MAPS™ Diameter Interface Emulator

S6a, S6d, S13, S13', Cx/Dx, Gx, Gy, Rf, Ro, Rx, Sh, SLg, SLh, and Zh Interfaces Emulation

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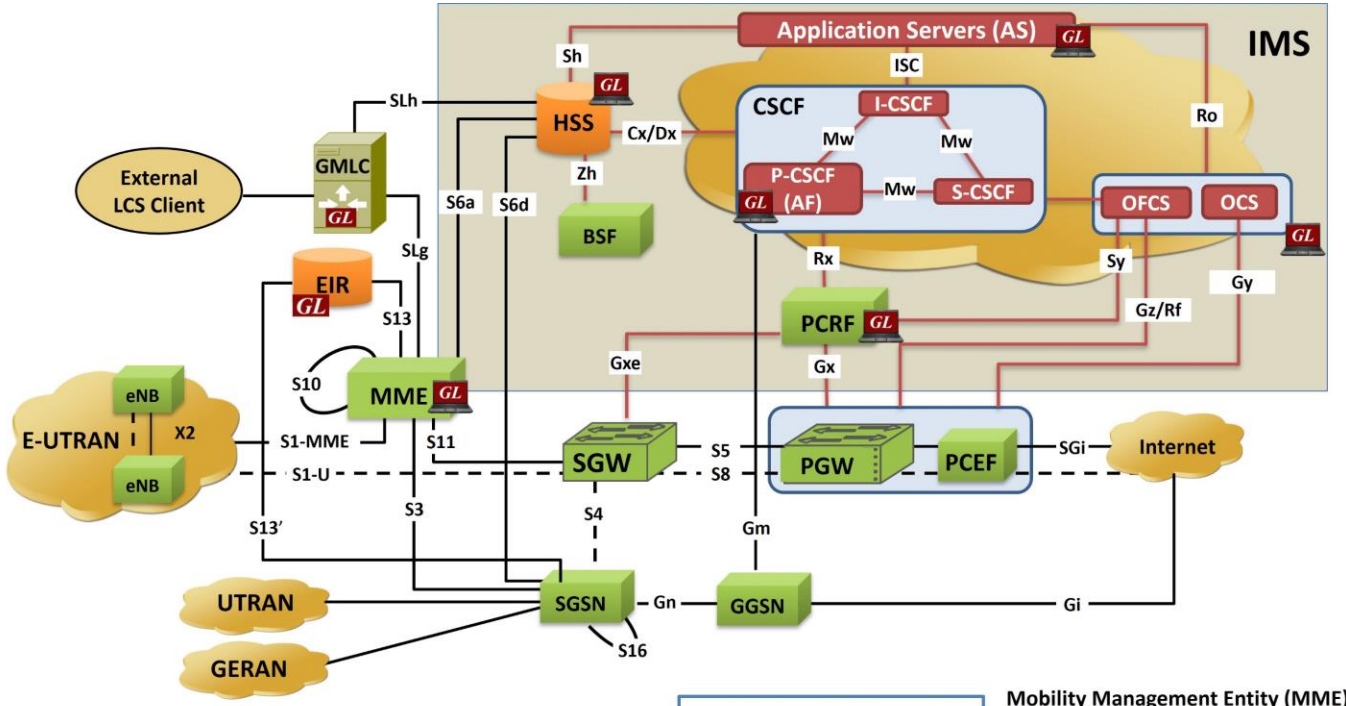
Architecture



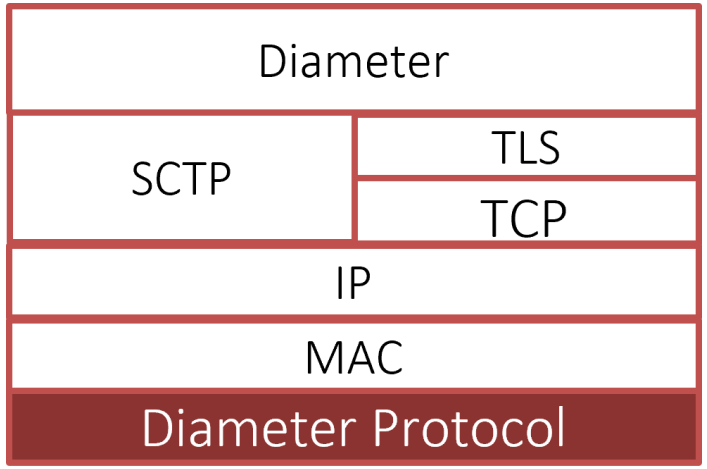
MAPS™ Diameter Emulator
(S6a, S13, S13', CxDx, Gx, Gy, Rf, Ro, Rx, Sh, SLg, SLh, and Zh)

Mobility Management Entity (MME)
Home Subscriber Server (HSS)
Equipment Identity Register (EIR)
Application Function (AF)
Test Application Server (AS)
Policy and Charging Rules Function (PCRF)
Policy and Charging Enforcement Function (PCEF)
Packet Data Network Gateway (PDN GW)
Signaling Gateway (SGW)
Gateway Mobile Location Center (GMLC)
Online Charging System (OCS)
Offline Charing System (OFCS)
Home Subscriber Server (HSS)
Bootstrapping Server Functionality (BSF)
Serving GPRS Support Node (SGSN)
Gateway GPRS Support Node (GGSN)
Call Session Control Function (CSCF)
Interrogating-Call Session Control Function (I-CSCF)
Proxy-Call Session Control Function (P-CSCF)
Serving-Call Session Control Function (P-CSCF)

Key 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, S13’, Cx/Dx, Gx, Gy, Rf, Ro, Rx, Sh, SLg, SLh, and Zh
- Supports emulation of Location Services (LCS) based SLh and SLg interfaces between the GMLC <-> HSS and GMLC <-> MME entities
- User-friendly GUI for generating hundreds of UE Signaling (Load Testing) over SCTP/TCP Layers
- Support for TCP/TLS for secured information transfer
- Ready scripts for procedures over interfaces such as –
  - Location Management, Subscriber Data Handling, Authentication, Fault Recovery, and Notification procedures over S6a interface
  - AA-Request/Answer, Abort-Session-Request/Answer, and Session-Termination- Request/Answer procedure over Rx interface
  - CC-Request/Answer, Re-Auth-Request/Answer Over Gx Interface
- Impairments can be applied to messages to emulate error conditions
- Supports customization of call flows and message templates using Script editor and Message editor

Protocol Stack



Supported Protocols	Standard / Specification Used
Diameter	IETF RFC 3588 S6a, S6d, S13 - 3GPP TS 29.272 V10.3.0 Rx - 3GGP TS 29214-b10 Cx/Dx - 3GPP TS 29.228 & TS29.229 Gx - 3GPP TS 29.212 & TS 23.203 Sh - 3GGP TS 29.328 & TS 29.329 Gy/Ro (DCCA)- 3GGP TS 32.225, 3GPP TS 32.299 and IETFRFC 4006 SLg - 3GPP TS 29.172 SLh - 3GPP TS 29.173 Zh - 3GPP TS 29.109
SCTP	RFC 4960
TCP	RFC793
TLS	RFC 5246

Elements and Interfaces of the Core Network

Interface	Elements	Purpose	Spec
S6a	MME and HSS	This enables the transfer of subscriber related data between the MME and the HS.	3GPP TS 29.272
Rx/Gx	AF and PCRF	Allows for dynamic QoS and charging-related service information to be exchanged between the PCRF and the AF. This information is used by the PCRF for the control of service data flows and IP bearer resources.	3GPP TS 23.203 & TS 29.214 V. B1.0
Gy/Ro	OCS and CTF	The PCEF node in LTE network, and CSCF node in IMS network perform the role of a Charging Trigger Function (CTF) entity to issue charging events to an Online Charging System (OCS).	3GGP TS 32.225, 3GPP TS 32.299 and IETFRFC 4006
SLg	GMLC and MME	SLg interface acts between GMLC (Gateway Mobile Location) and MME (Mobile Management Entity) to perform a Location Request.	3GPP TS 29.172
SLh	GMLC and HSS	SLh interface is used to obtain exact positioning request through GMCL (Gateway Mobile Location center) and HSS (Home Subscriber Server).	3GPP TS 29.173

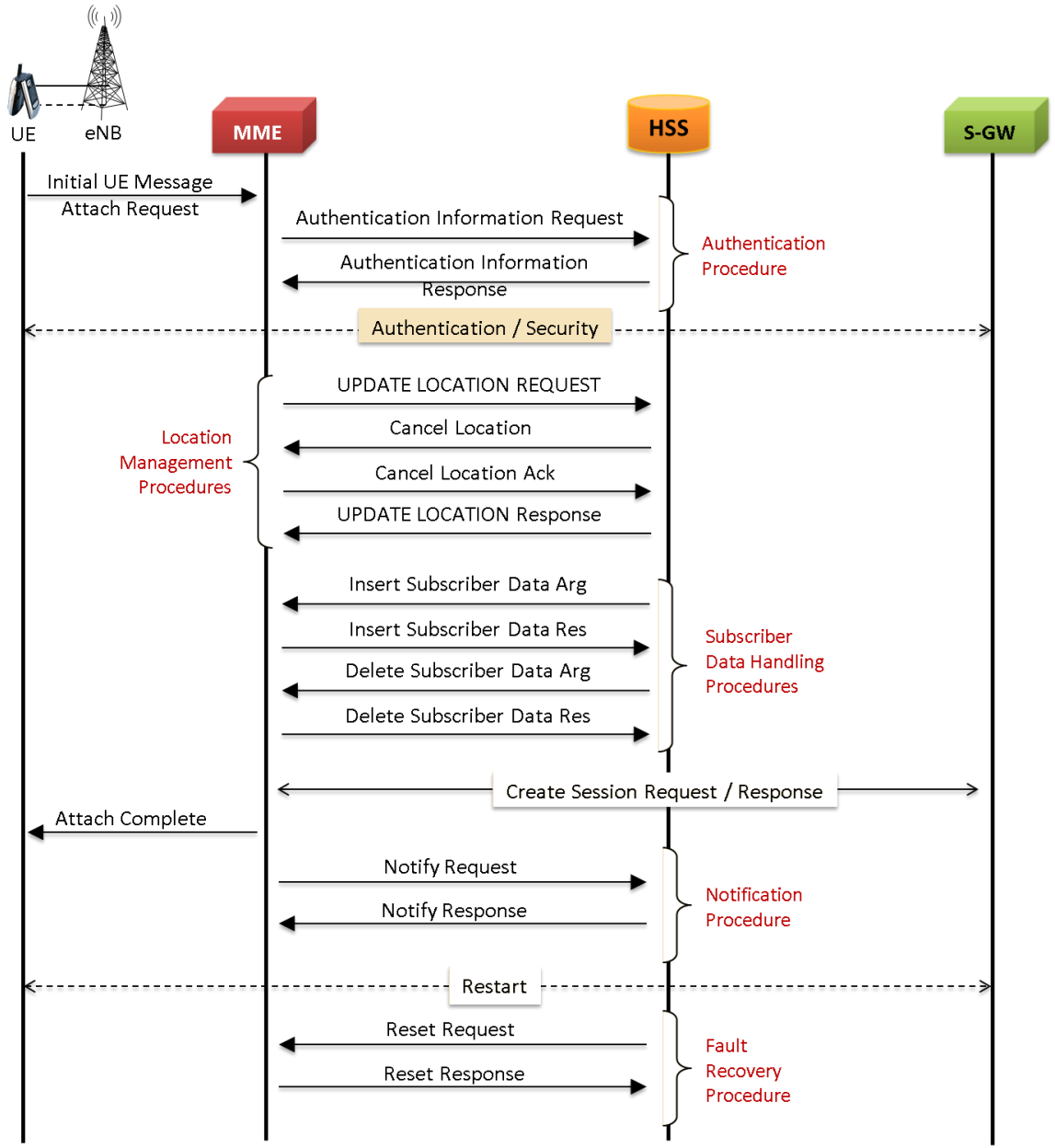
Elements and Interfaces of the Core Network (Contd.)

Interface	Elements	Purpose	Spec
CxDx	HSS and SCSCF	The Cx and Dx interfaces are the reference points for interactions between Home Subscriber Server (HSS) and Interrogating Call Session Control Function (I-CSCF) or Serving Call Session Control Function (S-CSCF).	3GPP TS 29.228 & TS29.229
S13/S13’	EIR and MME EIR and SGSN	The S13 and S13’ interfaces is used for Mobile Equipment Identity Check Procedure is used between the MME and the EIR to check the Mobile Equipment's identity status.	3GPP TS 29.272 V10.3.0
Sh	HSS and AS	The Sh interface uses the method of communication between the AS (Application Server) function and the HSS (Home Subscriber Server).	3GGP TS 29.328 & TS 29.329
Zh	BSF and HSS	The Zh interface uses the Multimedia-Auth-Request method to communicate between BSF and HSS	3GPP TS 29.109

S6a Interface Signaling Procedure

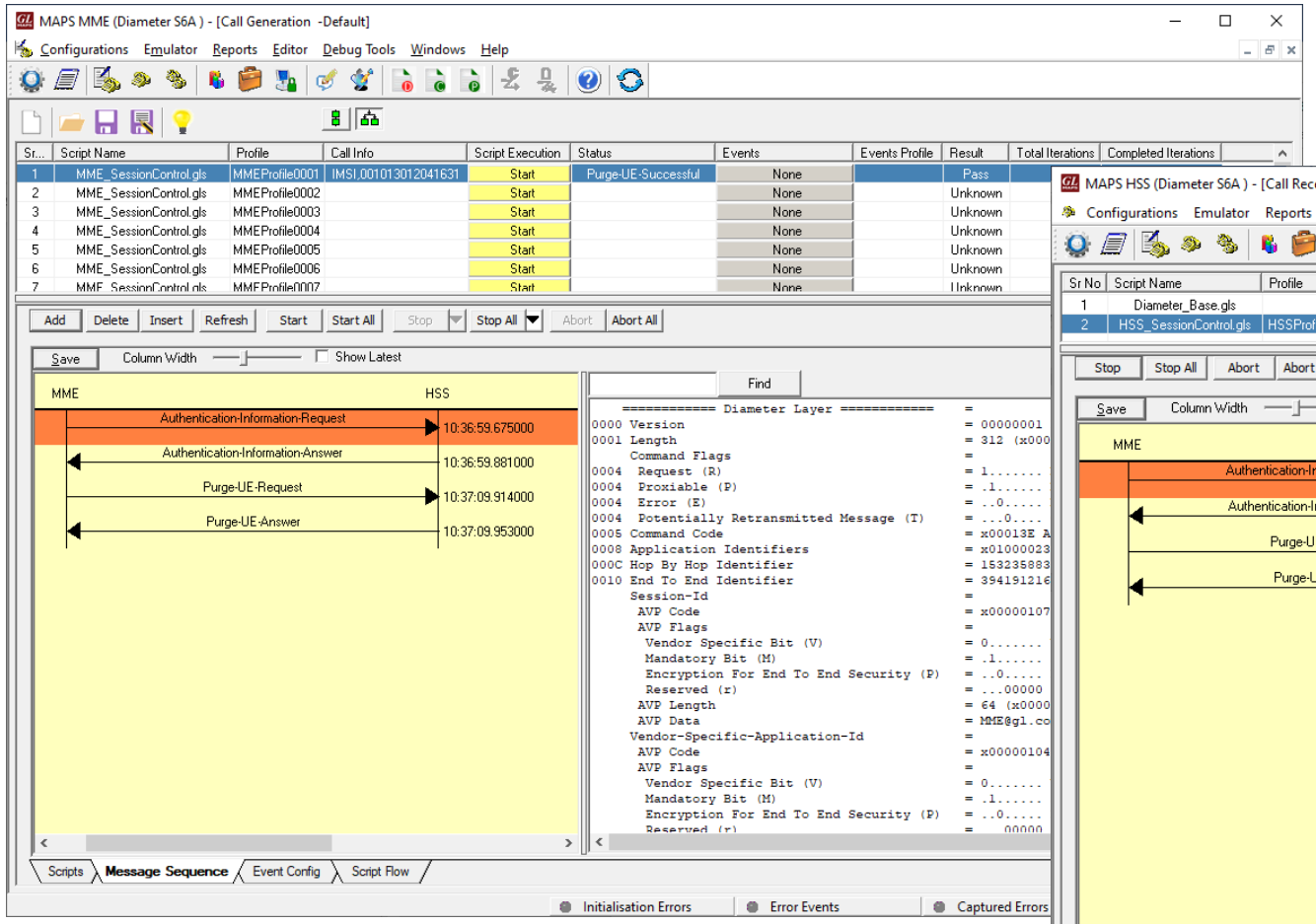
MAPS™ Diameter at the MME end initiates the following S6a interface procedures:

- initiates the Authentication procedure by sending Authentication-Information-Request message
- initiates the Update Location procedure by sending Update-Location-Request message
- initiates the Purge UE procedure by sending Purge-UE-Request message

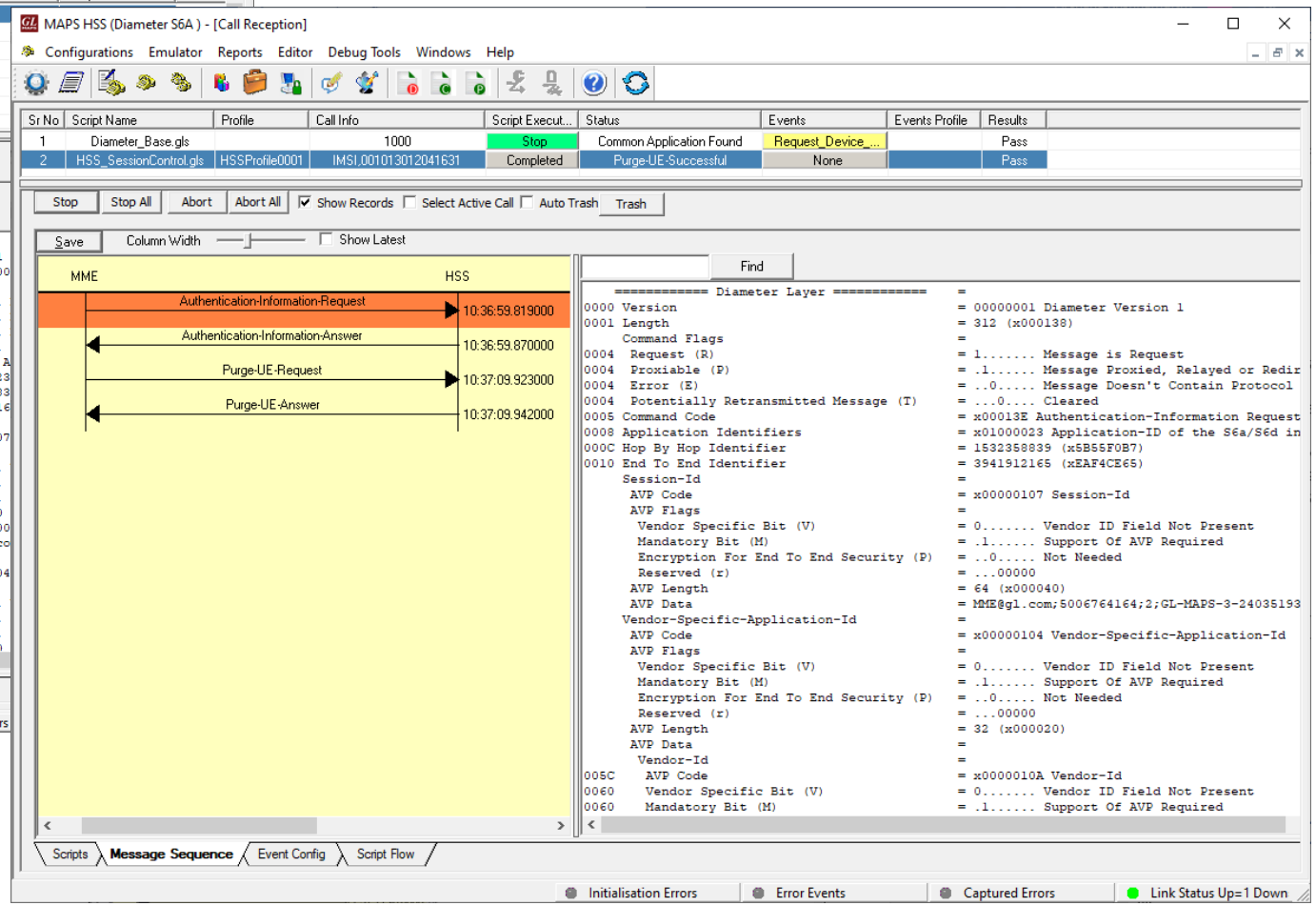


S6a Interface Call Generation and Reception

Call Generation at MME Node



Call Reception at HSS Node



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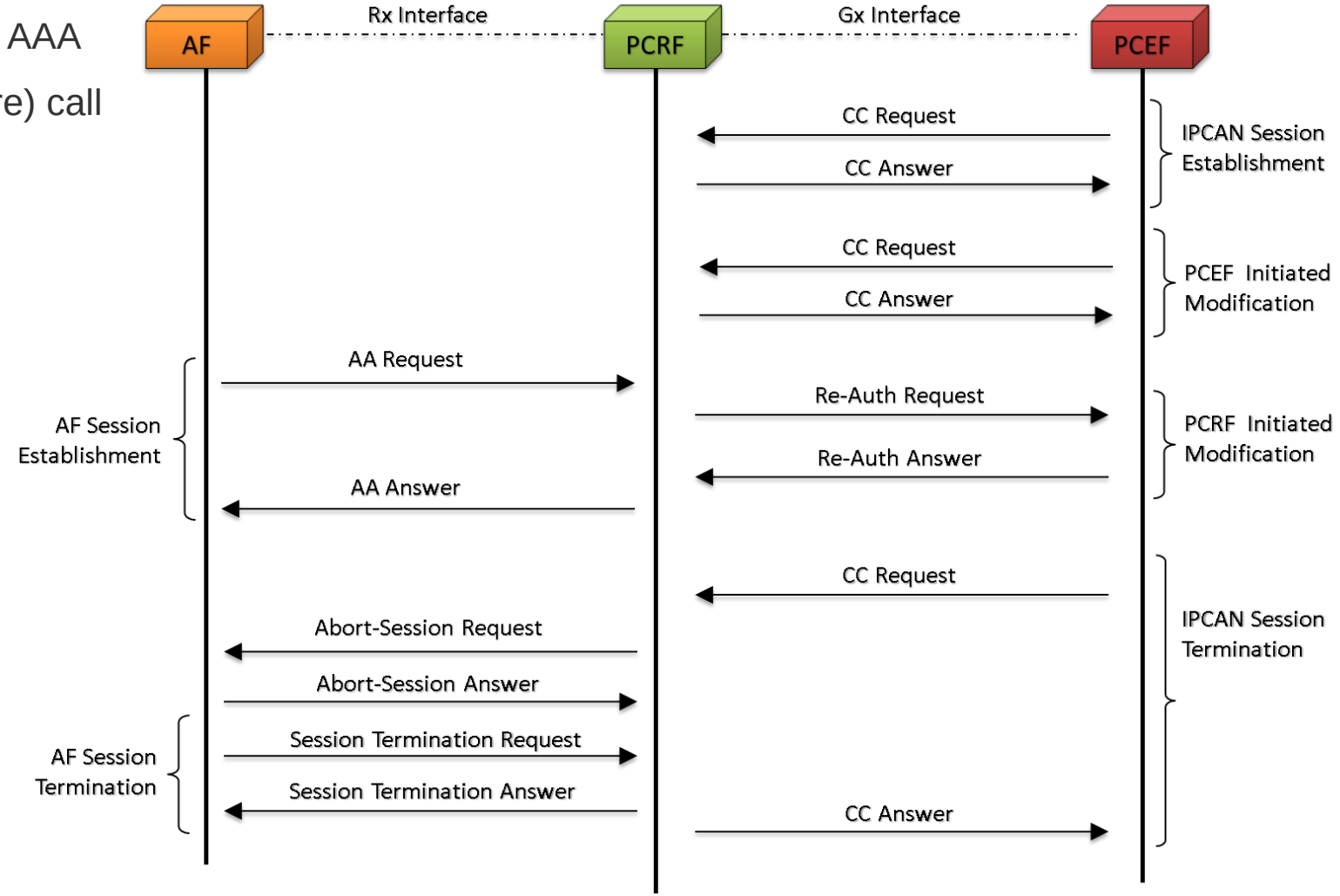
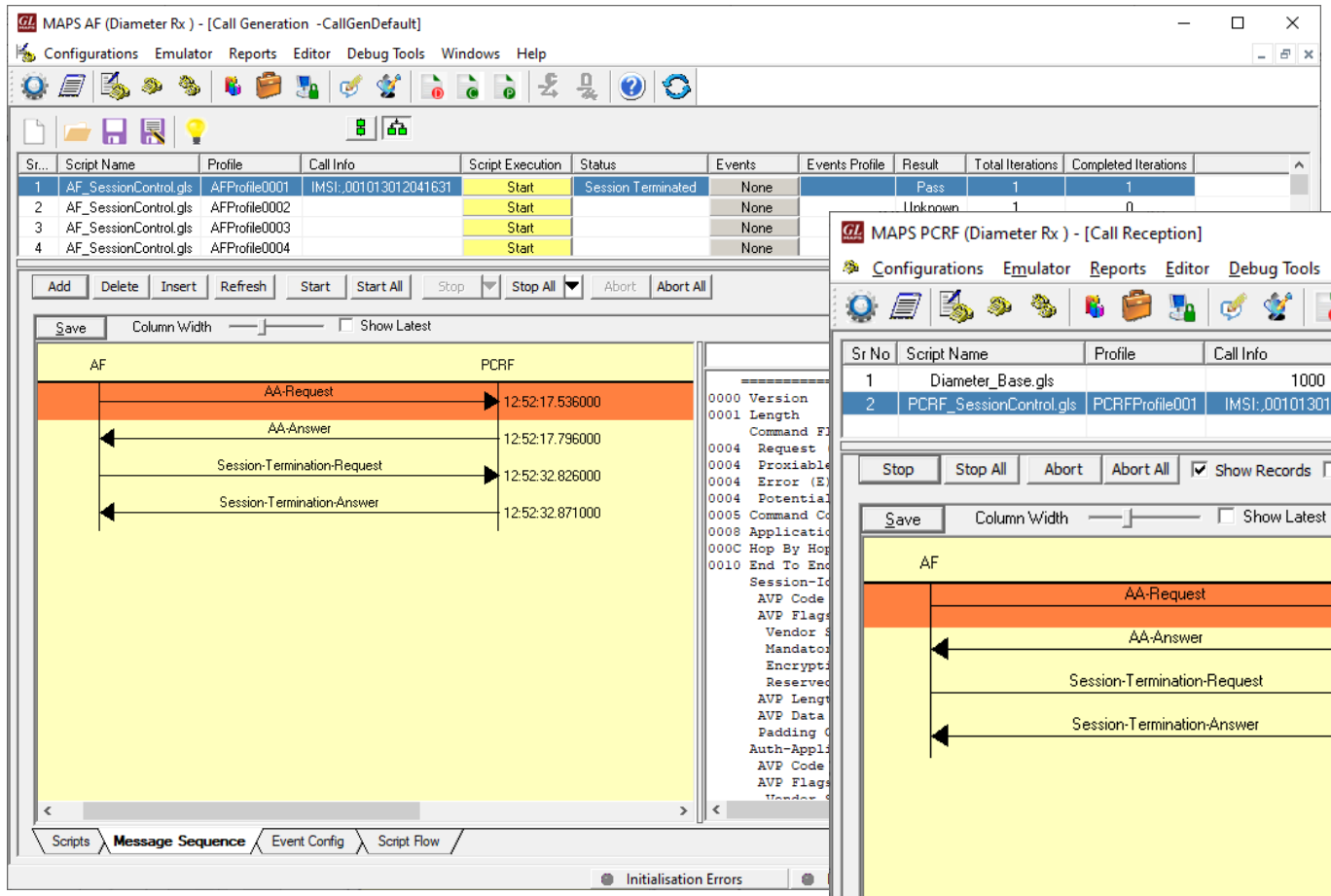
Rx/Gx Interface Signaling Procedure

- The MAPS™ Diameter emulate 3GPP AAA (Authentication Authorization Procedure) call control messages between the AF and PCRF nodes

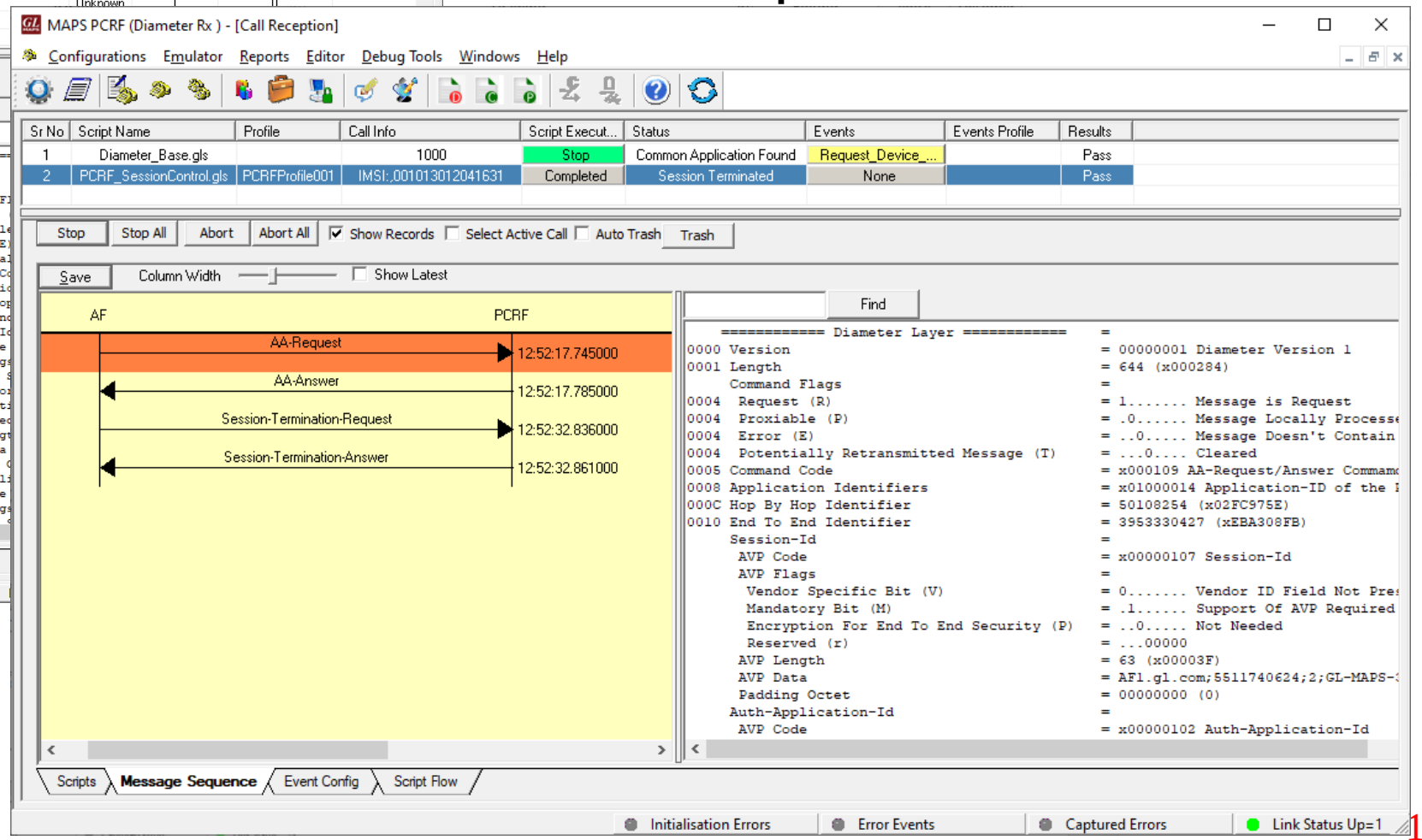


Rx/Gx Interface Call Generation and Reception

Call Generation at AF Node



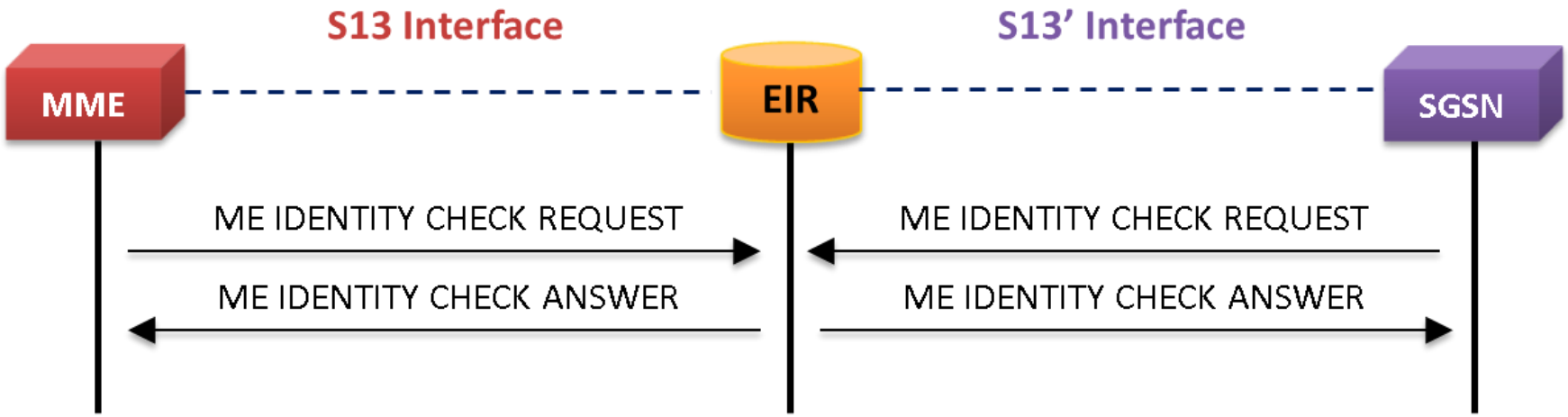
Call Reception at PCRF Node



S13/S13’ Interface Signaling Procedure

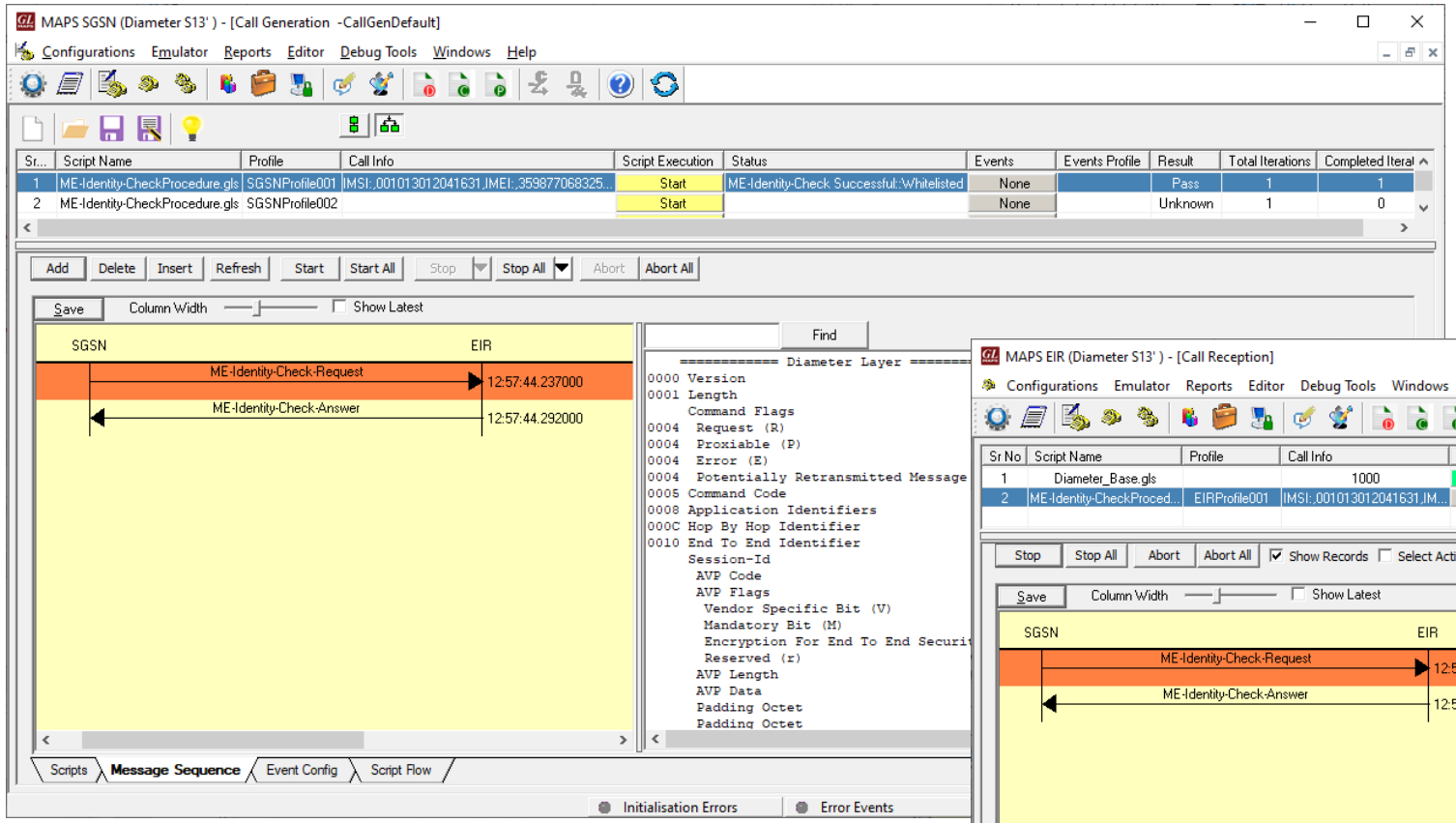
This procedure is mapped to the following commands in the Diameter application -

- ME-Identity-Check-Request (ECR) Command
- ME-Identity-Check-Answer (ECA) Command

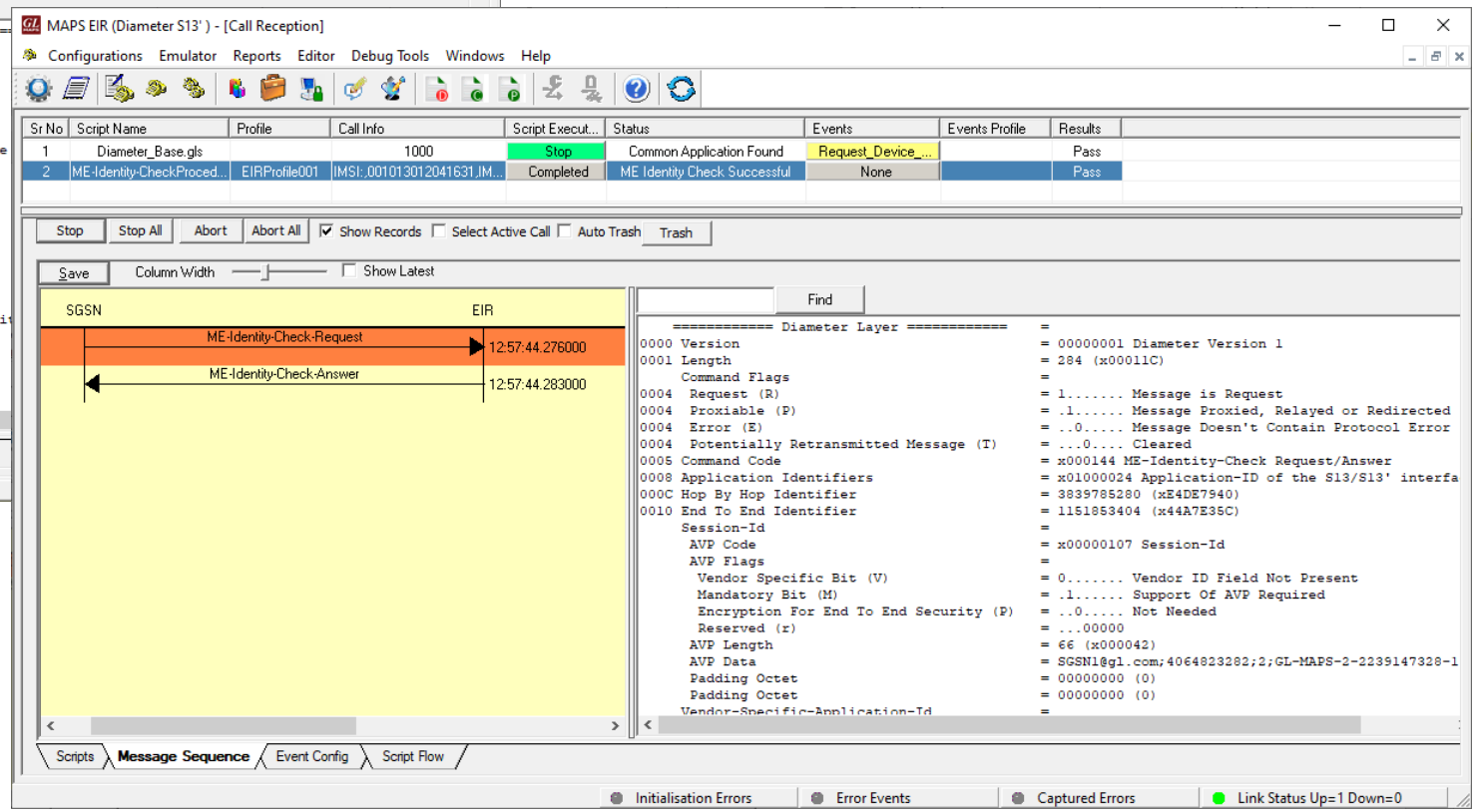


S13/S13' Interface Call Generation and Reception

Call Generation at SGSN Node



Call Reception at PCRF Node



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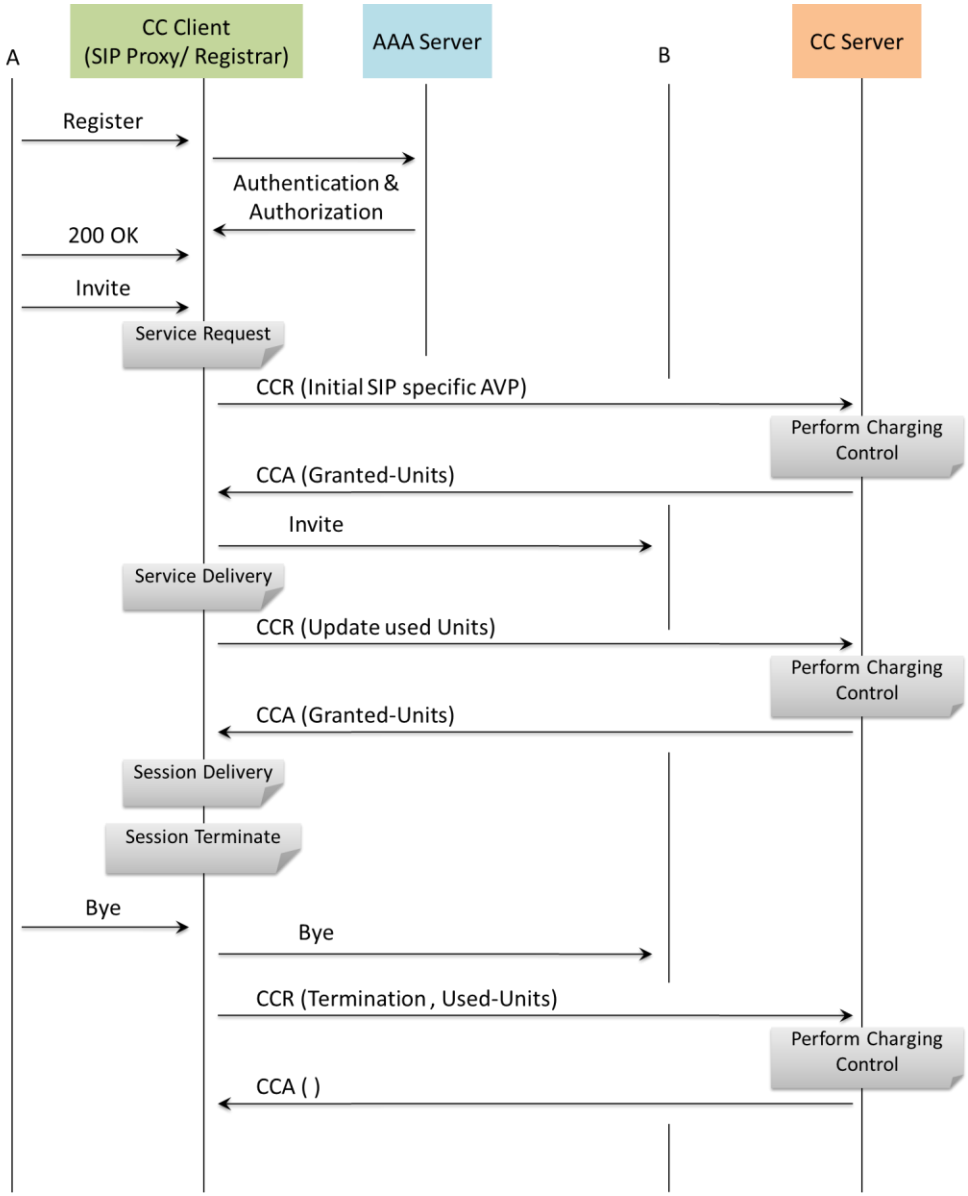
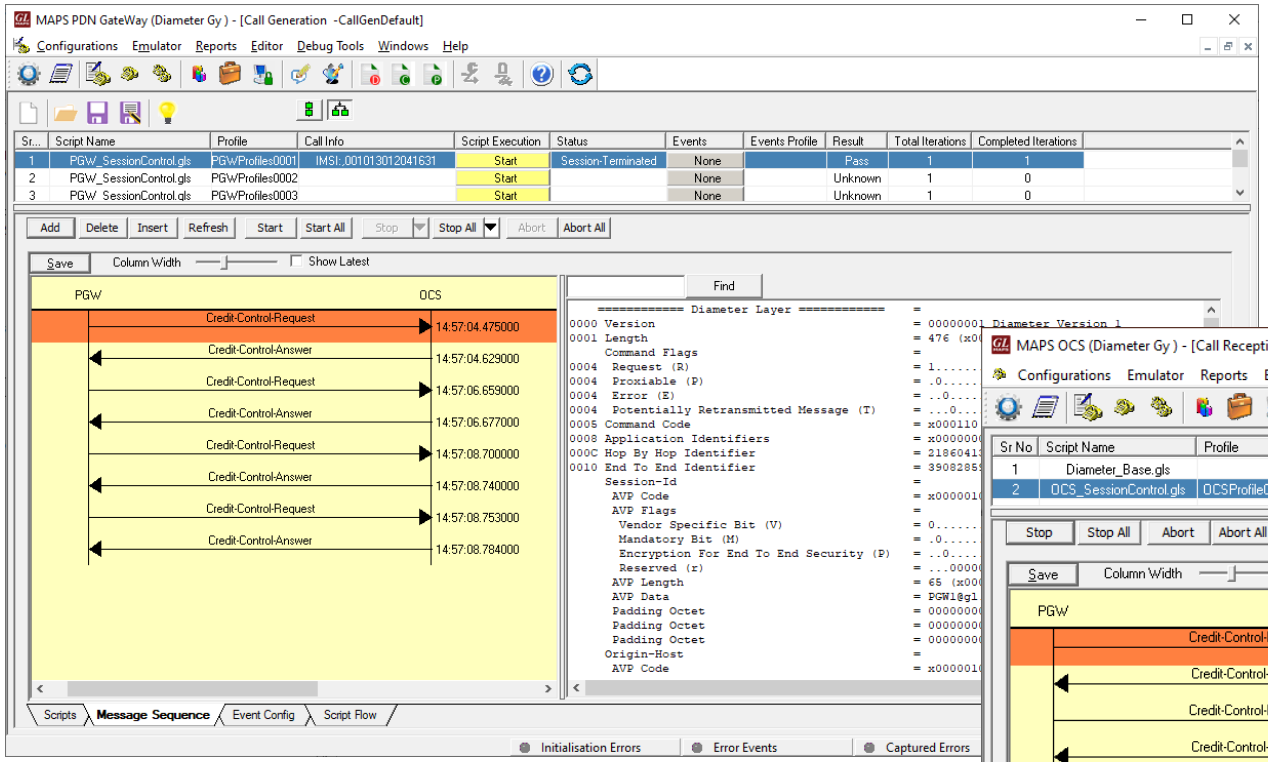
Gy Interface Signaling Procedures

- The PCEF node in LTE network, and CSCF node in IMS network perform the role of a Charging Trigger Function (CTF) entity to issue charging events to an Online Charging System (OCS)
- The charging events can be immediate (IEC), event-based (ECUR), or session-based (SCUR)

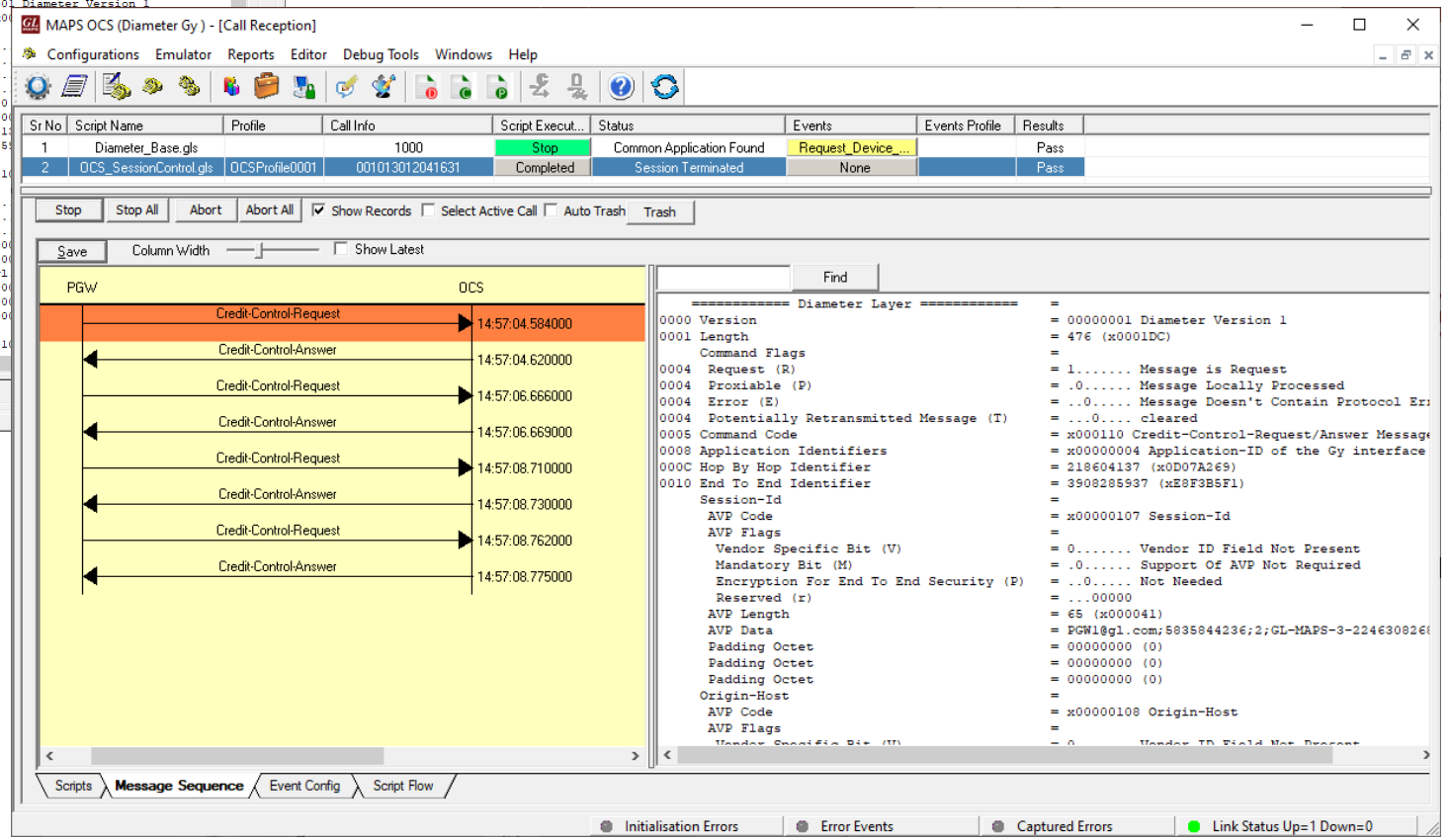


Gy Interface Call Generation and Reception

Call Generation at PDN GateWay Node



Call Reception at OCS Node



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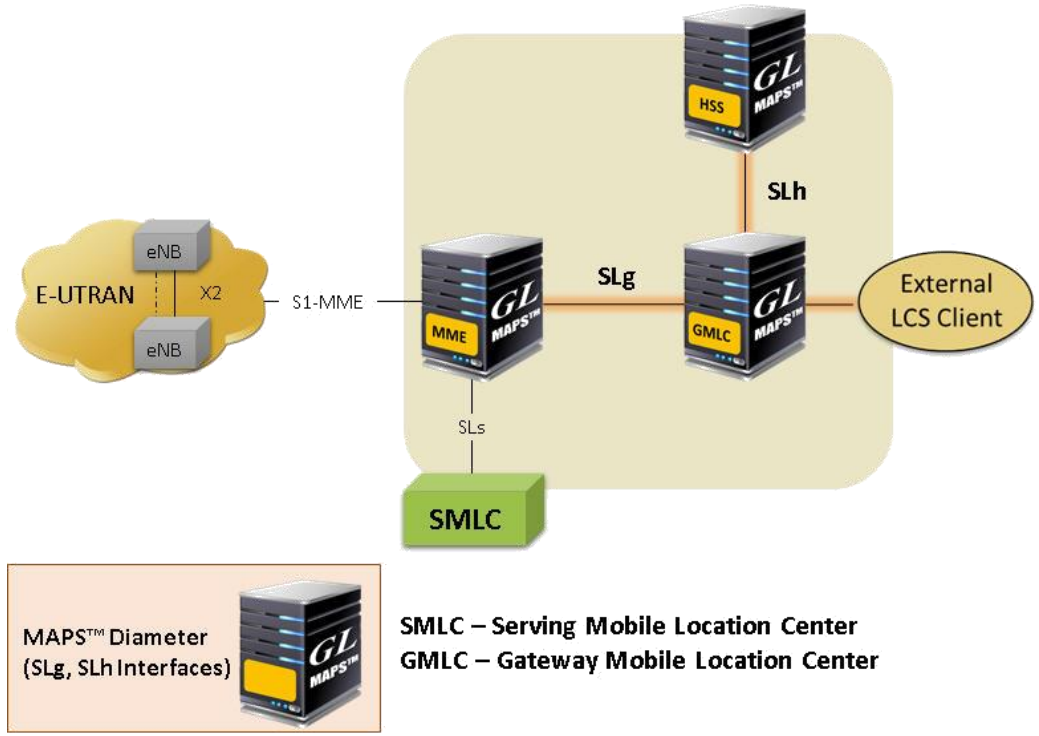
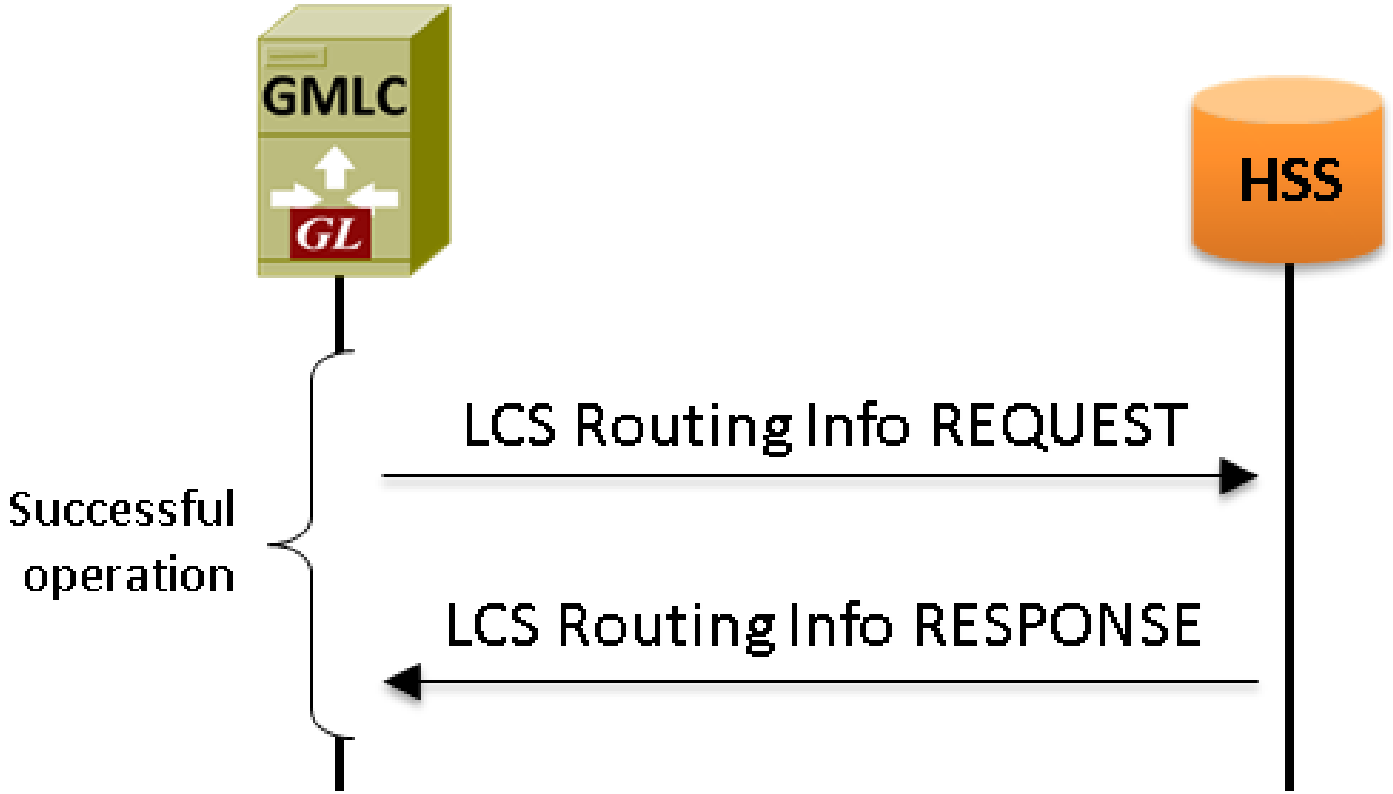
Location Services (LCS) Architecture

- SLh, SLg Interfaces
- MAPS™ Diameter supports Location Service (LCS) based SLh and SLg interfaces
- Between the GMLC <-> HSS is SLh interface and between GMLC <->MME is SLg interface



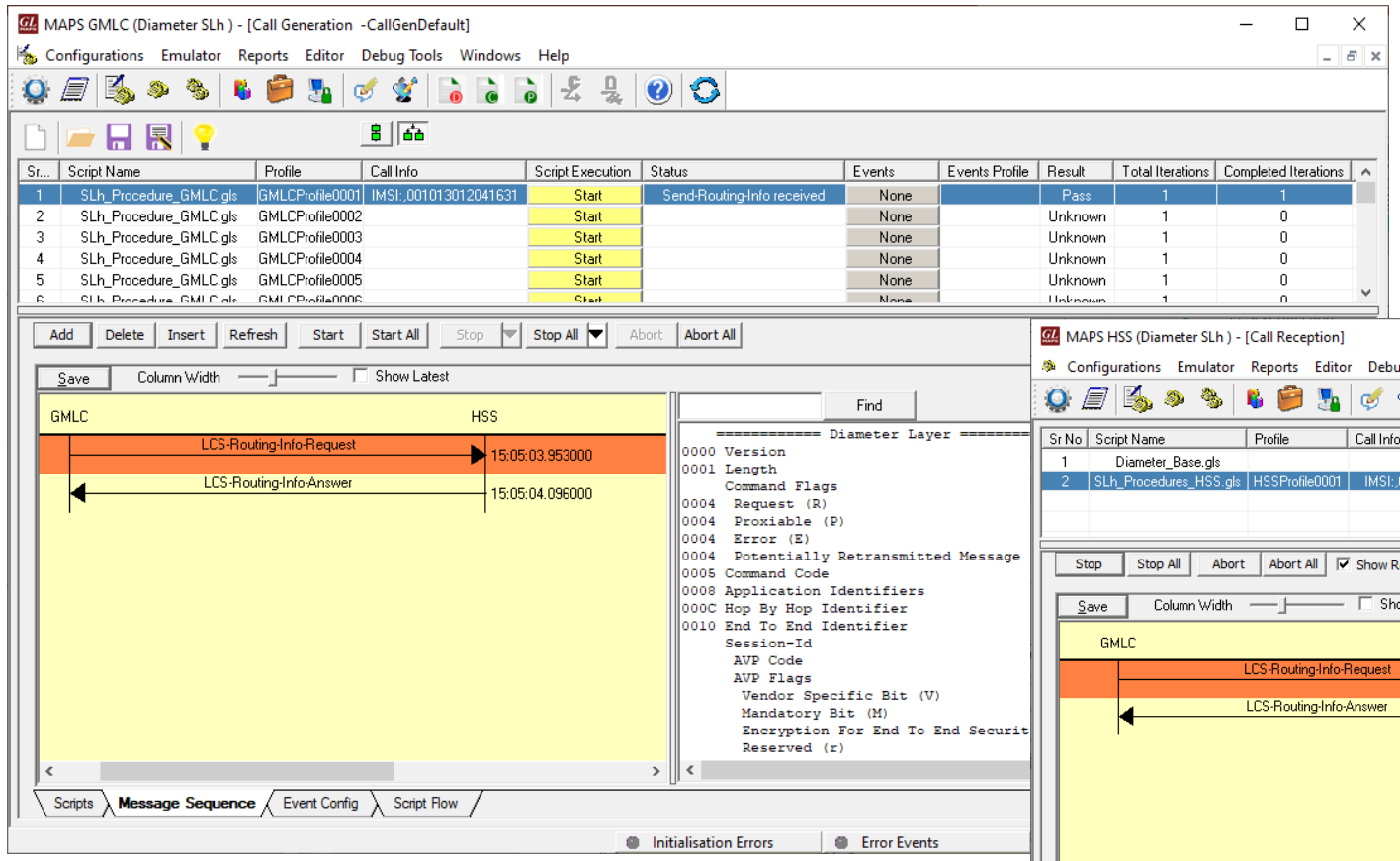
SLh Interface Signaling Procedure

- MAPS™ Diameter Emulator can be configured as GMLC (Gateway Mobile Location center), and HSS (Home Subscriber Server) in SLh interface
- Capable to connect the corresponding access network and the access network will provide the positioning of the UE

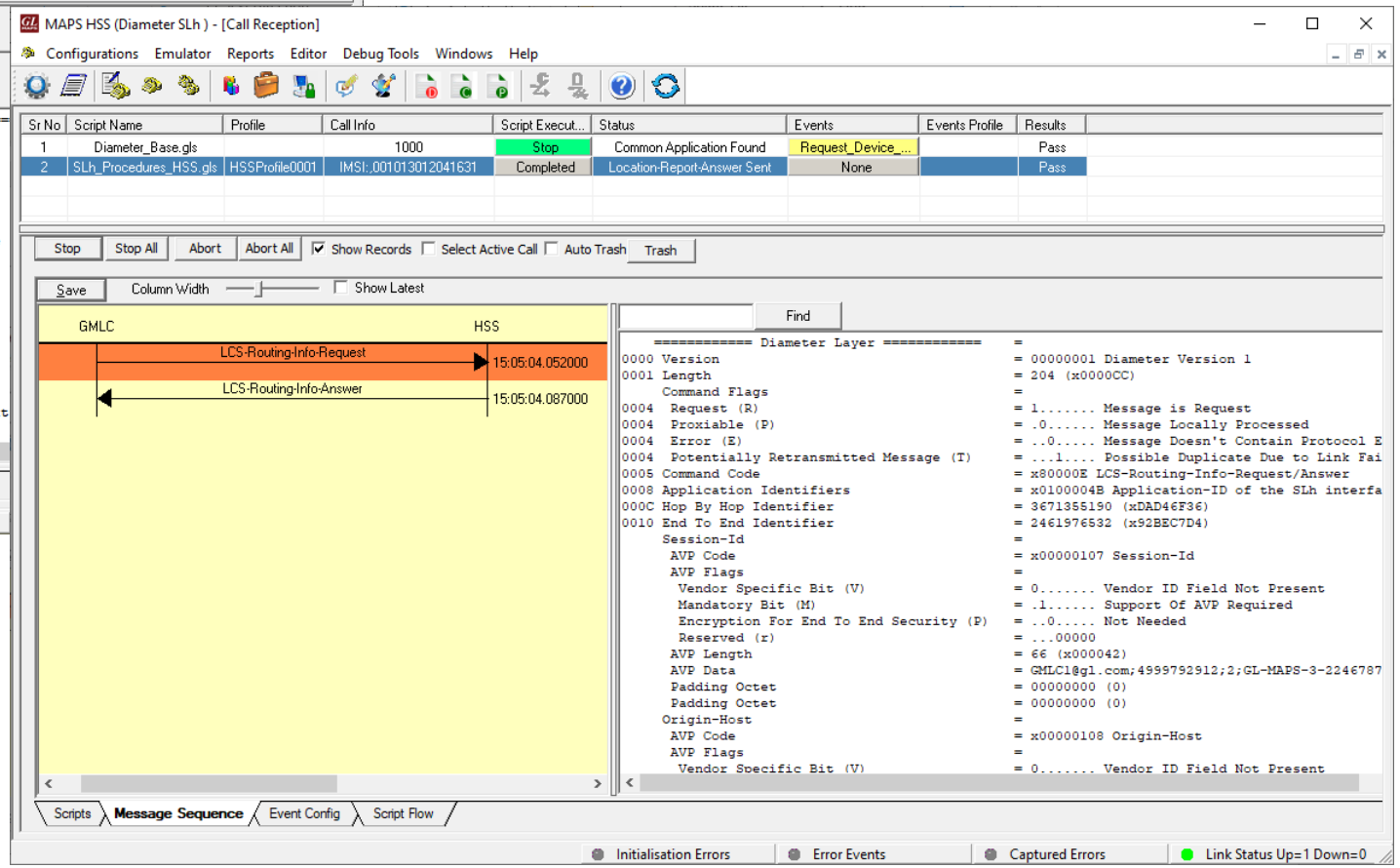


SLh Interface Call Generation and Reception

Call Generation at GMLC Node



Call Reception at HSS Node



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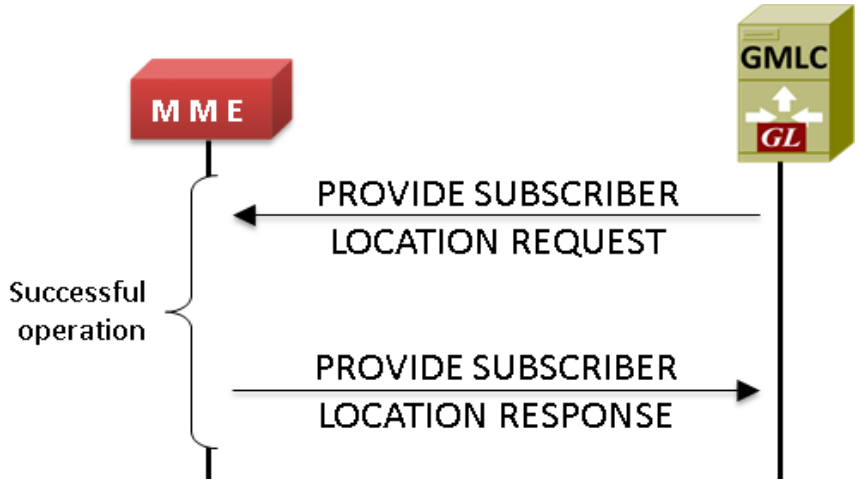
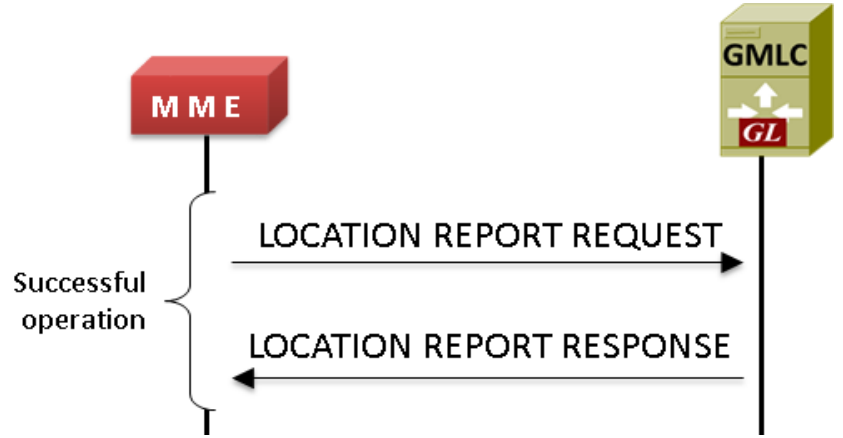
SLg Interface Signaling Procedure

- MAPS™ Diameter Emulator can be configured as GMLC (Gateway Mobile Location Center), and MME (Mobile Management Entity) in SLg interface
- Designed to estimate a location of the server and receive the exact location from the entity

Provide Subscriber Location Info (SLg)

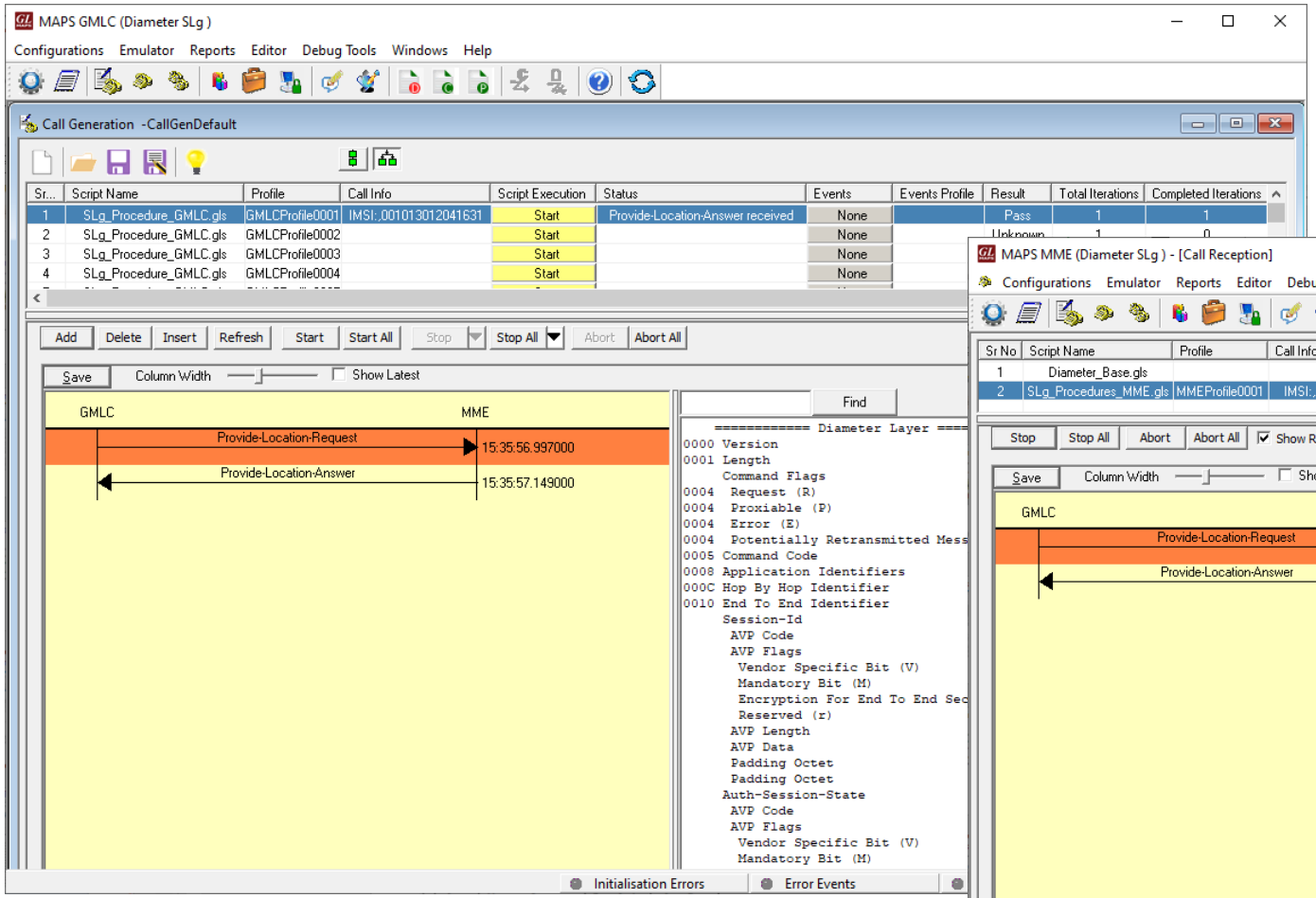


Subscriber Location Report (SLg)

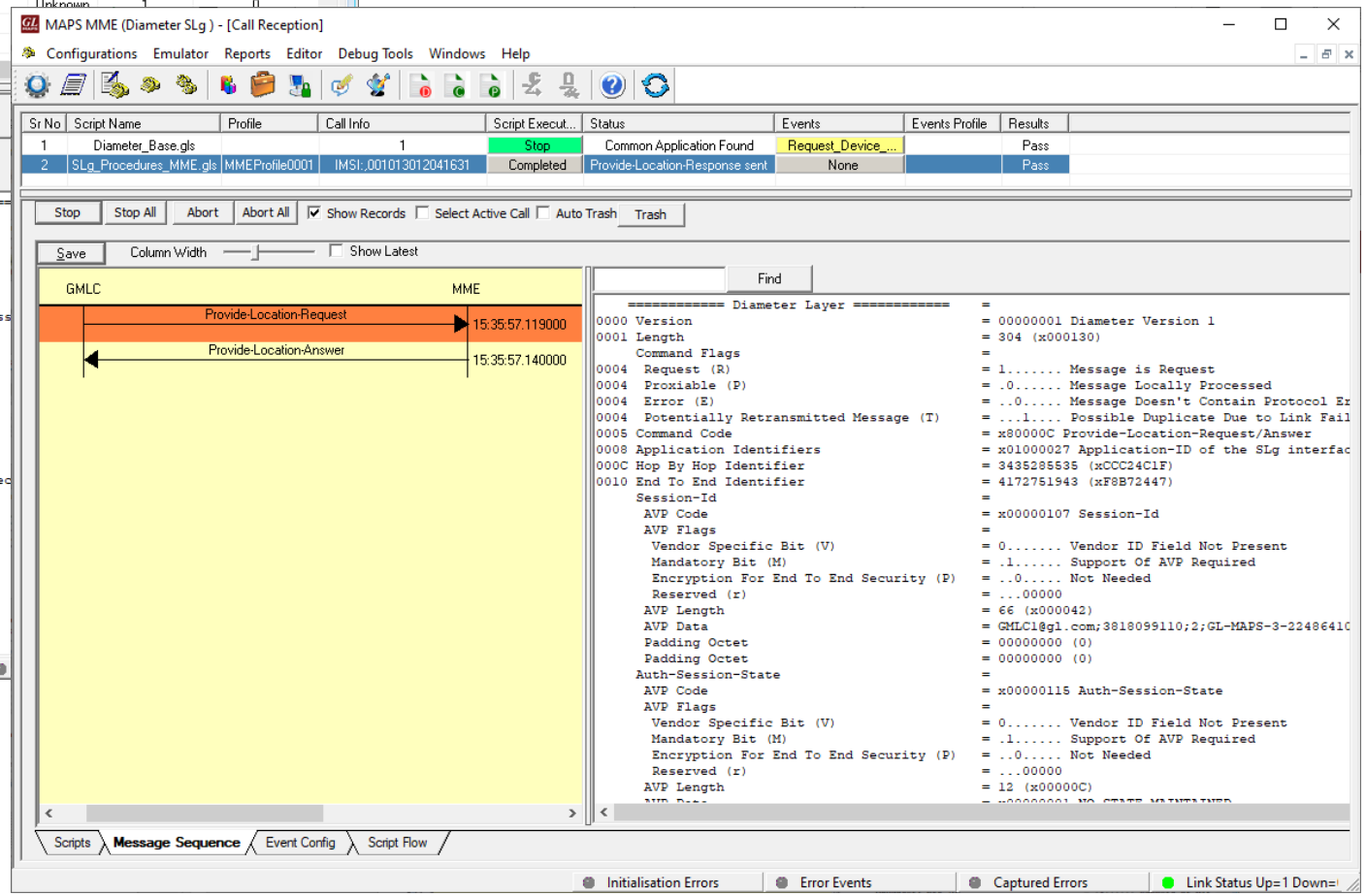


SLg Interface Call Generation and Reception

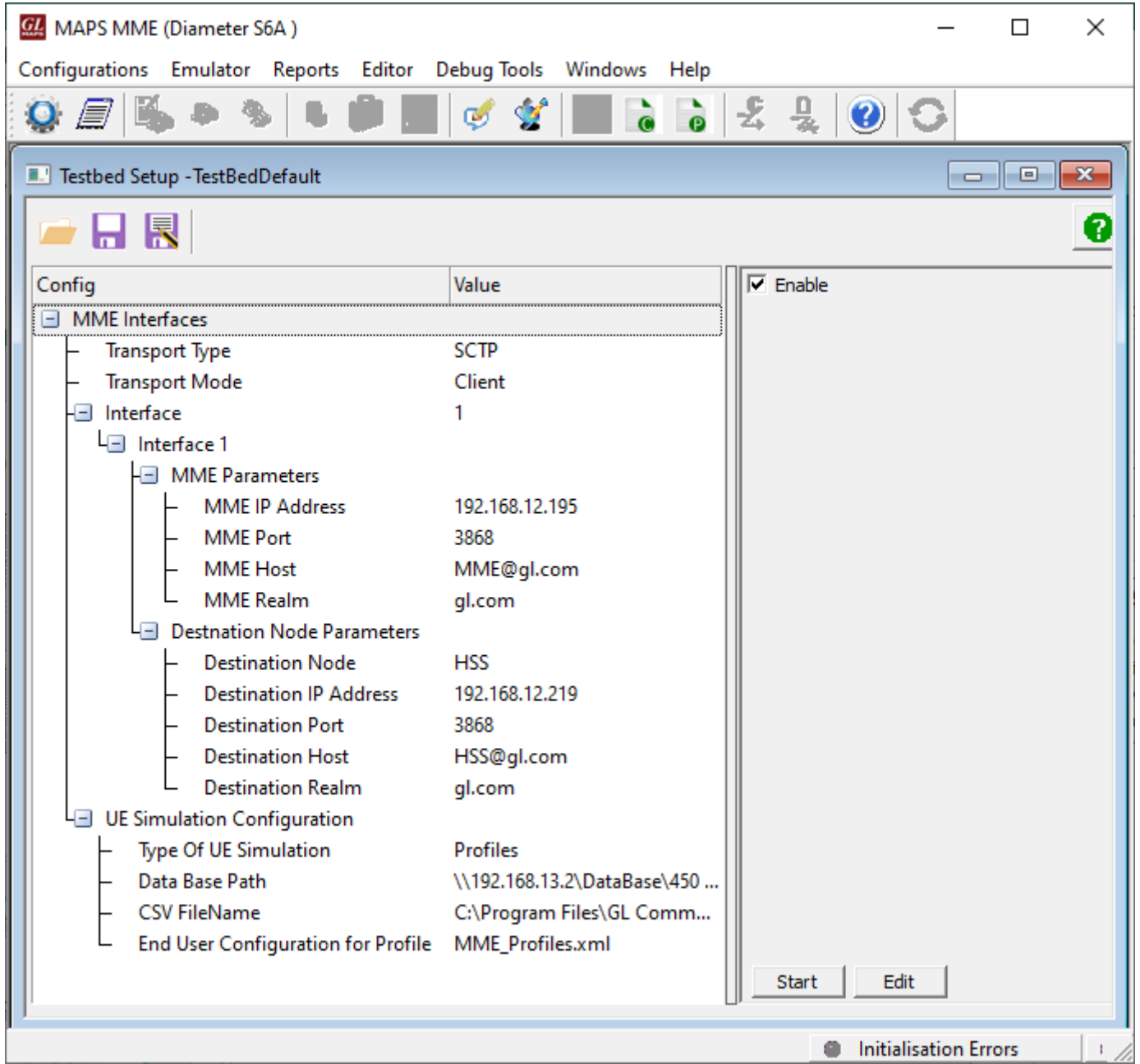
Call Generation at GMLC Node



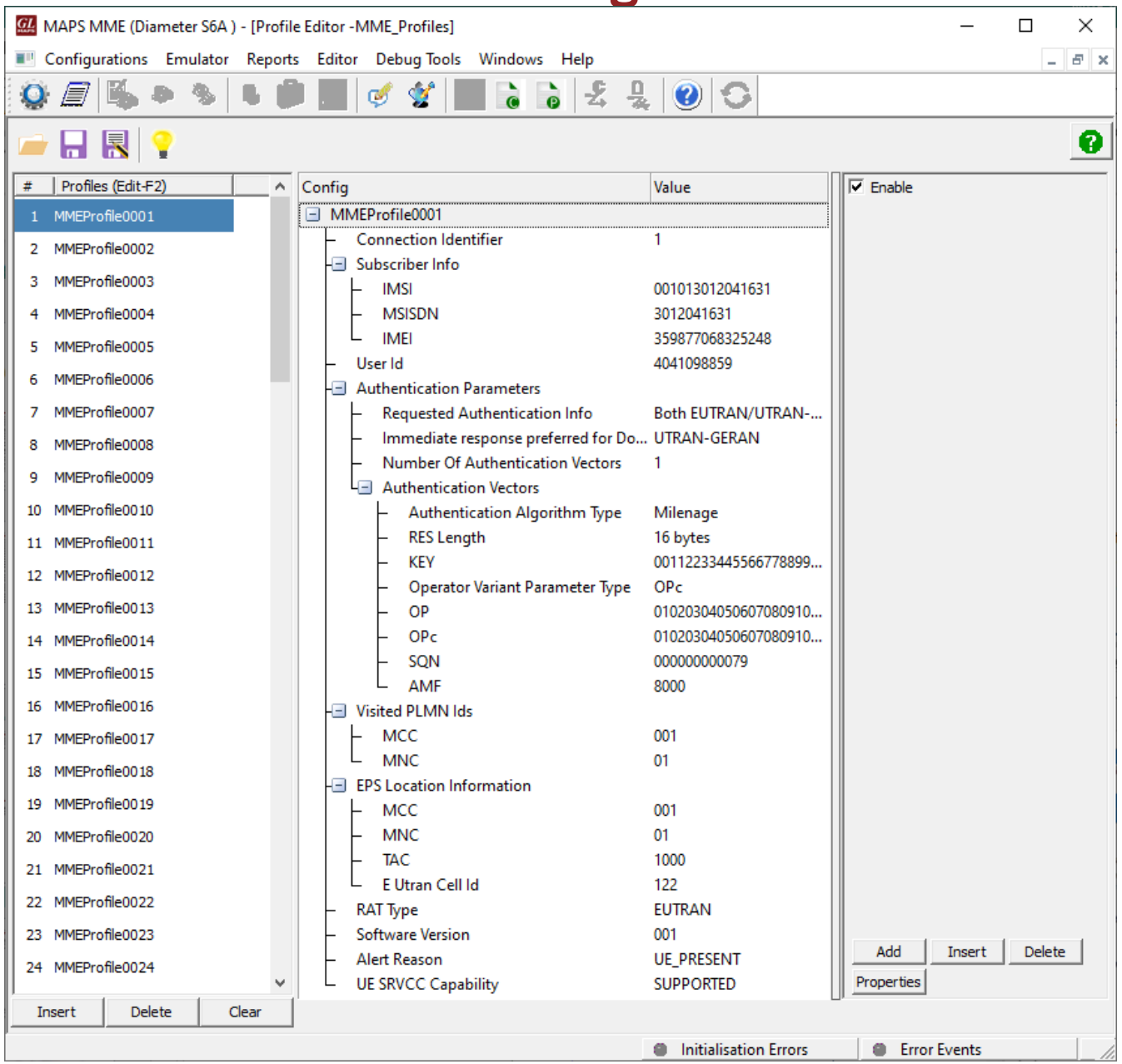
Call Reception at MME Node



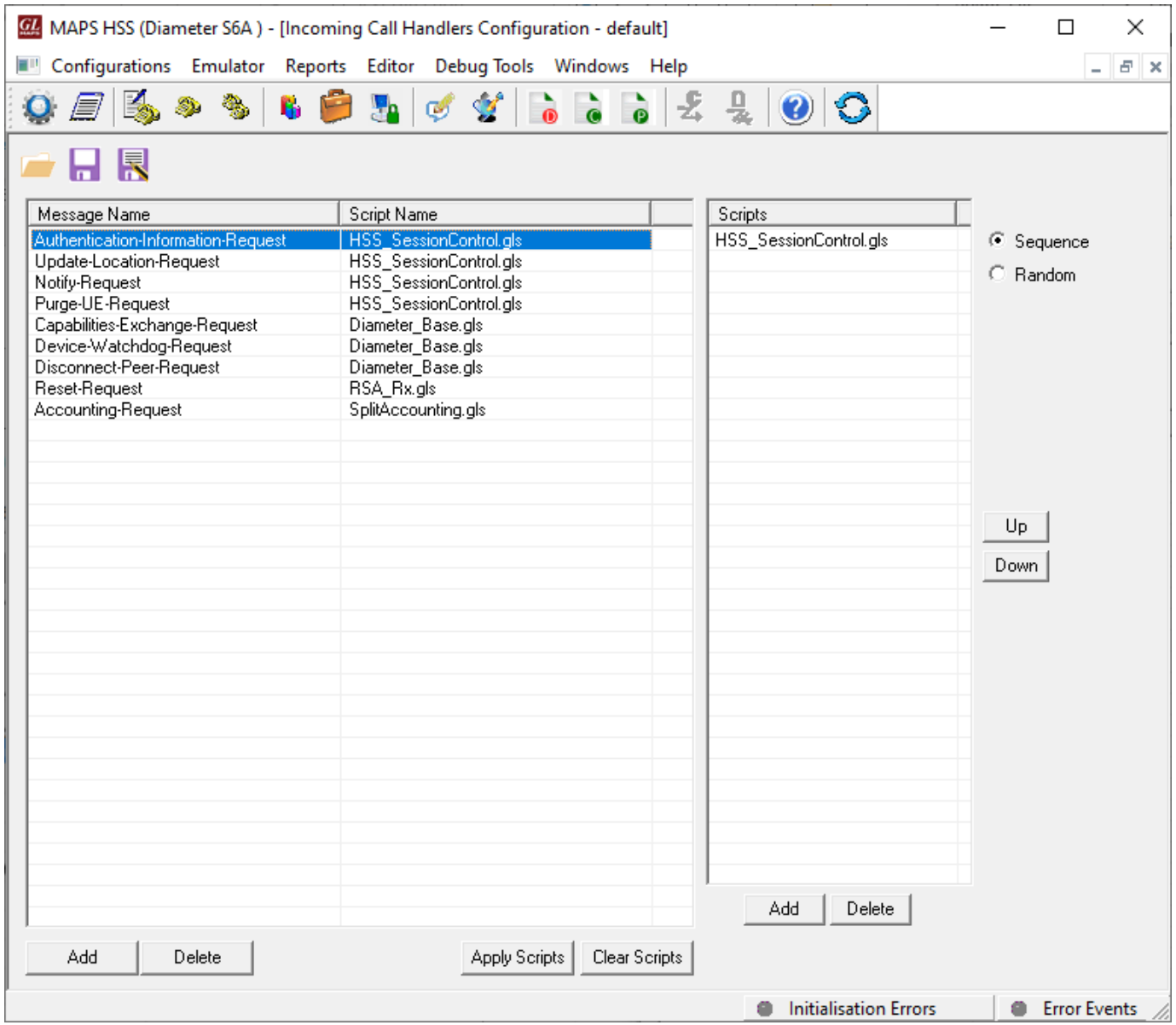
Testbed Setup Configuration



Profile Configuration



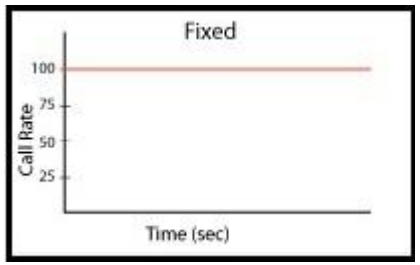
Incoming Call Handler Configuration



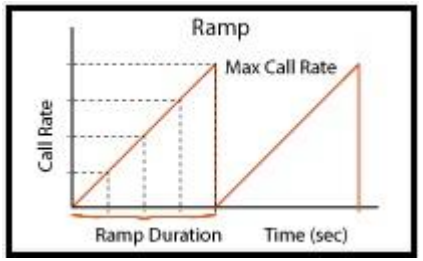
Load Generation

- 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.

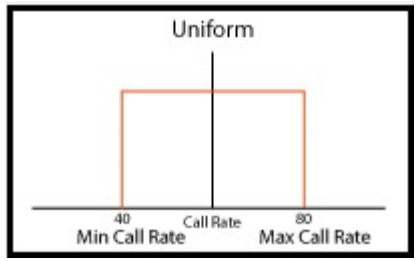
Fixed



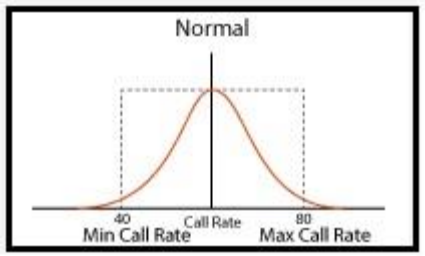
Ramp



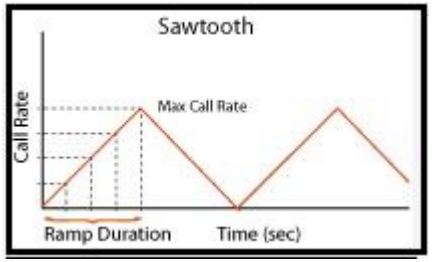
Uniform



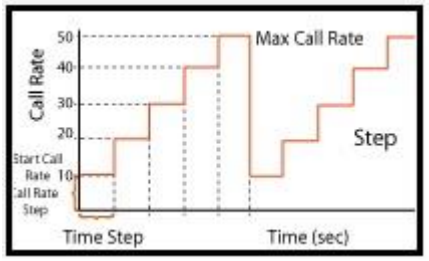
Normal

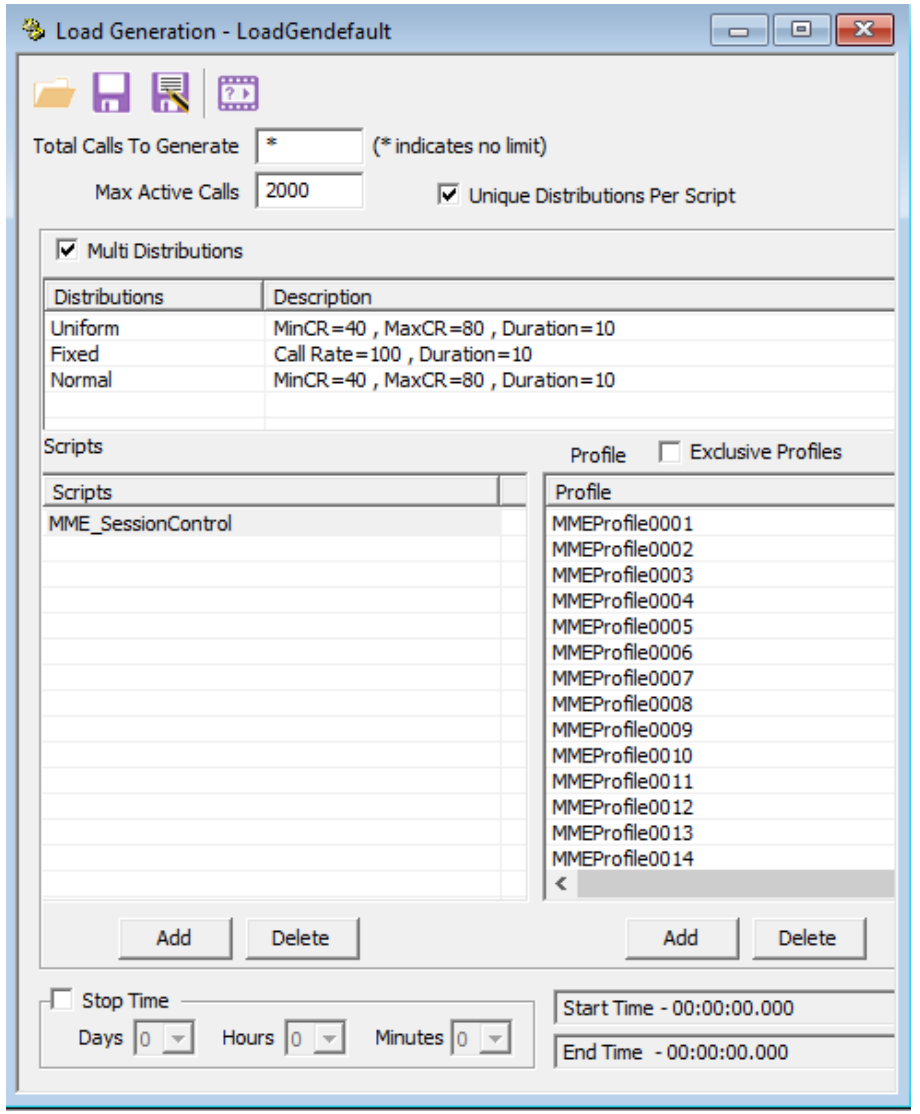


Saw-tooth



Step





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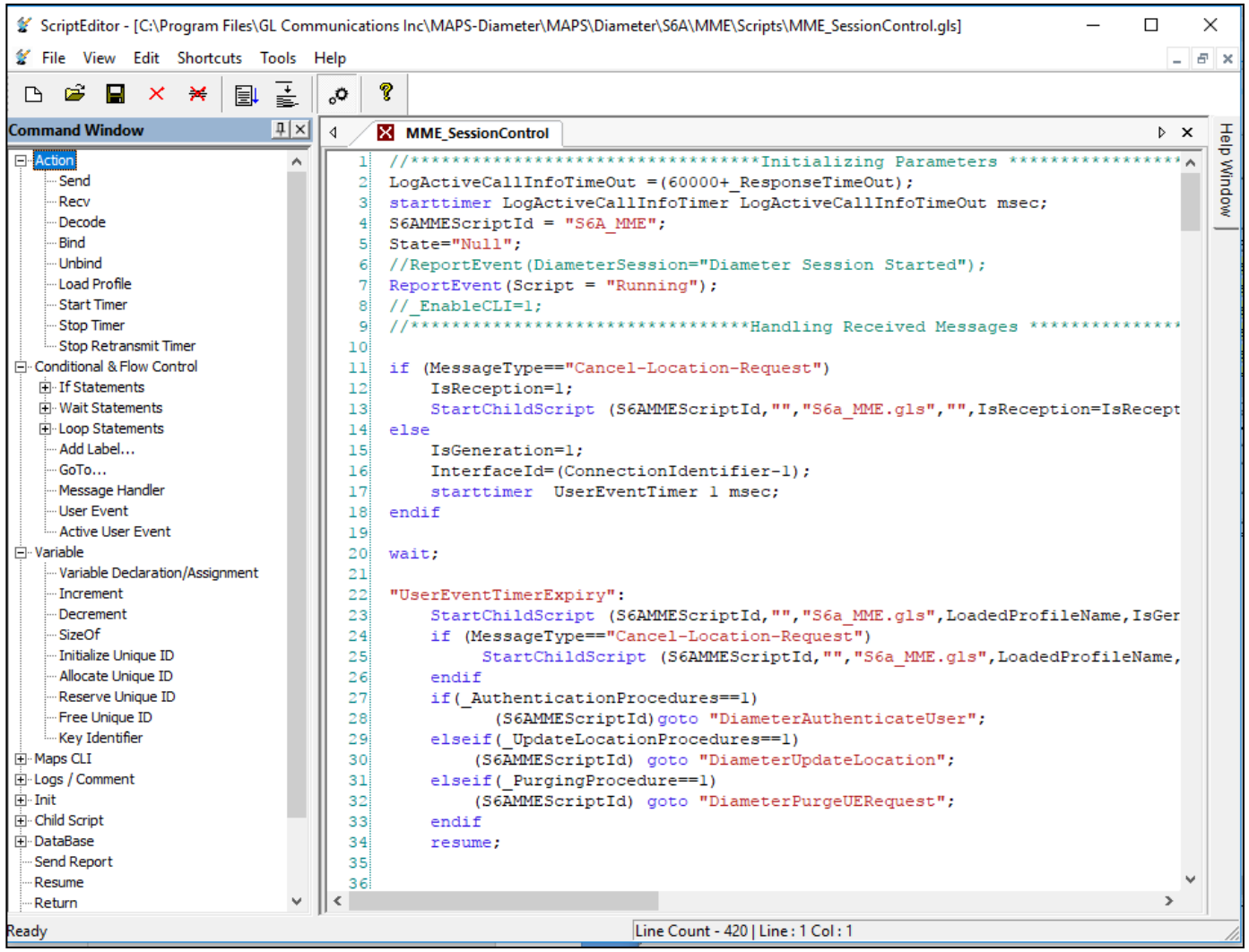
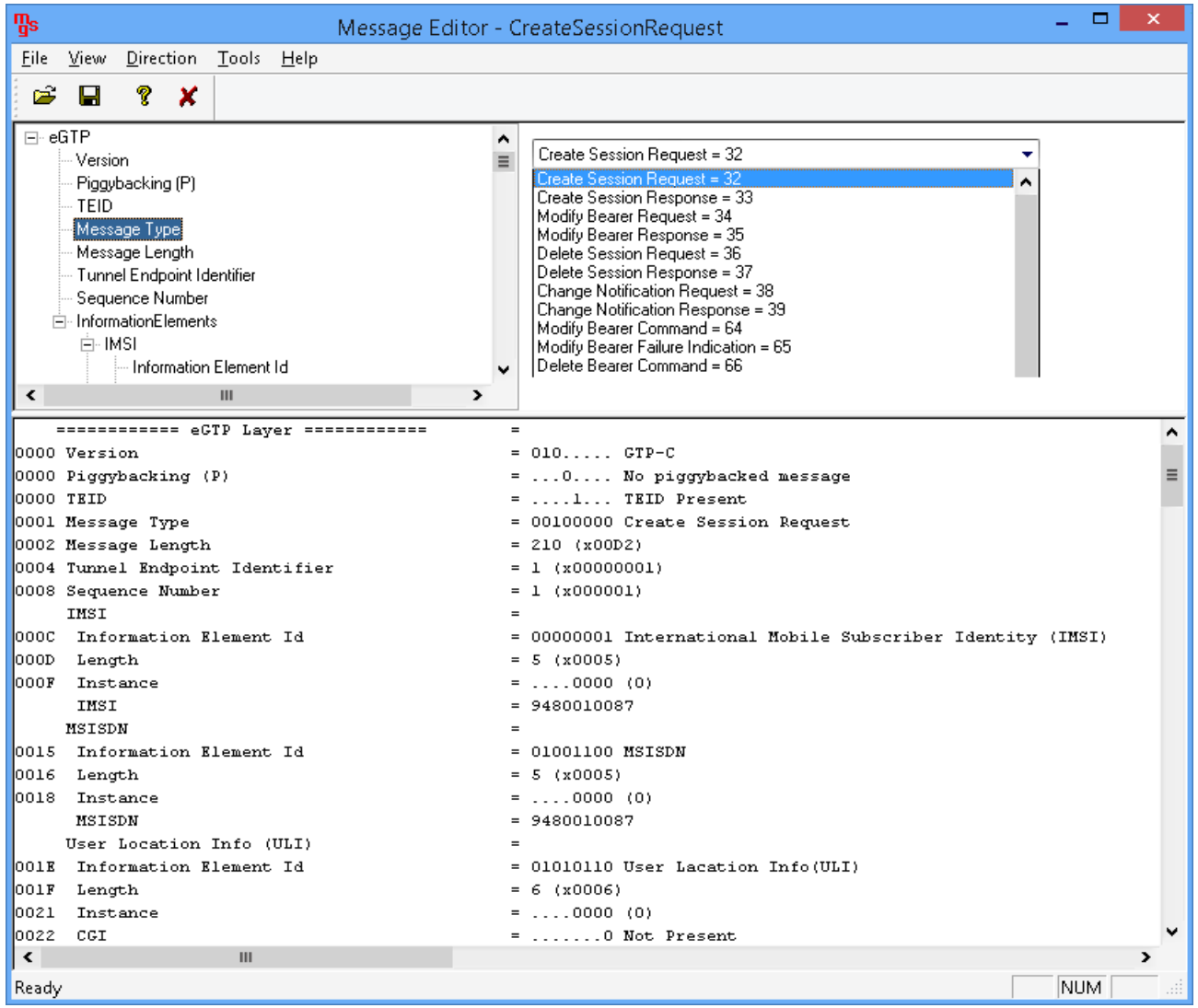
Customizations - Call Flow (Scripts)

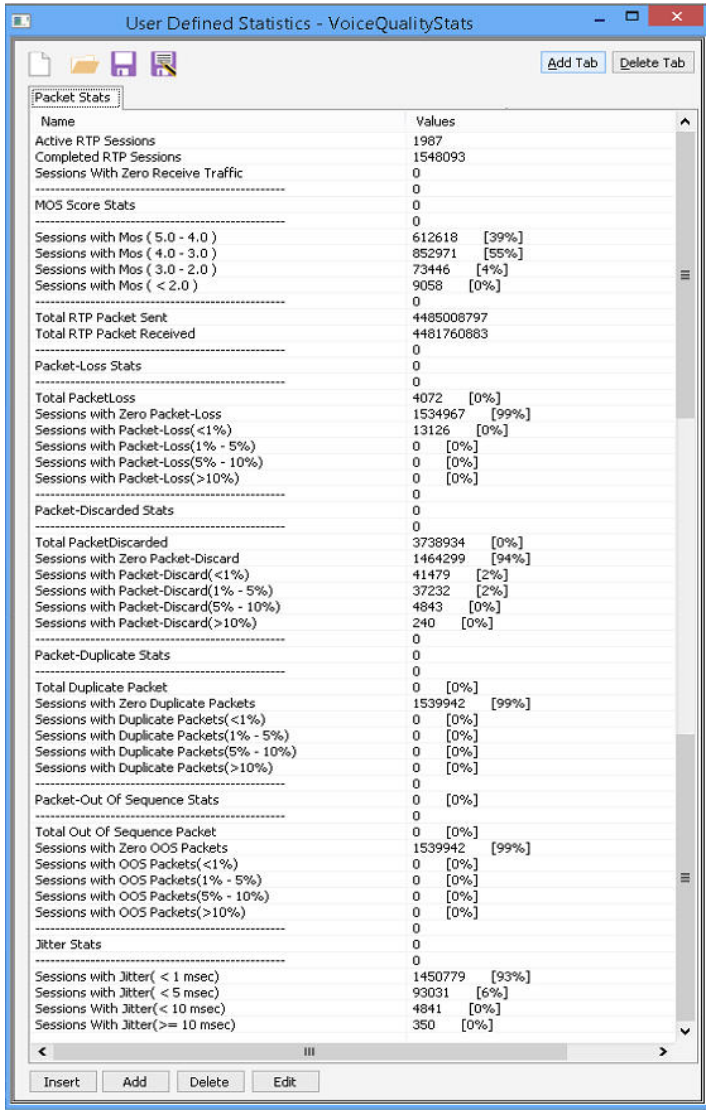


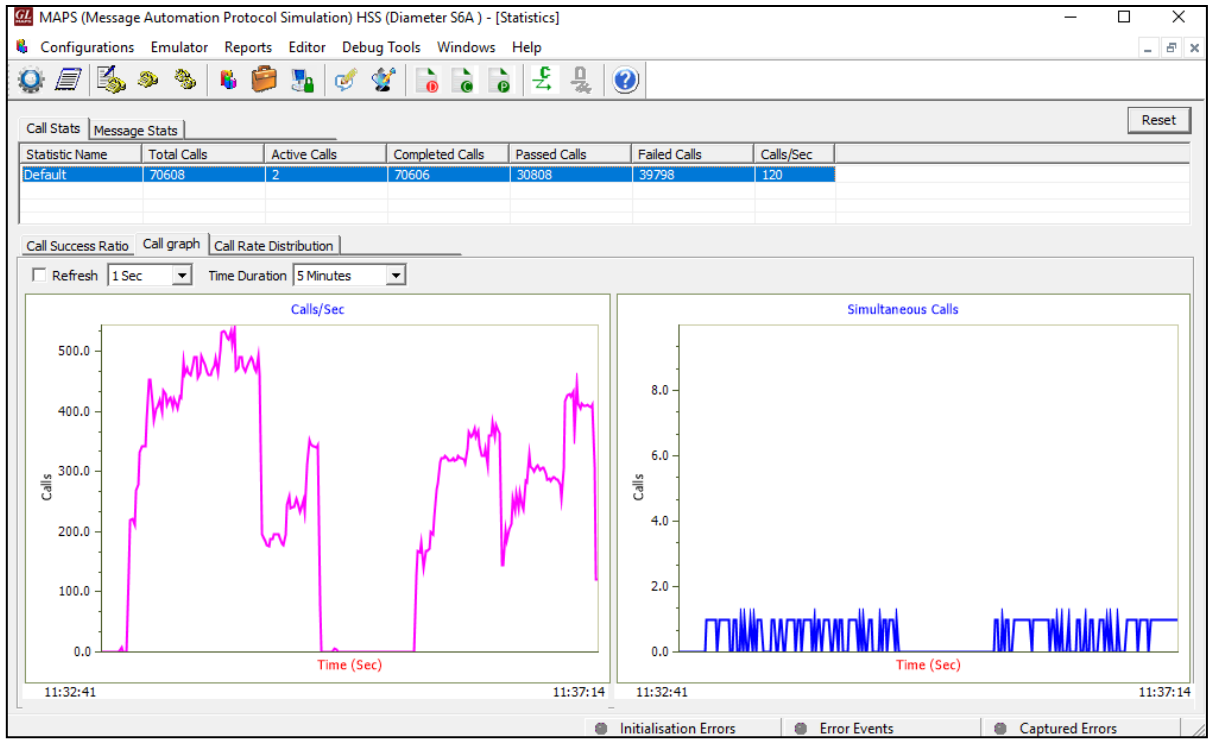
Customizations - Protocol Messages



Customizations - Statistics and Reports

- MOS, R-Factor
- Packet Loss
- Packets Discarded
- Duplicate Packets
- Out-Of-Sequence Packets
- Jitter Statistics





Call Stats provide a running tabular log of system level stats, tracked stats include Total Calls, Active Calls, Completed Calls, Passed Calls, Failed Calls, Instantaneous Calls/Sec

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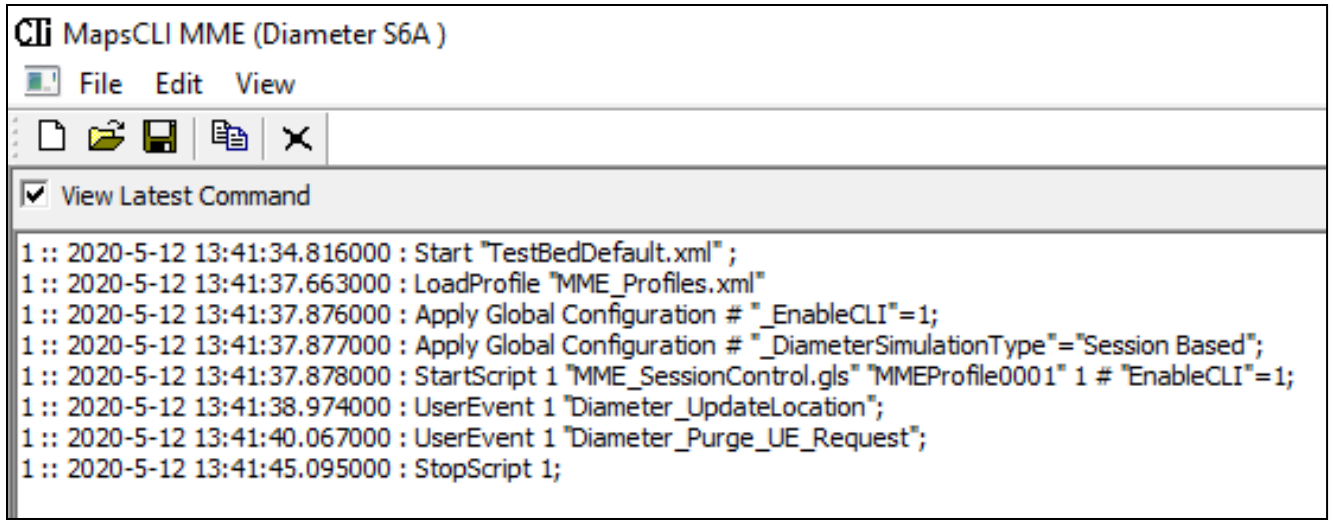
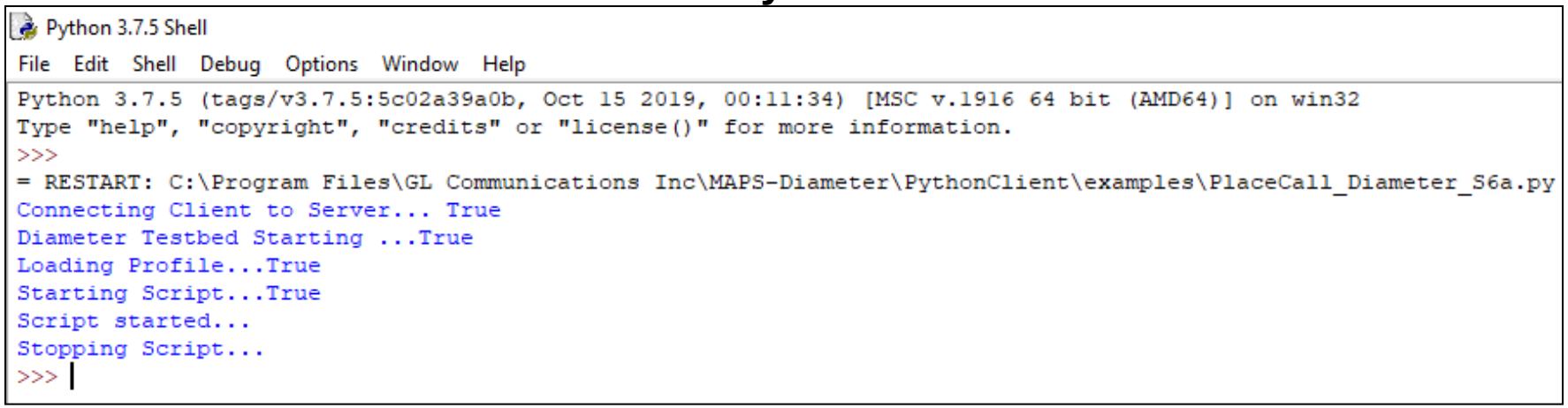
Command Line Interface

MAPS™ CLI Server



Python Client



Thank you