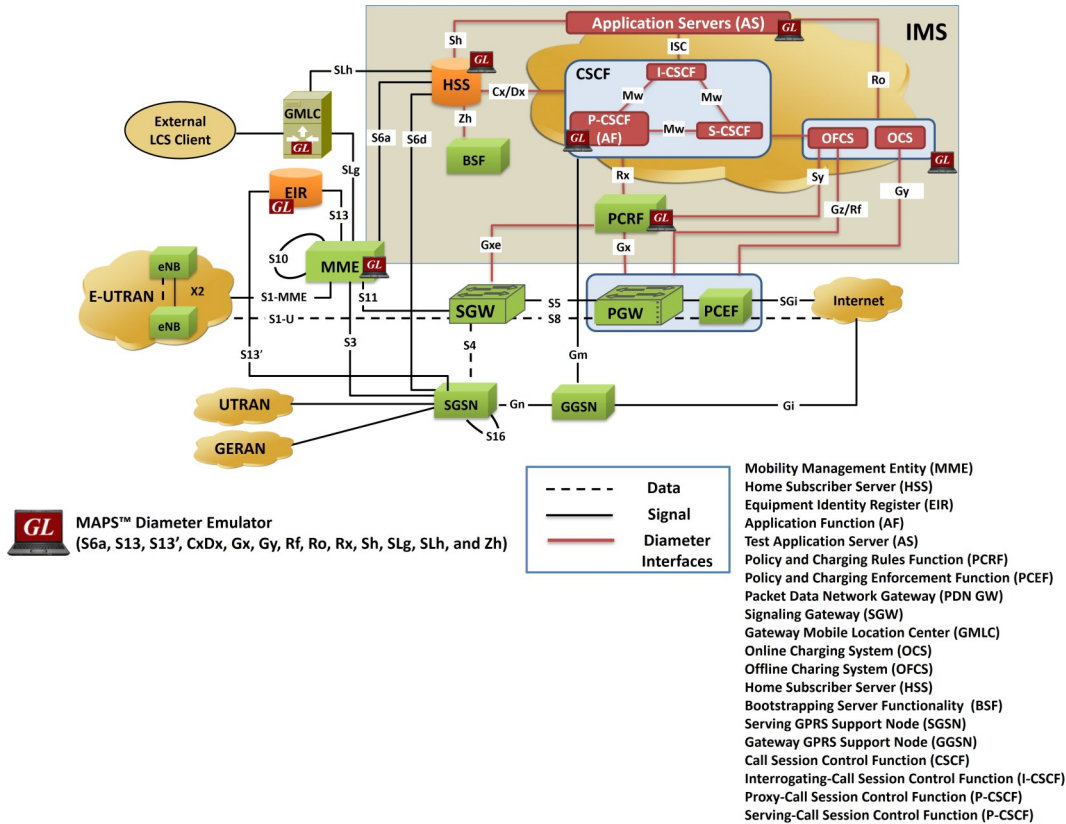


MAPS™ Diameter Emulator

(Diameter Interfaces Emulation)



Overview

GL's [Message Automation and Protocol Simulation \(MAPS™\) Diameter](#) emulate S6a, S13, and S13' interfaces, along with LTE IMS network elements such as Mobility Management Entity (MME), Home Subscriber Server (HSS), Equipment Identity Register (EIR), and Serving GPRS Support Node (SGSN).

With its additional licensing support for interfaces such as CxDx, Gx, Gy, Rf, Ro, Rx, Sh, SLg, SLh, and Zh, the MAPS™ Diameter emulator actively emulates various nodes within the network. These nodes include MME, HSS, Application Server (AS), Serving Call State Control Function (SCSCF), Policy and Charging Rules Function (PCRF), Policy and Charging Enforcement Function (PCEF), Charging Trigger Function (CTF), Packet Data Network Gateway (PDN GW), Online Charging System (OCS), Application Function (AF), Call Session Control Function (CSCF), Bootstrapping Server Functionality (BSF), and Gateway Mobile Location Center (GMLC). This active emulation framework empowers users to thoroughly test and analyze the behavior of these network nodes and their interactions.

The additional licenses for the enhanced MAPS™ Diameter emulator enable users to actively edit messages on supported interfaces, providing them with unlimited flexibility to support various procedures. Also, supports [Location Service \(LCS\)](#) based SLh and SLg interfaces between the GMLC <-> HSS and GMLC <-> MME defined for the Control Plane as per 3GPP TS 23.271 specifications.

MAPS™ Diameter Emulator supports communication over both Stream Control Transmission (SCTP) and Transmission Control Protocol (TCP) transport protocol layers. The TCP used along with IP provides reliable message transfer between interconnected computer communication networks. MAPS™ Diameter also supports Transport Layer Security (TCP/TLS) for the secured information transfer.

MAPS™ Diameter Emulator supports powerful utilities like Message Editor, Script Editor, and Profile Editor which allow new scenarios to be created or existing scenarios to be modified using Diameter messages and parameters.

For more information, refer to [MAPS™ Diameter Protocol Emulator](#) webpage.



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Main Features

- Supports emulation of real-time LTE network using [MAPS 4G Wireless Lab Suite](#)
- Allows users to configure MAPS™ Diameter emulator as MME, HSS, PCRF, PCEF, CSCF, SGSN, PDN GW, EIR, AF, BSF, and AS entities to emulate a variety of interfaces such as S6a, S6d, S13, Cx/Dx, Gx, Gy, Rf, Ro, Rx, Sh, SLg, SLh, and Zh
- Emulate thousands of smartphones (UEs) powering up and down
- Authenticate and confirm security procedures
- Manages temporary addressing for mobility and security purposes
- Supports Command Line Interface (CLI) based on a client-server model, allowing users to control all features through Python APIs
- Provides support for TCP/TLS for the secured information transfer
- Generates hundreds of UE Signaling (Load testing)
- Ready scripts for procedures over interfaces such as -
 - **S6a** interface - Location Management, Subscriber Data Handling, Authentication, Fault Recovery, and Notification procedures
 - **S13/S13'** interface - Mobile Equipment Identity Check procedure
 - **CxDx** interface – Server and User Authentication procedures
 - **Gx** interface - IP-CAN Session Establishment and Modification procedures
 - **Gy/Ro** interface - Online Credit Control procedure
 - **Rf** interface - Offline Charging procedure
 - **Rx** interface - Initial Provisioning, Modification of Session Information and AF Session Termination procedures
 - **Sh** interface - User Data Handling (User-Data-Update, Subscriber-Notification, User-Data-Pull) procedures
 - **SLg** interface - Subscriber Location procedures
 - **SLh** interface - Location Service Routing Information procedures
 - **Zh** interface - Bootstrapping- procedure
- Provides call statistics and associated events status
- Supports large number of subscribers with CSV based profiles for bulk call generation
- Software architecture is script-based and protocol independent
- During call generation, the emulator provides call statistics along with associated captured events and error events
- Supports real-time applications of location-based services, providing up-to-date information for vehicle tracking, stolen assets tracking, temperature monitoring, traffic services, and emergency services
- Users can apply impairments to messages in the emulator to emulate error conditions

Testbed Configuration

The testbed setup window allows users to setup the required test environment with SCTP configuration in Diameter interface. SCTP Configuration parameters consists of Source / Destination IP address, Port, to configure MAPS™ to emulate MME, HSS, PCRF, PCEF, CSCF, SGSN, PDN GW, EIR, AS, AF, CTF, OCS, BSF, and GMLC entities to emulate S6a, S6d, S13, Cx/Dx, Gx, Gy, Rf, Ro, Rx, Sh, SLg, SLh, and Zh interfaces. End user configuration profile used to configure MAPS™ Diameter with supported node parameters.

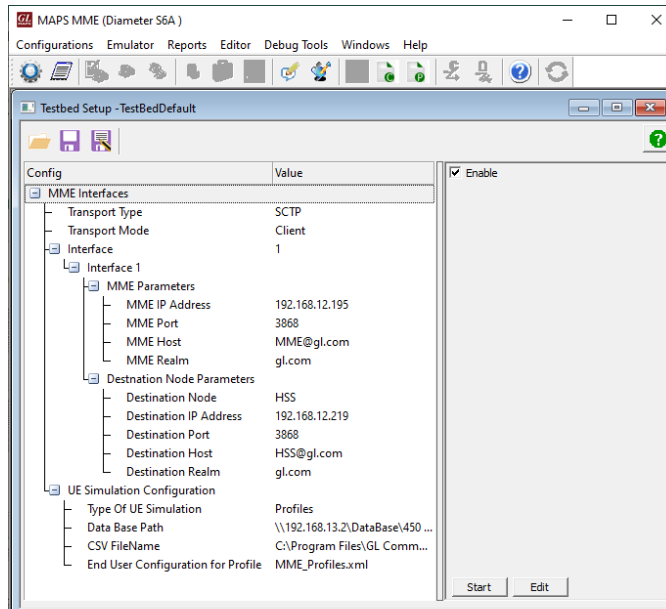


Figure: Testbed Configuration

Pre-processing Tools

Profile Editor

The profile editor allows user to edit or create profiles in order to define run-time values to the variables for the message templates. The users can edit the values of the variables thus replacing the original value of the variables in the message template. An XML file defines a set of multiple profiles with varying parameter values that allow users to configure call instances in call generation and to receive calls.

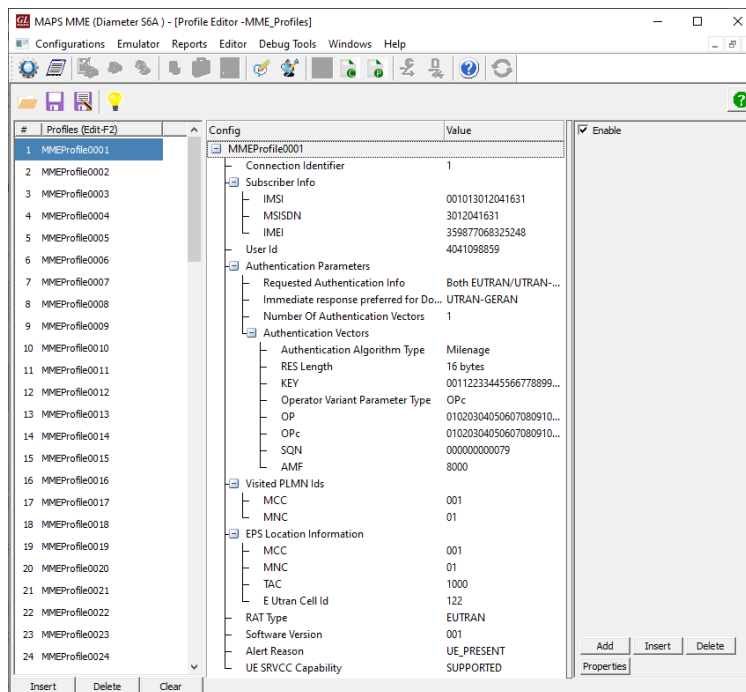


Figure: Profile Editor

Pre-processing Tools (Contd.)

Message Editor

With message editor, users can build a template for each protocol message type. The value for each field may be changed in the message template prior to testing. The protocol fields comprises of mandatory fixed parameters, mandatory variable parameters, & optional variable parameters.

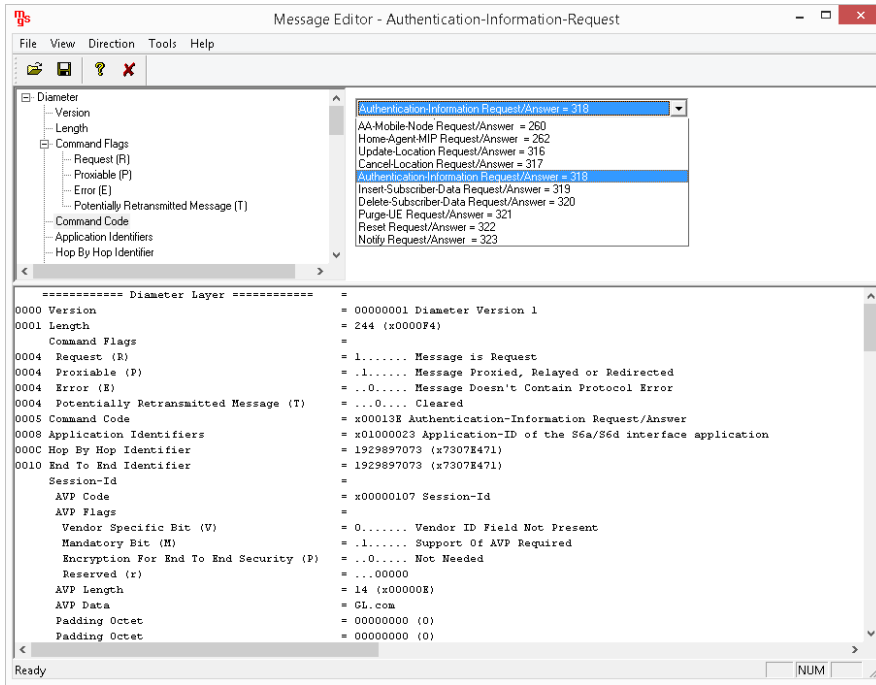


Figure: Message Editor

Script Editor

The script editor allows the user to create / edit scripts and also import/export files that define variables for the message template parameters. The script uses pre-defined message templates to perform send and receive actions. The editor allows to run the added scripts sequentially (in-order) or randomly (any script from the list of added scripts as per the call flow requirements).

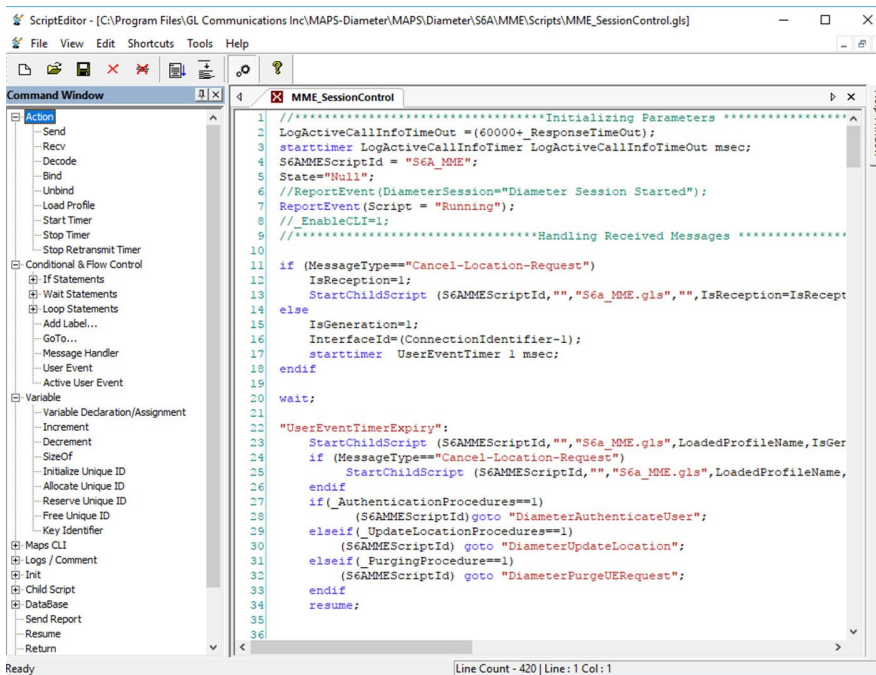


Figure: Script Editor

Call Generation and Call Reception

In call generation, MAPS™ is configured for the outgoing calls, and in call receive mode, it is configured to respond to incoming calls. Tests can be configured to run once, multiple iterations or continuously. Scripts can be set to run sequentially according to a call scenario or randomly.

The test scripts may be started manually or they can be automatically triggered by incoming messages. In receive mode, MAPS™ can be automated to respond to messages using script configuration dialog, where a receive script is preset against particular message expected to arrive.

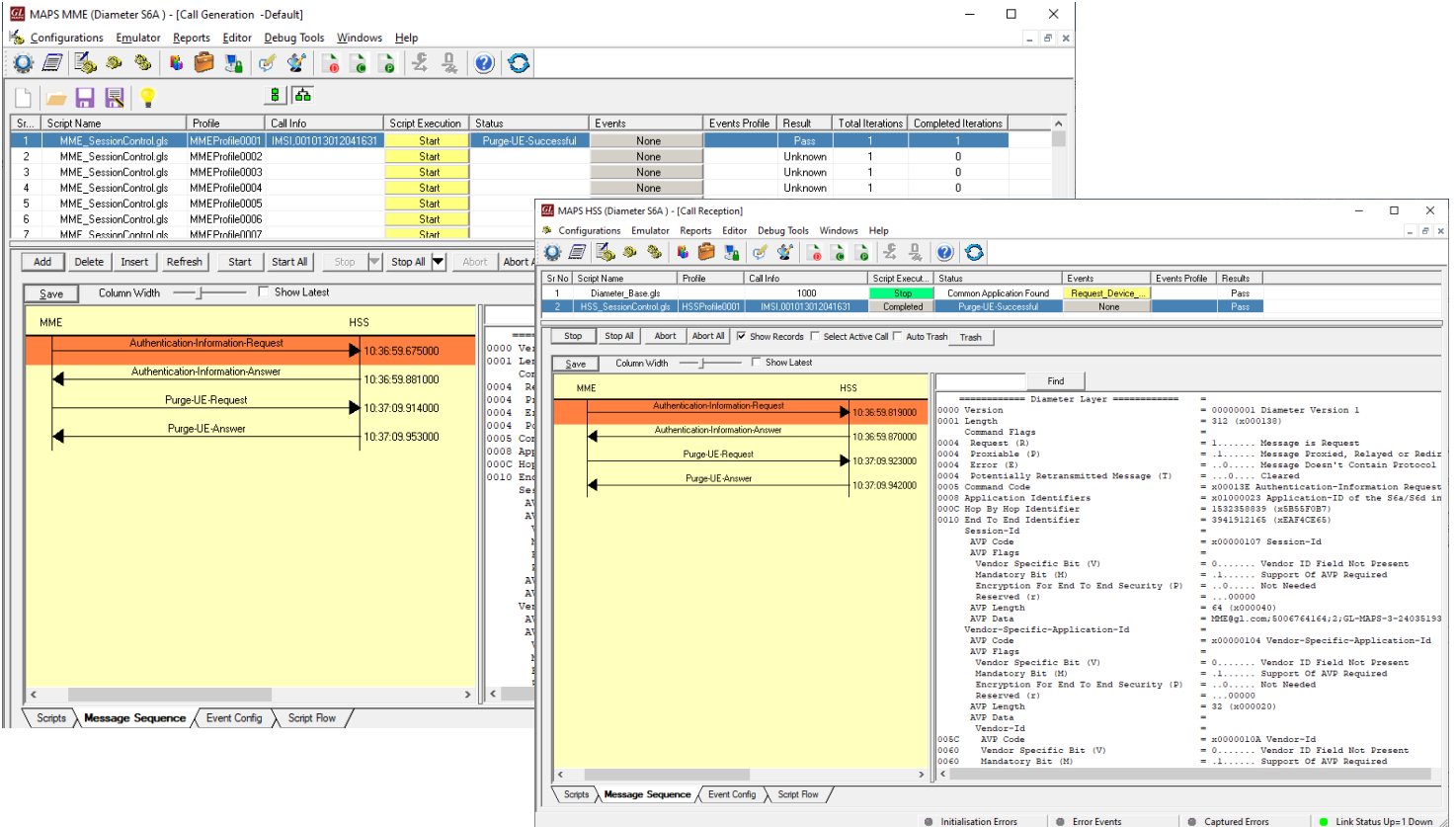


Figure: Call Generation and Reception

Capture Event Log

MAPS™ provides Events, Error Events, and Captured Errors log encountered during the progress of the call. The events are saved in the database which can be accessed via web interface.

Protocol specific signaling events and the traffic events are logged along with the Call Trace ID, Script Name, Script ID, and the Timestamp of the occurred event.

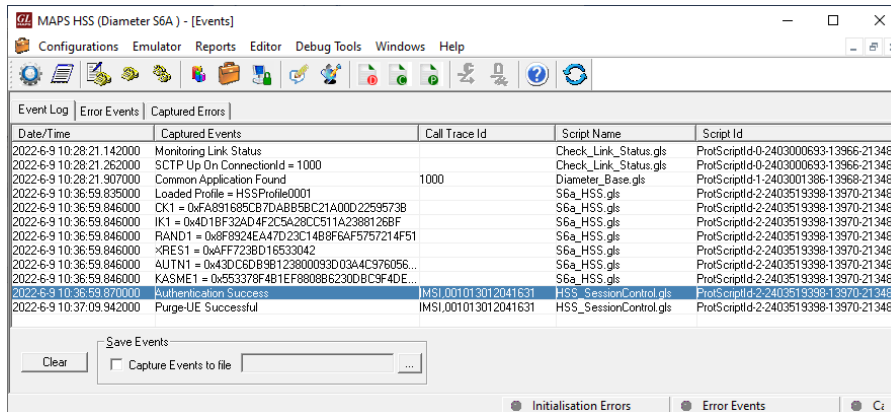


Figure: Capture Event Log

Diameter Procedures

Supported procedures over Diameter interfaces are -

- S6a interface
 - Location Management, Subscriber Data Handling, Authentication, Fault Recovery, and Notification procedures
- Rx interface
 - AA-Request/Answer, Re-Auth-Request/Answer, Abort-Session-Request/Answer, and Session-Termination-Request/Answer procedures
 - See [Rx Interface Call Generation](#) screenshot
 - See [Rx Interface Call Reception](#) screenshot
- Gx interface
 - IPCAN Session Establishment and Modification procedures
- S13/S13' interface
 - ME (Mobile Equipment) Identity Check procedure
- Cx Dx interface
 - Server Assignment Request and Server Assignment Answer procedures
- Gy/Ro interface
 - Credit Control-Request/Answer, Re-Auth-Request for Session based Charging and One-time Event based Charging procedures
- SLh, SLg interfaces
 - Location Request/Response procedure
 - Emergency Location Request/Response procedure
 - Repeated Location Report procedure
 - See [SLh Interface Call Generation](#) screenshot
 - See [SLg Interface Call Generation](#) screenshot
- Zh interface
 - Bootstrapping procedure

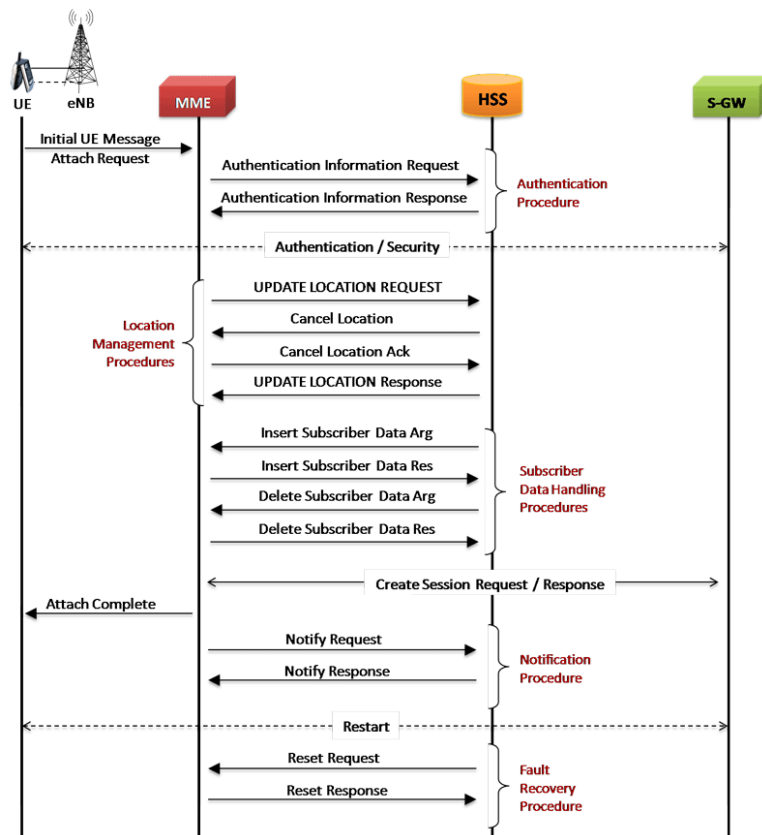
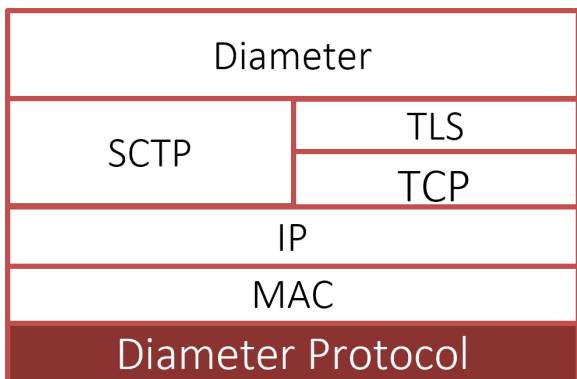


Figure: S6a Interface Procedure

Supported Protocols and Specifications



Supported Protocols	Standard / Specification Used
Diameter	IETF RFC 3588 S6a, S13, S13' - 3GPP TS 29.272 V10.3.0 Rx - 3GPP TS 29214-b10 Cx/Dx - 3GPP TS 29.228 & TS29.229 Gx - 3GPP TS 29.212 & TS 23.203 Gy/Ro (DCCA)- 3GPP TS 32.225, 3GPP TS 32.299 and IETF RFC 4006 Sh - 3GPP TS 29.328 SLg - 3GPP TS 29.172 SLh - 3GPP TS 29.173 Zh - 3GPP TS 29.109
SCTP	RFC 4960
TCP	RFC793
TLS	RFC5246

MAPS™ CSV Support

MAPS™ is enhanced with CSV database system to support massive number of subscriber profiles. Note that, even with CSV based profiles, the maximum simultaneous calls that can be emulated is approximately about 2000.

CSV database system used with MAPS™ is a simple Excel® file format, which can be used to create **N** number of UE entries each with unique UE parameters such as IMSI, MSISDN as in real-time bulk call generation.

CSV files are saved in working directory of the emulated Diameter and is loaded in MAPS™.

MS_Profiles_IMSI.csv file for key=IMSI,

1	IMSI	Subscribe TMSI	CallingNumber	CalledNumber	CMService	LUT	TypeOfId	IMEI	IMEISV	LAC	SAC	CellIdentity	RNCID	DestinationKey
2	binary	string hex	binary	binary	int	int	int	binary	binary	hex	hex	hex	int	binary hex
3	001013012040001	LTE 0x11110001	3012040001	3012050001	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
4	001013012040002	LTE 0x11110002	3012040002	3012050002	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
5	001013012040003	LTE 0x11110003	3012040003	3012050003	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
6	001013012040004	LTE 0x11110004	3012040004	3012050004	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
7	001013012040005	LTE 0x11110005	3012040005	3012050005	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
8	001013012040006	LTE 0x11110006	3012040006	3012050006	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
9	001013012040007	LTE 0x11110007	3012040007	3012050007	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
10	001013012040008	LTE 0x11110008	3012040008	3012050008	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
11	001013012040009	LTE 0x11110009	3012040009	3012050009	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
12	001013012040010	LTE 0x11110010	3012040010	3012050010	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
13	001013012040011	LTE 0x11110011	3012040011	3012050011	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
14	001013012040012	LTE 0x11110012	3012040012	3012050012	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
15	001013012040013	LTE 0x11110013	3012040013	3012050013	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
16	001013012040014	LTE 0x11110014	3012040014	3012050014	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
17	001013012040015	LTE 0x11110015	3012040015	3012050015	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
18	001013012040016	LTE 0x11110016	3012040016	3012050016	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
19	001013012040017	LTE 0x11110017	3012040017	3012050017	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
20	001013012040018	LTE 0x11110018	3012040018	3012050018	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
21	001013012040019	LTE 0x11110019	3012040019	3012050019	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
22	001013012040020	LTE 0x11110020	3012040020	3012050020	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
23	001013012040021	LTE 0x11110021	3012040021	3012050021	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
24	001013012040022	LTE 0x11110022	3012040022	3012050022	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001
25	001013012040023	LTE 0x11110023	3012040023	3012050023	1	0	1	867802029630010	3500775232370010	0x0002	0x0002	0x301E602	1	0x001

MAPS™ CLI Support

MAPS™ Diameter can be configured as server-side application, to enable remote controlling through multiple command-line based clients. Supported clients include Python. The Diameter APIs allows for programmatic and automated control over all Diameter protocols. Each MAPS™ Diameter server can receive multiple client connections and offer independent execution to each client. Likewise, a single client can connect to multiple MAPS™ Diameter servers, including servers running different protocols, permitting complex cross-protocol test cases.

The image shows two overlapping windows. The top window is a 'Python 2.7.9 Shell' with a menu bar (File, Edit, Shell, Debug, Options, Windows, Help) and a command prompt. The bottom window is 'MapsCLI MME (Diameter S6A)' with a menu bar (File, Edit, View) and a log viewer showing a sequence of events.

```

Python 2.7.9 Shell
File Edit Shell Debug Options Windows Help
Python 2.7.9 (default, Dec 10 2014, 12:28:03) [MSC v.1500 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>> ===== RESTART =====
>>>
Diameter Server Connection... True
Diameter Testbed Starting ... True
Loading Profile... True
Starting Script...
True
script started...
Stopping Script...
>>> |

MapsCLI MME (Diameter S6A)
File Edit View
View Latest Command
1 :: 2018-3-14 16:04:51.525000 : Start "TestBedDefault.xml" ;
1 :: 2018-3-14 16:04:53.905000 : LoadProfile "MME_Profiles.xml"
1 :: 2018-3-14 16:04:53.982000 : IncomingCallHandler # "Capabilities-Exchange-Request"="Diameter_Base.gls", "IsApiClient"="True";
1 :: 2018-3-14 16:04:54.027000 : Apply Global Configuration # "_EnableCLI"=1;
1 :: 2018-3-14 16:04:54.039000 : Apply Global Configuration # "_DiameterSimulationType"="Session Based";
1 :: 2018-3-14 16:04:54.040000 : StartScript 1 "MME_SessionControl.gls" "MMEProfile0001" 1 ;
1 :: 2018-3-14 16:04:55.149000 : UserEvent 1 "Diameter_UpdateLocation";
1 :: 2018-3-14 16:04:56.171000 : UserEvent 1 "Diameter_Purge_UE_Request";
1 :: 2018-3-14 16:05:01.254000 : StopScript 1;
  
```


Buyer's Guide

Item No	Product Description
PKS139	MAPS™ Diameter Emulator
PK1390	MAPS™ Diameter CxDx Interface Emulator (requires PKS139)
PK1391	MAPS™ Diameter Gx Interface Emulator (requires PKS139)
PK1392	MAPS™ Diameter Gy Interface Emulator (requires PKS139)
PK1393	MAPS™ Diameter Rf Interface Emulator (requires PKS139)
PK1394	MAPS™ Diameter Ro Interface Emulator (requires PKS139)
PK1395	MAPS™ Diameter Rx Interface Emulator (requires PKS139)
PK1396	MAPS™ Diameter Sh Interface Emulator (requires PKS139)
PK1397	MAPS™ Diameter SLg Interface Emulator (requires PKS139)
PK1398	MAPS™ Diameter SLg Interface Emulator (requires PKS139)
PK1399	MAPS™ Diameter Zh Interface Emulator (requires PKS139)
ETH100	Mobile Traffic - PacketCheck™
ETH101	MobileTrafficCore - GTP
ETH102	MobileTrafficCore - Gateway
PKS170	CLI Support for MAPS™

Item No	Related Software
PKS132	MAPS™ MAP Protocol Emulation over IP
PKS147	MAPS™ Lb Interface Emulator
PKS148	MAPS™ LTE SLs Interface Emulator
PKS164	MAPS™ UMTS – Iu-PS Interface Emulation

For more information, refer to [MAPS™ Diameter Protocol Emulator](#) webpage.



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