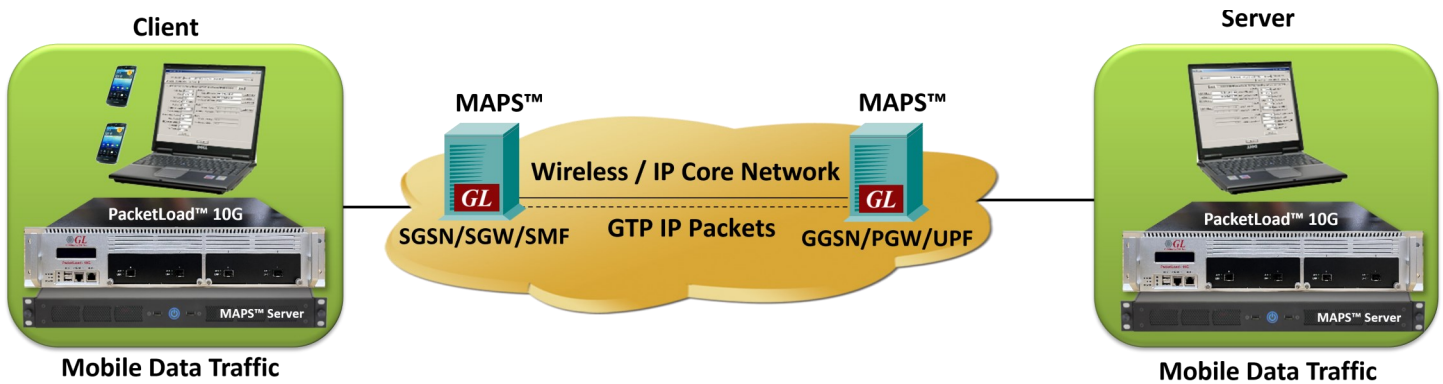


# High Density Mobile Traffic Generation – PacketLoad™



## Overview

GL's **MAPS™ Server with PacketLoad™** appliance supports massive simulation of UEs (up to 100000) with high density (up to 40 Gbps) mobile data traffic emulation for 5G, UMTS, and LTE networks.

The solution allows to encapsulate the generated packet data within GTP headers and transmit through the gateway points such as Serving GPRS Support Node (**SGSN**) and Gateway GPRS Support Node (**GGSN**), and Mobility Management Entity (**MME**) or Serving Gateway (**SGW**) and Packet Data Network Gateway (**PGW**) or Next Generation Node B (**gNodeB**) and User Plane Function (**UPF**). 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 emulation with the base requirements such as port number, server IP address, and pre-canned HTTP traffic file.

The MAPS™ Server system controls PacketLoad™ appliance through Command Line Interface (CLI). At the generating end, MAPS™ automates the process of creating UEs with different mobile traffic parameters. At the receiving end, MAPS™ with PacketLoad™ verifies the received data and provides various statistics, which include, Total packets transmitted and received, Latency, Delay, Bandwidth, Total TCP connections created, Successful connections, Packet loss, etc.

For detailed information on PacketLoad™, visit [MAPS™ PacketLoad High-Density Traffic Generation](#).

PacketLoad™ is available in following platform variants-

PacketLoad™ 4 x 1Gbps (PKS172) - Data Traffic Generator 1U Rack Appliance with 4 x 1Gbps NIC interfaces: total capacity of up to 4 Gbits/sec Stateful TCP/HTTP Traffic.



Figure: MAPS™ Server with PacketLoad™ 1G Appliance

PacketLoad™ 4 x 10Gbps (PKS174) - Data Traffic Generator 2U Rack Appliance with 4 x 10Gbps NIC interfaces: total capacity of up to 40 Gbits/sec Stateful TCP/HTTP Traffic.



Figure: MAPS™ Server with PacketLoad™ 10G Appliance





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## Key Features

- Generate multiple simultaneous mobile traffic streams to simulate real-world network conditions
- User-friendly interface for easy configuration and monitoring
- Generate traffic for various protocols such as 5G, 4G LTE, and 3G, ensuring compatibility with a wide range of networks
- Create and modify traffic profiles dynamically, adjusting parameters such as bandwidth, latency, and packet loss to simulate different network scenarios
- Scripting and automation for creating custom test scenarios and automating repetitive tasks, enhancing efficiency
- Features for managing multiple calls and sessions simultaneously, allowing users to simulate a variety of communication scenarios
- Provide real-time reporting and logging of test results, allowing users to monitor to analyze the network performance during testing

## PacketLoad™ System Specifications

	PacketLoad™ 1G	PacketLoad™ 10G
		
<b>Hardware Specifications</b>	1U Rack Mountable 4 x 10M/100M/1GigE Electrical or 4 x 1GigE Fiber 2 x 10M/100M/1GigE Electrical Management 1 Console 2 x USB 2.0 100-240VAC 100W power w/switch 0°C – 40°C Operating Temperature	2U Rack Mountable 4 x 10M/100M/1G/10GigE Electrical or 4 x 10 GigE Fiber 1 x 10M/100M/1GigE Electrical Management 1 Console 2 x USB 2.0 100-240VAC 100W power w/switch 0°C – 40°C Operating Temperature
<b>Wire-Speed Traffic Types</b>	Bidirectional 4 Gbit / sec HTTP/TCP PCAP Replay	Bidirectional 40 Gbit / sec HTTP/TCP PCAP Replay
<b>TCP/HTTP Stateful Traffic Generation</b>	445K Transactions/sec 20M+ Concurrent TCP flows Zero-transaction size support Variable POST vs. GET Ratio	2M+ TCP/HTTP Transactions/sec 100M+ Concurrent TCP flows Zero-transaction size support Variable POST vs. GET Ratio
<b>HTTP Payload Control</b>	Custom Payload Files Generated Patterns	Custom Payload Files Generated Patterns
<b>Mobile Infrastructure Testing</b>	Dynamically add/stop/delete 60,000 subscribers simulation (per appliance) User Bandwidth Allocation	Dynamically add/stop/delete 10K+ User Adds and Deletes per sec Up to 1,00,000 maximum subscribers GTP-U Encapsulation (User Bandwidth Allocation)
<b>PCAP Replay</b>	Split PCAPs to emulate “stateful” traffic Timestamp with scaling or wirespeed	Split PCAPs to emulate “stateful” traffic Timestamp with scaling or wirespeed

## PacketLoad™ System Specifications (Contd.)

	PacketLoad™ 1G	PacketLoad™ 10G
<b>UDP</b>	Single Size Packets or Multi-Sized Packet Streams UDP IP Fragmentation Testing Controlled UDP Fragment Drop Testing	Single Size Packets or Multi-Sized Packet Streams UDP IP Fragmentation Testing Controlled UDP Fragment Drop Testing
<b>System Interface</b>	Web GUI REST API CLI	Web GUI REST API CLI
<b>Analysis and Reporting</b>	Full HTTP/PCAP/UDP/URL/User Statistics Total packets transmitted and received, Latency, Delay, Bandwidth, No of TCP connection created, Successful connection, Packet loss, etc. PCAP capture on all ports to identify setup issues	Full HTTP/PCAP/UDP/URL/User Statistics Total packets transmitted and received, Latency, Delay, Bandwidth, No of TCP connection created, Successful connection, Packet loss, etc. PCAP capture on all ports to identify setup issues
<b>Firewall/ Content Control Testing</b>	URL Filtering - 50M+ URL List Capacity Test DUT's HTTP Response for malicious URLs "allow/block/redirect/accept/custom" Action Firewall Filtering Performance	URL Filtering - 50M+ URL List Capacity Test DUT's HTTP Response for malicious URLs "allow/block/redirect/accept/custom" Action Firewall Filtering Performance
<b>Graphic Run-time Test Reporting</b>	TX and RX Mbits - Each Port Active Connections Total TX and RX Thru-put Total TX and RX Good-put	TX and RX Mbits - Each Port Active Connections Total TX and RX Thru-put Total TX and RX Good-put
<b>PCAP capture on all ports</b>	RX, TX, Error "Wireshark"-ready	RX, TX, Error "Wireshark"-ready
<b>Flexible Configuration Options</b>	Basic Server/Client (op. VLAN) Virtual Router Server/Client (op. VLAN) Client-only / Server-only Proxy NAT Ping Response ARP support	Basic Server/Client (op. VLAN) Virtual Router Server/Client (op. VLAN) Client-only / Server-only Proxy NAT Ping Response ARP support

## Applications on 5G Networks

### End to End Testing

MAPS™ configured as gNodeB emulates GTP traffic in LTE network. MAPS™ gNodeB emulator allows to emulate massive number of UEs (more than 100,000) with the packet data traffic encapsulated within GTP headers. The generated packet data is transmitted through the UPF gateway point. At the receiving end, MAPS™ Server with PacketLoad™ is used to verify the received data with the various statistics such as Total packets transmitted and received, Latency, Delay, Bandwidth per port, Total TCP connections created, Successful connections, Packet loss, etc.

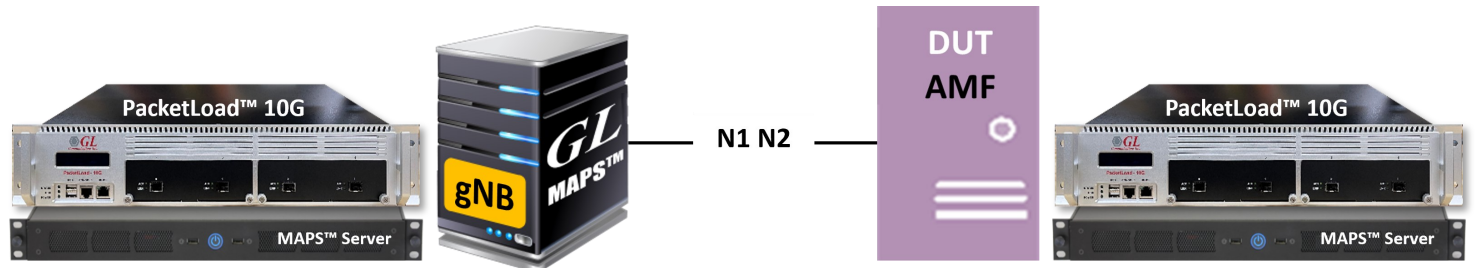


Figure: PacketLoad™ in 5G Network with End to End Testing

### Single Interface Testing

Emulated GNode + AMF (MAPS™ 5G N1N2), UPF (MAPS™ 5G N4) along with the PacketLoad™ appliance can function together to test customer's AMF/UPF, gNB/SMF operation at full load under various traffic conditions, and thus perform comprehensive load testing.

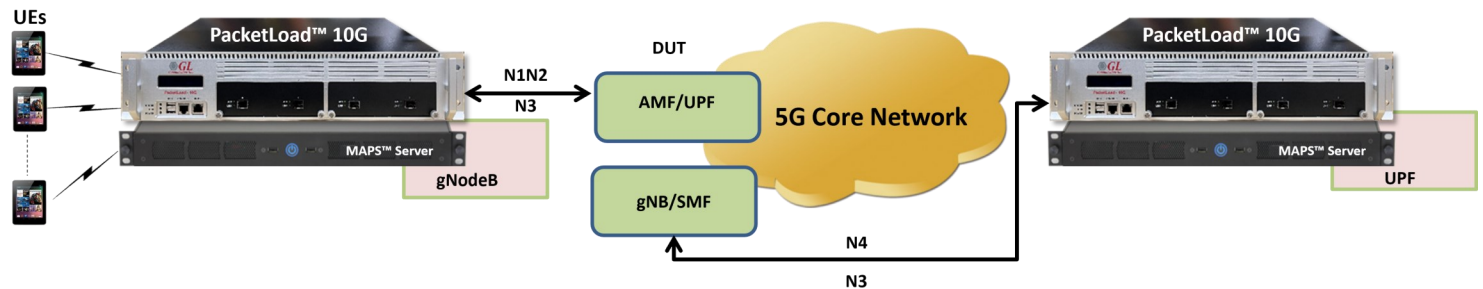


Figure: PacketLoad™ in 5G Network with Single Interface Testing

## Applications on 4G Networks

### End to End Testing

MAPS™ configured as eNodeB emulates GTP traffic in LTE network. MAPS™ eNodeB simulator allows to emulate massive number of UEs (more than 100,000) with the packet data traffic encapsulated within GTP headers. The generated packet data is transmitted through the SGW & PGW gateway points. At the receiving end, MAPS™ Server with PacketLoad™ is used to verify the received data with the various statistics such as Total packets transmitted and received, Latency, Delay, Bandwidth per port, Total TCP connections created, Successful connections, Packet loss, etc.

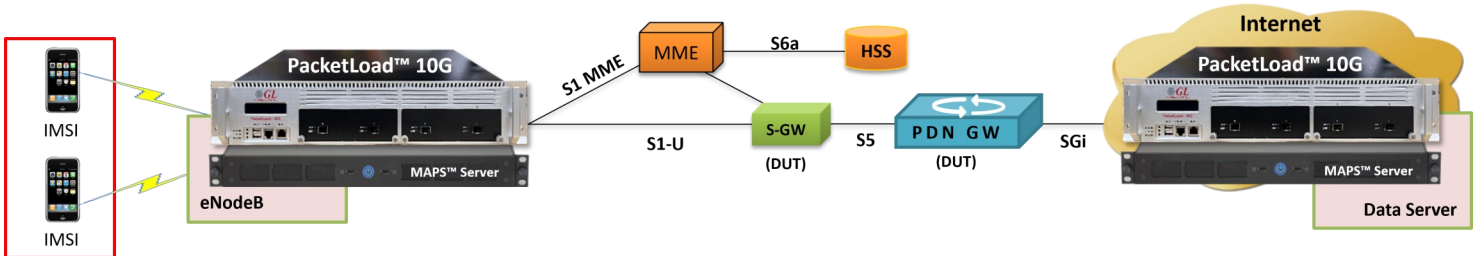


Figure: PacketLoad™ in 4G LTE Network with End to End Testing

### Single Interface Testing

Emulated eNode +MME ([MAPS™ LTE S1](#)), PGW ([MAPS™ LTE eGTP](#)) along with the PacketLoad™ appliance can function together to test customer's SGW operation at full load under various traffic conditions, and thus perform comprehensive load testing.

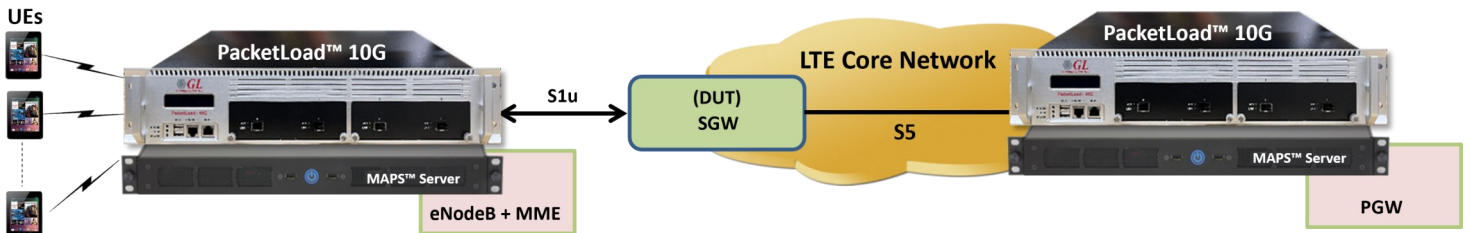


Figure: PacketLoad™ in 4G LTE Network with Single Interface Testing

## Application on 3G Networks

### End to End Testing

MAPS™ Server configured as RNC emulates GTP-U traffic with the help of PacketLoad™ and transmits through the SGSN & GGSN gateway points in UMTS network. The generated packet data is encapsulated within GTP headers. At the receiving end, MAPS™ Server with PacketLoad™ is used to verify the incoming packet data. The solution provides various statistics such as Total packets transmitted and received, Latency, Delay, Bandwidth per port, Total TCP connections created, Successful connections, Packet loss, etc. This helps to test UMTS network performance end to end at full load under various traffic conditions.

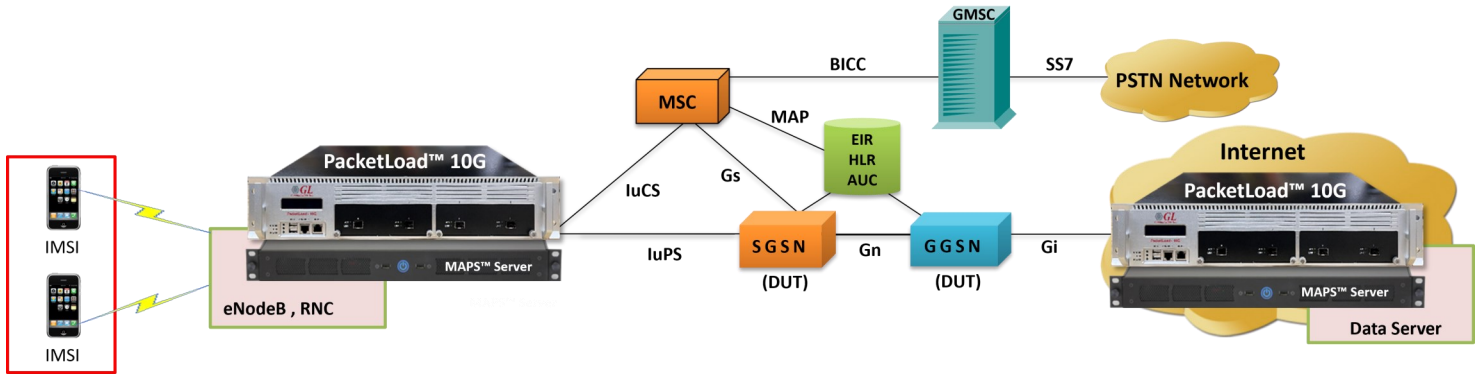


Figure: PacketLoad™ in 3G Network with End to End Testing

### Single Interface Testing

MAPS™ Server as RNC ([MAPS™ UMTS IuPS](#)), and GGSN ([MAPS™ UMTS Gn Gp](#)) along with PacketLoad™ appliance can function together to test customer’s SGSN operation at full load under various traffic conditions, and thus perform comprehensive load testing.

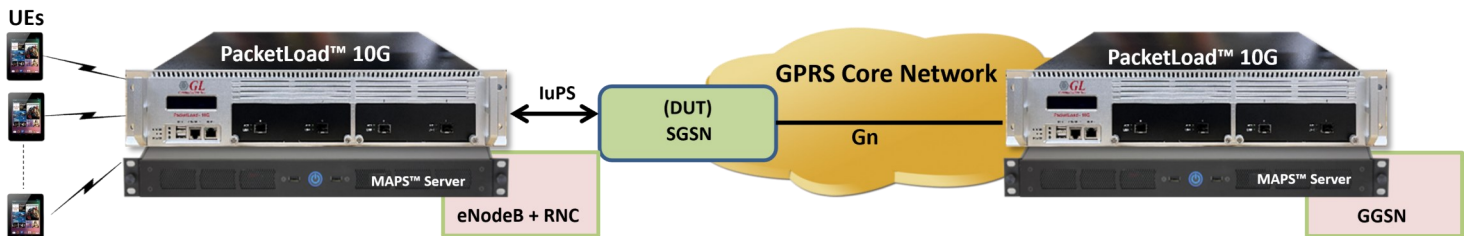


Figure: PacketLoad™ in 3G Network with Single Interface Testing

## Modes of Operation

The application offers Transparent mode (with VLAN), Routed mode (with VLAN), Server-only, and Client-only modes of operating methods. When a DUT is operating transparently (example: L2 devices, IPS), “Transparent” (or “GTP to GTP Traffic”) mode of operation is chosen. To work with devices such as routers and L3 switches, selected “Routed Mode” (or “GTP to IP Traffic”) mode of operation is chosen.

### Transparent Mode (GTP to GTP Traffic)

Transparent mode supports the user plane GTP packets through a DUT that is transparent to the network and passes the traffic without any IP translation.

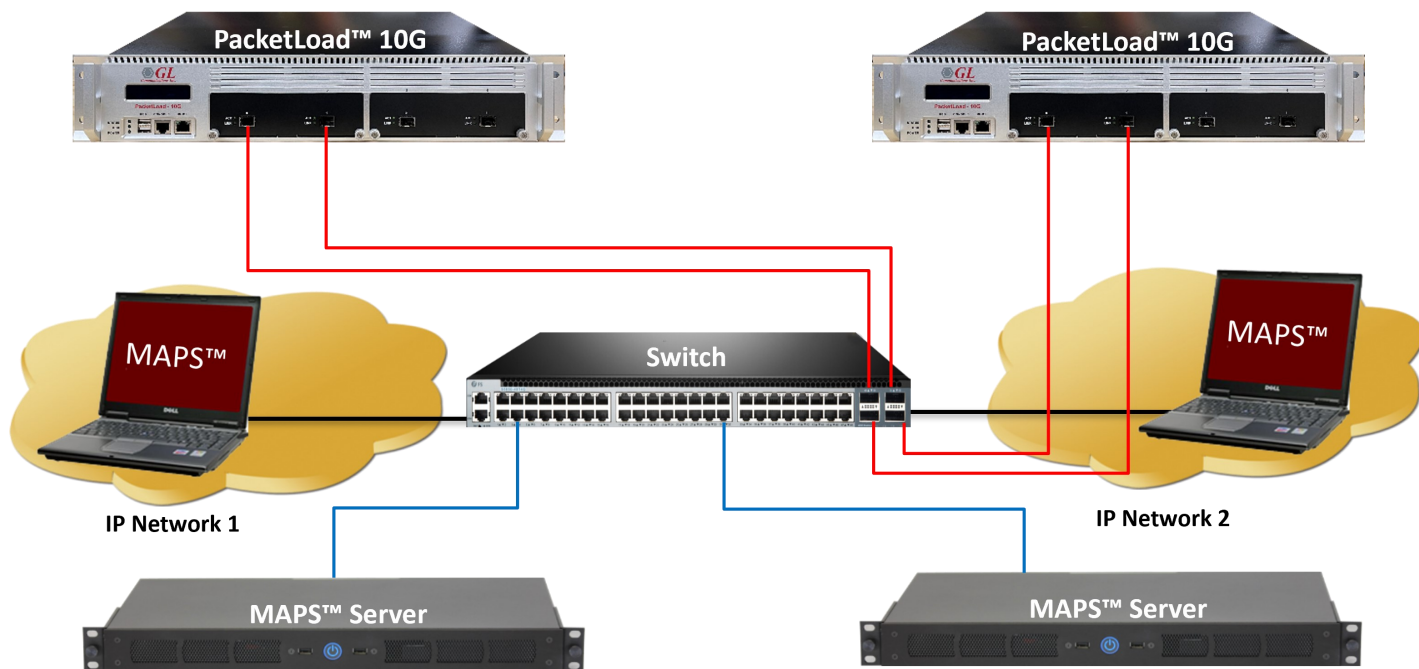


Figure: GTP to GTP (Transparent mode) Traffic Operation

### Routed Mode (GTP to IP)

Routed Mode supports the packet transmission and reception services through a gateway, where the network packets from PacketLoad™ will pass through a Gateway and converts the traffic mode form GTP to IP, and sends the IP traffic for further analysis.

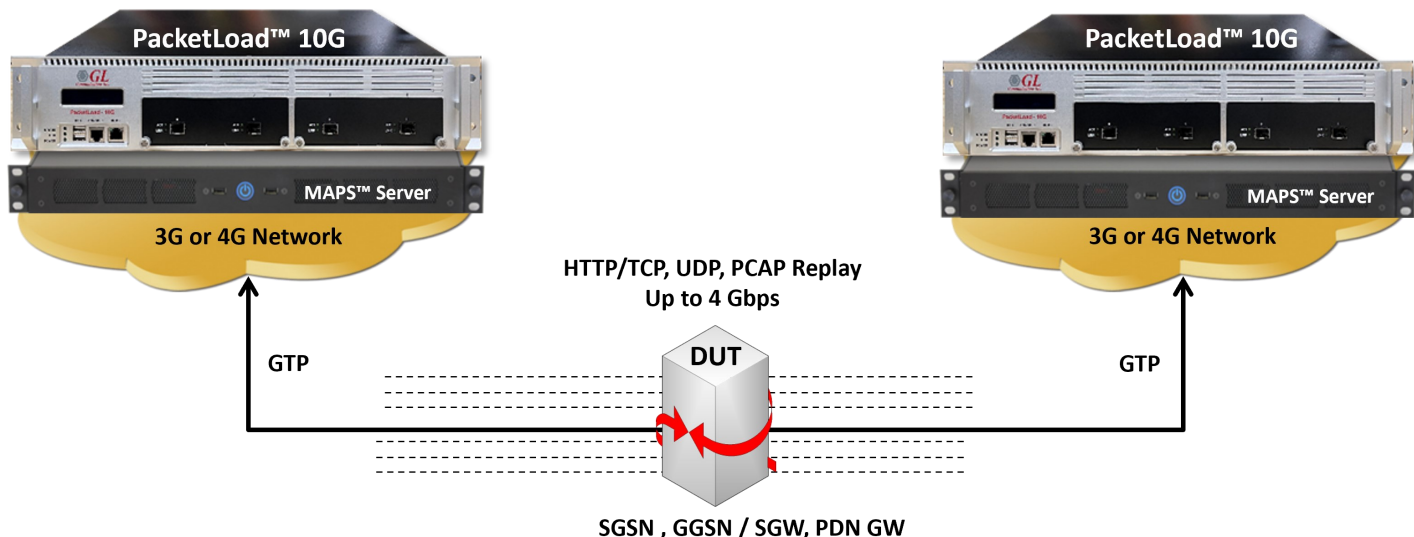


Figure: GTP to IP (Routed mode) Traffic Operation

## Call Control and Mobile Data Traffic Statistics

The PacketLoad™ global parameters are defined in the call generation scripts, which are calculated and updated periodically providing real-time mobile data traffic metrics. Typically following statistics are generated from the application. Users can customize the statistics for the generated stateful TCP/HTTP, and PCAP Replay and other Mobile Data traffic.

- Link Level- Link state/speed, ARP
- Per Port - TX/RX rate/s, packets /sizes, Bytes
- Packet - Payload Size via MSS (1B to 9400B)
- TCP/IP– SYN, SYN\_ACK, ACK, RST, HTTP\_GET, HTTP\_POST, TCP/IP Checksum Errors
- PCAP Replay - Packets Sent and Received
- UDP - Packets Sent and Received

Name	Values
eth0_INPUT_MBPS	26.0
eth1_INPUT_MBPS	27.0
eth2_INPUT_MBPS	48.4
eth3_INPUT_MBPS	48.4
eth0_OUTPUT_MBPS	48.4
eth1_OUTPUT_MBPS	48.4
eth2_OUTPUT_MBPS	26.0
eth3_OUTPUT_MBPS	27.0
eth0_INPUT_PPS	26626
eth1_INPUT_PPS	26698
eth2_INPUT_PPS	73953
eth3_INPUT_PPS	73882
eth0_OUTPUT_PPS	73943
eth1_OUTPUT_PPS	73871
eth2_OUTPUT_PPS	26615
eth3_OUTPUT_PPS	26687
CLIENT_PACKET_SENT	0
CLIENT_PACKET_SENT_MAX_RATE	70392
CLIENT_BYTES_SENT_TOTAL	206392657
CLIENT_BYTES_SENT_MAX_RATE	7069496
CLIENT_BYTES_AND_IPG_SENT_TOTAL	256372537
CLIENT_BYTES_AND_IPG_SENT_MAX_RATE	8681496
CLIENT_ACK_SENT_TOTAL	0
CLIENT_ACK_SENT_MAX_RATE	0
CLIENT_TOTAL	0
CLIENT_MAX_RATE	0
CLIENT_PACKET_RCV_TOTAL	3141424
CLIENT_PACKET_RCV_MAX_RATE	148309
CLIENT_BYTES_RCV_TOTAL	2480088030
CLIENT_BYTES_RCV_MAX_RATE	118061460
CLIENT_SYN_SENT_TOTAL	0
CLIENT_SYN_SENT_MAX_RATE	0
CLIENT_FIN_SENT_TOTAL	0
CLIENT_FIN_SENT_MAX_RATE	0
CLIENT_ACK_TO_FIN_SENT_TOTAL	0
CLIENT_ACK_TO_FIN_SENT_MAX_RATE	0
CLIENT_MISST_SENT_TOTAL	0

Figure: Mobile Data Traffic Statistics

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

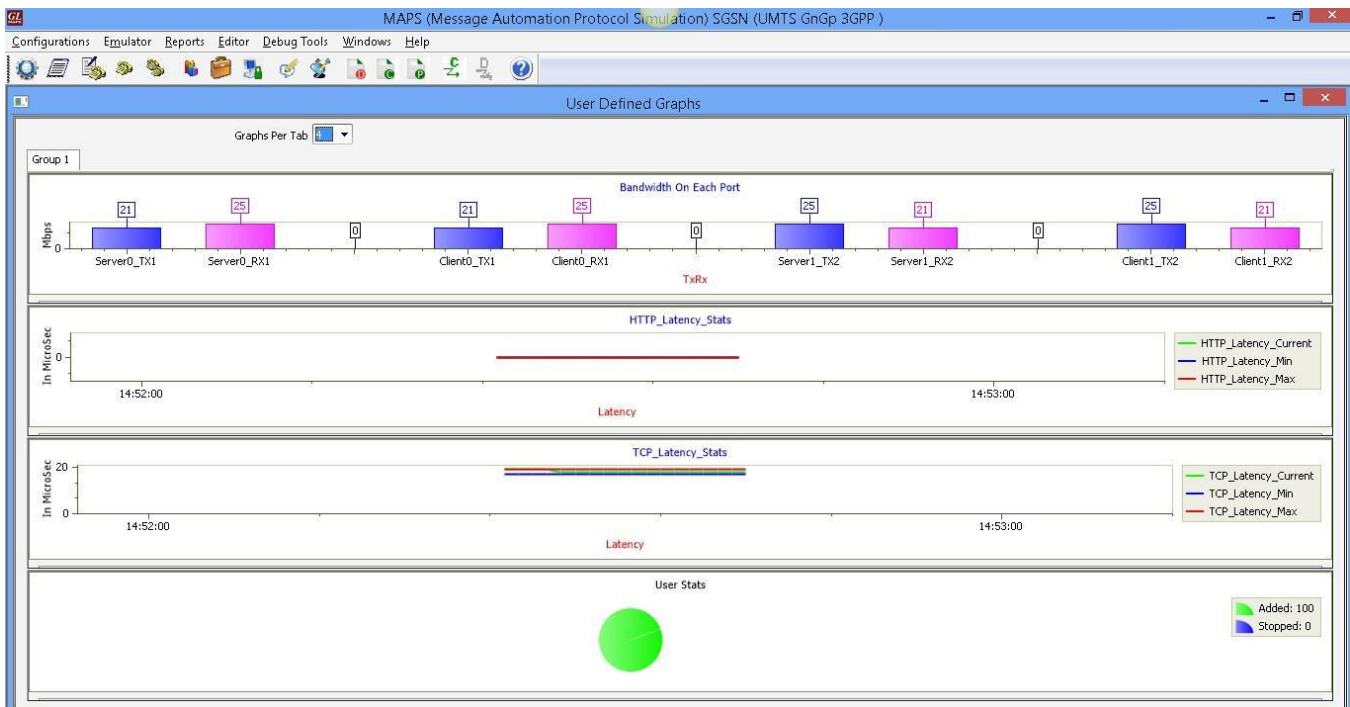


Figure: Mobile Traffic Call Graph



## Buyer's Guide

Item No	Product Description
<a href="#">PKS172</a>	MAPS™ Server with PacketLoad™ 1G
<a href="#">PKS174</a>	MAPS™ Server with PacketLoad™ 10G

Item No	Related Software
<a href="#">ETH100</a>	Packet Traffic Simulation - GTP
<a href="#">ETH101</a>	Mobile Traffic Core-GTP
<a href="#">ETH102</a>	Mobile Traffic Core-Gateway
<a href="#">ETH103</a>	Mobile Traffic - Gb
<a href="#">PKS166</a>	MAPS™ UMTS Gn Gp Emulator
<a href="#">PKS140</a>	MAPS™ LTE S1 Emulator
<a href="#">PKS142</a>	MAPS™ LTE eGTP (S3, S4, S5, S8, S10, S11 & S16) Emulator
<a href="#">PKS160</a>	MAPS™ UMTS IuCS IP Emulator MAPS™ UMTS IuH IP Emulator
<a href="#">PKS131</a>	MAPS™ Gb Emulator over IP for BSC & SGSN
<a href="#">PKS500</a>	MAPS™ 5G N1N2 Interface Emulator
<a href="#">PKS501</a>	MAPS™ 5G N4 Interface Emulator

For more details, refer to [MAPS™ PacketLoad high-density traffic simulation](#) webpage.



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