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# MAPS™ GPRS GB INTERFACE EMULATOR

## GPRS Gb Interface Emulation over IP

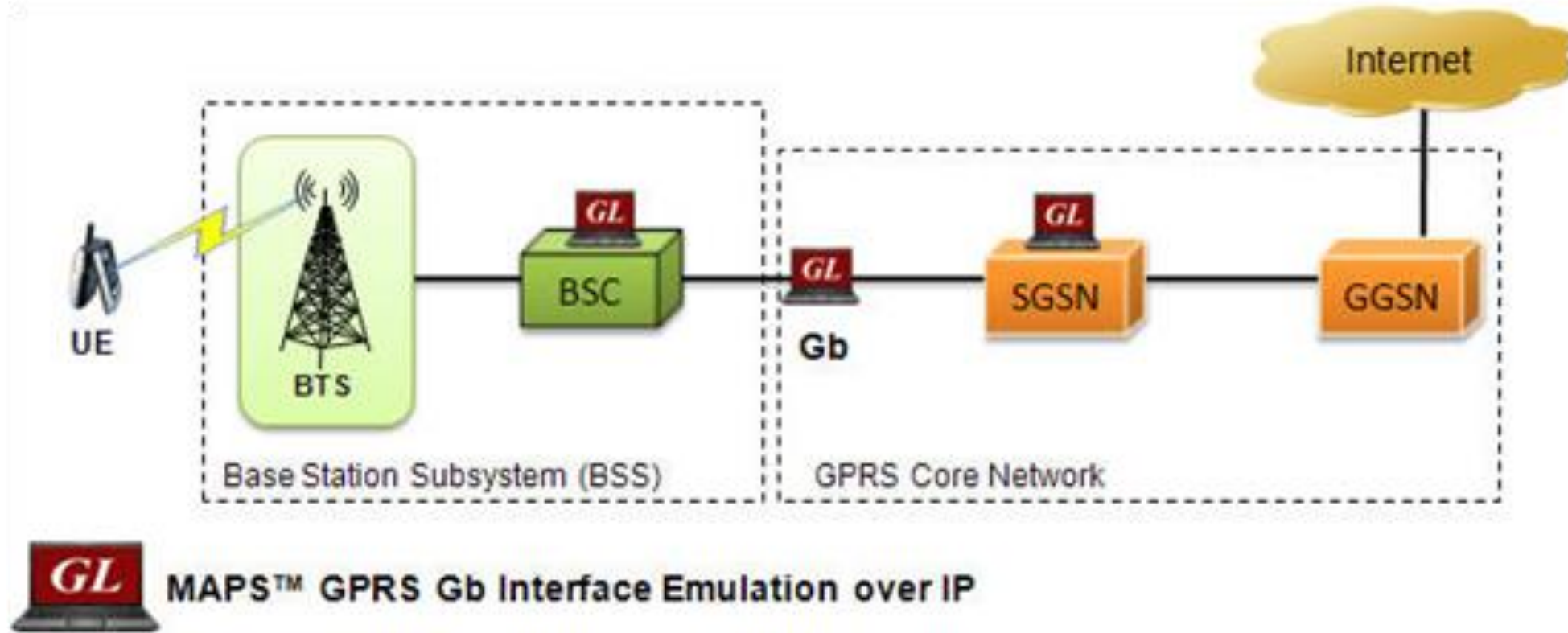
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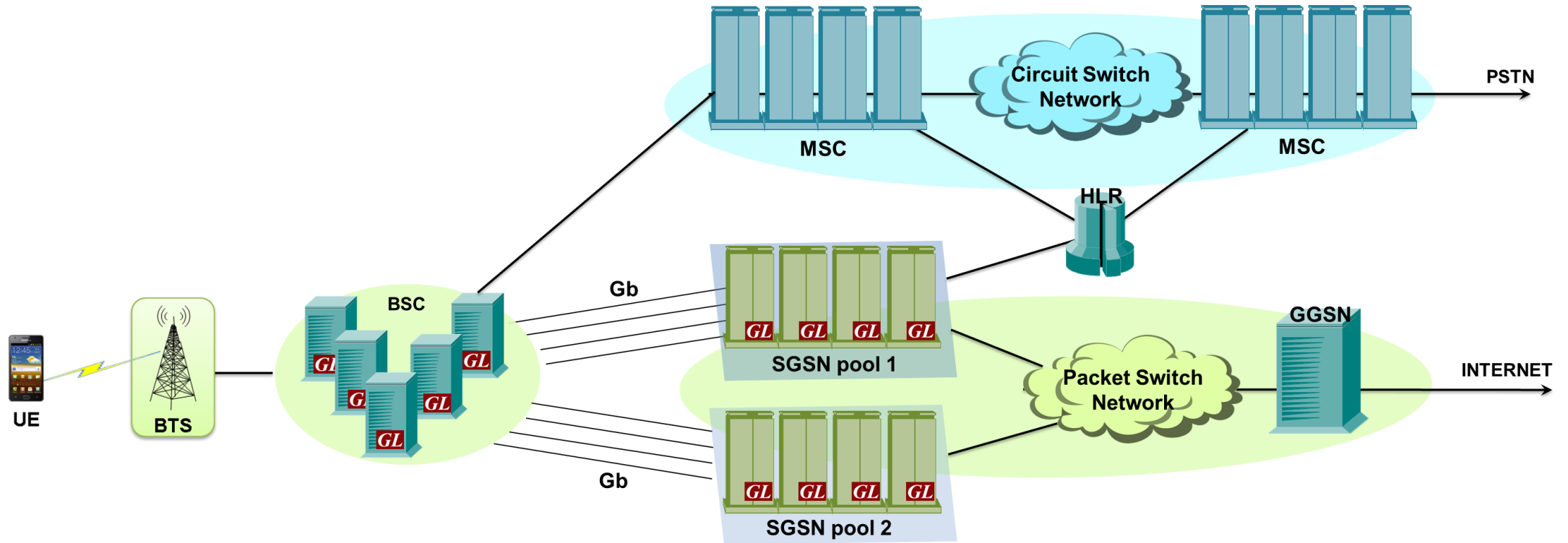


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# Overview



# SGSN Pooling



MAPS™ GPRS Gb Interface Emulation over IP

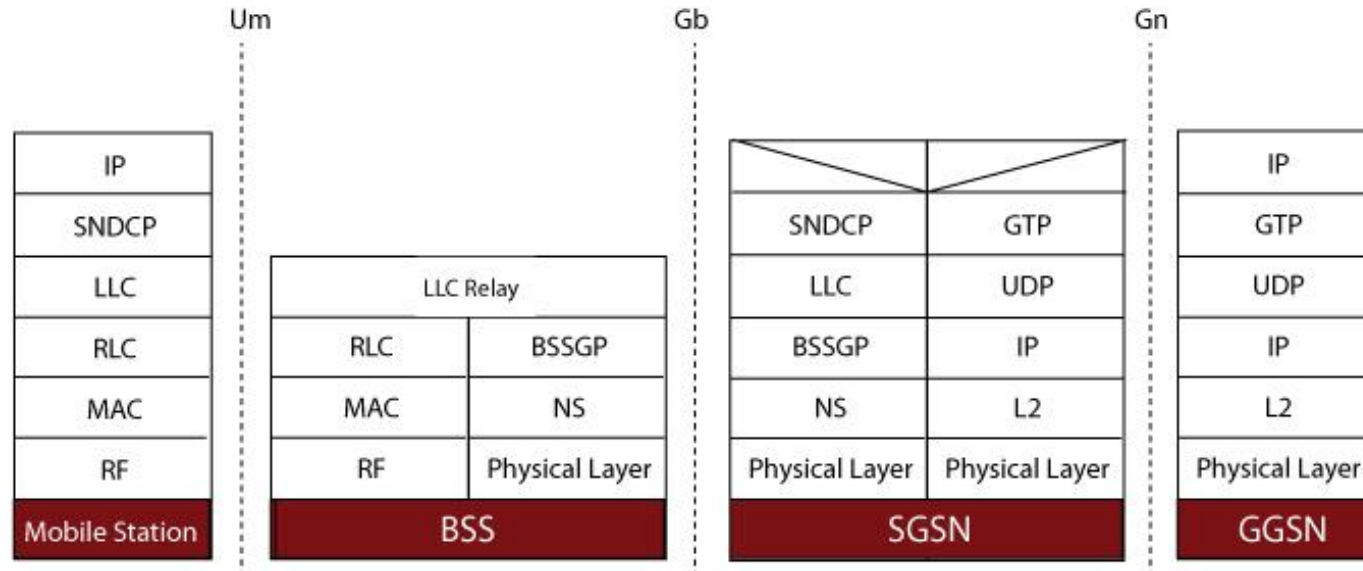
# Key Features

- Setup a virtual real-time network simulating 2G-GSM GPRS network elements using 'MAPS™ 2G Wireless Lab Suite'
- Simulates SGSN (Serving GPRS Support Node) and BSS (Base Station Subsystem) elements in GPRS Gb interface over IP
- Simulates Control plane Gb mode
- Supports SGSN pooling to test and verify redundancy, load balancing, and scalability of network
- Generates hundreds of Control signaling (Load Testing)
- Generates and processes NS (Network Service), BSSGP (Base Station Subsystem GPRS Protocol), and various GPRS session procedure messages
- Supports Gb interface procedures including Network Service Control, Identity Check, Combined GPRS / IMSI Attach, and Routing Area Update
- Insertion of impairments to create invalid messages
- Supports GTP Traffic (GTP User Plane Data) which includes: verification like BERT testing, HTTP traffic generation capability, GGSN can actually be connected to real IP network to simulate Gateway testing

# Applications

- Complete analysis and simulation capability
- Provides fault insertion, and erroneous call flows testing capability
- 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
- QoS requests for greater or lesser bandwidth
- GSM GPRS lab setup can be used in educational institutions for training purposes

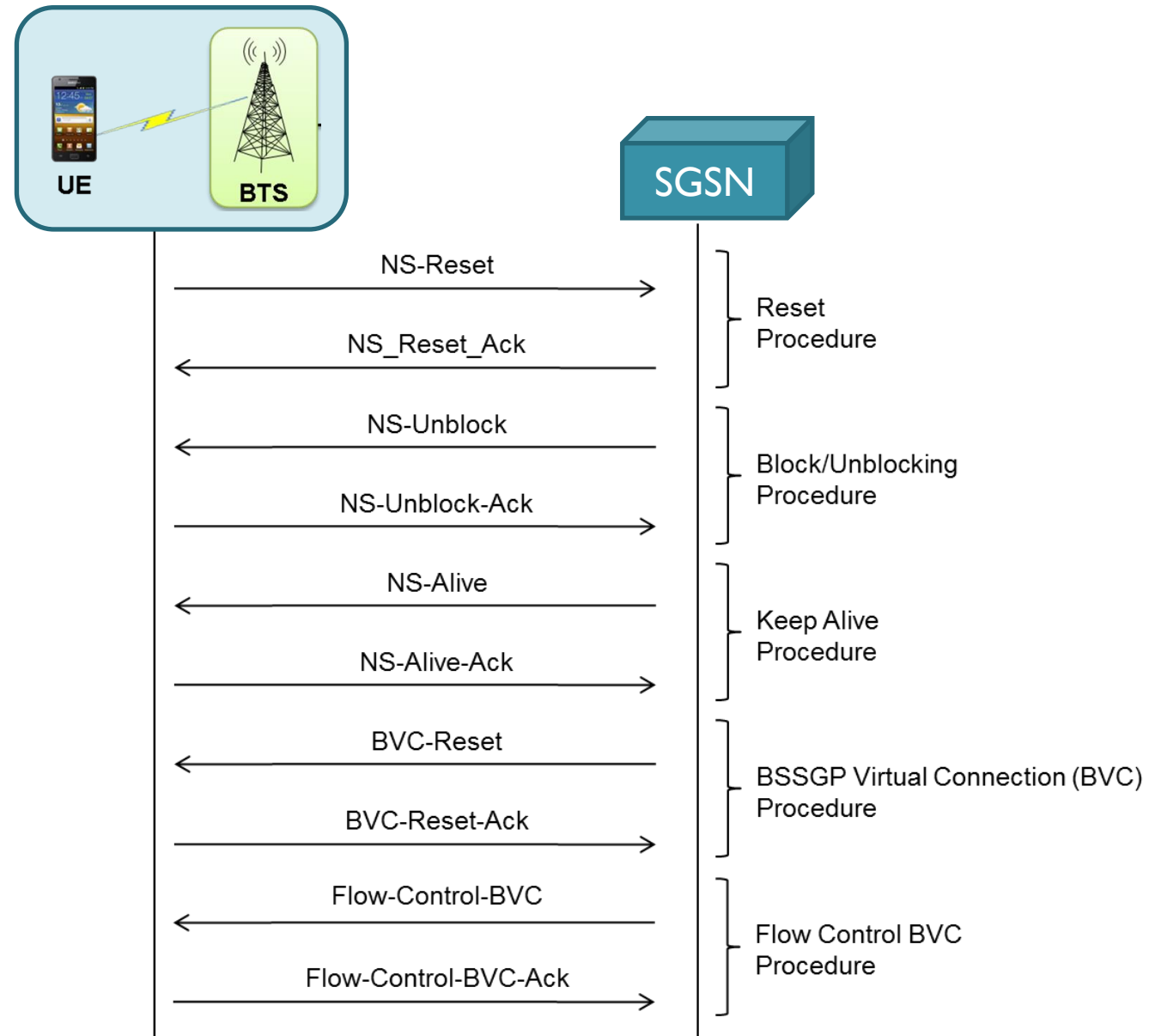
# GPRS Gb Protocol Stack



- **BSSGP** - Base Station Subsystem GPRS Protocol
- **NS** – Network Service
- **LLC** - Logical Link Control
- **SNDCP** - Sub Network Dependent Convergence Protocol

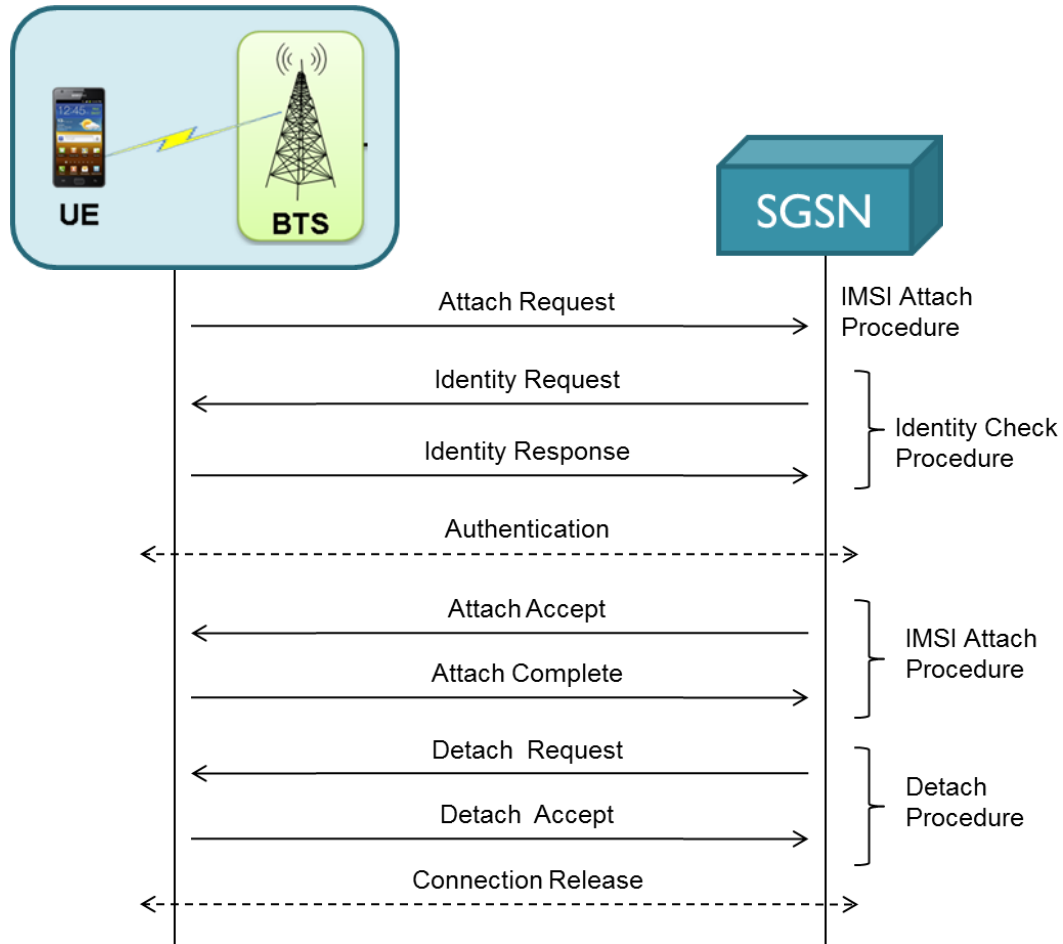
Supported Protocols	Specification Used
<b>GPRS Gb Interface</b>	
BSSGP	3GPP TS 08.18 V8.10.0 (2002-05)
LLC	3GPP TS 04.64 V8.7.0 (2001-12)
NS (Network Service)	GSM 8.16 (ETSI TS 101 299 V8.0.0)
GMM	3GPP 24.008
SMG (GPRS Session Mgmt)	3GPP TS 24.008 V5.16.0 (2006-06) (Release 5)
SNDCP	3GPP TS 04.64 V8.7.0 (2001-12)

# GPRS Gb Network Service Control

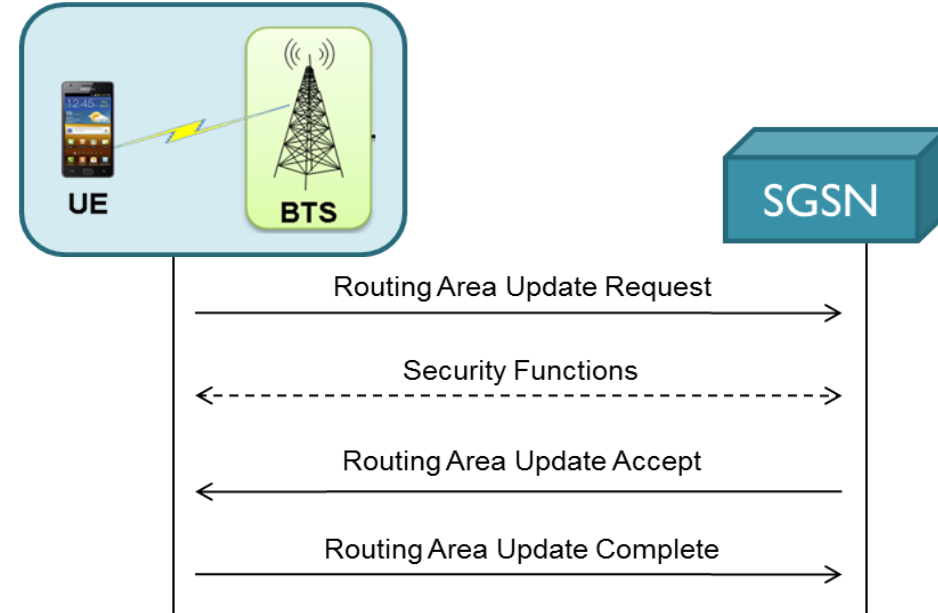


# GPRS Gb Combined GPRS and IMSI attach

## IMSI Attach and Identity Check



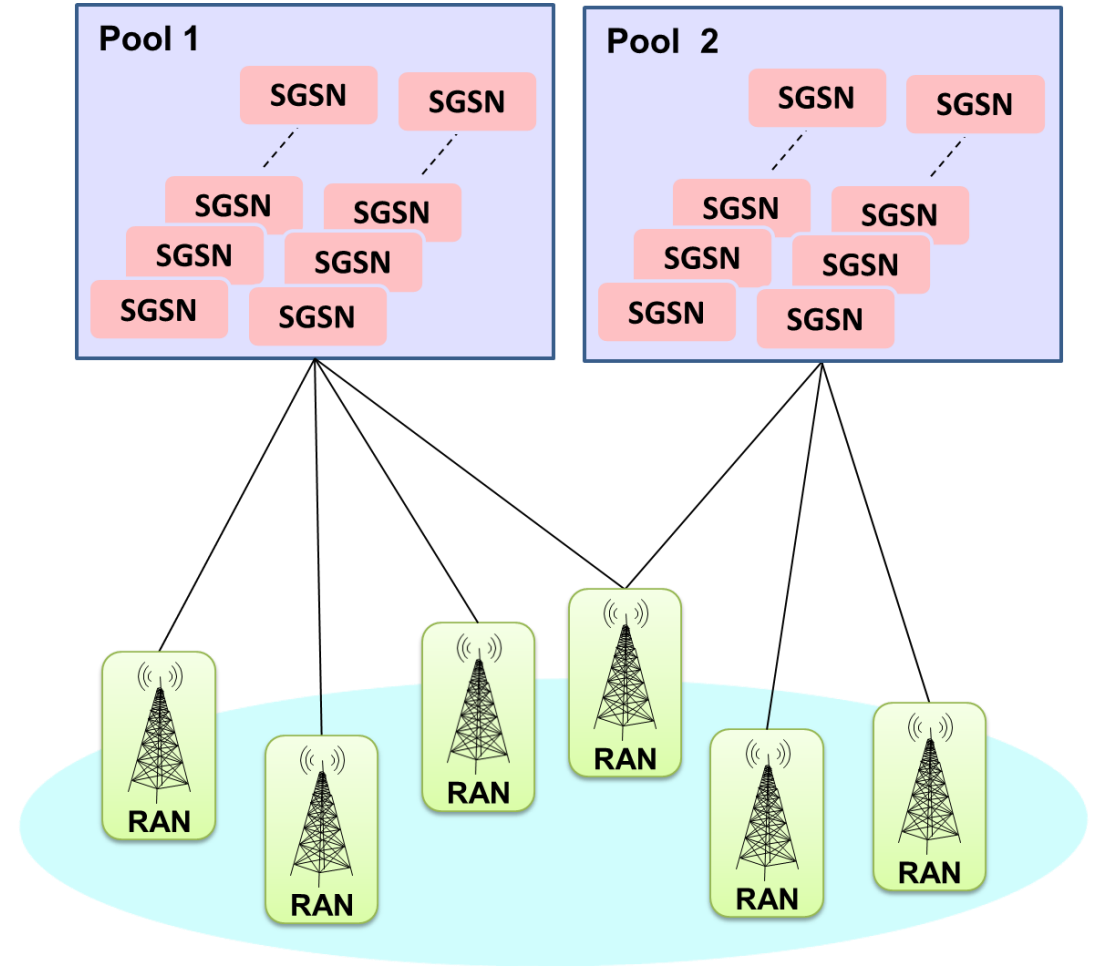
## Routing Area Update





# SGSN Pooling

- SGSN in Pool solution overcomes the strict hierarchy which restricts the connection of a BSC node to just one SGSN
- It introduces a new routing mechanism which allows a BSC belonging to an SGSN Pool connect to all SGSNs in that pool
- SGSN Pooling solution provides
  - Increased Availability
  - Increased Scalability
  - Reduced signaling and Increased Coverage Area



# Features of SGSN Pool

- User configurable number of SGSN Pool
- User configurable number of SGSN within a Pool
- SGSN Pool Identifier - Selection of SGSN Pool for each BSC
- NRI configuration at SGSN - The Network Resource Identifier (NRI) identifies uniquely an individual SGSN out of all SGSNs, which serve in parallel a pool-area
- NAS Node Selection Function - Selects the specific SGSN to which initial session establishment request are routed
- Load Balancing – selects appropriate SGSN and offloads the traffic available SGSNs in a pool, when the derived NRI does not map to indicated SGSN

# Testbed Setup

Archana Krishnamurthy (Archana@glcommunicationsind.onmicrosoft.com) is si

Config	Value	Enable
SGSN Configurations		<input checked="" type="checkbox"/>
Traffic Adaptor Index	0	
SGSN	1	
SGSN 1		
SGSN IP Address	192.168.12.226	
Traffic	Disable	
Traffic IP Address	192.168.8.2	
PLMN Identifiers		
Mobile Country Code	901	
Mobile Network Code	70	
BSC Parameters		
Supported BSCs	1	
Supported BSCs 1		
BSC IP Address	192.168.12.225	
BSC Port	23001	
SGSN Port	23001	
Location Area Identifier		
Location Area Code	10000	
Cell Identifier	1	
Cell Identifier 1		
Cell Identity	3	
Primary DNS Address	192.168.1.3	
Secondary DNS Address	8.8.8.8	
End User Configuration	MS_Profiles.xml	

Start Edit

Initialisation Errors Error Events Captured

# Profile Editor

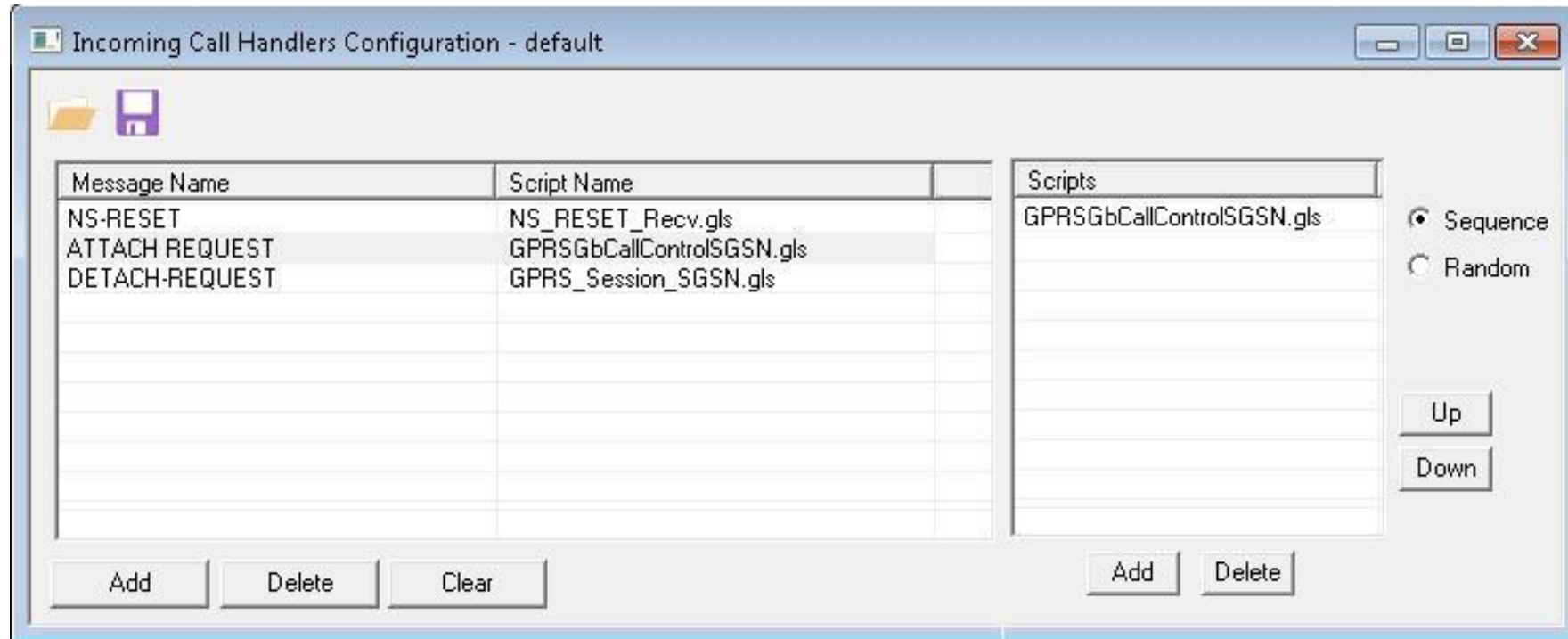
The screenshot displays the 'Profile Editor' window within the MAPS (Message Automation Protocol Simulation) environment. The window title is 'MAPS (Message Automation Protocol Simulation) SGSN (GPRSGB 3GPP) - [Profile Editor - MS\_Profiles]'. The interface includes a menu bar (Configurations, Emulator, Reports, Editor, Debug Tools, Windows, Help) and a toolbar with various icons. The main area is divided into three panes:

- Profiles (Edit-F2):** A list of 18 profiles, with 'MSProfile0001' selected.
- Config:** A tree view showing configuration parameters for the selected profile. The parameters and their values are:

Config	Value
Guaranteed bit rate for...	1
Maximum bit rate for ...	Maximum bit rate...
Guaranteed bit rate for...	Maximum bit rate...
<b>Handover Parameter</b>	
Cell Identity	2
Cause	cell traffic conges...
Handover Type	Handover Accept
<b>Authentication Info</b>	
OP	0102030405060708...
KEY or Ki	0123456789abcdef...
AMF	8000
SQN	000000000079
Call Selection	PDP Call
<b>SMS Call Parameters</b>	
SMS Character Set	Default
SMS Data for Default and 8...	Test MT SMS 001
SMS Data for UCS2	0054006500730074...
Originating SC	885643722001
Originating SME	995643722001
<b>Traffic Parameters</b>	
<b>Mobile Traffic Parameters</b>	
HTTP Server IP Address	192.168.14.181
TCP port for HTTP	80

At the bottom right of the main area, there are buttons for 'Add', 'Insert', 'Delete', and 'Properties'. The 'Enable' checkbox is checked. At the bottom of the window, there are status indicators for 'Initialisation Errors', 'Error Events', and 'Captured Error:'.

# GPRS Gb Incoming Call Handler Configuration



# Script Editor

```
ScriptEditor - [C:\Program Files\GL Communications Inc\MAPS-GPRS-Gb\MAPS\GPRSGB\3GPP\SGSN\Scripts\GPRSGbCallControlSGSN.gls]
File View Edit Shortcuts Tools Help
Command Window
GPRSGbCallControlSGSN
1 GPRSGBScriptId = "Null" ;
2 TempSessionId = 0;
3 MsgHandler:"GPRSMessagesHandler";
4
5 //***** LogActiveCallInfoTimer should be set to a value greater than UserInactive Timer
6 LogActiveCallInfoTimeOut = ( _UserInactiveTimeOut + 120000);
7 if(EnableCLI == 1)
8 else
9     starttimer LogActiveCallInfoTimer LogActiveCallInfoTimeOut msec;
10 endif
11
12 "GPRSGBInitialization":
13 "GPRS Procedures":
14     GPRSGBScriptId = "GPRSGB";
15     PDP_CONTEXT="DEACTIVE";
16     SECONDARY_PDP_CONTEXT = "DEACTIVE";
17     StartChildScript (GPRSGBScriptId,"GPRSGB","GPRS_Session_SGSN.gls",LoadedProfileName);
18 wait;
19
20 "OnAttachRequest" (TOI,TLLI,MobileId):
21     Status = "GMM-REGISTER-INITIATED";
22     State="ATTACH-REQUEST RECEIVED";
23     EventLog("ATTACH-REQUEST RECEIVED");
24     if (TOI == 4)
25         PTMSI=$MobileId;
26         Loadprofile (PTMSI);
27         KidDispStrl="PTMSI";
28         SetScriptVariable (GPRSGBScriptId,TOI=TOI,PTMSI=PTMSI,TrafficIPAddress=TrafficIPAddress);
29         KeyIdentifier: KidDispStrl,MobileId;
30         if !(ProfileLoaded)
31             (GPRSGBScriptId) goto "Identity Procedures":
```

Ready Line Count - 551 | Line: 1 Col: 1 NUM

# Message Editor

Message Editor - ATTACH-REQUEST

File View Direction Tools Help

Gprs Mobility Mgmt  
Message Type  
InformationElements  
MS network capability  
Length  
MS Network Capability Data  
Attach type/CipheringKey  
Attach Type Value  
Follow-on Request  
Ciphering Key Seq #  
DRX parameter  
Split PG Cycle Code

ATTACH REQUEST = 1  
ATTACH REQUEST = 1  
ATTACH ACCEPT = 2  
ATTACH COMPLETE = 3  
ATTACH REJECT = 4  
DETACH REQUEST = 5  
DETACH ACCEPT = 6  
ROUTING AREA UPDATE REQUEST = 8  
ROUTING AREA UPDATE ACCEPT = 9  
ROUTING AREA UPDATE COMPLETE = 10  
ROUTING AREA UPDATE REJECT = 11  
SERVICE REQUEST = 12  
SERVICE ACCEPT = 13

```
===== Network Service Layer =====  
0000 PDU Type = 00000000 NS-UNITDATA  
      BVC I =  
0002 BVC I = 2 (x0002)  
===== BssGp Layer =====  
0004 PDU Type = 00000001 UL-UNITDATA  
      TLLI =  
0005 TLLI value = x781875C0  
      QoS Profile =  
0009 Peak bit rate = 0 (x0000)  
000B Precedence(UL-Unidata) = .....100 Radio priority unknown  
000B A bit = ....0... Radio interface uses RLC/MAC ARQ functionality  
000B T bit = ...0.... SDU contains signalling  
000B C/R bit = ..0.... SDU contains a LLC ACK or SACK C/R frame  
      Cell Identifier =  
000C IE Identifier(CI) = 00001000 Cell Identifier  
000D Length Ext = 1..... Extension Absent  
000D Length of Cell Identifier = .0001000 (8)  
000D Ext(Cell Identifier) = 1..... Extension absent  
000E MCC = 901  
000F MNC = 70  
0011 Location area code = 1 (00000000 00000001)  
0013 Cell Id RAC = 00000000 (0)  
0014 Cell Identity = 0 (x0000)
```

Ready NUM

# GPRS Gb Call Generation

Active Calls Call Status Call Events

Loading Scripts and Profiles

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Eve...	Result	Total Iteratio...	Completed Iterations
1	GPRSgbCallControlBSC.gls	MSProfile0001	IMSI.901700000000624	Stop	GTP-U Mobile-Traffic Started	Stop/Traffic	Unknown	Unknown	1	0
2	GPRSgbCallControlBSC.gls	MSProfile0002		Start		None	Unknown	Unknown	1	0
3	GPRSgbCallControlBSC.gls	MSProfile0003		Start		None	Unknown	Unknown	1	0
4	GPRSgbCallControlBSC.gls	MSProfile0004		Start		None	Unknown	Unknown	1	0
5	GPRSgbCallControlBSC.gls	MSProfile0005		Start		None	Unknown	Unknown	1	0
6	GPRSgbCallControlBSC.gls	MSProfile0006		Start		None	Unknown	Unknown	1	0
7	GPRSgbCallControlBSC.gls	MSProfile0007		Start		None	Unknown	Unknown	1	0
8	GPRSgbCallControlBSC.gls	MSProfile0008		Start		None	Unknown	Unknown	1	0

Time	Direction	Message
17:38:43.402000	→	ATTACH REQUEST
17:38:43.693000	←	AUTHENTICATION AND CIPHERING REQ
17:38:43.719000	→	AUTHENTICATION AND CIPHERING RESP
17:38:43.731000	←	ATTACH ACCEPT
17:38:43.751000	→	ATTACH COMPLETE
17:38:43.770000	→	Activate PDP Context Request
17:38:43.817000	←	Activate PDP Context Accept

```

===== Network Service Layer =====
0000 PDU Type = 00000000 NS-UNITDATA
      BVCI =
0002 BVCI = 2 (x0002)
===== BssGp Layer =====
0004 PDU Type = 00000001 UL-UNITDATA
      TLLI =
0005 TLLI value = x00000003
      QoS Profile =
0009 Peak bit rate = 0 (x0000)
000B Precedence(UL-Unidata) = .....100 Radio priority unknown
000B A bit = ....0... Radio interface uses RLC/MAC ARQ functiona
000B T bit = ...0... SDU contains signalling
000B C/R bit = ..0.... SDU contains a LLC ACK or SACK C/R frame
      Cell Identifier =
000C IE Identifier(CI) = 00001000 Cell Identifier
000D Length Ext = 1..... Extension Absent
000D Length of Cell Identifier = .0001000 (8)
000D Ext(Cell Identifier) = 1..... Extension absent
000E MCC = 400
000F MNC = 05
    
```

Message Sequence

Decode Message



# GPRS Gb Call Reception

MAPS (Message Automation Protocol Simulation) SGSN (GPRSGb 3GPP) - [Call Reception]

Sr No	Script Name	Call Info	Script Execution	Status	Events	Events Pro..	Results
1	GbSessionInit.gls		Stop		None		Unknown
2	GPRSGbCallControlSGSN.gls	IMSI_901700000000624	Completed	Detach Accept	None		Pass
3	GPRSGbCallControlSGSN.gls	IMSI_901700000000625	Completed	Detach Accept	None		Pass
4	GPRSGbCallControlSGSN.gls	IMSI_901700000000626	Completed	Detach Accept	None		Pass
5	GPRSGbCallControlSGSN.gls	IMSI_901700000000627	Stop	Mobile-Traffic Started	Stop Traffic		Unknown
6	GPRSGbCallControlSGSN.gls	IMSI_901700000000628	Stop	Mobile-Traffic Started	Stop Traffic		Unknown
7	GPRSGbCallControlSGSN.gls	IMSI_901700000000629	Stop	Mobile-Traffic Started	Stop Traffic		Unknown

Show Records  Auto Trash

Column Width

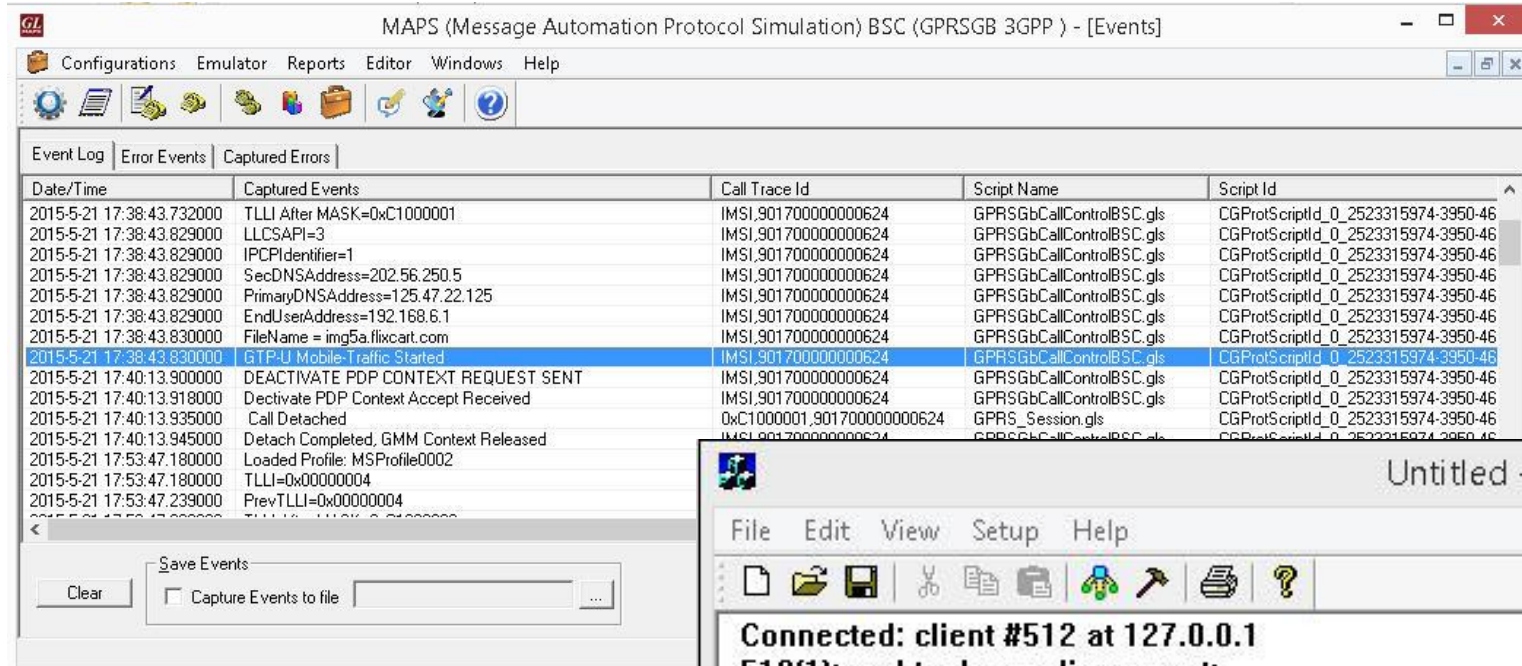
**Message Sequence** (Left side of diagram)

**Decode Message** (Right side of diagram)

**Call Results** (Red arrow pointing to the Results column)

# GPRS Gb Event and Traffic Log

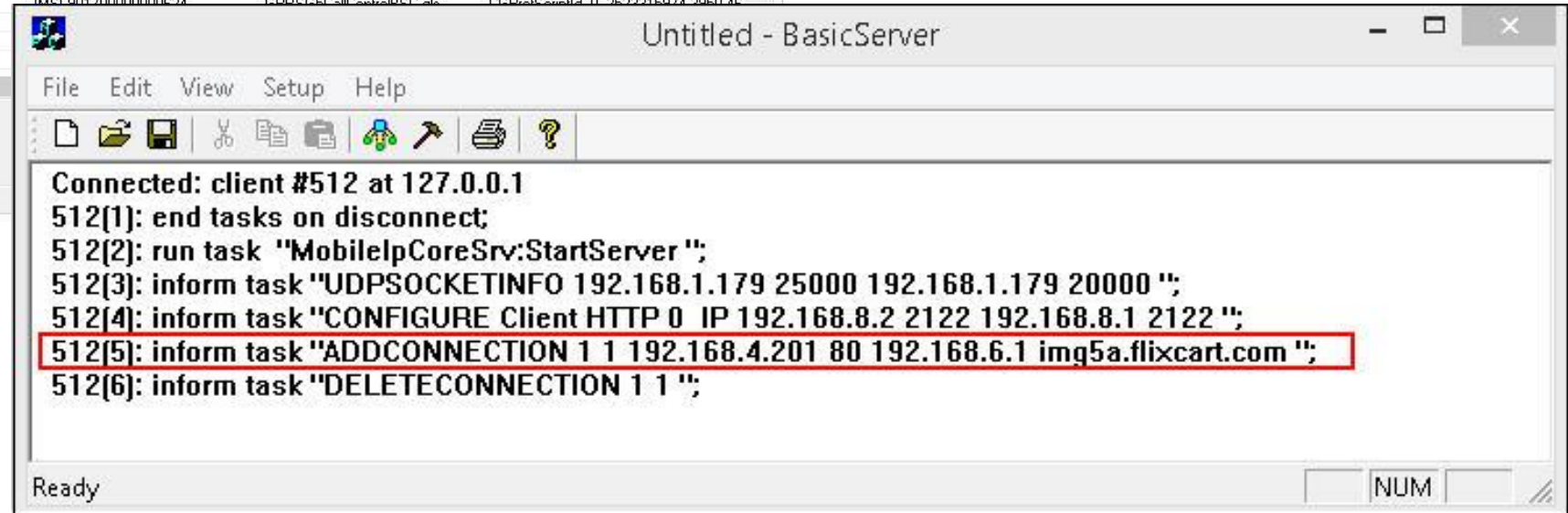
## Event Log



The screenshot shows the MAPS (Message Automation Protocol Simulation) BSC (GPRSGb 3GPP) - [Events] window. The window title is "MAPS (Message Automation Protocol Simulation) BSC (GPRSGb 3GPP) - [Events]". The menu bar includes "Configurations", "Emulator", "Reports", "Editor", "Windows", and "Help". The toolbar contains various icons for file operations and simulation control. The main area displays an "Event Log" table with the following columns: "Date/Time", "Captured Events", "Call Trace Id", "Script Name", and "Script Id". The table contains several rows of event data, with the row for "GTP-U Mobile-Traffic Started" highlighted in blue. Below the table, there is a "Save Events" section with a "Clear" button and a checkbox for "Capture Events to file".

Date/Time	Captured Events	Call Trace Id	Script Name	Script Id
2015-5-21 17:38:43.732000	TLLI After MASK=0xC1000001	IMSI.901700000000624	GPRSGbCallControlBSC.gls	CGProtScriptId_0_2523315974-3950-46
2015-5-21 17:38:43.829000	LLCSAPI=3	IMSI.901700000000624	GPRSGbCallControlBSC.gls	CGProtScriptId_0_2523315974-3950-46
2015-5-21 17:38:43.829000	IPCPIIdentifier=1	IMSI.901700000000624	GPRSGbCallControlBSC.gls	CGProtScriptId_0_2523315974-3950-46
2015-5-21 17:38:43.829000	SecDNSAddress=202.56.250.5	IMSI.901700000000624	GPRSGbCallControlBSC.gls	CGProtScriptId_0_2523315974-3950-46
2015-5-21 17:38:43.829000	PrimaryDNSAddress=125.47.22.125	IMSI.901700000000624	GPRSGbCallControlBSC.gls	CGProtScriptId_0_2523315974-3950-46
2015-5-21 17:38:43.829000	EndUserAddress=192.168.6.1	IMSI.901700000000624	GPRSGbCallControlBSC.gls	CGProtScriptId_0_2523315974-3950-46
2015-5-21 17:38:43.830000	FileName = img5a.flixcart.com	IMSI.901700000000624	GPRSGbCallControlBSC.gls	CGProtScriptId_0_2523315974-3950-46
2015-5-21 17:38:43.830000	GTP-U Mobile-Traffic Started	IMSI.901700000000624	GPRSGbCallControlBSC.gls	CGProtScriptId_0_2523315974-3950-46
2015-5-21 17:40:13.900000	DEACTIVATE PDP CONTEXT REQUEST SENT	IMSI.901700000000624	GPRSGbCallControlBSC.gls	CGProtScriptId_0_2523315974-3950-46
2015-5-21 17:40:13.918000	Deactivate PDP Context Accept Received	IMSI.901700000000624	GPRSGbCallControlBSC.gls	CGProtScriptId_0_2523315974-3950-46
2015-5-21 17:40:13.935000	Call Detached	0xC1000001,901700000000624	GPRS_Session.gls	CGProtScriptId_0_2523315974-3950-46
2015-5-21 17:40:13.945000	Detach Completed, GMM Context Released	IMSI.901700000000624	GPRSGbCallControlBSC.gls	CGProtScriptId_0_2523315974-3950-46
2015-5-21 17:53:47.180000	Loaded Profile: MSProfile0002			
2015-5-21 17:53:47.180000	TLLI=0x00000004			
2015-5-21 17:53:47.239000	PrevTLLI=0x00000004			

## Traffic Log



The screenshot shows an "Untitled - BasicServer" window with a menu bar (File, Edit, View, Setup, Help) and a toolbar. The main area displays a traffic log with the following text:

```
Connected: client #512 at 127.0.0.1
512(1): end tasks on disconnect;
512(2): run task "MobilelpCoreSrv:StartServer ";
512(3): inform task "UDPSOCKETINFO 192.168.1.179 25000 192.168.1.179 20000 ";
512(4): inform task "CONFIGURE Client HTTP 0 IP 192.168.8.2 2122 192.168.8.1 2122 ";
512(5): inform task "ADDCONNECTION 1 1 192.168.4.201 80 192.168.6.1 img5a.flixcart.com ";
512(6): inform task "DELETECONNECTION 1 1 ";
```

The line "512(5): inform task 'ADDCONNECTION 1 1 192.168.4.201 80 192.168.6.1 img5a.flixcart.com '" is highlighted with a red border. The status bar at the bottom shows "Ready" and a "NUM" field.

# GPRS Gb Bulk Call Generation

MAPS (Message Automation Protocol Simulation) BSC (GPRSGb 3GPP) - [Call Generation - Untitled]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Ev...	Result	Total Iterations	Completed Iterations
1	GPRSGbCallControlBSC.gls	MSPProfile0001		Start		None		Unknown	10	0
2	GPRSGbCallControlBSC.gls	MSPProfile0002		Start		None		Unknown	10	0
3	GPRSGbCallControlBSC.gls	MSPProfile0003		Start		None		Unknown	10	0
4	GPRSGbCallControlBSC.gls	MSPProfile0004		Start		None		Unknown	10	0
5	GPRSGbCallControlBSC.gls	MSPProfile0005		Start		None		Unknown	10	0
6	GPRSGbCallControlBSC.gls	MSPProfile0006		Start		None		Unknown	10	0
7	GPRSGbCallControlBSC.gls	MSPProfile0007		Start		None		Unknown	10	0
8	GPRSGbCallControlBSC.gls	MSPProfile0008		Start		None		Unknown	10	0
9	GPRSGbCallControlBSC.gls	MSPProfile0009		Start		None		Unknown	10	0
10	GPRSGbCallControlBSC.gls	MSPProfile0010		Start		None		Unknown	10	0

Add Delete Insert Refresh Start Start All Stop Stop All Abort Abort All

View Executing Line

Script Contents

```
GPRSGbScriptId = "Null" ;

MsgHandler:"GPRSGbMessageHandler";

"GPRSGbInitialization":

"GPRS Procedures":

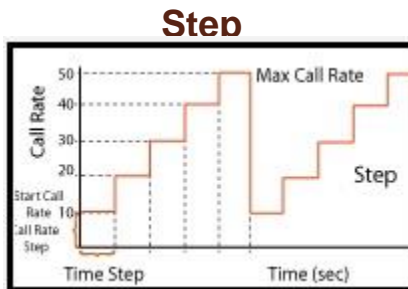
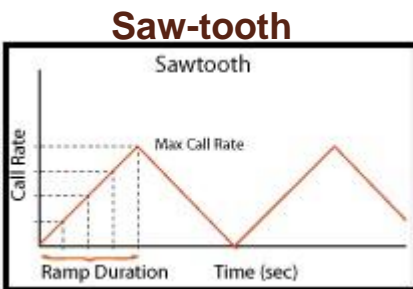
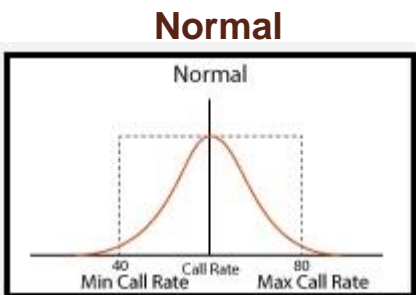
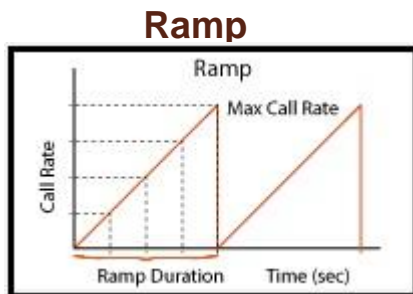
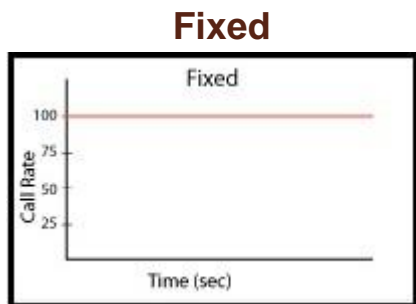
    GPRSGbScriptId = "GPRSGb";
    EventLog("Loaded Profile: ",LoadedProfileName);
    TLLI=(binarystring)00;
    Mask=(binarystring)00;
    nFileCount=0;
```

Scripts Message Sequence Event Config Script Flow

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

# 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.



Load Generation - default

Total Calls To Generate \* (\* indicates no limit)  
Max Active Calls 10000  
Statistical Distribution Fixed  
Call Rate 100

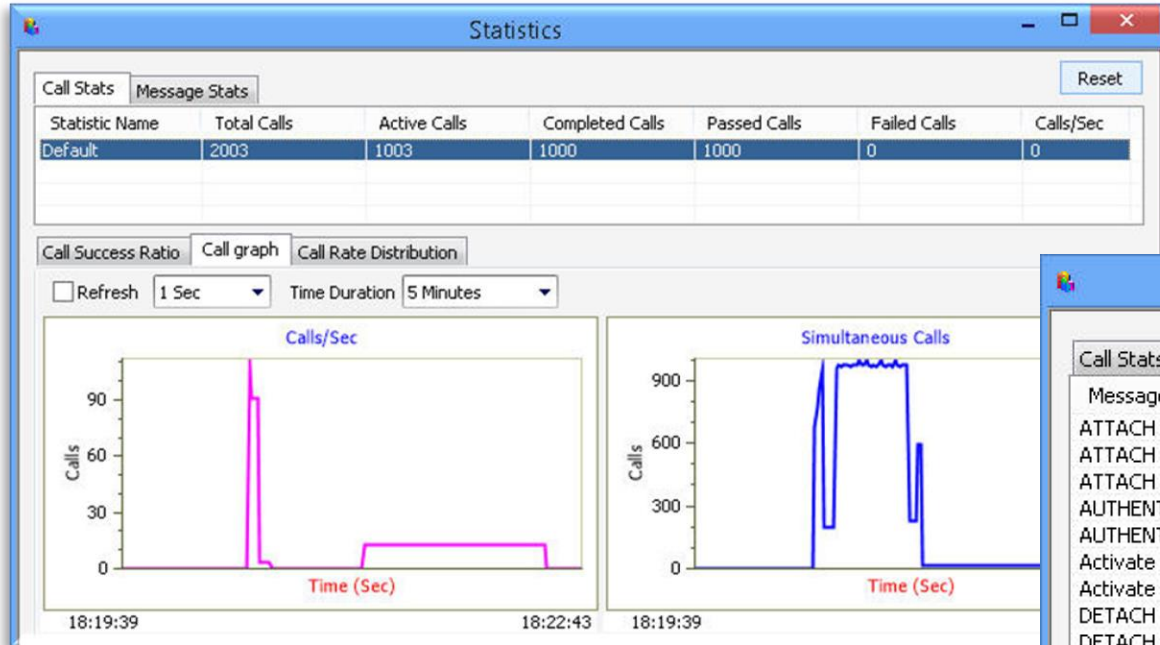
Scripts  
GPRSgbcCallControlBSC

Profile  Exclusive Profiles  
MSProfile0001  
MSProfile0002  
MSProfile0003  
MSProfile0004  
MSProfile0005  
MSProfile0006  
MSProfile0007  
MSProfile0008  
MSProfile0009  
MSProfile0010

Add Delete Start

# Call and Message Statistics

## Call Stats and Graph



## Message Stats

The screenshot shows the 'Statistics' window with the 'Message Stats' tab selected. The table below displays the message statistics for various message types.

Message Type	Tx Count	Rx Count	Retransmit Count
ATTACH ACCEPT	0	202	0
ATTACH COMPLETE	202	0	0
ATTACH REQUEST	202	0	4
AUTHENTICATION AND CIPHERING REQ	0	202	0
AUTHENTICATION AND CIPHERING RESP	202	0	0
Activate PDP Context Accept	0	202	0
Activate PDP Context Request	202	0	0
DETACH ACCEPT	0	101	0
DETACH REQUEST	102	0	1
Deactivate PDP Context Request	101	0	5
IDENTITY REQUEST	0	89	0
IDENTITY RESPONSE	89	0	0
NS-RESET	1	0	0
ROUTING AREA UPDATE ACCEPT	0	4	0
ROUTING AREA UPDATE COMPLETE	4	0	0
ROUTING AREA UPDATE REQUEST	5	0	0
Deactivate PDP Context Accept	0	100	0

**Thank You**