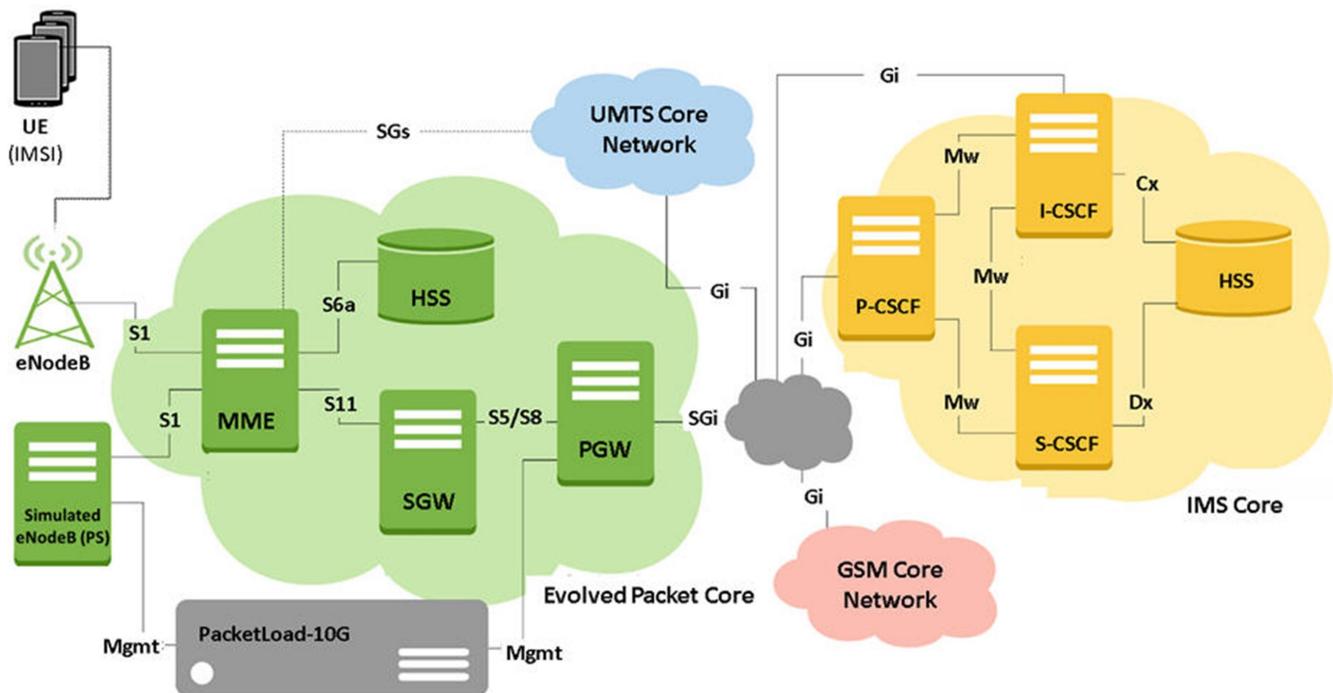


# 4G LTE IMS Wireless Network Lab Simulation



## Overview

GL Communications enhanced Message Automation and Protocol Simulation (MAPS™) protocol emulation tool emulates 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, refer to [4G LTE Communication Network Lab](#).



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## Key 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

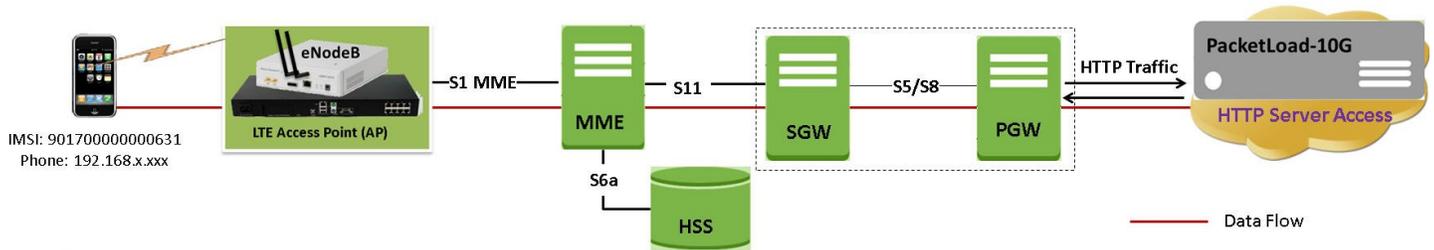
**IMS Interfaces** - Mw, Mi, Mj, Mg, ISC

#### Nodes

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

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

## 4G CNL SYSTEM w/ Real eNodeB



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

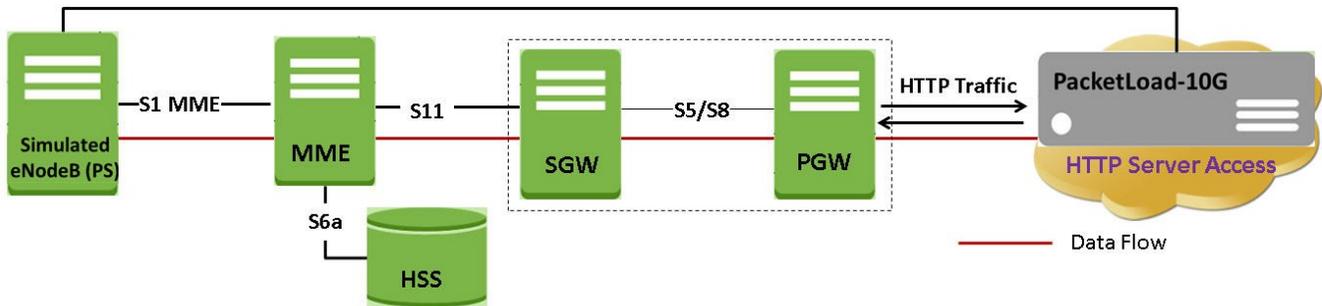
The above lab setup is realized using the real-time User Equipment (with 2 registered SIMs) and the real eNodeB (IP Access Point) to generate the HTTP traffic.

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



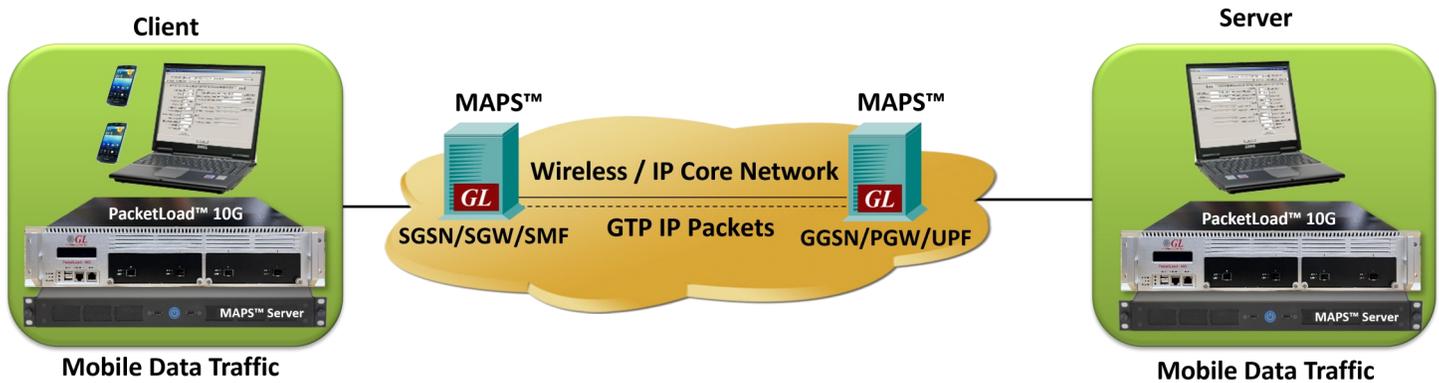
**Figure: Complete 4G LTE + IMS Network Simulation Test Suite with Simulated eNodeB**

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 100000) 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 and packet core to ensure negotiated QoS is met.

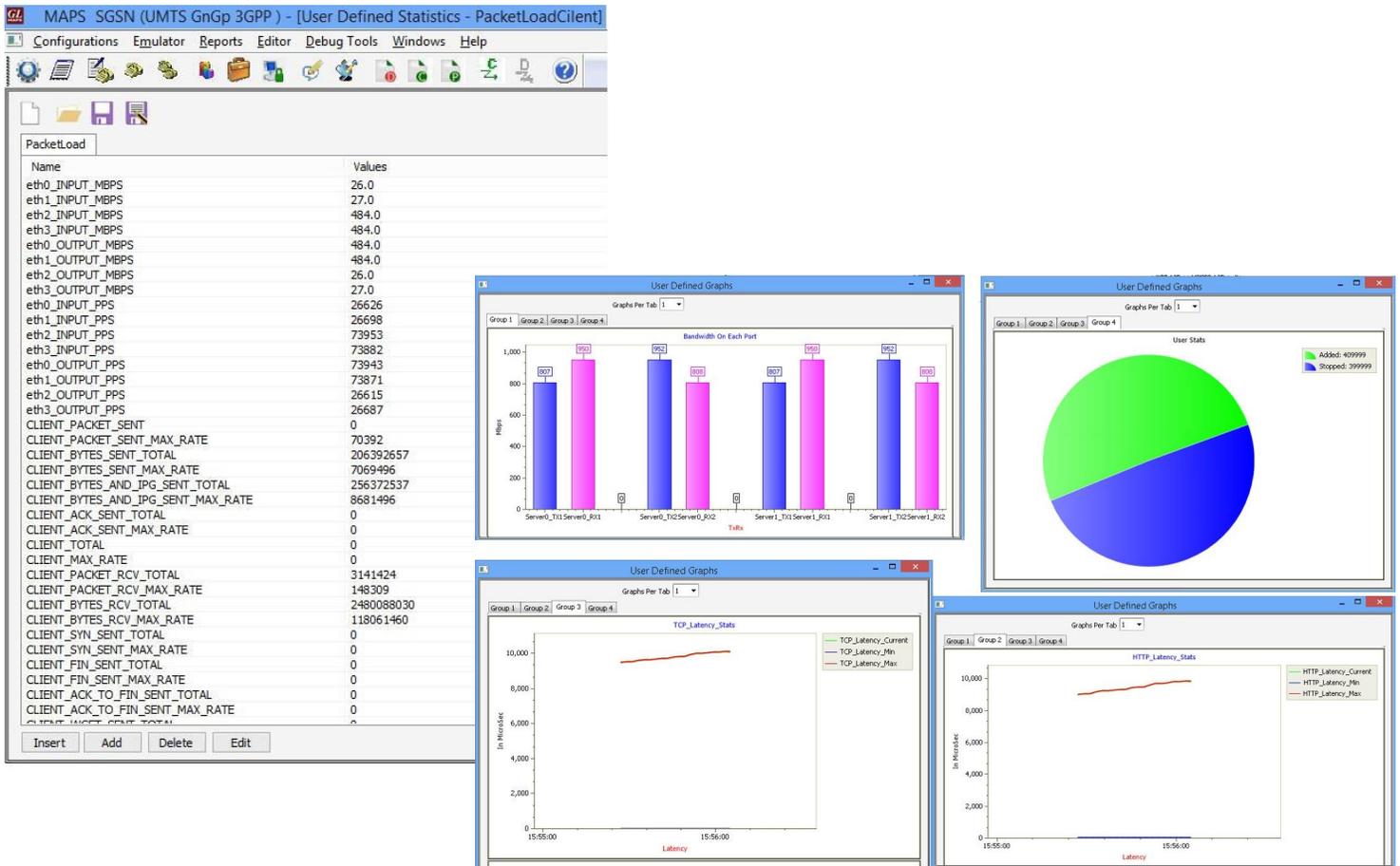
The solution allows to encapsulate the generated packet data within GTP headers and transmit through the gateway points such as SGW & PGW. It allows simultaneous simulation of multiple sessions per user to verify bearer allocation bandwidth at the end points. Currently, the solution offers stateful TCP/HTTP, 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

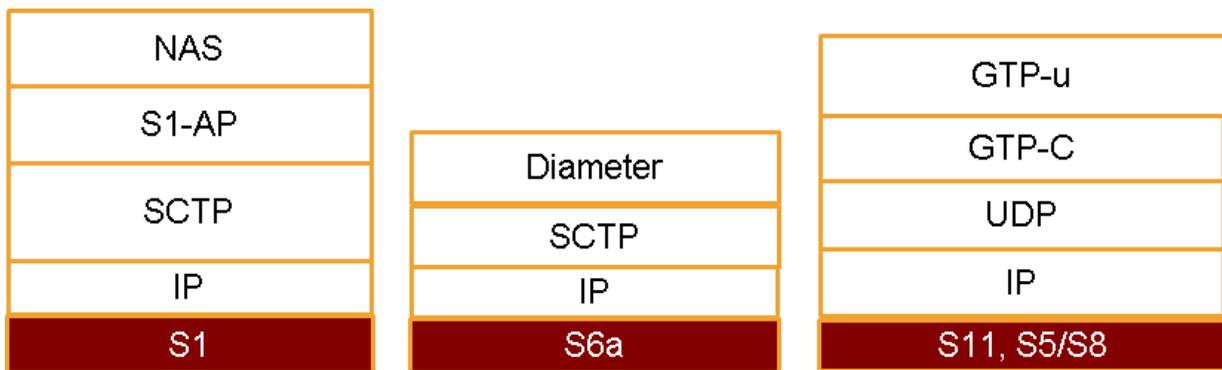
Link level	Link state/speed ARP
Per Port	TX/RX Rate/s Packets Sent/Received Bytes Sent/Received
Packet	Payload Size via MSS (1B to 9400B)
TCP/IP	SYN, SYN_ACK ACK FIN RST HTTP POST/RESPONSE TCP/IP Checksum Errors
PCAP Replay	Packets Sent and Received
UDP	Packets Sent and Received
URL	Connections Established 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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