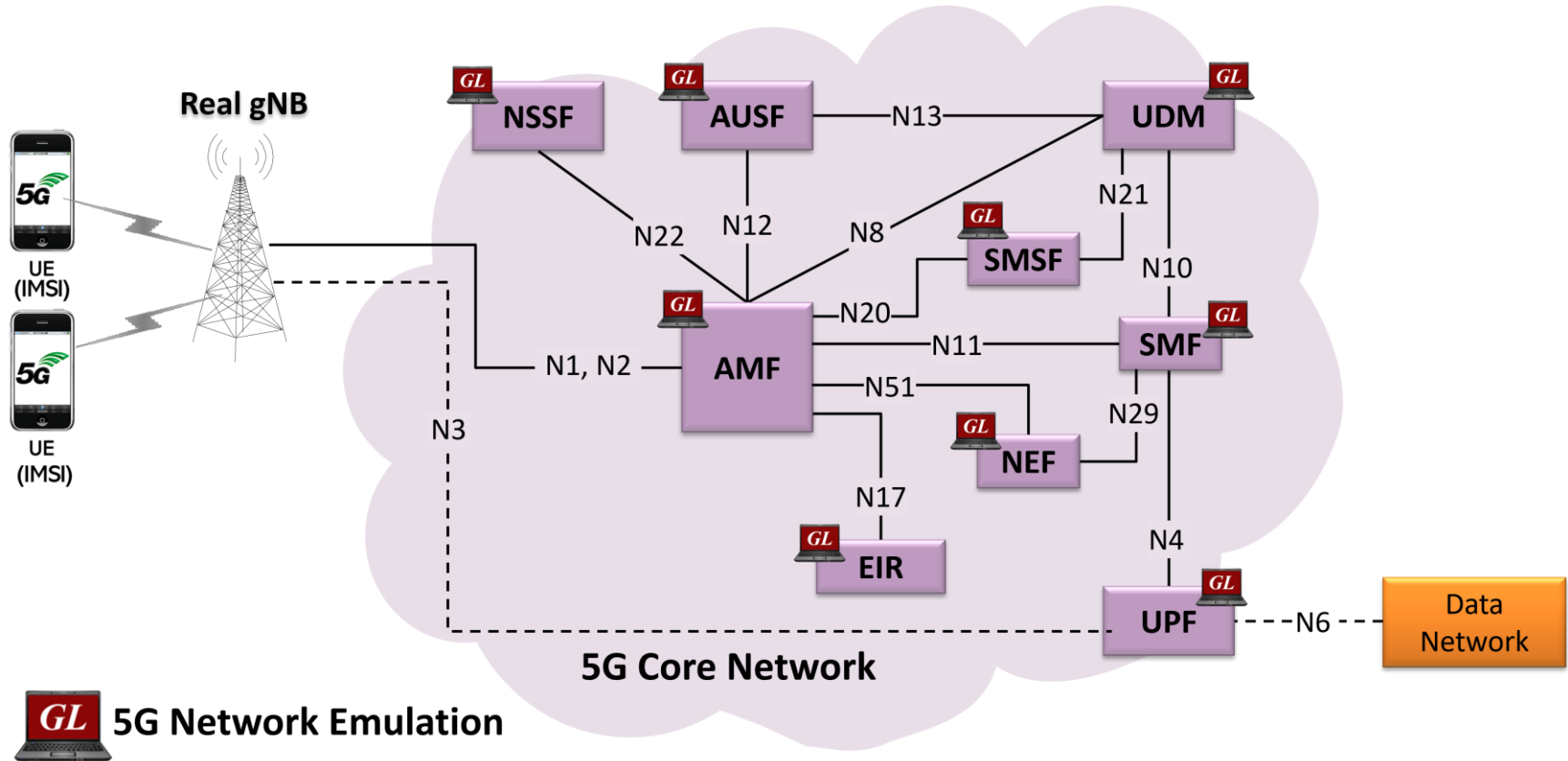

MAPS™ - 5G N4 Interface Emulator

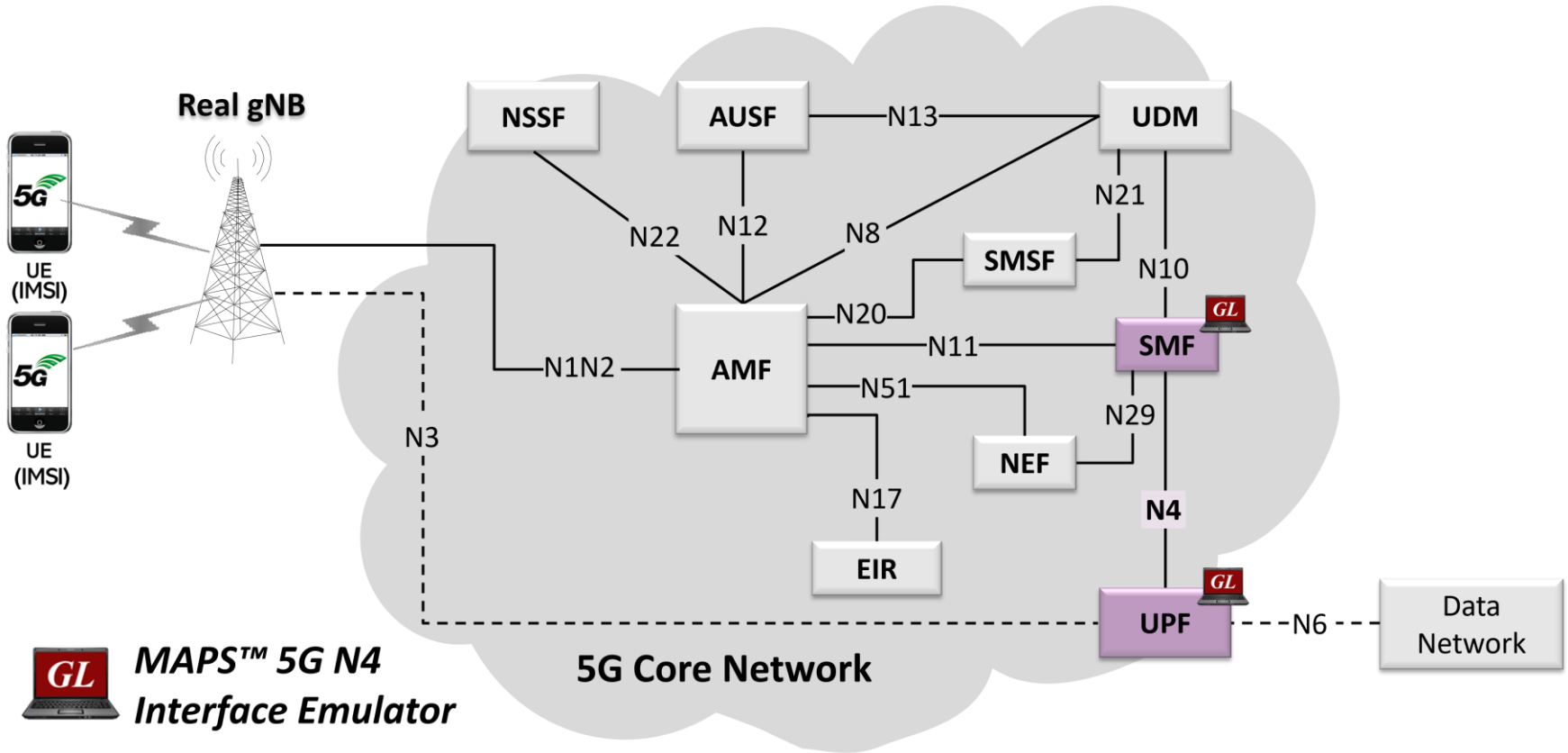


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Phone: (301) 670-4784 Fax: (301) 670-9187 Email: info@gl.com
Website: <https://www.gl.com>

5G Network Diagram



MAPS™ 5G N4 Interface Emulator Architecture



Features

- Emulate Session Management Function (SMF) and User Plane Function (UPF) elements
- Supports 5G Control plane and User plane
- Supports Mobile Traffic type
- Generates and process PFCP (valid and invalid) messages
- Supports PDU Session Establishment, Modification, Release and Reporting of traffic data usage procedures
- Supports GTP Traffic (GTP User Plane Data), HTTP traffic generation capability

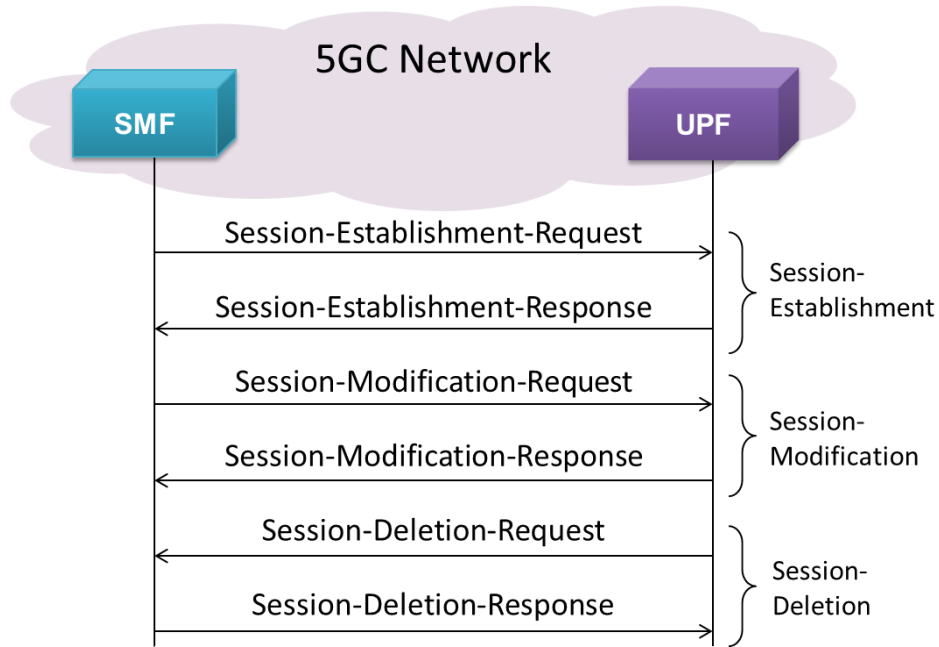
Protocol Stack Specification

PFCP
UDP
IP
L2
L1

Supported Protocols	Standard / Specification Used
N4 Interface	
N4 Interface (SMF - UPF)	TS29.244 Release 15
PFCP	3GPP TS 23.501 [28] 3GPP TS 23.502 [29]
UDP	IETF RFC 768
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

- PFCP entity supports IPv4 protocol

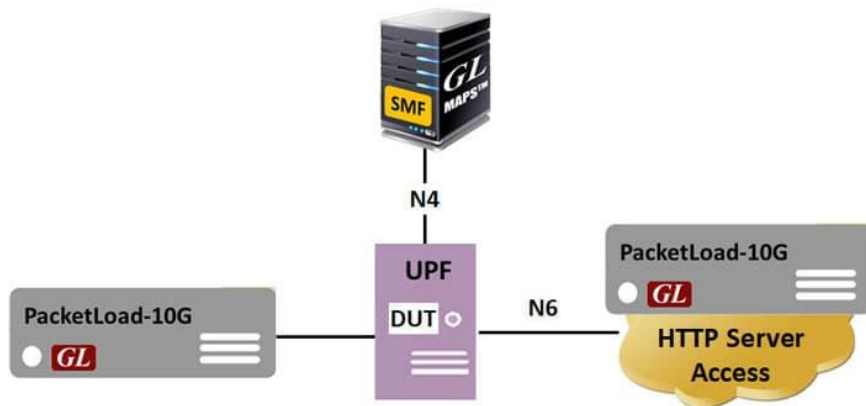
MAPS™ 5G Call Scenarios



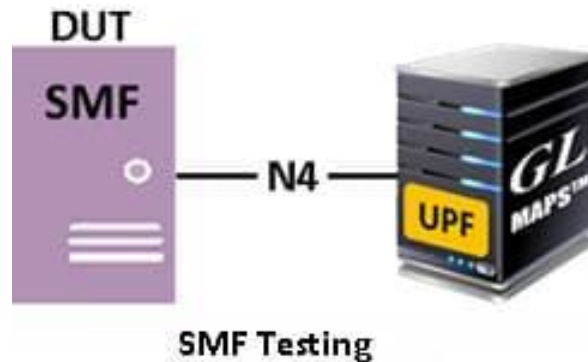
- PFCP Session Establishment Procedure
 - Session Establishment Request
 - Session Establishment Accept
- PFCP Session Modification Procedure
 - Session Modification Request
 - Session Modification Response
- PFCP Session Deletion Procedure
 - Session Deletion Request
 - Session Deletion Response

MAPS™ 5G N4 Single Interface Testing – Use Cases

UPF Testing



SMF Testing



- In SMF Testing, SMF node is the device under test and all the other nodes (AMF, UDM, UPF)UPF node interacting with the SMF node are emulated
- In UPF Testing, UPF node is the device under test and all the other nodes (gNodeB, SMF, Data Network) SMF node interacting with the UPF node are emulated

Testbed Configurations

MAPS SMF (N4 RELEASE15) - [Testbed Setup -TestBedDefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Config Value

SMF Parameters		<input checked="" type="checkbox"/> Enable
Adapter Index	2	
SMF	1	
SMF 1		
SMF IP Address	192.168.1.27	
SMF Traffic IP Address	192.168.1.27	
SMF Port	8805	
PLMN Identities		
Mobile Country Code	001	
Mobile Network Code	001	
UPF Configuration	1	
UPF Configuration 1		
UPF IP Address	192.168.1.127	
UPF Port	8805	
Local FTEID Allocation	UPF	
UPF Traffic IP Address	192.168.13.77	
Traffic	Enable	
DNN Configuration	3	
DNN Configuration 1		
DNN Configuration 2		
DNN Configuration 3		

Start Edit

Initialisation Errors Error Events

Profile Configurations

The screenshot displays the 'Profile Editor - MobileIPCore' window in the MAPS SMF (N4 RELEASE15) application. The interface includes a menu bar (Configurations, Emulator, Reports, Editor, Debug Tools, Windows, Help) and a toolbar with various icons. A left sidebar shows a list of profiles under 'Profiles (Edit-F2)', with '1 Profile' selected. The main area is divided into a tree view on the left and a configuration table on the right.

Tree View Structure:

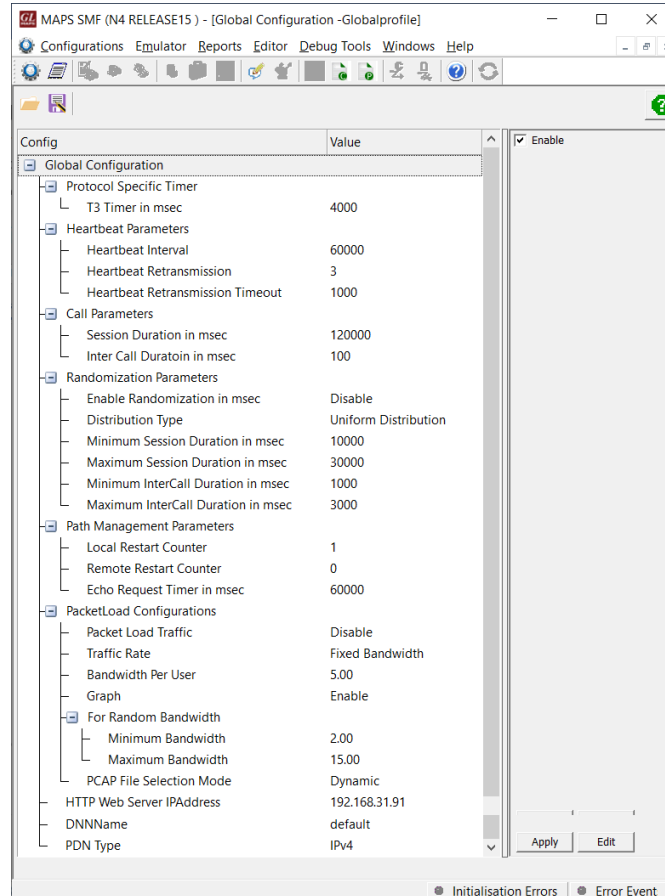
- Profile
 - Traffic Parameters
 - Mobile Traffic Parameters
 - Udp Src Port
 - Udp Dst Port
 - HTTP Server IP Address
 - TCP port for HTTP
 - TCP Connection Identifier
 - Transmission Type
 - Start File Count
 - Traffic File Name
 - File Count For Concurrent Or Sequential
 - OS Socket
 - TxFile For Once Transmission From List
 - File Playback Count

Configuration Table:

Config	Value	Enable
Udp Src Port	2152	<input checked="" type="checkbox"/>
Udp Dst Port	2152	<input checked="" type="checkbox"/>
HTTP Server IP Address	192.168.15.80	<input checked="" type="checkbox"/>
TCP port for HTTP	80	<input checked="" type="checkbox"/>
TCP Connection Identifier	1	<input checked="" type="checkbox"/>
Transmission Type	Once	<input checked="" type="checkbox"/>
Start File Count	1	<input checked="" type="checkbox"/>
Traffic File Name	img5a.flixcart.com	<input checked="" type="checkbox"/>
File Count For Concurrent Or Sequential	4	<input checked="" type="checkbox"/>
OS Socket	Enable	<input checked="" type="checkbox"/>
TxFile For Once Transmission From List	9	<input checked="" type="checkbox"/>
File Playback Count	1	<input checked="" type="checkbox"/>

At the bottom of the configuration table, there are buttons for 'Add', 'Insert', 'Delete', and 'Properties'. The status bar at the very bottom shows 'Initialisation Errors', 'Error Events', 'Captured Errors', and 'Link Status Up=0 I'.

Global Configuration



Incoming Call Handler Configuration

MAPS UPF (N4 RELEASE15) - [Incoming Call Handlers Configuration - default]

Configurations Emulator Reports Editor Debug Tools Windows Help

Message Name Script Name

Session Establishment Request	UPFSessionControl.gls
Association Setup Request	PFCPManagementHandler.gls
Heartbeat Request	PFCPManagementHandler.gls

Scripts

- UPFSessionControl.gls

☒ Sequence
☐ Random

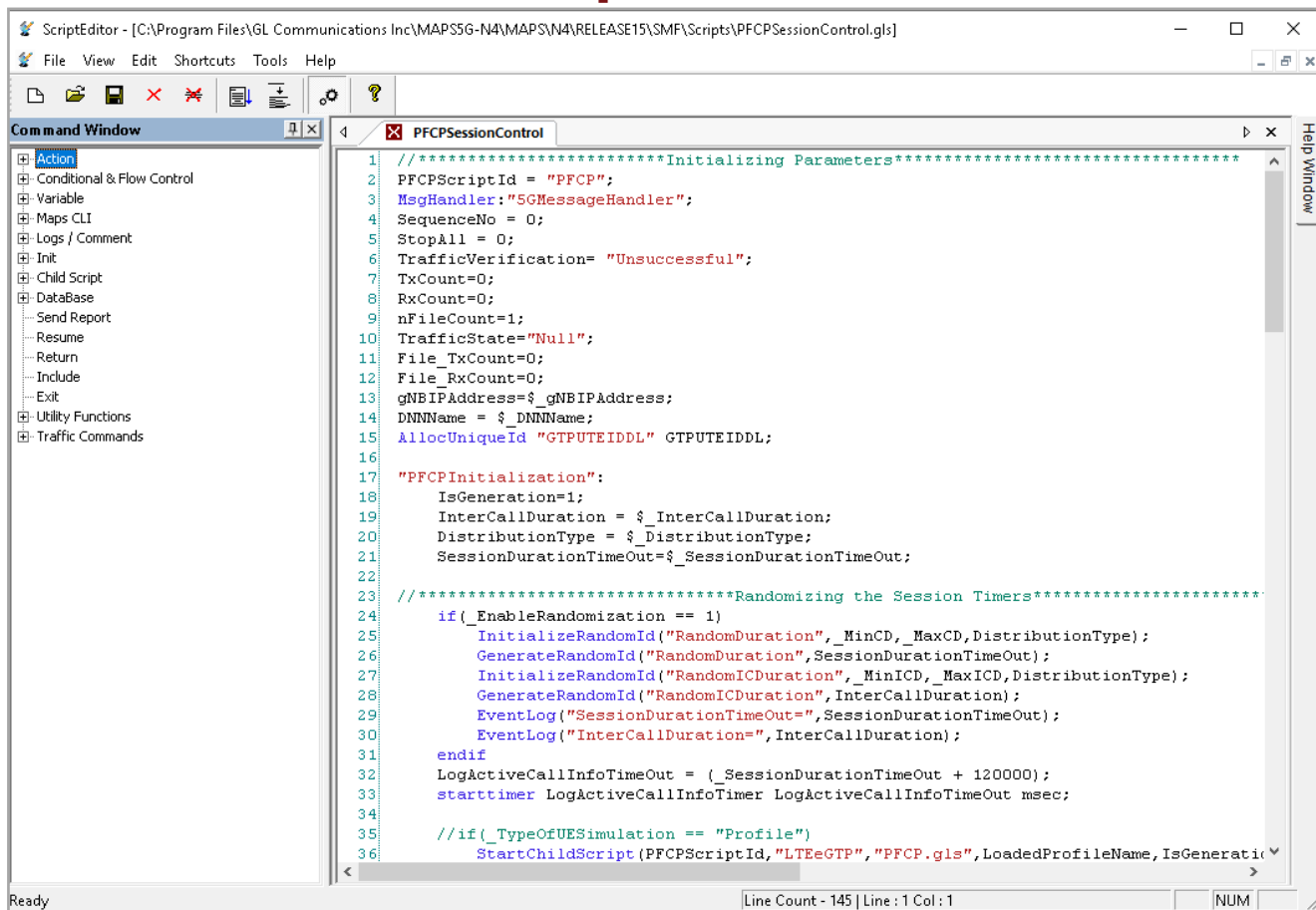
Up
Down

Add Delete

Add Delete Apply Scripts Clear Scripts

Initialisation Errors Error Events Captured Errors

Script Editor



Message Editor

Message Editor - Untitled

File View Direction Tools Help

Frame No 1

PFCP

- S
 - Message Priority:
 - Version
 - Message Type
 - Length
 - Session Endpoint Identifier
 - Sequence Number
 - Message Priority
- InformationElements
 - Update PDR
 - Information Element Id

Session Modification Request = 52
 Session Establishment Request = 50
 Session Establishment Response = 51
 Session Modification Request = 52
 Session Modification Response = 53
 Session Deletion Request = 54
 Session Deletion Response = 55
 Session Report Request = 56
 Session Report Response = 57

```

===== PFCP Layer =====
0000 S = .....1 SEID field is present
0000 Message Priority: = .....1. Present
0000 Spare = ...000.. (0)
0000 Version = 001..... PFCP Version 1
0001 Message Type = 00110100 Session Modification Request
0002 Length = 44 (x002C)
0004 Session Endpoint Identifier = x0000000000000000
000C Sequence Number = 0 (x000000)
000F Spare = ....0000 (0)
000F Message Priority = 0000.... (0)
Update PDR =
0010 Information Element Id = x0009 Update PDR
0012 Length = 28 (x001C)
PDR ID =
Information Element Id = x0038 Packet Detection Rule ID
Length = 2 (x0002)
Rule ID = 0 (x0000)
PDI =
001A Information Element Id = x0002 PDI
001C Length = 18 (x0012)
Source Interface =
Information Element Id = x0014 Source Interface
Length = 1 (x0001)
Interface value = ....0000 Access
  
```

Ready NUM

MAPS™ 5G N4 Interface – Call Emulation

Call Generation

GL MAPS SMF (N4 RELEASE15) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No.	Script Name	Profile	Call Info	Script Execution
1	PFCPSessionControl.gls	Profile	SMFSEID : 0x02.UPFSEID : 0	Start
2	PFCPSessionControl.gls			Start
3	PFCPSessionControl.gls			Start
4	PFCPSessionControl.gls			Start
5	PFCPSessionControl.gls			Start

Save Column Width Show Latest

SMF UPF

Session Establishment Request 3:05:41.394000

Session Establishment Response 3:05:41.572000

Session Modification Request 3:05:41.583000

Session Modification Response 3:05:41.603000

Session Deletion Request 3:05:45.735000

Session Deletion Response 3:05:45.761000

Scripts Message Sequence Event Config Script Flow

Initialisation

Call Reception

GL MAPS UPF (N4 RELEASE15) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Pro...	Call Info	Script Execution	Status	Events	Results
1	PFCPManagementHand...		ConnectionID : 1	Stop	Heartbeat Success	None	Pass
2	UPFSessionControl.gls		UEIPAddress : 192.168.121.1.SMFSEID : 0x00000000	Completed	Session Deletion Response Sent	None	Pass

Stop Stop All Abort Abort All Show Record: Select Active Cal Auto Trash Trash Show Hidden Calls

Save Column Width Show Latest

SMF UPF

Session Establishment Request 3:05:41.558000

Session Establishment Response 3:05:41.567000

Session Modification Request 3:05:41.592000

Session Modification Response 3:05:41.599000

Session Deletion Request 3:05:45.739000

Session Deletion Response 3:05:45.750000

Scripts Message Sequence Event Config Script Flow

Find

***** PFCP Layer *****

0000 S = .

0000 Message Priority: = .

0000 Spare = .

0000 Version = 0

0001 Message Type = 0

0002 Length = 1

0004 Session Endpoint Identifier = x

000C Sequence Number = 0

000F Spare = .

000F Message Priority = 0

Node ID =

0010 Information Element Id = x

0012 Length = 5

0014 Node ID Type = .

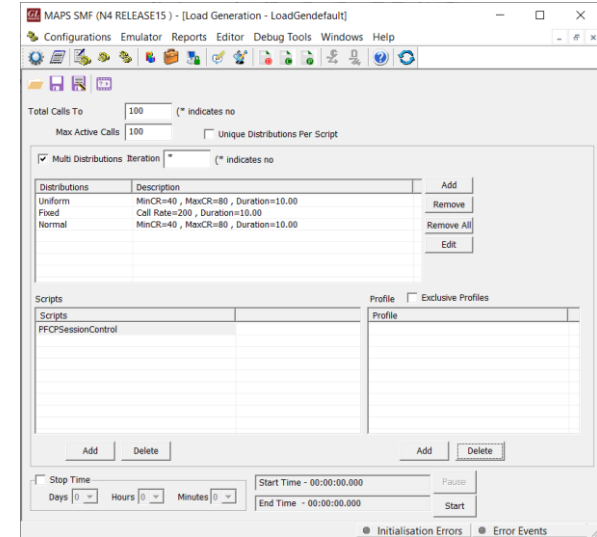
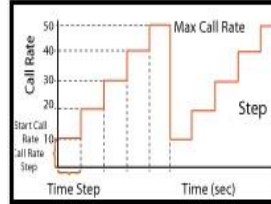
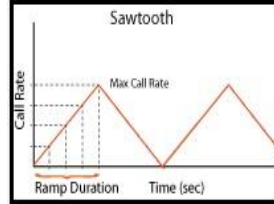
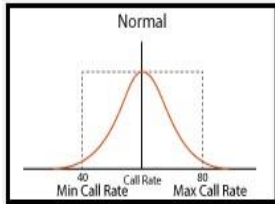
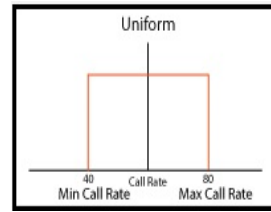
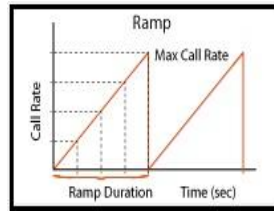
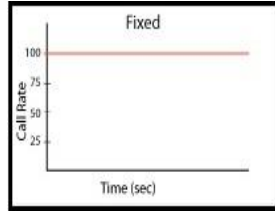
0014 Spare = 0

0015 IPv4 Address = 1

CP F-SEID =

Initialisation Errors Error Events Captured Errors Link Status

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.

Traffic Emulation

"All Interfaces"



"All Protocols"

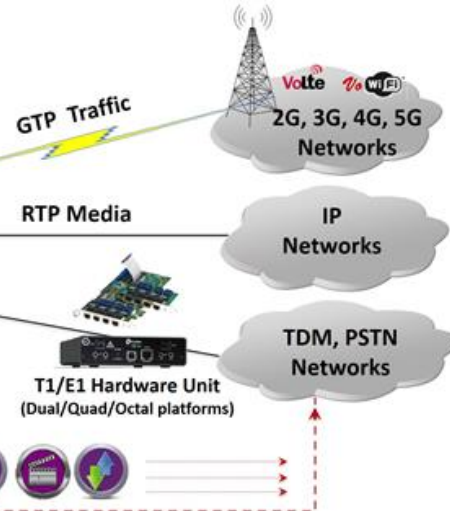


Scales up to 100K to 200K Sustained Calls



Remote Scripting and
Client Access

"Large Capacities"



- Voice Files (wav, pcm, GL's Proprietary GLW)
- Video Trace Files (hdl - GL's Proprietary format)
- DTMF and MF Digits
- Tones (single, dual and user-defined)
- Industry Standard Codecs (a-law, u-law, gsm and more)
- FAX (T.30 RTP pass-through and T.38 UDPTL)
- Impairments (Latency, Packet Loss, Packet Effects)
- Mobile Data, Packet, GTP Gateway Traffic

Thank you