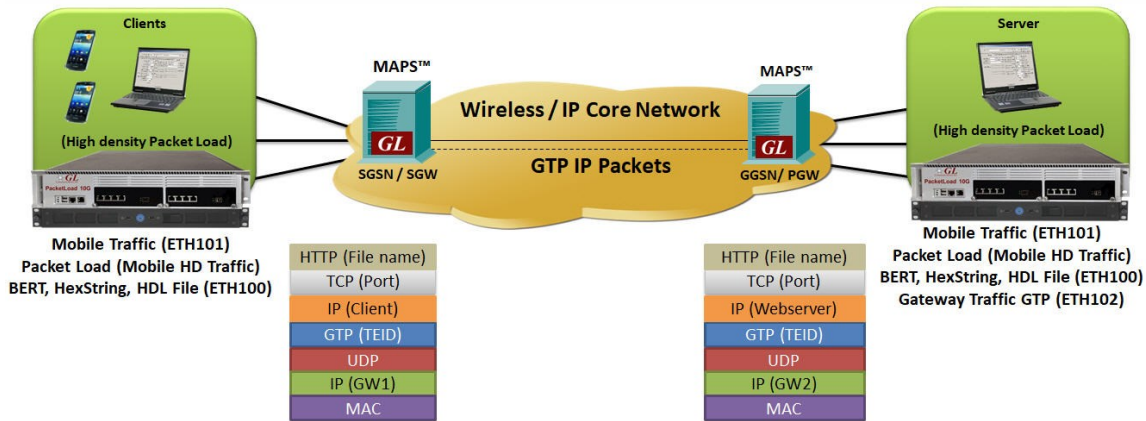
**Figure: Complete 4G LTE + IMS Network Simulation Test Suite with Simulated eNodeB**

The above lab setup is realized using the MAPS™ application to simulate both the User Equipment and the eNodeB functionalities generating the Voice/SMS traffic in CS network and HTTP (Web Access Emulation) traffic generation in LTE IMS network.

Supported procedures in LTE IMS network -

- VoLTE Calls using IMS
- Mobile-to-Mobile Voice and SMS call
- 4G user calling 3G/2G user via CSFB
- Mobile Traffic and Web Access procedures

## High Density Mobile Traffic Simulation



GL's MAPS™ Server with PacketLoad appliance supports massive simulation of UEs (up to 500000) with mobile data traffic at very high speed rates (up to 4 Gbps or 40 Gbps) over LTE IMS network.

The PacketLoad is a 1U/2U network appliance that includes 4 x 1/10 GigE ports supporting total capacity of up to 40 Gbps and also includes 2 Ethernet management ports.

It offers all features to perform functional unit tests at every integration point within the wireless infrastructure. The MAPS™ Server with PacketLoad™ can be used to test all network elements in access & packet core to ensure negotiated QoS is met.

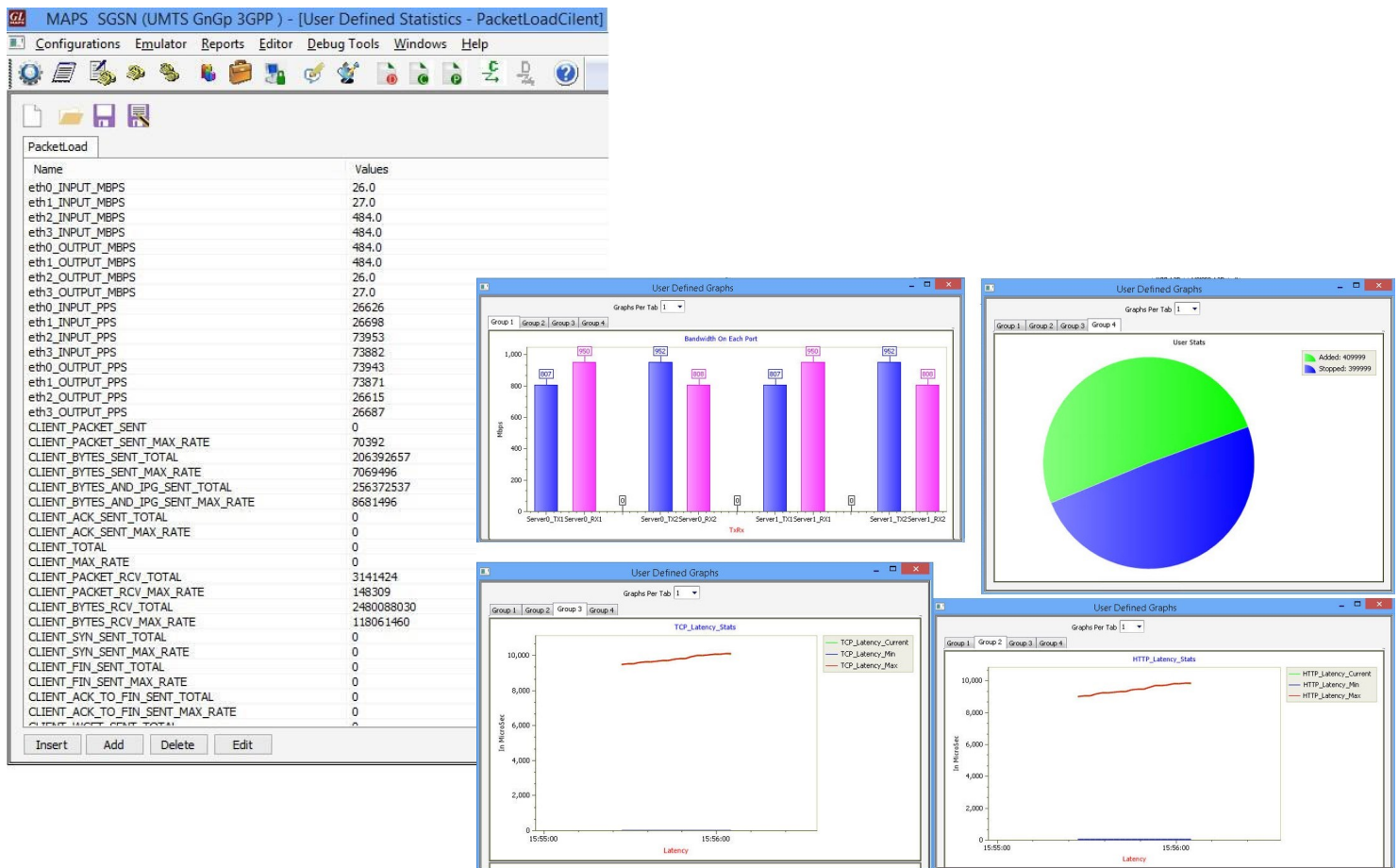
The solution allows to encapsulate the generated packet data within GTP headers and transmit through the gateway points such as SGW & PGW. It allows simultaneous simulation of multiple sessions per user to verify bearer allocation bandwidth at the end points. Currently, the solution offers stateful TCP/HTTP, and PCAP Replay traffic types. PacketLoad™ supports HTTP traffic simulation with the base requirements such as port number, server IP address, and pre-canned HTTP traffic file.

## Mobile Data Traffic Statistics

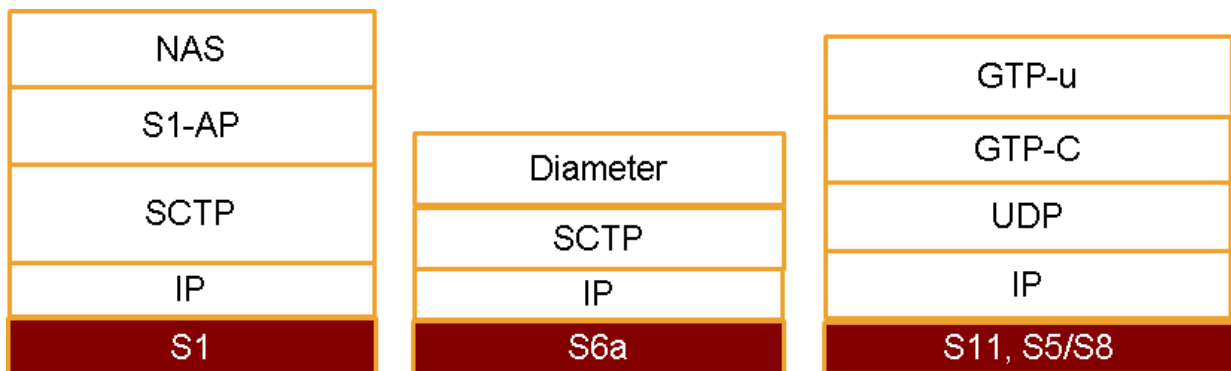
Link level	Link state/speed ARP
Per Port	TX/RX Rate/s Packets Sent/Received Bytes Sent/Received
Packet	Payload Size via MSS (1B to 9400B)
TCP/IP	SYN, SYN_ACK ACK FIN RST HTTP POST/RESPONSE TCP/IP Checksum Errors
PCAP Replay	Packets Sent and Received
UDP	Packets Sent and Received
URL	Connections Established FW Addresses Not Blocked URL HTTP Wrong Response RX

## Mobile Data Traffic Statistics (Contd.)

Call Graph uses the results from statistics to plot graphically the Bandwidth on each port, HTTP\_latency, TCP\_Latency, and UE related statistics in form Bar/Line/Pie charts.



## Protocol Stack Specification



## Buyer's Guide

Item No	Product Description
BTS001	Real eNodeB (IP Access) + Mobile Phones + SIMs (Optional)
<a href="#">PKS142</a>	MAPS™ LTE S1-MME interface
<a href="#">PKS139</a>	MAPS™ Diameter Emulator
<a href="#">PKS140</a>	MAPS™ LTE eGTP (S3, S4, S5, S8, S10, S11 & S16) interface
<a href="#">PKS146</a>	MAPS™ SGs Interface Emulation
<a href="#">PKS127</a>	MAPS™ IMS Emulator
<a href="#">PKS111</a>	MAPS™ Remote Controller
<a href="#">PKS170</a>	CLI Support for MAPS™
<a href="#">PKS172</a>	PacketLoad™ 4 x 1Gig, Data Traffic Generator
<a href="#">PKS174</a>	PacketLoad™ 4 x 10Gig, Data Traffic Generator
<a href="#">ETH100</a>	Packet Traffic Simulation - GTP
<a href="#">ETH101</a>	PacketLoad™ 4 x 1Gig, Data Traffic Generator
<a href="#">PKS174</a>	PacketLoad™ 4 x 10Gig, Data Traffic Generator
<a href="#">ETH100</a>	Packet Traffic Simulation - GTP
<a href="#">ETH101</a>	Mobile Traffic Core-GTP
<a href="#">ETH102</a>	Mobile Traffic Core-Gateway

For more details, refer to [4G LTE Communication Network Lab](#) webpage.



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