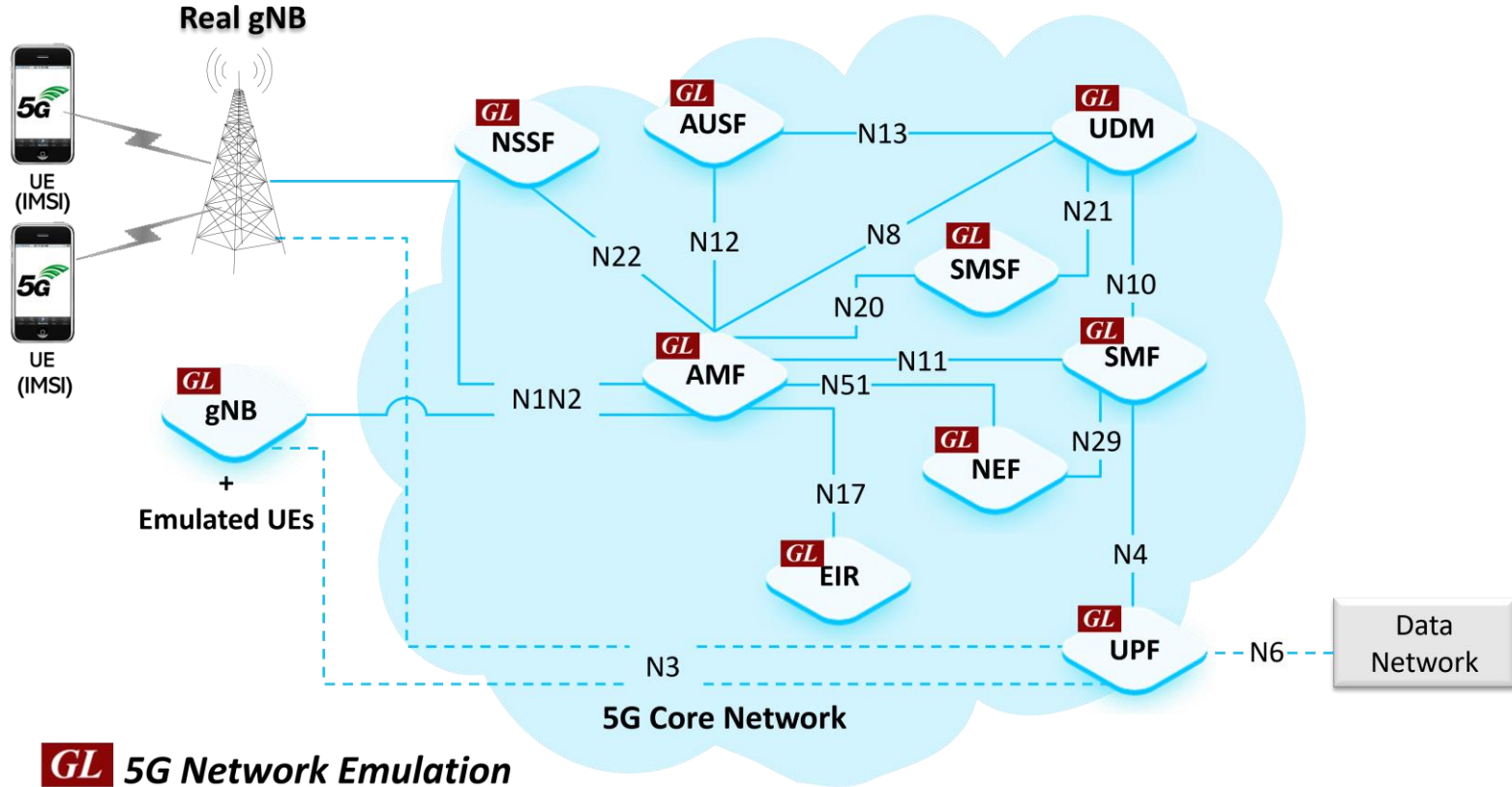

MAPS™ 5G Core Network Emulation

N1N2, N4, N8, N10, N11, N12, N13, N17, N20, N21, N22, N29, N51



818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878
Phone: (301) 670-4784 Fax: (301) 670-9187 Email: info@gl.com
Website: <https://www.gl.com>

5G Network Diagram



GL 5G Network Emulation

Features

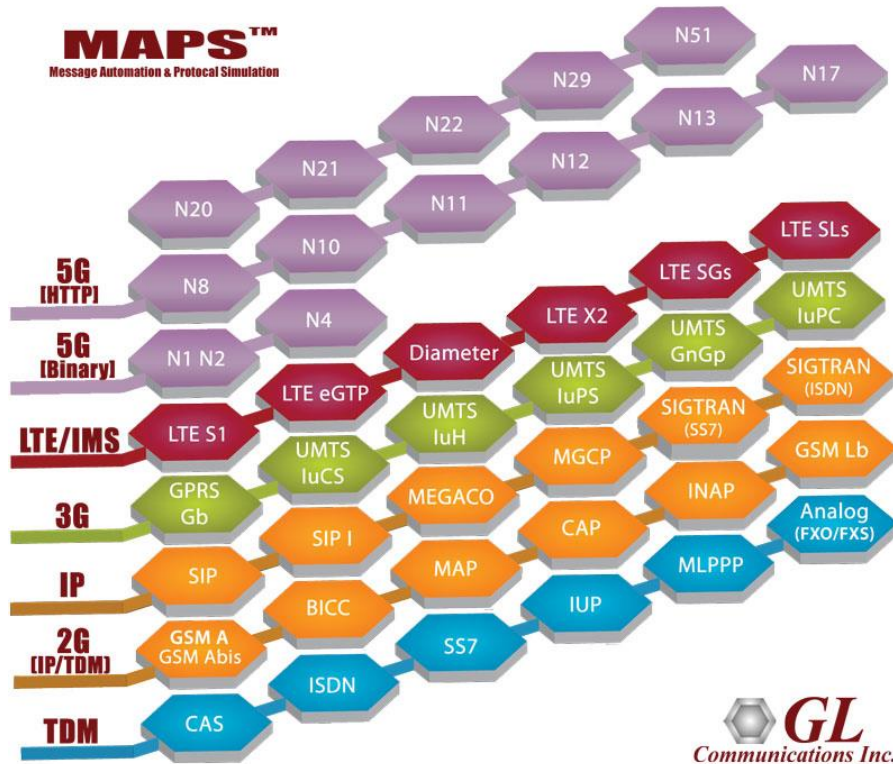
- End-to-End 5G Network Emulation
- MAPS™ 5GC network supports N1N2, N4, N8, N10, N11, N12, N13, N17, N20, N21, N22, N29, and N51 interfaces
- Emulates 5G - UE+gNB, AMF, SMF, AUSF, NSSF, AUSF, UDM, SMSF, NEF, EIR and UPF
- Features Functional Testing, Performance Testing, Inter-Operability Testing and Migration Testing
- Supports, advanced voice feature testing, such as IVR, Voice Recognition and Speech-to-Text
- Emulate Massive UEs (up to 64,000) with Voice Traffic
- Emulate User-plane GTP traffic at high line rates (up to 40 Gbps)
- Assess Voice Quality (eModel, PESQ, POLQA) Supports Control plane signaling and User plane traffic

Features (Contd.)

- Generate and process NGAP/NAS (valid and invalid) messages
- Supports customization of call flow and message templates using Script and Message Editor
- Supports scripted call generation and automated call reception
- Provides Call Statistics and Events Status
- Voice Quality, Data Retention, Lawful Interception, Fraud Detection
- Record thousands of Voice Calls - Filter & Record Only Calls-Of-Interest
- Capture up to 30,000 Simultaneous Voice Calls
- Supports Command Line Interface (CLI) using Python APIs

Message Automation and Protocol Simulation (MAPS™)

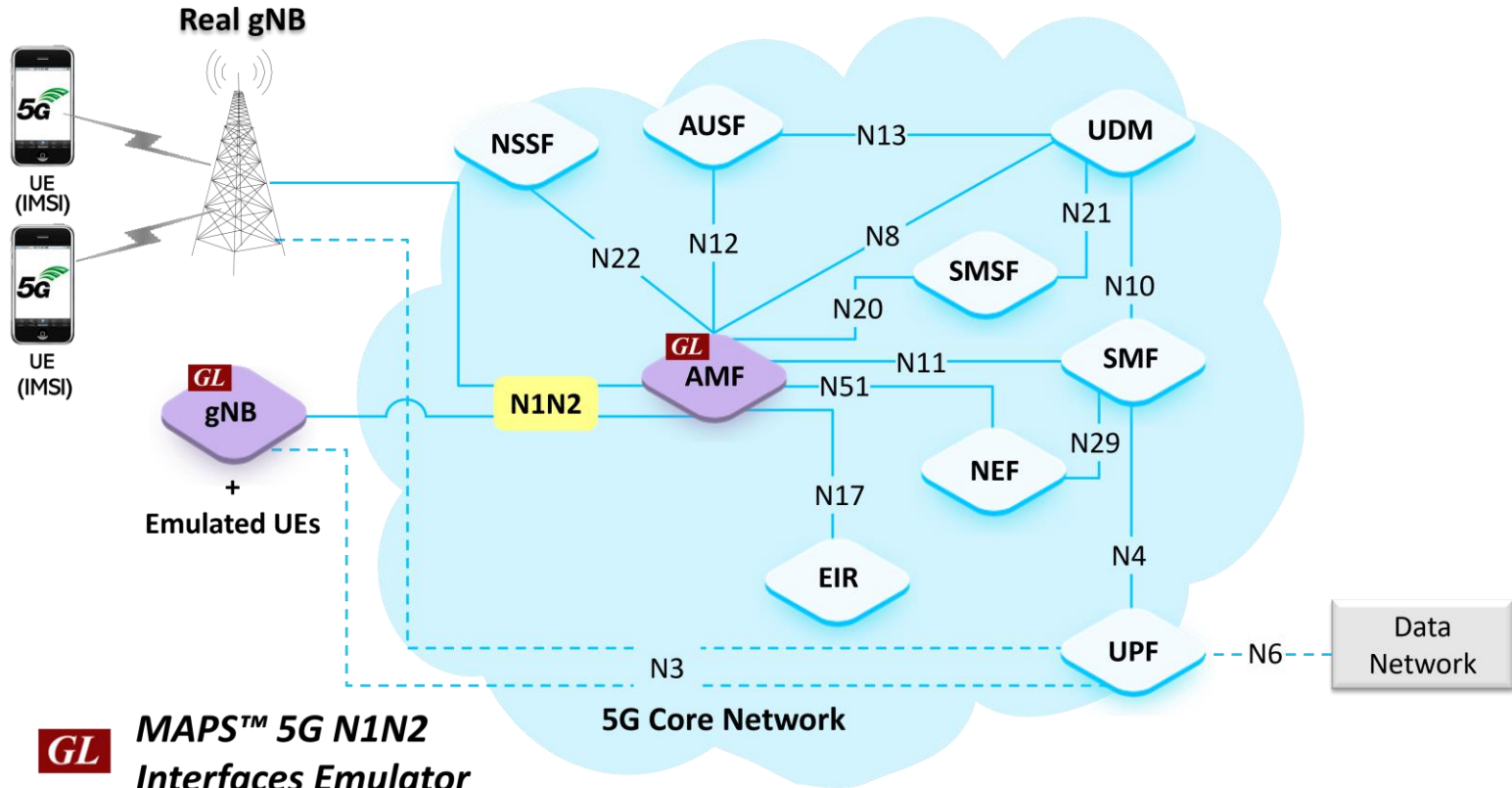
About MAPS™



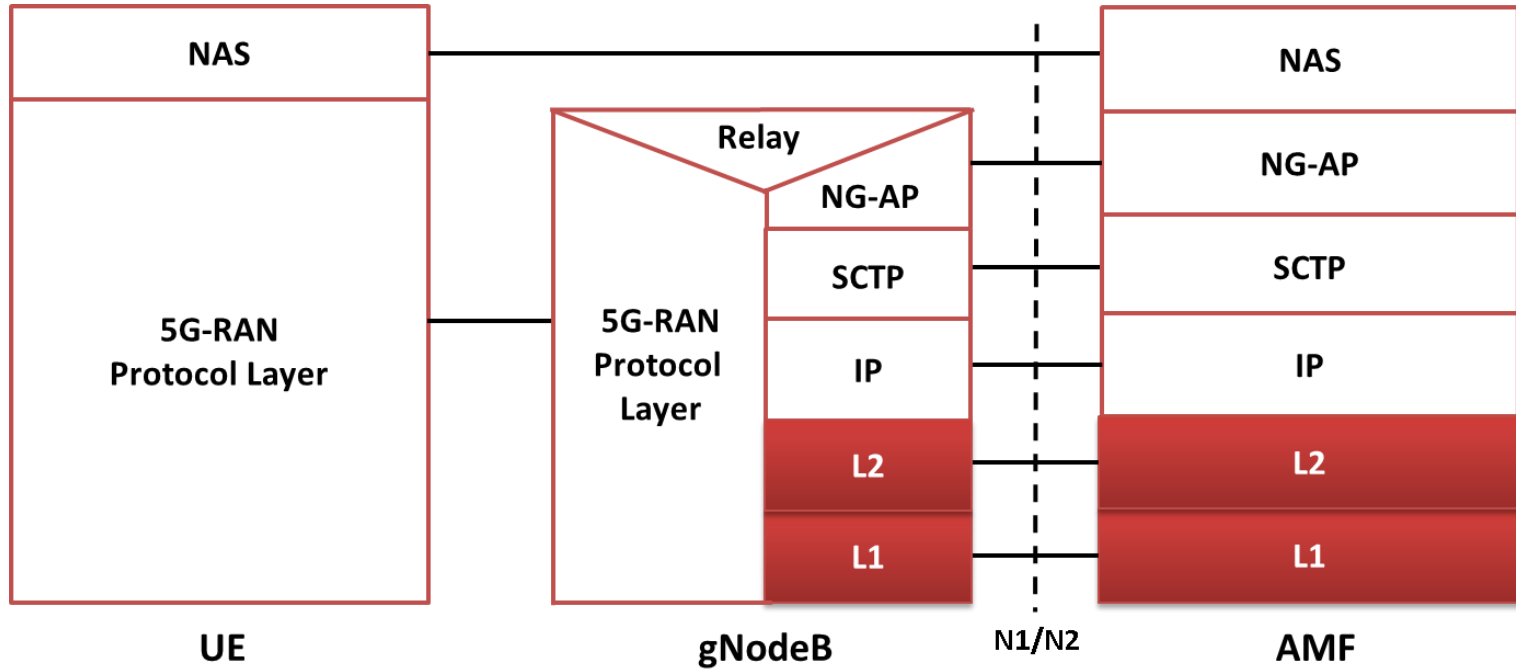
- **MAPS** stands for Message Automation and Protocol Simulation
- It is a generic framework for the generation of telecommunications protocol messages and transmission of bearer traffic
- **MAPS™** is built on a proprietary scripting language developed by GL Communications
- All **MAPS™** products come with out-of-the-box scripts that act as fully functional state machines for the relevant protocol

MAPS™ 5G N1 N2 Interface Emulation

MAPS™ 5G N1 N2 Interface Network Architecture



Protocol Stack Specification



Protocol Stack Specification (Contd.)

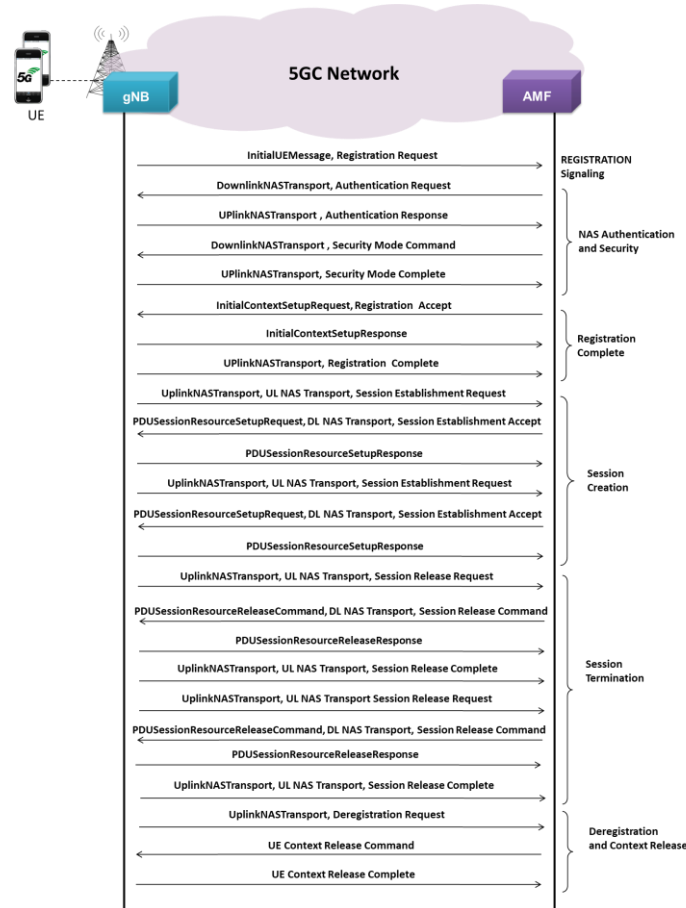
Supported Protocols	Standard / Specification Used
N1N2 Interface	
System Architecture for the 5G	3GPP TS 23.501 (Release 17)
Non-Access-Stratum (NAS)	3GPP TS 24.501 (Release 17)
NG Application Protocol (NGAP)	3GPP TS 38.413 (Release 17)
GPRS Tunneling Protocol for User Plane (GTP-U)	3GPP TS 29.281 (Release 17)
SCTP	RFC 2960

- NG Application Protocol (NGAP): Application Layer Protocol between the gNodeB and the AMF
- SCTP for the control plane (SCTP): This protocol guarantees delivery of signaling messages between AMF and gNodeB (N1N2). SCTP is defined in RFC 2960

MAPS™ 5G N1 N2 Interface Call Procedures

- UE Registration Signalling
 - Initial UE Message
 - Downlink NAS Transport
 - Uplink NAS Transport
 - Registration Procedure
 - Authentication Procedure
 - Security Mode Procedure
 - PDN Connectivity Request
 - Initial Context Setup Procedure
- Session Establishment Procedure
 - Session Establishment Request
 - Session Establishment Accept
- Session Release Procedure
 - Session Release Request
 - Session Release Command
 - Session Release Complete
- Deregistration procedures
 - Deregistration Request
 - Deregistration Accept
- UE Context Release Procedure
 - UE Context Release Command
 - UE Context Release Complete

MAPS™ 5G N1 N2 Interface Call Scenarios



MAPS™ 5G N1N2 Interface – Call Generation

Call Generation (gNB)

The screenshot displays the MAPS gNB (N1N2 RELEASE17) - [Call Generation - CallGenDefault] interface. The top section shows a table of call generation results, and the bottom section shows a detailed message sequence diagram for a gNB 0 AMF 0.

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events Profile	Result	Total Iterations	Completed Iterations
1	5GNGAP_UESessionControl.gls	MSIN3012041631	TMSI_0x0FBD3D8IMSI_001013012	Start	UE CONTEXT RELEASED	Pass	Unknown	1	1
2	5GNGAP_UESessionControl.gls	MSIN3012041632		Start		Unknown	Unknown	1	0
3	5GNGAP_UESessionControl.gls	MSIN3012041633		Start		Unknown	Unknown	1	0
4	5GNGAP_UESessionControl.gls	MSIN3012041634		Start		Unknown	Unknown	1	0
5	5GNGAP_UESessionControl.gls	MSIN3012041635		Start		Unknown	Unknown	1	0

The bottom section shows a detailed message sequence diagram for a gNB 0 AMF 0. The diagram illustrates the sequence of messages between the gNB and the UE, including InitialUEMessage, DownlinkNASTransport, UplinkNASTransport, and PDUSessionResourceSetupRequest/Response. The right pane shows the corresponding NGAP Layer messages and their parameters, such as InitiatingMessage, ProcedureCode, and Value.

MAPS™ 5G N1N2 Interface – Call Reception

Call Reception (AMF)

MAPS AMF (N1N2 RELEASE17) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Results
1	NGAPManagementHandler.gls		RANName: gnb000000001, gNBId: 0x10000001, ConnectorId: 1001	Stop	NG Setup Successful	SendAMFConfigurationUpdate		Pass
2	AMFSessionControl.gls		MSIN: 3012041631	Completed	UE CONTEXT RELEASED	None		Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash Show Hidden Calls

Save Column Width Show Latest

gNB 0 AMF

InitialUEMessage, Registration Request 16:50:59.752000

DownlinkNAS Transport, Authentication Request 16:50:59.821000

UplinkNAS Transport, Authentication Response 16:50:59.991000

DownlinkNAS Transport, Security Mode Command 16:51:00.006000

UplinkNAS Transport, Security Mode Complete 16:51:00.188000

InitialContextSetupRequest, Registration Accept 16:51:00.210000

InitialContextSetupResponse 16:51:00.390000

UplinkNAS Transport, Registration Complete 16:51:00.395000

UplinkNAS Transport, UL NAS Transport, Session Establishment Request 16:51:00.400000

PDU Session Resource Setup Request, DL NAS Transport, Session Establishment Accept 16:51:00.423000

PDU Session Resource Setup Response 16:51:00.590000

UplinkNAS Transport, UL NAS Transport, Session Establishment Request 16:51:00.596000

PDU Session Resource Setup Request, DL NAS Transport, Session Establishment Accept 16:51:00.606000

PDU Session Resource Setup Response 16:51:00.690000

UplinkNAS Transport, UL NAS Transport, Session Release Request 16:52:00.763000

PDU Session Resource Release Command, DL NAS Transport, Session Release Command 16:52:00.809000

PDU Session Resource Release Response 16:52:00.884000

UplinkNAS Transport, UL NAS Transport, Session Release Complete 16:52:00.984000

UplinkNAS Transport, UL NAS Transport, Session Release Request 16:52:00.988000

PDU Session Resource Release Command, DL NAS Transport, Session Release Command 16:52:00.989000

PDU Session Resource Release Response 16:52:01.085000

UplinkNAS Transport, UL NAS Transport, Session Release Complete 16:52:01.086000

Find

```
===== NGAP Layer =====
NGAP-PDU
InitiatingMessage
  ProcedureCode = 16 id-InitialUEMessage
  procedureCriticality = 0 reject(0)
  Value
    InitialUEMessage
      ProtocolIE-Container
        Item
          ProtocolIE-Field
            ProtocolIE-ID = 85 id-RAN-UE-NGAP-ID
            procedureCriticality = 0 reject(0)
            Value
              RAN-UE-NGAP-ID = 3
          Item
            ProtocolIE-Field
              ProtocolIE-ID = 38 id-RAS-PDU
              procedureCriticality = 0 reject(0)
              Value
                RAS-PDU
                  NAS-PDU
                    Value = n7E004171000D0100F110000000000321406
                    Item
                      ProtocolIE-Field
                        ProtocolIE-ID = 121 id-UserLocationInformation
                        procedureCriticality = 0 reject(0)
                        Value
                          UserLocationInformation
                            userLocationInformationNR = 1
                            nr-CGI
                              pLMNIdentity =
                                MCC = 001
                                MNC = 01
                                nRCellIdentity = 0000000000
                              tAI
                                pLMNIdentity =
                                  MCC = 001
                                  MNC = 01
                                  tAC = n000001
                                Item
                                  ProtocolIE-Field
                                    ProtocolIE-ID = 90 id-RRCEstablishmentCause
                                    procedureCriticality = 0 reject(0)
                                    Value
                                      RRCEstablishmentCause = 3 mo-Signalling(3)
                                Item
                                  ProtocolIE-Field
                                    ProtocolIE-ID = 3 id-AMFSetID
                                    procedureCriticality = 0 reject(0)
```

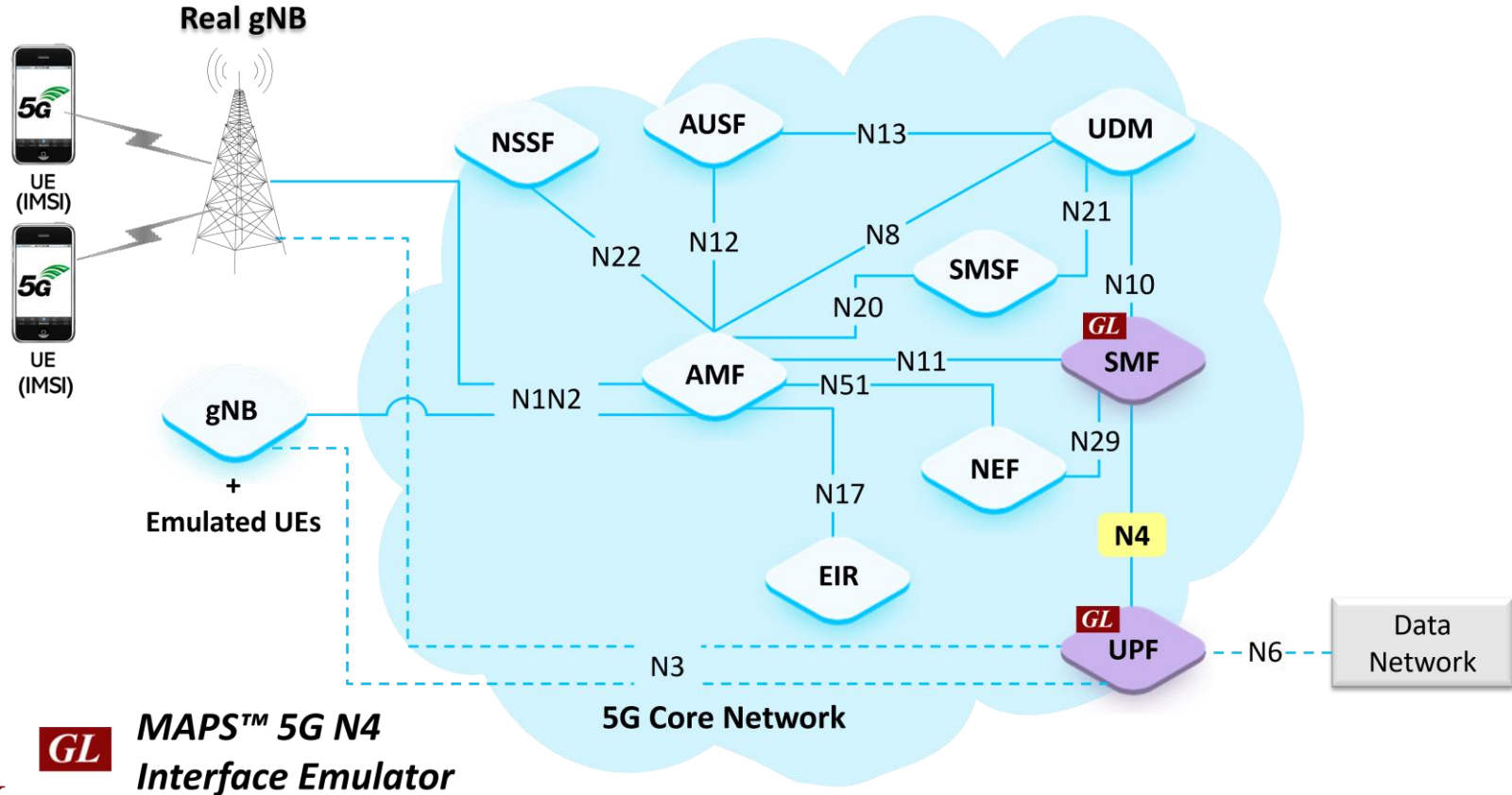
Activate Windows
Go to Settings to activate Windows.

Scripts Message Sequence Event Config Script Flow

Initialisation Errors Error Events Captured Errors Link Status Up=1 Down=0

MAPS™ 5G N4 Interface Emulation

MAPS™ 5G N4 Network Architecture



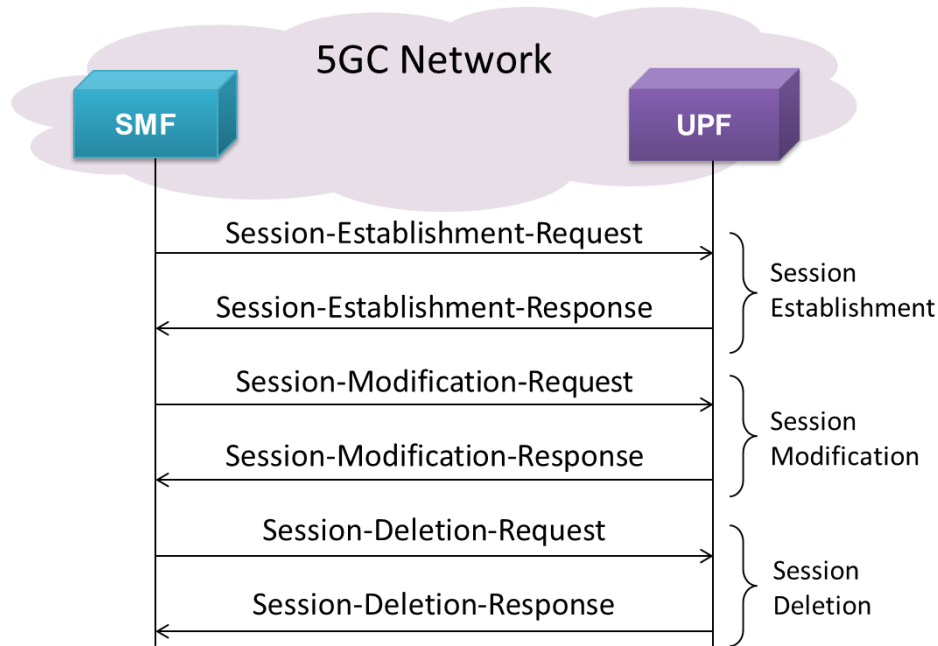
Protocol Stack Specification

PFCP
UDP
IP
L2
L1

Supported Protocols	Standard / Specification Used
N4 Interface	
N4 Interface (SMF - UPF)	TS29.244
PFCP	3GPP TS 23.501 (Release 17) 3GPP TS 23.502 (Release 17)
UDP	IETF RFC 768
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

- PFCP entity supports IPv4 protocol

MAPS™ 5G N4 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 Interface – Call Emulation

Call Generation

MAPS SMF (N4 RELEASE17) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Exec...	Status	Events	Events Profile	Result	Total Itera...	Completed Iterations
1	PFCPSessionControl.gls	Profile	SMFSEID : 0x03, UPFSEID : 0x00000000000002712	Start	SESSION-TERMINATED	None		Pass	1	1
2	PFCPSessionControl.gls			Start		None		Unknown	1	0
3	PFCPSessionControl.gls			Start		None		Unknown	1	0
4	PFCPSessionControl.gls			Start		None		Unknown	1	0

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

Save Column Width Show Latest

SMF UPF

Session Establishment Request 10:13:43.633000

Session Establishment Response 10:13:43.649000

Session Modification Request 10:13:43.649000

Session Modification Response 10:13:43.671000

Session Deletion Request 10:13:46.463000

Session Deletion Response 10:13:46.483000

Scripts Message Sequence Event Config Script Flow

Initialisation Errors Error Events

Call Reception

MAPS UPF (N4 RELEASE17) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Results
1	UPF_HTTP2_Connection_Monitor.gls		UPF Server Clients : UPF,	Stop	Monitoring HTTP2 Connection Status	None		Unknown
2	NRF_ResourceMonitor.gls		ConnectionID : 1	Stop		None		Unknown
3	PFCPManagementHandler.gls			Stop	Heartbeat Success	None		Pass
4	UPFSessionControl.gls		UEIPAddress : 192.168.15.141, SMFSEID : 0x00000000	Completed	Session Deletion Response Sent	None		Pass
5	UPFSessionControl.gls		UEIPAddress : 192.168.15.142, SMFSEID : 0x00000000	Completed	Session Deletion Response Sent	None		Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash Show Hidden Calls

Save Column Width Show Latest

SMF UPF

Session Establishment Request 10:13:43.640000

Session Establishment Response 10:13:43.641000

Session Modification Request 10:13:43.659000

Session Modification Response 10:13:43.659000

Session Deletion Request 10:13:46.473000

Session Deletion Response 10:13:46.473000

Scripts Message Sequence Event Config Script Flow

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

Find

0000 S =1 SEID field is present

0000 Message Priority: =1. Present

0000 FO (Follow On) =0.. Not Present

0000 Spare =00... (0)

0000 Version = 001..... PFCP Version 1

0001 Message Type = 00110010 Session Establishment Req

0002 Length = 156 (x009C)

0004 Session Endpoint Identifier = x0000000000000000

000C Sequence Number = 0 (x00000000)

000F Spare =0000 (0)

000F Message Priority = 0000.... (0)

0010 Information Element Id = x003C Node ID

0012 Length = 5 (x0005)

0014 Node ID Type =0000 IPv4 address

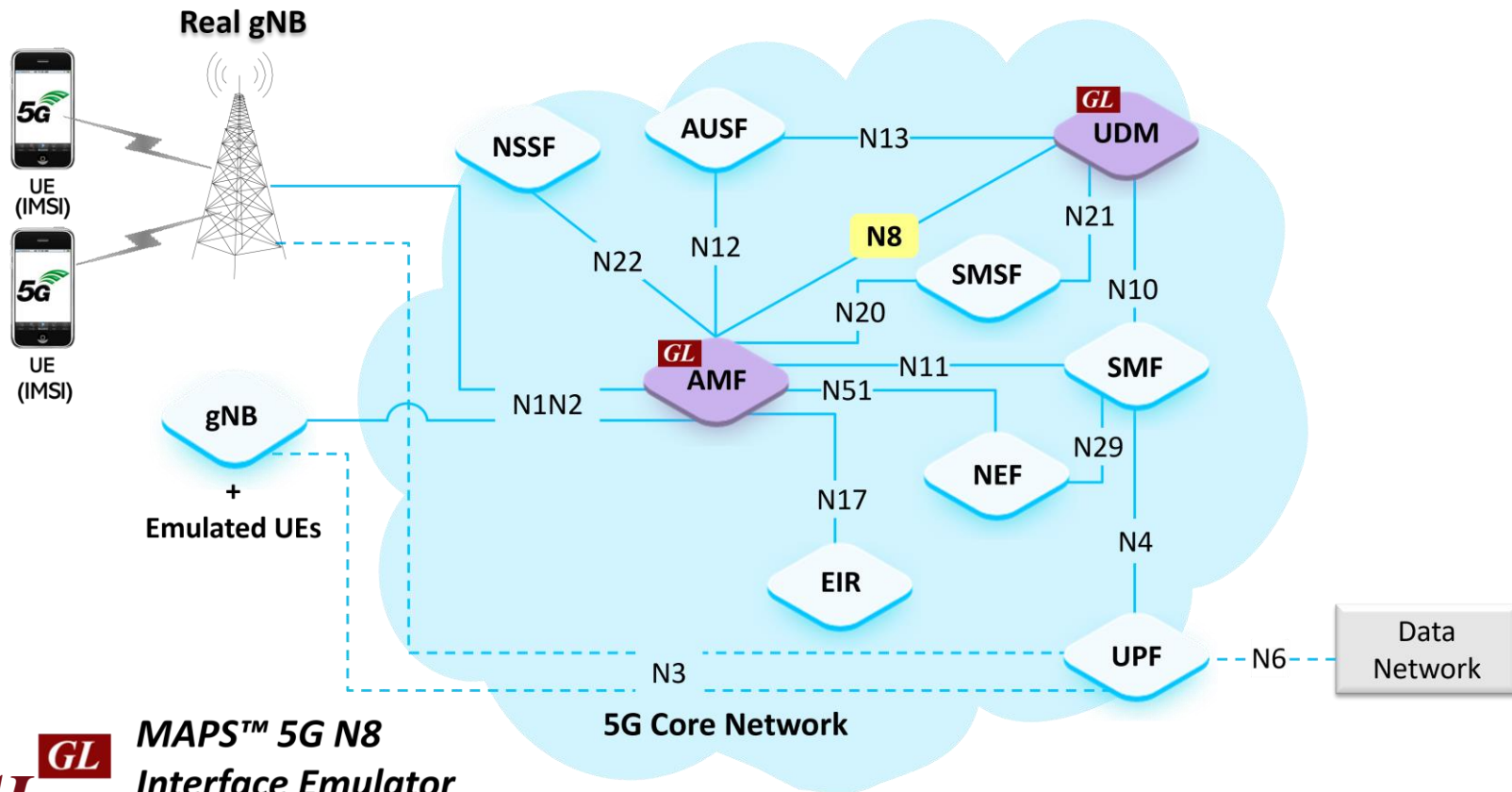
0014 Spare = 0000.... (0)

0015 IPv4 Address = 192.168.12.89 (x0A80C59)

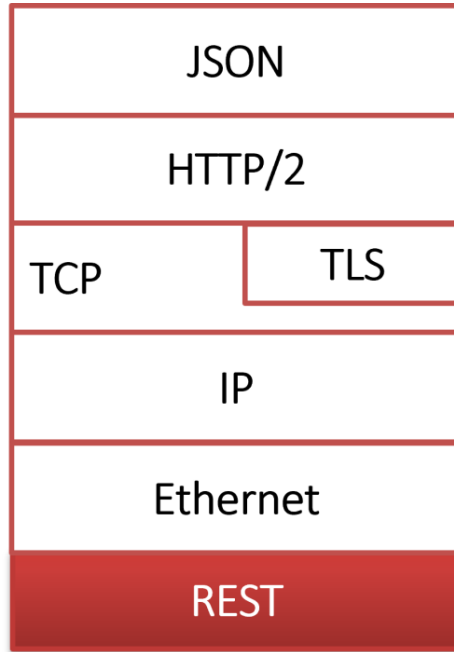
CP F-SEID =

MAPS™ 5G N8 Interface Emulation

MAPS™ 5G N8 Network Architecture



Protocol Stack Specification



Supported Protocols	Standard / Specification Used
N8 Interface	
N8 Interface (UDM - AMF)	TS29.503
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP	IETF RFC 7231
HTTP / 2	IETF RFC 7540/RFC 7541
TLS	IETF RFC 8446
TCP	IETF RFC 793
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

MAPS™5G N8 Interface Procedures

- Nudm_UEContextManagement Service
 - AMF registration for 3GPP access
 - Update AMF registration for 3GPP access
 - AMF deregistration for 3GPP access
 - UDM Initiated NF(AMF) Deregistration for 3GPP access
 - AMF registration for Non 3GPP access
 - Update AMF registration for Non 3GPP access
 - AMF deregistration for Non 3GPP access
 - UDM Initiated NF(AMF) Deregistration for NON 3GPP Access
 - UDM initiated P-CSCF-Restoration
- Nudm_SubscriberDataManagement Service
 - Slice Selection Subscription Data Retrieval
 - Access and Mobility Subscription Data Retrieval
 - SMF Selection Subscription Data Retrieval
 - SMS Subscription Data Retrieval
 - Retrieval Of Multiple Data Sets
 - UE Context in SMF Data Retrieval
 - UE Context In SMSF Data Retrieval
 - LCS Mobile Originated Data Retrieval
 - Subscription to notifications of data change
 - Modification of a subscription to notifications of data change
 - Unsubscribe to notifications of data change

MAPS™ 5G N8 Interface – Call Emulation

Call Generation

MAPS AMF (N8 RELEASE17) - [Call Generation -Default]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Ev...	Result	Total It...	Completed Iterations
1	Nudm_UECM_Control.gls	UEProfile0001	SUPI :imsi-001013012041631	Start	AMF Registration is successful	None		Pass	1	1
2	Nudm_SDM_Control.gls	UEProfile0001		Start		None		Unknown	1	0

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

Save Column Width Show Latest

AMF UDM

PUT /nudm-uecm/v1/imsi-001013012041631/registrations/amf-3gpp-access 15.49.58.596000

201 CREATED 15.49.58.979000

Scripts Message Sequence Event Config Script Flow

Initialisation Errors

Call Reception

MAPS UDM (N8 RELEASE17) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Results
1	UDM_HTTP2_Connection_Monitor.gls		UDM Server Clients : AMF	Stop	Monitoring HTTP2 Connection Status	None		Unknown
2	Nudm_UECM_Control.gls		SUPI :imsi-001013012041631	Completed	AMF Registration is updated	None		Pass
3	Nudm_SDM_Control.gls		SUPI :imsi-001013012041631	Completed	Successful Response Sent	None		Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash

Save Column Width Show Latest

AMF UDM

PUT /nudm-uecm/v1/imsi-001013012041631/registrations/amf-3gpp-access 15.49.58.961000

201 15.49.58.970000

Status: 3

method : PUT

path : /nudm-uecm/v1/imsi-001013012041631/registrations/amf-3gpp-access

scheme : http

authority : 192.168.12.198:6666

content-type : application/json

accept : application/json, application/problem+json

content-length : 317

{

"amfInstanceId": "f19d267b-dd40-4276-b396-92437d45c35e",

"deregCallbackUri": "http://192.168.12.170:6666/nudm-uecm/v1/imsi-001013012041631/registrations/amf-3gpp-access"

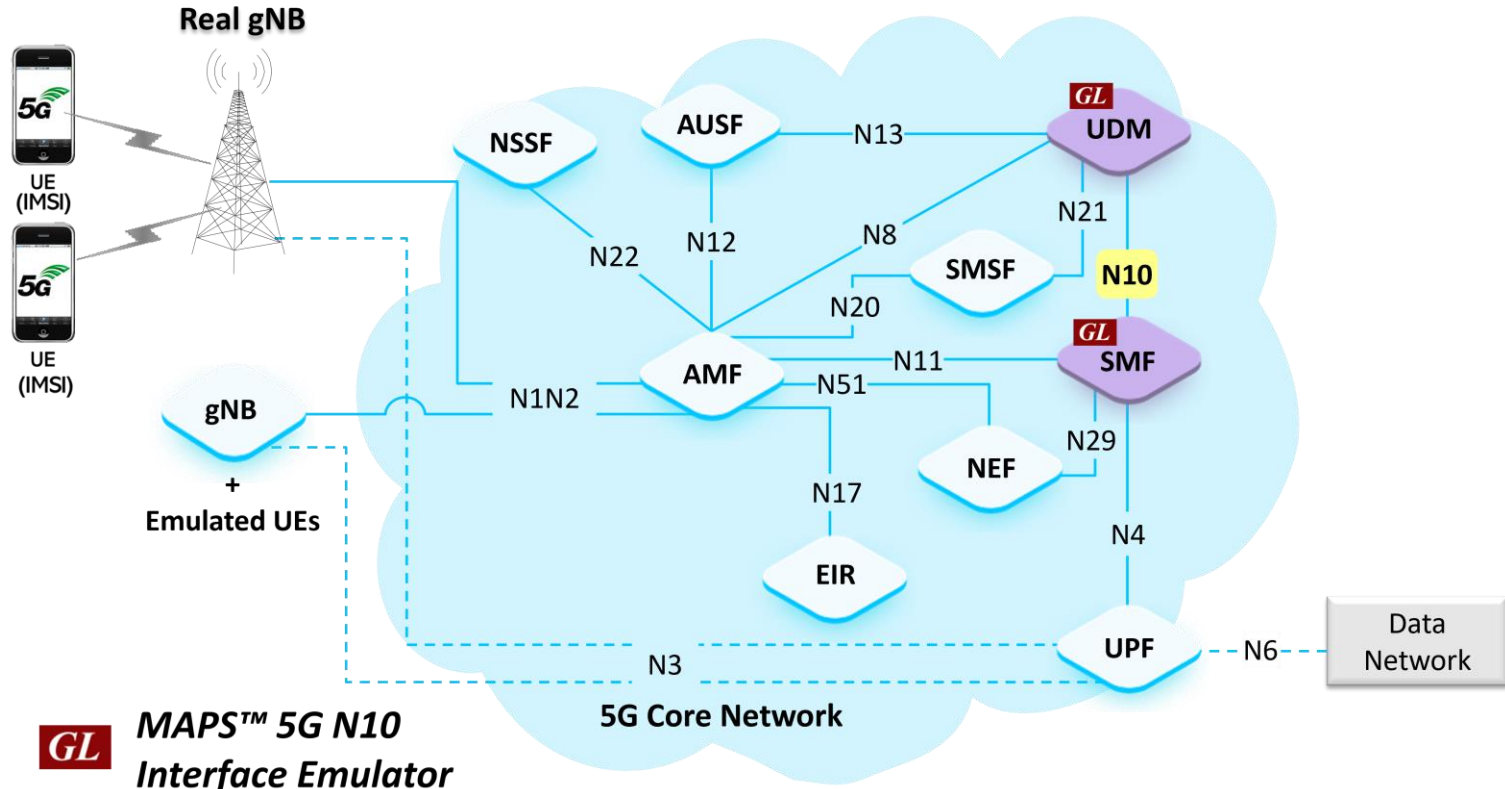
}

Scripts Message Sequence Event Config Script Flow

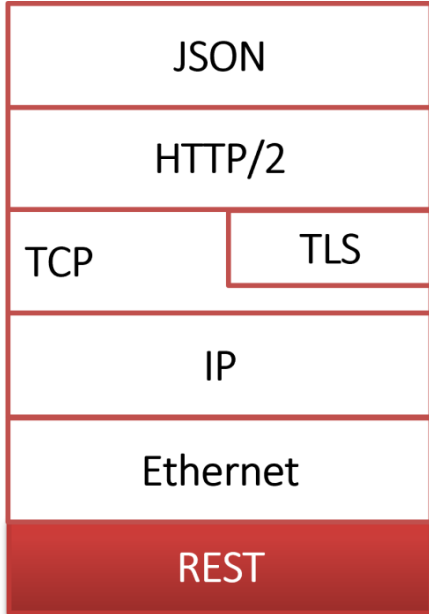
Initialisation Errors Error Events Captured Errors Link Status Up=0 Down=0

MAPS™ 5G N10 Interface Emulation

MAPS™ 5G N10 Network Architecture



Protocol Stack Specification



Supported Protocols	Standard / Specification Used
N10 Interface	
N10 Interface (UDM - SMF)	TS29.503 Release 15
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP / 2	IETF RFC 7231 IETF RFC 7540/RFC 7541
TLS	IETF RFC 8446
TCP	IETF RFC 793
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

MAPS™ 5G N10 Interface Procedures

- Nudm_SubscriberDataManagement Services:
 - Session Management Subscription Data Retrieval
 - Subscription to Notifications of Data Change
 - Modification of a subscription to notifications of data change
 - Unsubscribe to notifications of data change
- Nudm_UEContextManagement Services:
 - SMF registration
 - SMF deregistration
 - SMF Deregistration Notification
 - UDM Initiated P-CSCF-Restoration Notification

MAPS™ 5G N10 Interface - Call Emulation

Call Generation

MAPS SMF (N10 RELEASE17) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Result	Total It...	Completed Iterations
1	Nudm_UECM_Control.gls	UEProfile0001	SUPI : jmsi-001013012041631	Start	SMF Registration is successful	None	Pass	1	1
2	Nudm_SDM_Control.gls	UEProfile0001	SUPI : jmsi-001013012041631	Start	UE's SM Data Received	None	Pass	1	1

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

Save Column Width Show Latest

SMF UDM

GET /nudm-sdm/v2/jmsi-001013012041631/sm-data?dn=internet 12:36:33.716000

200 OK 12:36:34.111000

Scripts Message Sequence Event Config Script Flow

Call Reception

MAPS UDM (N10 RELEASE17) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Results
1	UDM_HTTP2_Connection_Monitor.gls		UDM Server Clients : SMF,	Stop	Monitoring HTTP2 Connection Status	None		Unknown
2	Nudm_UECM_Control.gls		SUPI : jmsi-001013012041631	Completed	SMF Registration is updated	None		Pass
3	Nudm_SDM_Control.gls		SUPI : jmsi-001013012041631	Completed	Successful Response Sent	None		Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash

Save Column Width Show Latest

SMF UDM

GET /nudm-sdm/v2/jmsi-001013012041631/sm-data 12:36:34.092000

200 12:36:34.104000

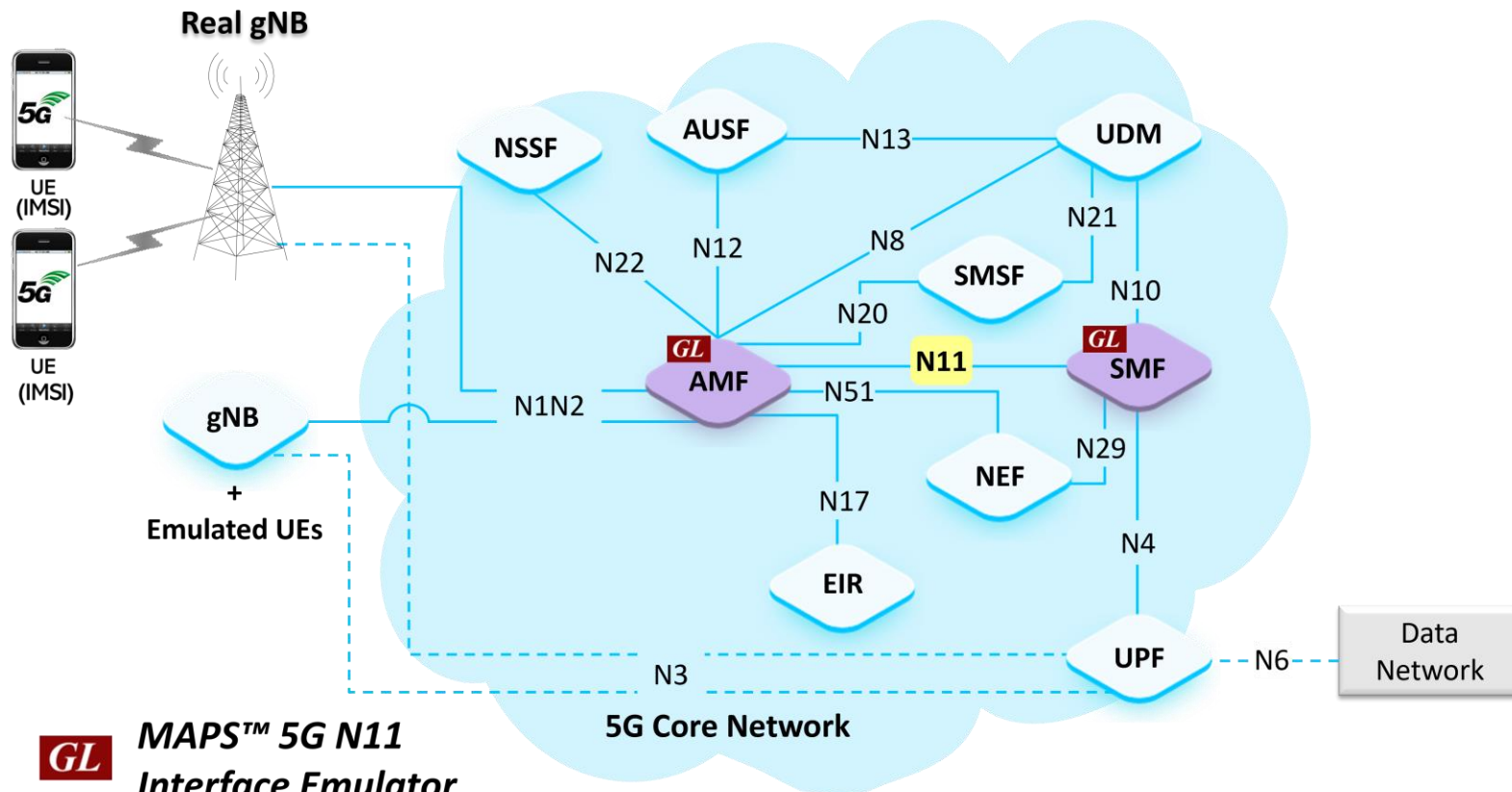
Status: 0
:method : GET
:path : /nudm-sdm/v2/jmsi-001013012041631/sm-data?dn=internet
:scheme : http
:authority : 192.168.12.198:6666
accept : application/json,
application/problem+json

Scripts Message Sequence Event Config Script Flow

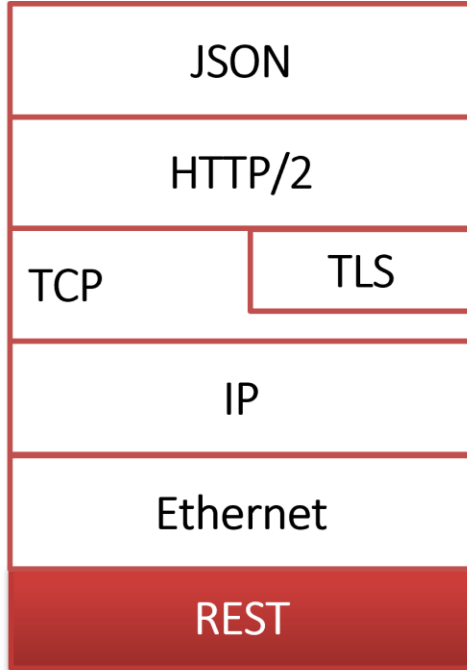
Initialisation Errors Error Events Captured Errors Link Status

MAPS™ 5G N11 Interface Emulation

MAPS™ 5G N4 Network Architecture



Protocol Stack Specification



Supported Protocols	Standard / Specification Used
N11 Interface (SMF - AMF)	TS29.502 (Release 17)
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP / 2 (Hypertext Transfer Protocol)	3GPP TR 21.905 (Release 17) IETF RFC 7540 IETF RFC 7232 IETF RFC 7234
TCP	IETF RFC 793
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

MAPS™ 5G N11 Interface Procedures

- Nsmf_PDUSession Services
 - Create SM Context Service Operation
 - Update SM Context Service Operation
 - Release SM Context Service Operation
 - Notify SM Context Status Service Operation
 - Retrieve SM Context Service Operation
- Nudm_UEContextManagement Service
 - Network triggered Service Request
 - PDU Session establishment
 - PDU Session modification
 - PDU Session release
 - Session continuity, service continuity and UP path management
 - Inter NG-RAN node N2 based handover
 - SMS over NAS procedures
 - UE assisted and UE based positioning procedure
 - Network assisted positioning procedure
 - UE configuration update procedure for transparent UE policy delivery

MAPS™ 5G N11 Interface - Call Emulation

Call Generation

MAPS AMF (N11 RELEASE17) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Result	Total Iterations	Completed Itera
1	Namf_Session_Control.gls	MSIN3012041631	imsi-001013012041631	Start	SM Context Released	None	Pass	1	1
2	Namf_Session_Control.gls	MSIN3012041632		Start		None	Unknown	1	0

AMF SMF

POST /nsmf-pdusession/v1/sm-contexts 16:18:53.008000

201 CREATED 16:18:53.707000

POST /namf-comm/v1/ue-contexts/imsi-001013012041631_2/n1-n2-messages 16:18:53.818000

200 16:18:53.818000

POST /nsmf-pdusession/v1/sm-contexts/imsi-001013012041631_2/modify 16:18:53.916000

201 CREATED 16:18:53.951000

POST /nsmf-pdusession/v1/sm-contexts/imsi-001013012041631_2/release 16:19:52.760000

204 NO-CONTENT 16:19:52.793000

Scripts Message Sequence Event Config Script Flow

Initialisation Errors Error Events

Call Reception

MAPS SMF (N11 RELEASE17) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Results
1	SMF_HTTP2_Connection_Monitor.gls		SMF Server Clients : AMF,	Stop		Connect Server	Unknown
2	Namf_Session_Control.gls		SUPIorGPSI:imsi-001013012041631, DNN :internet	Completed	SM Context Released	None	Pass

AMF SMF

POST /nsmf-pdusession/v1/sm-contexts 16:18:53.567000

201 16:18:53.699000

POST /namf-comm/v1/ue-contexts/imsi-001013012041631_2/n1-n2-messages 16:18:53.791000

200 OK 16:18:53.825000

POST /nsmf-pdusession/v1/sm-contexts/imsi-001013012041631_2/modify 16:18:53.930000

201 16:18:53.946000

POST /nsmf-pdusession/v1/sm-contexts/imsi-001013012041631_2/release 16:19:52.771000

204 16:19:52.783000

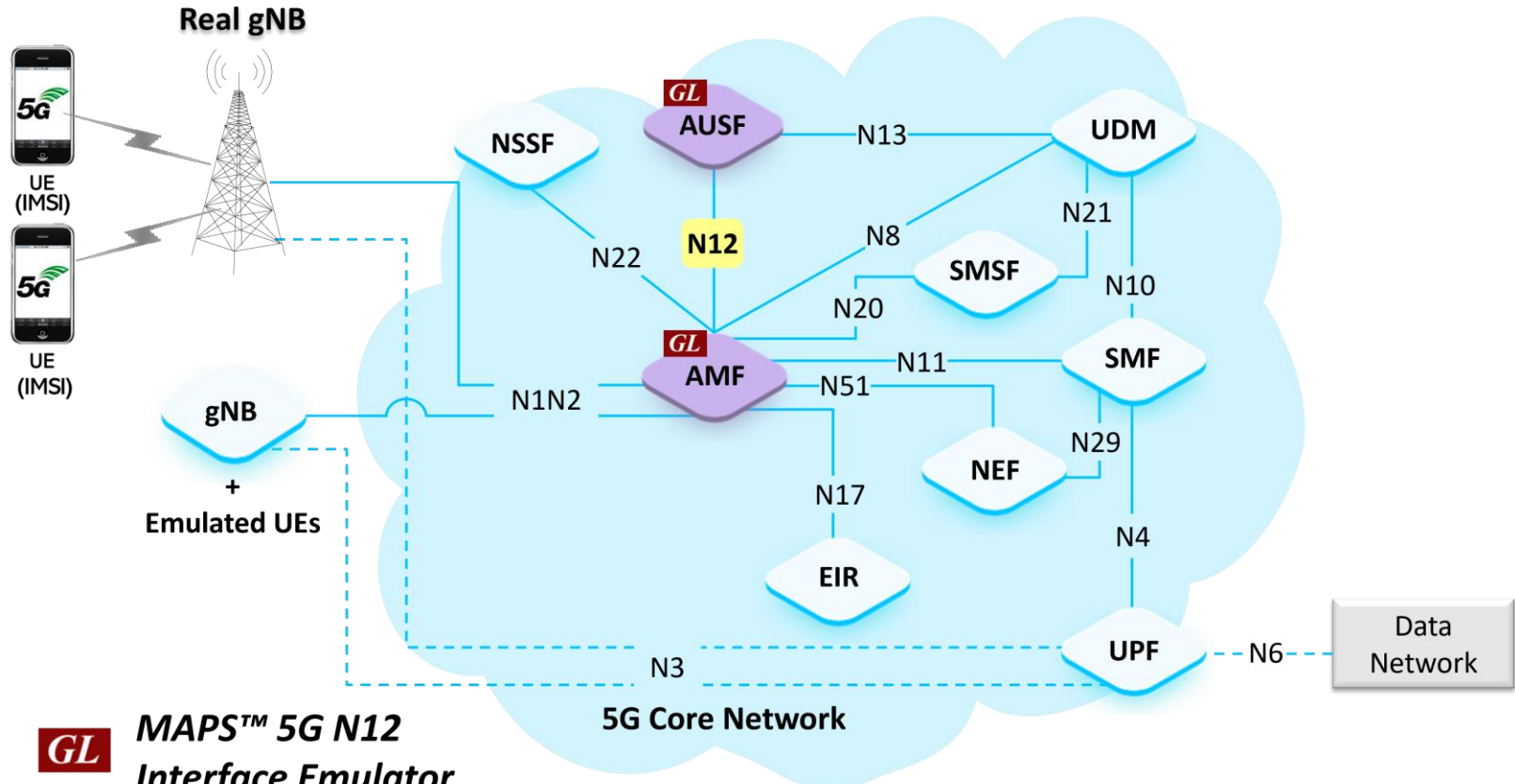
Status: 1
:method: POST
:path: /nsmf-pdusession/v1/sm-contexts
:scheme: http
:authority: 192.168.12.198:6666
accept: application/json,
application/vnd.3gpp.ngap,
application/problem+json
content-type: multipart/related; boundary="8F8924ea47d23c14b"
mime-version: 1.0
content-length: 642
--"8F8924ea47d23c14b86"
Content-Type: application/json
{
"anType": "3GPP_ACCESS",
"dnn": "internet",
"gpsi": "msisdn-3012041631",
"n1sMsg": {
"contentId": "5gnas-sm"
},
}

Scripts Message Sequence Event Config Script Flow

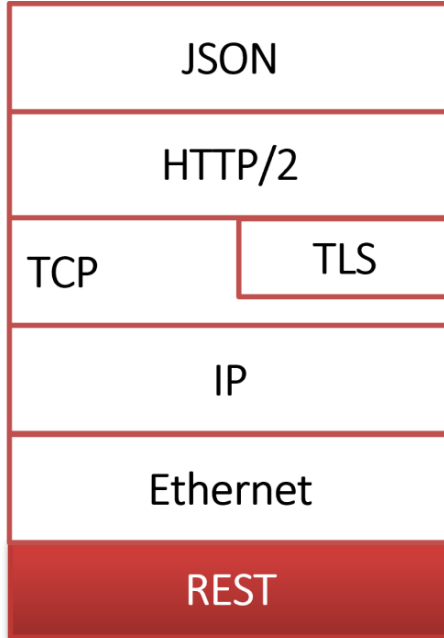
Initialisation Errors Error Events Captured Errors Link Sta

MAPS™ 5G N12 Interface Emulation

MAPS™ 5G N12 Interface



Protocol Stack Specification



Supported Protocols	Standard / Specification Used
N12 Interface	
N12 Interface (AUSF - AMF)	TS29.509
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP/2	IETF RFC 7231 IETF RFC 7540/RFC 7541
TLS	IETF RFC 8446
TCP	IETF RFC 793
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

MAPS™ 5G N12 Interface Procedures

- Nausf_UEAuthentication (Authentication and Key Agreement)
- Authentication Result Removal with 5G AKA method

MAPS™ 5G N12 Interface - Call Emulation

Call Generation

GL MAPS AMF (N12 RELEASE17) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr...	Script Name	Profile	Call Info	Script Execu...	Status	Events	Events Profile	Result
1	Nausf_AMF_UEAuthentication_Request.gls	UEProfile0001	suci-0-001-01-0-0-0-3012041631	Start	Authentication Successful	None		Pass
2	Nausf_AMF_UEAuthentication_Request.gls	UEProfile0002		Start		None		Unknown
3	Nausf_AMF_UEAuthentication_Request.gls	UEProfile0003		Start		None		Unknown

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

Save Column Width Show Latest

AMF AUSF

POST /nausf-auth/v1/ue-authentications 16:19:10.834000

201 CREATED 16:19:10.859000

PUT /nausf-auth/v1/ue-authentications/AuthCtx_001013012041631/5g-ai 16:19:10.861000

200 OK 16:19:10.883000

Scripts Message Sequence Event Config Script Flow

Initialisation Errors Error Events

Call Reception

GL MAPS AUSF (N12 RELEASE17) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

SrNo	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Results
1	AUSF_HTTP2_Connection_Monitor.gls		AUSF Server Clients : AMF	Stop	Monitoring HTTP2 Connection Status	None		Unknown
2	Nausf_Control.gls		suci-0-001-01-0-0-0-3012041631	Completed	Authentication Vectors sent	None		Pass
3	Nausf_Control.gls		AuthCtx_001013012041631	Completed	5G_AKA_ConfirmationResponseSent	None		Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash

Save Column Width Show Latest

AMF AUSF

POST /nausf-auth/v1/ue-authentications 16:19:10.849000

201 16:19:10.850000

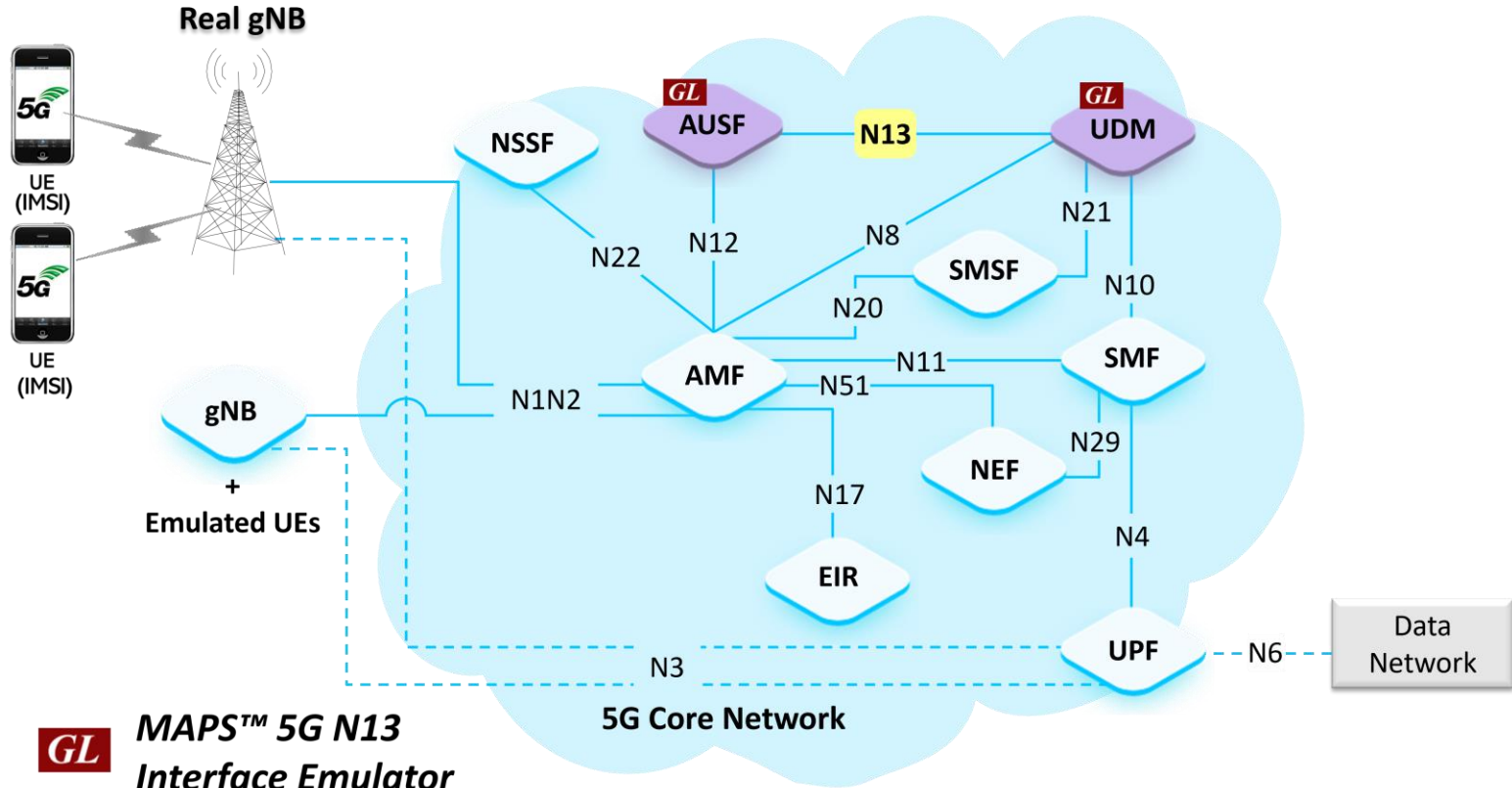
Status: 1
:method : POST
:path : /nausf-auth/v1/ue-authentications
:scheme : http
:authority : 192.169.12.37:6666
:content-type : application/json
:accept : application/3gpphal+json, application/problem+json
:content-length : 103
{
"servingNetworkName": "5G:mnc001.mcc001.3gppnetwork.org",
"supiOrSuci": "suci-0-001-01-0-0-0-3012041631"
}

Scripts Message Sequence Event Config Script Flow

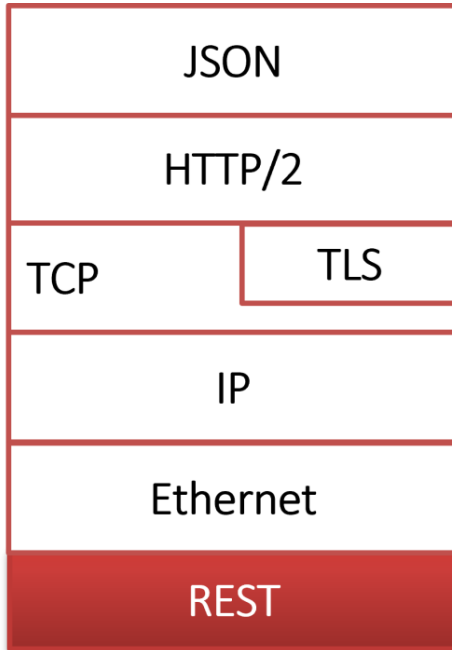
Initialisation Errors Error Events Captured Errors Link Status Up=0 Down

MAPS™ 5G N13 Interface Emulation

MAPS™ 5G N13 Interface



Protocol Stack Specification



Supported Protocols	Standard / Specification Used
N13 Interface	
N13 Interface (UDM - AUSF)	TS29.509
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP / 2	IETF RFC 7231 IETF RFC 7540/RFC 7541
TLS	IETF RFC 8446
TCP	IETF RFC 793
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

MAPS™ 5G N13 Interface Procedures

- Nudm_UEAuthentication Service
 - Authentication Information Retrieval
 - Authentication Confirmation
 - Authentication Result Removal

MAPS™ 5G N13 Interface - Call Emulation

Call Generation

MAPS AUSF (N13 RELEASE17) - [Call Generation - Default]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Result	Total Iterations	Completed Iterations
1	Nudm_UEAU_AUSF_Control.gls	UEProfile0001	suci-0-001-01-0-0-0-3012041631	Start	Authentication Successful	None	Pass	1	1
2	Nudm_UEAU_AUSF_Control.gls	UEProfile0002		Start		None	Unknown	1	0
3	Nudm_UEAU_AUSF_Control.gls	UEProfile0003		Start		None	Unknown	1	0
4	Nudm_UEAU_AUSF_Control.gls	UEProfile0004		Start		None	Unknown	1	0
5	Nudm_UEAU_AUSF_Control.gls	UEProfile0005		Start		None	Unknown	1	0

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

Save Column Width Show Latest

AUSF UDM

POST /nudm-ueau/v1/suci-0-001-01-0-0-0-3012041631/security-information/generate-auth-data 12:27:03.967000

200 OK 12:27:04.102000

POST /nudm-ueau/v1/imsi-001013012041631/auth-events 12:27:04.225000

201 CREATED 12:27:04.253000

Scripts Message Sequence Event Config Script Flow

Initialisation Errors Error Events

Call Reception

MAPS UDM (N13 RELEASE17) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Results
1	UDM_HTTP2_Connection_Monitor.gls		UDM Server Clients : AUSF	Stop	Monitoring HTTP2 Connection Status	None	Unknown
2	Nudm_UEAU_Control.gls		suci-0-001-01-0-0-0-3012041631	Completed	Authentication Vectors sent	None	Pass
3	Nudm_UEAU_Control.gls		imsi-001013012041631	Completed	Authentication Vectors sent	None	Pass
4	Nudm_UEAU_Control.gls		suci-0-001-01-0-0-0-3012041632	Completed	Authentication Vectors sent	None	Pass
5	Nudm_UEAU_Control.gls		imsi-001013012041632	Completed	Authentication Vectors sent	None	Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash

Save Column Width Show Latest

AUSF UDM

POST /nudm-ueau/v1/suci-0-001-01-0-0-0-3012041631/security-information/generate-auth-data 13:01:30.169000

200 13:01:30.171000

Status: 1
method : POST
path : /nudm-ueau/v1/suci-0-001-01-0-0-0-3012041631/security-info
scheme : http
authority : 192.168.1.20:6666
content-type : application/json
accept : application/json,
application/problem+json
content-length : 113

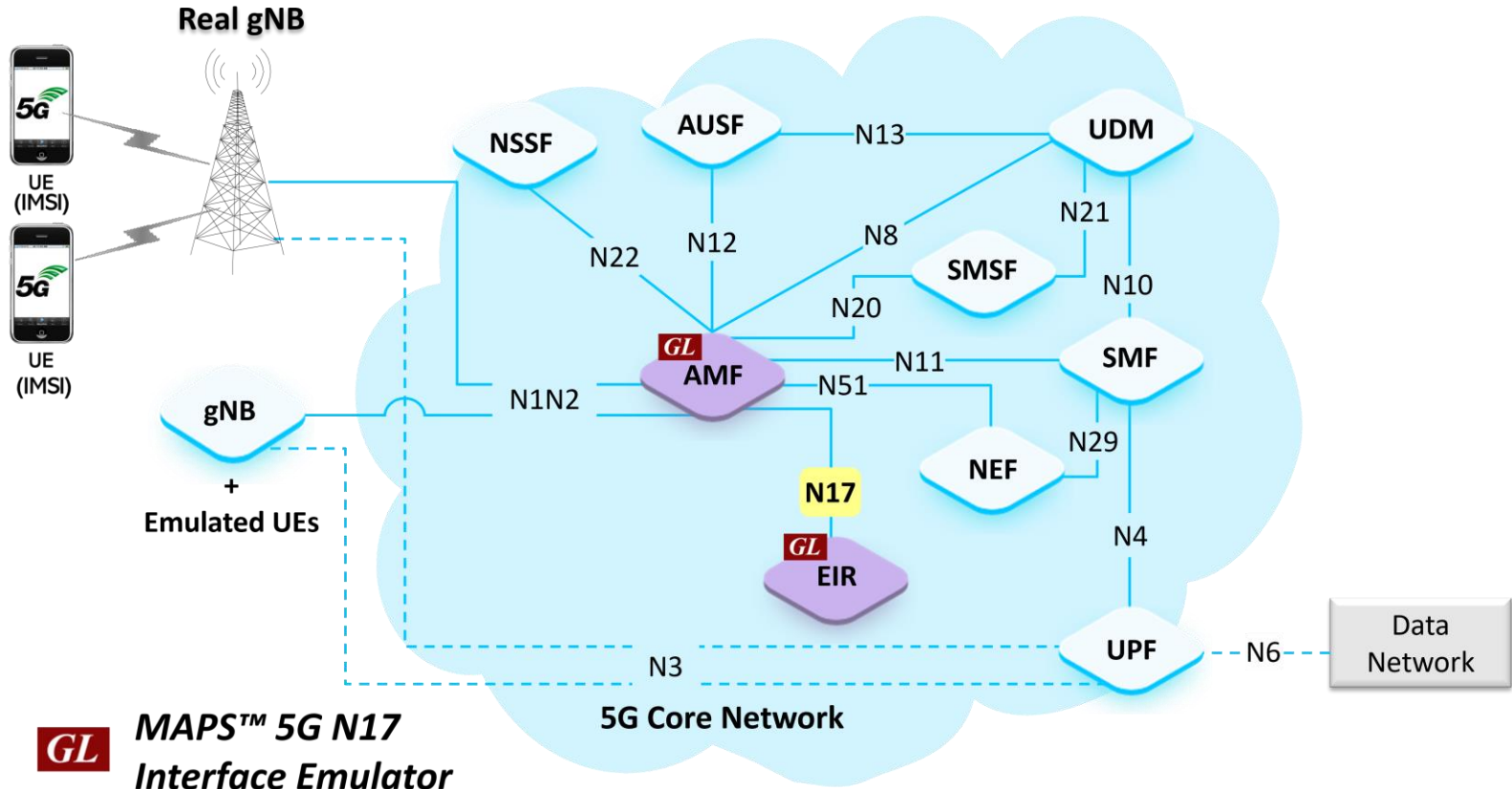
{
"ausfInstanceId": "7f54c042-7f58-4a44-b377-b8e48f0b7163",
"servingNetworkName": "SG:mnc001.mcc001.3gppnetwork.org"
}

Scripts Message Sequence Event Config Script Flow

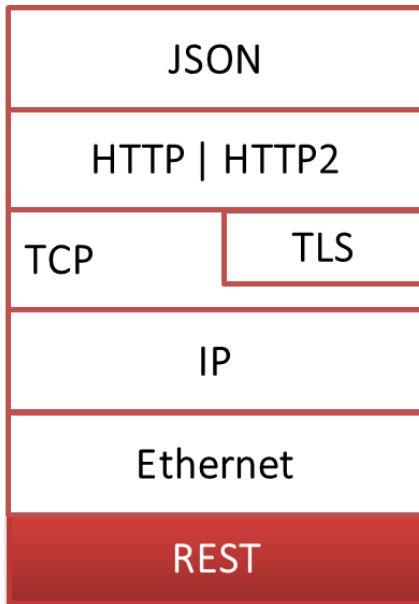
Initialisation Errors Error Events Captured Errors Link Status Up

MAPS™ 5G N17 Interface Emulation

MAPS™ 5G N17 Network Architecture



Protocol Stack Specification



Supported Protocols	Standard / Specification Used
N17 Interface (EIR)	3GPP TS 29.511 (Release 17)
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP HTTP / 2	IETF RFC 7231 IETF RFC 7540/RFC 7541
TLS	IETF RFC 8446
TCP	IETF RFC 793
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

MAPS™ 5G N17 Interface - Call Emulation

MAPS AMF (N17 RELEASE17) - [Call Generation -CallGenDefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Result	Total Iterations	Completed Iterations
1	N5g-eir_AMF_Control.gls	UEProfile0002	359877068325249	Start	WHITELISTED	None	Pass	1	1
2	N5g-eir_AMF_Control.gls	UEProfile0003		Start		None	Unknown	1	0
3	N5g-eir_AMF_Control.gls	UEProfile0004		Start		None	Unknown	1	0
4	N5g-eir_AMF_Control.gls	UEProfile0005		Start		None	Unknown	1	0

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

Save Column Width Show Latest

AMF EIR

GET /n5g-eir-eic/v1/equipment-status?pei=imei-359877068325249&gpsi=msisdn-3012041632 12:23:18.950000

200 OK 12:23:19.016000

Scripts Message Sequence Event Config Script Flow

Initialisation Errors

MAPS EIR (N17 RELEASE17) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Results
1	EIR_HTTP2_Connection_Monitor.gls		EIR Server Clients : AMF,	Stop	Monitoring HTTP2 Connection Status	None	Unknown
2	N5g-eir_Control.gls		imei-359877068325248	Completed	WHITELISTED	None	Pass
3	N5g-eir_Control.gls		imei-359877068325249	Completed	WHITELISTED	None	Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash

Save Column Width Show Latest

AMF EIR

GET /n5g-eir-eic/v1/equipment-status 12:44:56.405000

200 12:44:56.406000

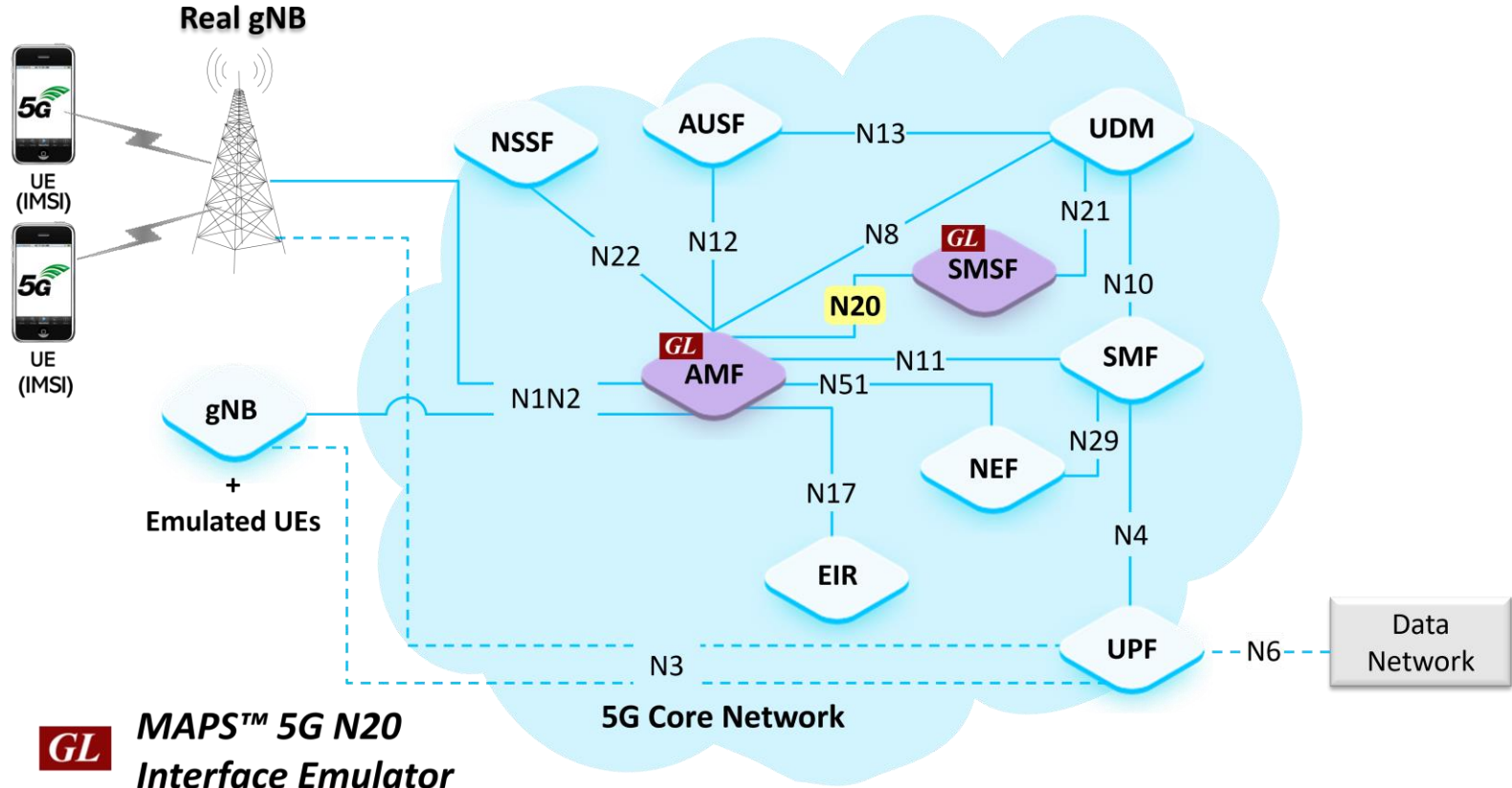
Status: 0
:method : GET
:path : /n5g-eir-eic/v1/equipment-status?pei=imei-359877068325248
:scheme : http
:authority : 192.168.12.29:6666
accept : application/json,
application/problem+json

Scripts Message Sequence Event Config Script Flow

Initialisation Errors Error Events Captured Errors

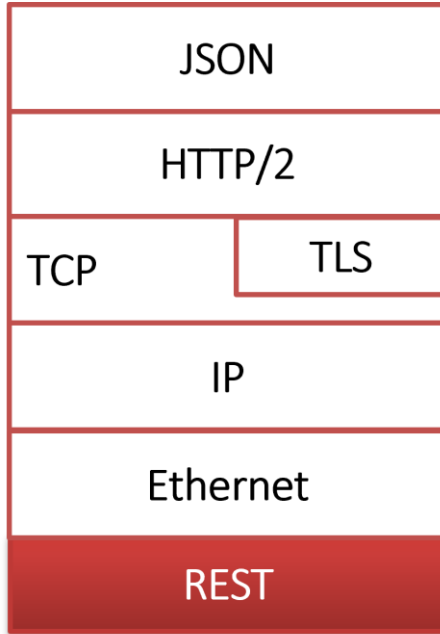
MAPS™ 5G N20 Interface Emulation

MAPS™ 5G N20 Network Architecture



MAPS™ 5G N20
Interface Emulator

Protocol Stack Specification



Supported Protocols	Standard / Specification Used
N20 Interface	
N20 Interface (SMSF - AMF)	TS29.540 TS29.518
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP HTTP / 2	IETF RFC 7231 IETF RFC 7540/RFC 7541
TLS	IETF RFC 8446
TCP	IETF RFC 793
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

MAPS™ 5G N20 Interface Procedures

- Nsmsf procedures
 - Registration using Activate service procedure
 - De-Registration using Deactivate service procedure
 - Send SMS payload in uplink direction procedure
 - Namf_Communication Service procedure

MAPS™ 5G N20 Interface - Call Emulation

Call Generation

MAPS AMF (N20 RELEASE17) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Executi...	Status	Events	Events Profile	Result	Total Iterations	Comp
1	Nsmf_AMF_SMSservice_Activation.gls	MSIN3012041631	imsi-001013012041631	Start	SMSservice Activation Successful	None		Pass	1	
2	Nsmf_AMF_Mo_SMS.gls			Start		None		Unknown	1	
3	Nsmf_AMF_SMSservice_Deactivation.gls			Start		None		Unknown	1	

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

Save Column Width Show Latest

AMF SMSF

PUT /nsmf-sms/v2/ue-contexts/imsi-001013012041631 11:07:37.660000

201 CREATED 11:07:37.956000

Scripts Message Sequence Event Config Script Flow

Call Reception

MAPS SMSF (N20 RELEASE17) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Results
1	SMSF_HTTP2_Connection_Monitor.gls		SMSF Server Clients :	Stop	Monitoring HTTP2 Connction Status	Connect Server		Unknown
2	SMSF_Control.gls		imsi-001013012041631	Completed	SM Service Activated	None		Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash Show Hidden Calls

Save Column Width Show Latest

AMF SMSF

PUT /nsmf-sms/v2/ue-contexts/imsi-001013012041631 11:07:37.931000

201 11:07:37.948000

Status: 201
content-type : application/json
location : https://192.168.1.31:7777/nsmf-sms/v2/ue-cont

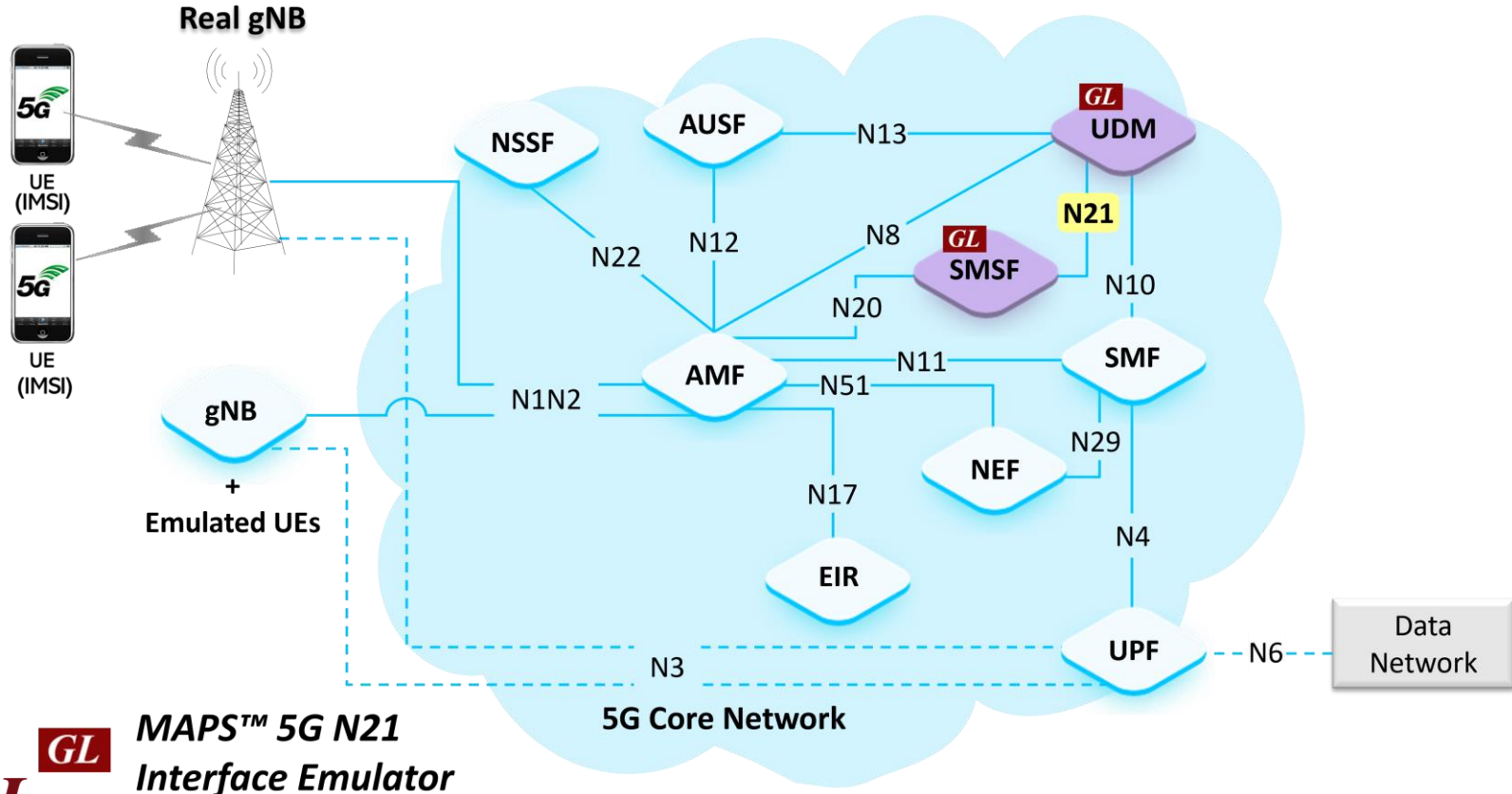
```
{
  "accessType": "3GPP_ACCESS",
  "amfId": "9300ef7b-93ca-440a-905a-cc3f64af71e5",
  "ratType": "NR",
  "supi": "imsi-001013012041631"
}
```

Scripts Message Sequence Event Config Script Flow

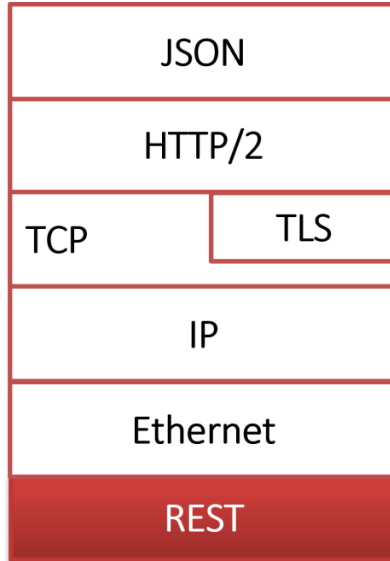
Initialisation Errors Error Events Captured Errors Li

MAPS™ 5G N21 Interface Emulation

MAPS™ 5G N21 Network Architecture



Protocol Stack



Supported Protocols	Standard / Specification Used
N21 Interface	
N21 Interface (UDM-SMSF)	TS29.503
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP/2	IETF RFC 7231 IETF RFC 7540/RFC 7541
TLS	IETF RFC 8446
TCP	IETF RFC 793
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

MAPS™ 5G N21 Interface Procedures

- **Nudm_SubscriberDataManagement Service**
 - SMS Management Subscription Data Retrieval
 - Subscription to Notifications of Data Change
 - Unsubscribe to notifications of data change
 - Modification of a subscription to notifications of data change
- **Nudm_UEContextManagement Service**
 - SMSF Registration for 3GPP Access
 - SMSF Registration for Non 3GPP Access
 - SMSF Deregistration for 3GPP Access
 - SMSF Deregistration for Non 3GPP Access

MAPS™ 5G N21 Interface - Call Emulation

Call Generation

MAPS SMSF (N21 RELEASE17) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Exec...	Status	Events	Events Profile	Result	Tot
1	Nudm_UECM_Control.gls	UEProfile0001	SUPI : imsi-001013012041631	Start	SMSF Registration for 3GPP access is successful	None		Pass	

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

Save Column Width Show Latest

SMSF UDM

PUT /nudm-uecm/v1/imsi-001013012041631/registrations/smf-3gpp-access 17:11:55.936000

200 OK 17:11:56.065000

Scripts Message Sequence Event Config Script Flow

Call Reception

MAPS UDM (N21 RELEASE17) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Exec...	Status	Events	Ev...	Results
1	UDM_HTTP2_Connection_Monitor.gls		UDM Server Clients : AMF	Stop	Monitoring HTTP2 Connection Status	None		Unknown
2	Nudm_UECM_Control.gls		SUPI : imsi-001013012041631	Completed	SMSF Registration is updated	None		Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash

Save Column Width Show Latest

SMSF UDM

PUT /nudm-uecm/v1/imsi-001013012041631/registrations/smf-3gpp-access 17:26:31.518000

200 17:26:31.519000

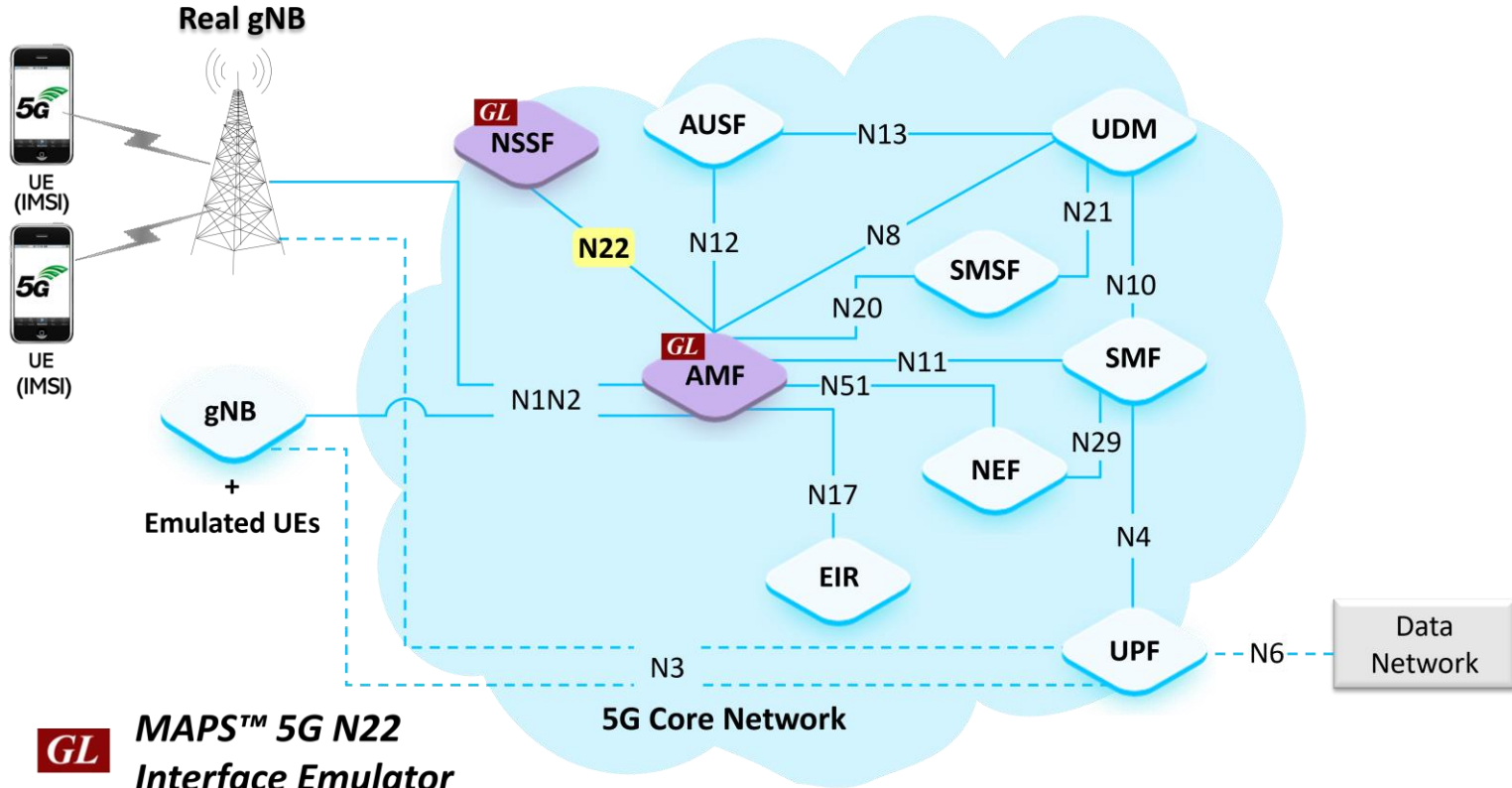
Status: 3
method : PUT
path : /nudm-uecm/v1/imsi-001013012041631/registrations/smf-3gpp-access
scheme : http
authority : 192.168.12.89:6666
content-type : application/json
accept : application/json,
application/problem+json
content-length : 115
{
 "plmnId": {
 "mcc": "001",
 "mnc": "01"
 },
 "smfInstanceId": "5f5a7379-0609-4bf7-9a16-30b417ac8eab",
 "supportedFeatures": "0"
}

Scripts Message Sequence Event Config Script Flow

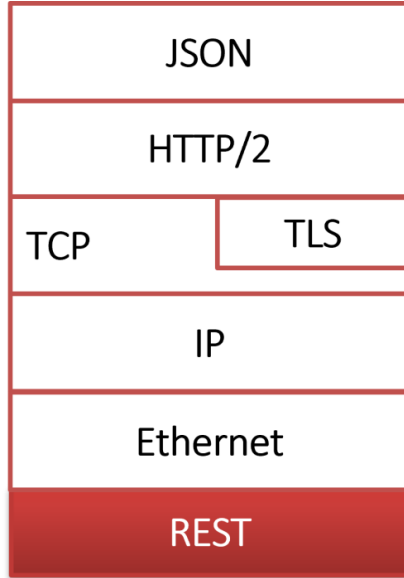
Initialisation Errors Error Events Captured Errors Link Status Up=0 Down=0

MAPS™ 5G N22 Interface Emulation

MAPS™ 5G N22 Network Architecture



Protocol Stack



Supported Protocols	Standard / Specification Used
N22 Interface	
N22 Interface (NSSF - AMF)	TS29.531 Release 17
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP / 2	IETF RFC 7231 IETF RFC 7540/RFC 7541
TLS	IETF RFC 8446
TCP	IETF RFC 793
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

MAPS™ 5G N22 Interface - Call Emulation

Call Generation

MAPS AMF (N22 RELEASE15) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Result	Total Iterations	Completed Iterations
1	Nnsf_AMF_NSSelection_Get_Request_Registration.gls	UEProfile0001	0187850d-b35f-4a8f-a...	Start	Slice Selected for Registration	None	Pass	1	1
2	Nnsf_AMF_NSSelection_Get_Request_PDUSession.gls	UEProfile0001		Start		None	Unknown	1	0
3	Nnsf_AMF_NSSAIAvailabilityPut_Request.gls	UEProfile0001		Start		None	Unknown	1	0

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

Save Column Width Show Latest

MAPS DUT

GET /nnsf-nssselection/v2/network-slice-information 17:18:16.946000

200 OK 17:18:17.021000

Scripts Message Sequence Event Config Script Flow

Initialisation Errors Error Events

Call Reception

MAPS NSSF (N22 RELEASE15) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Results
1	Nnsf_NSS_Control.gls		0187850d-b35f-4a8f-a429-5be1e933...	Completed	Slice Requested for Registration Successful	None	Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash Show Hidden Calls

Save Column Width Show Latest

DUT MAPS

GET /nnsf-nssselection/v2/network-slice-information 17:18:17.007000

200 17:18:17.013000

Status: 0
:method : GET
:path : /nnsf-nssselection/v2/network-slice-information
:scheme : http
:authority : 192.168.1.20:6666
accept : application/json,
application/problem+json

Scripts Message Sequence Event Config Script Flow

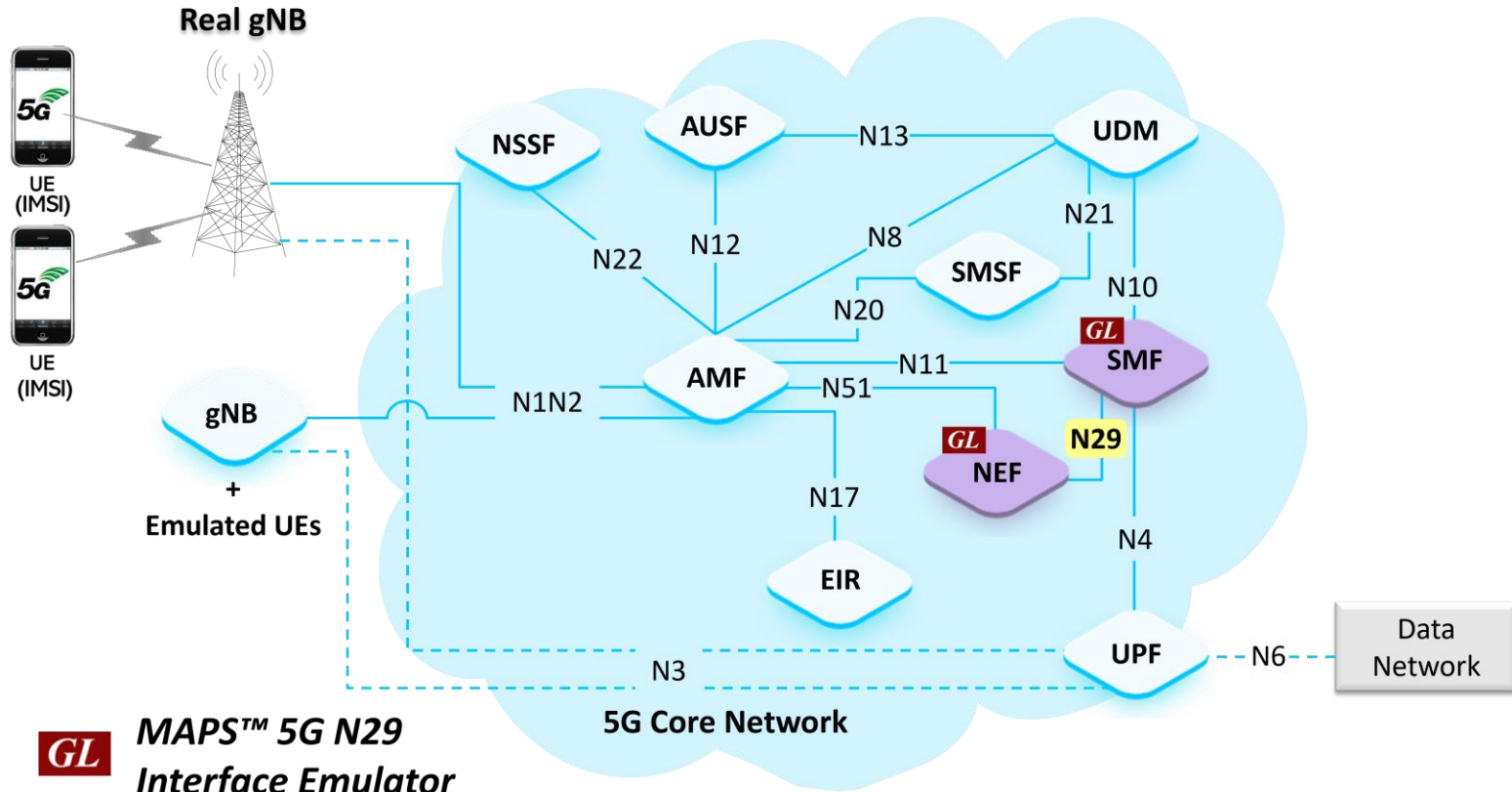
Initialisation Errors Error Events Captured Errors

MAPS™ 5G N22 Interface Procedures

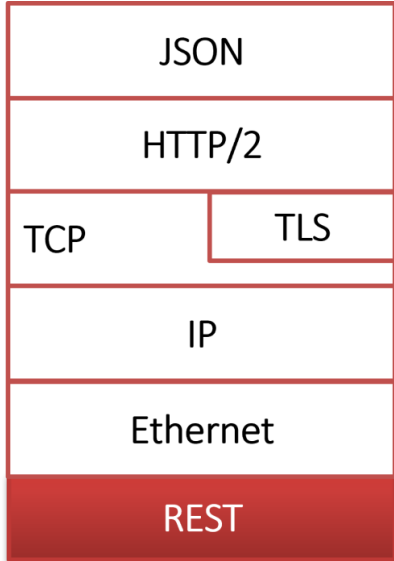
- **Nnssf_NSSelection Service**
 - Get service operation
- **Nnssf_NSSAIAvailability Service**
 - Update Service Operation
 - Subscribe Service Operation
 - Unsubscribe Service Operation
 - Notify Service Operation
 - Delete Service Operation

MAPS™ 5G N29 Interface Emulation

MAPS™ 5G N29 Network Architecture



Protocol Stack



Supported Protocols	Standard / Specification Used
N29 Interface	
N29 Interface (NEF-SMF)	TS29.508 TS29.522
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP/2	IETF RFC 7231 IETF RFC 7540/RFC 7541
TLS	IETF RFC 8446
TCP/TLS	IETF RFC 793 IETF RFC 8446
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

MAPS™ 5G N29 Interface - Call Emulation

Call Generation

MAPS NEF (N29 RELEASE17) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Result	Total Iterations	Completed Iterations
1	NEF_EventExp_Control.gls	UEProfile0001	SUPI :imsi001013012041631	Start	Nsmf EE SessionEstEventNotify Response Sent	None	Pass	1	1

Save Column Width Show Latest

NEF SMF

POST /nsmf_event-exposure/v1/subscriptions 12:11:21.926000

201 CREATED 12:11:22.391000

POST /nsmf_event-exposure/v1/subscriptions/nsmfsubid-3012041631/pdusession_event 12:11:25.027000

204 12:11:25.027000

Find

POST http://192.168.12.170:6666/nsmf_event-exposure/v1/subscriptions
content-type : application/json
accept : application/json,
application/problem+json

{
 "Immediate": false,
 "eventSubs": [{
 "event": "PDU_SESS_EST"
 }],
 "notifId": "pdu_status"
}

Scripts Message Sequence Event Config Script Flow

Initialisation Errors Error Events

Call Reception

MAPS SMF (N29 RELEASE17) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Results
1	SMF_HTTP2_Connection_Monitor.gls		SMF Server Clients : NEF,	Stop		Connect Server	Unknown
2	Nsmf_EventExp_Control.gls		SubId :nsmfsubid-3012041631,SUPI :imsi001013012041...	Completed	Successful Subscribe Response Sent	None	Pass
3	Nsmf_EventExp_Control.gls		SubId :nsmfsubid-3012041631,SUPI :imsi001013012041...	Completed	Nsmf EE Notty Response Received	None	Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash

Save Column Width Show Latest

SMF NEF

POST /nsmf_event-exposure/v1/subscriptions/nsmfsubid-3012041631/pdusession_event_notify 12:11:25.017000

204 NO-CONTENT 12:11:25.036000

Find

POST http://192.168.12.170:6666/nsmf_event-exposure/v1/subscriptions
content-type : application/json

{
 "eventNotifs": [{
 "dmn": "internet",
 "event": "PDU_SESS_EST",
 "ipV4Addr": "10.10.1.1",
 "pduSessType": "IPV4",
 "supi": "imsi-001013012041631",
 "timeStamp": "2024-01-25T12:11:24+05:30"
 }],
 "notifId": "pdu_statusId-3012041631-6"
}

Scripts Message Sequence Event Config Script Flow

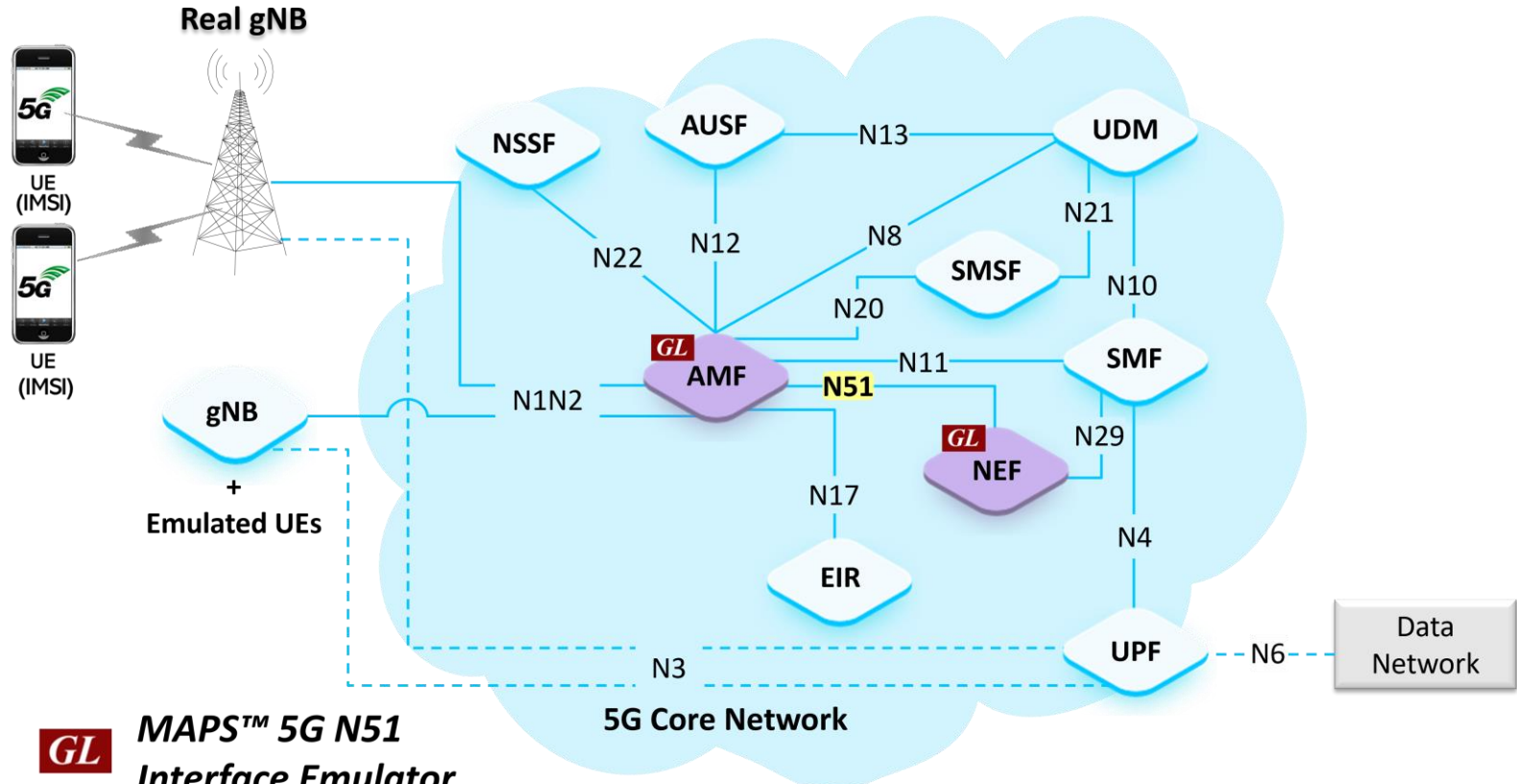
Initialisation Errors Error Events Captured Errors Link Status Up

MAPS™ 5G N29 Interface Procedures

- **Nsmf_EventExposure Procedures**
 - Subscription
 - Unsubscription
 - Notify
 - Session Management Event Exposure Event Types:
 - PDU session establishment Event
 - PDU session release Event
 - QFI allocation Event
 - UE IP address/prefix change Event

MAPS™ 5G N51 Interface Emulation

MAPS™ 5G N51 Network Architecture



Protocol Stack

JSON	
HTTP/2	
TCP	TLS
IP	
Ethernet	
REST	

Supported Protocols	Standard / Specification Used
N51 Interface	
N51 Interface (NEF-AMF)	TS29.518
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP/2 (Hypertext Transfer Protocol)	IETF RFC 7540
TCP/TLS	IETF RFC 793
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

MAPS™ 5G N51 Interface - Call Emulation

Call Generation

MAPS NEF (N51 RELEASE17) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Result	Total Iterations	Completed Iterations
1	NEF_EventExp_Control.gls	UEProfile0001	SUPI : jmsi-001013012041631	Start	Namf EE S...				

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

Save Column Width Show Latest

NEF AMF

POST /namf-evts/v1/subscriptions 12:10:41.880000

201 CREATED 12:10:42.253000

POST /namf-evts/v1/subscriptions/notifyid-3012041631/namf_report_eve... 12:10:47.787000

204 12:10:47.788000

```
{
  "subscription": {
    "eventList": [
      {
        "immediateFlag": true,
        "type": "REGISTRATION_STATE_REPORT"
      }
    ],
    "eventNotifyUri": "http://192.168.12.170:6666/namf-evts/v1/subscriptions/notifyid-3012041631",
    "nfId": "4b7412b5-760a-41b6-a673-edc55ae850d",
    "notifyCorrelationId": "notifyid-3012041631",
    "options": {
      "trigger": "ONE_TIME"
    }
  }
}
```

Scripts Message Sequence Event Config Script Flow

Initialisation Errors

Call Reception

MAPS AMF (N51 RELEASE17) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Results
1	AMF_HTTP2_Connection_Monitor.gls		AMF Server Clients :	Stop		Connect Server	Unknown
2	Namf_EventExp_Control.gls		jmsi-001013012041631	Completed	Successful Subscribe Response Sent	None	Pass
3	Namf_EventExp_Control.gls		SUPI : jmsi-001013012041631	Completed	Namf EE Notify Response Received	None	Pass

Stop Stop All Abort Abort All Show Records Select Active Call Auto Trash Trash

Save Column Width Show Latest

NEF AMF

POST /namf-evts/v1/subscriptions 12:10:42.238000

201 12:10:42.243000

Status: 1
method : POST
path : /namf-evts/v1/subscriptions
scheme : http
authority : 192.168.12.198:6666
content-type : application/json
accept : application/problem+json
content-length : 361

```
{
  "subscription": {
    "eventList": [
      {
        "immediateFlag": false,
        "type": "REGISTRATION_STATE_REPORT"
      }
    ],
    "eventNotifyUri": "http://192.168.12.170:6666/namf-evts/v1/subscriptions/notifyid-3012041631",
    "nfId": "4b7412b5-760a-41b6-a673-edc55ae850d",
    "notifyCorrelationId": "notifyid-3012041631",
    "options": {
      "trigger": "ONE_TIME"
    }
  }
}
```

Scripts Message Sequence Event Config Script Flow

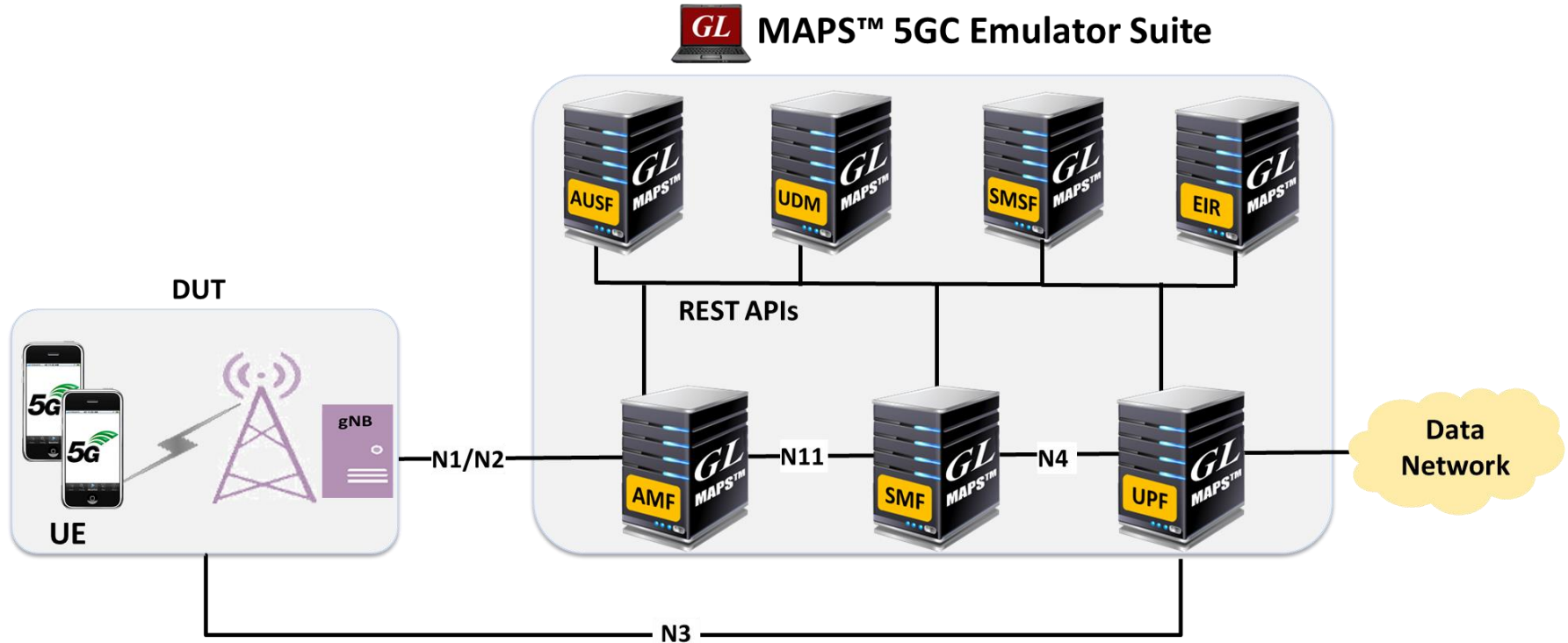
Initialisation Errors Error Events Captured Errors

MAPS™ 5G N51 Interface Procedures

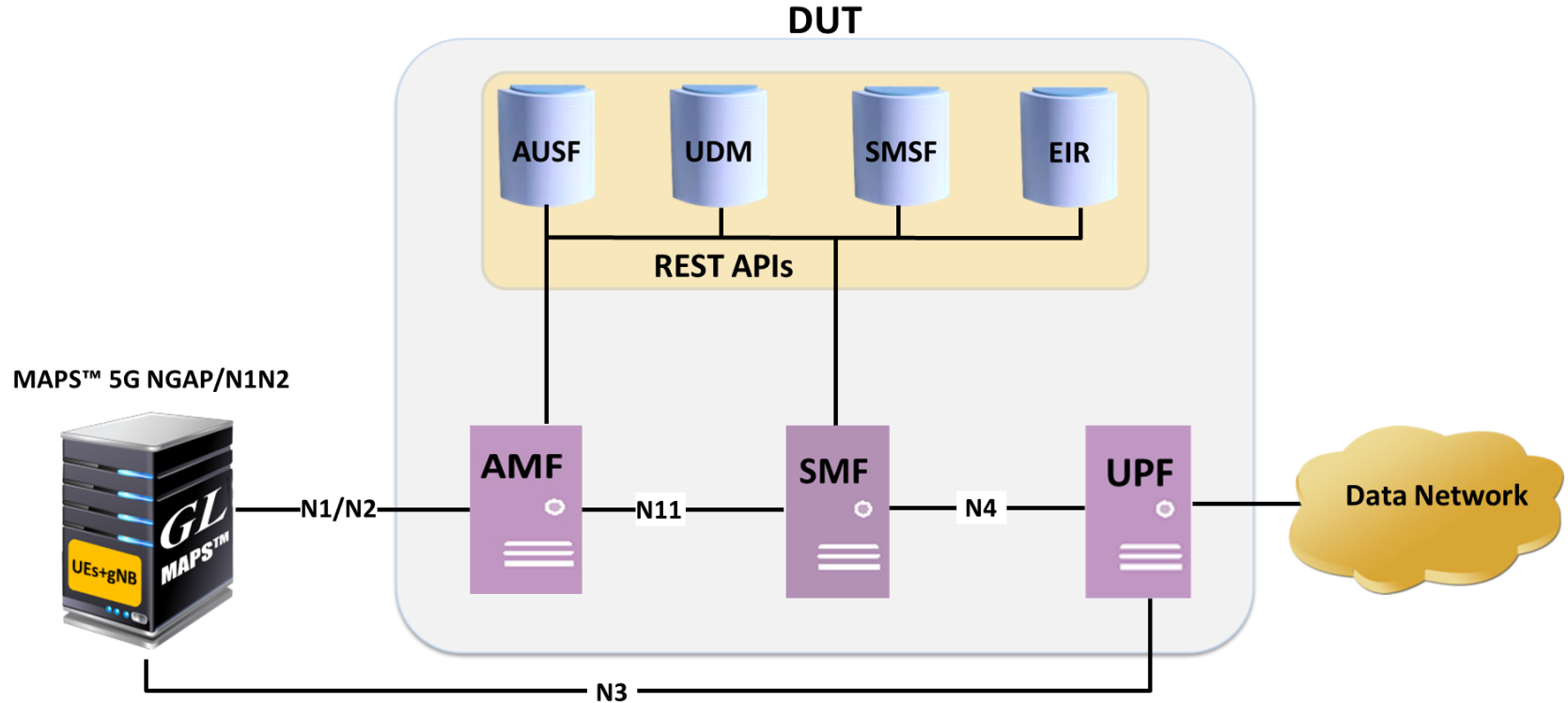
- **Namf_EventExposure Service**
 - Subscription
 - Unsubscription
 - Notify Subscription
 - Registration State Change Event
 - Connection State Change Event
 - Location Report Event
 - Presence In Area of Interest Event

MAPS™ 5G Use Cases

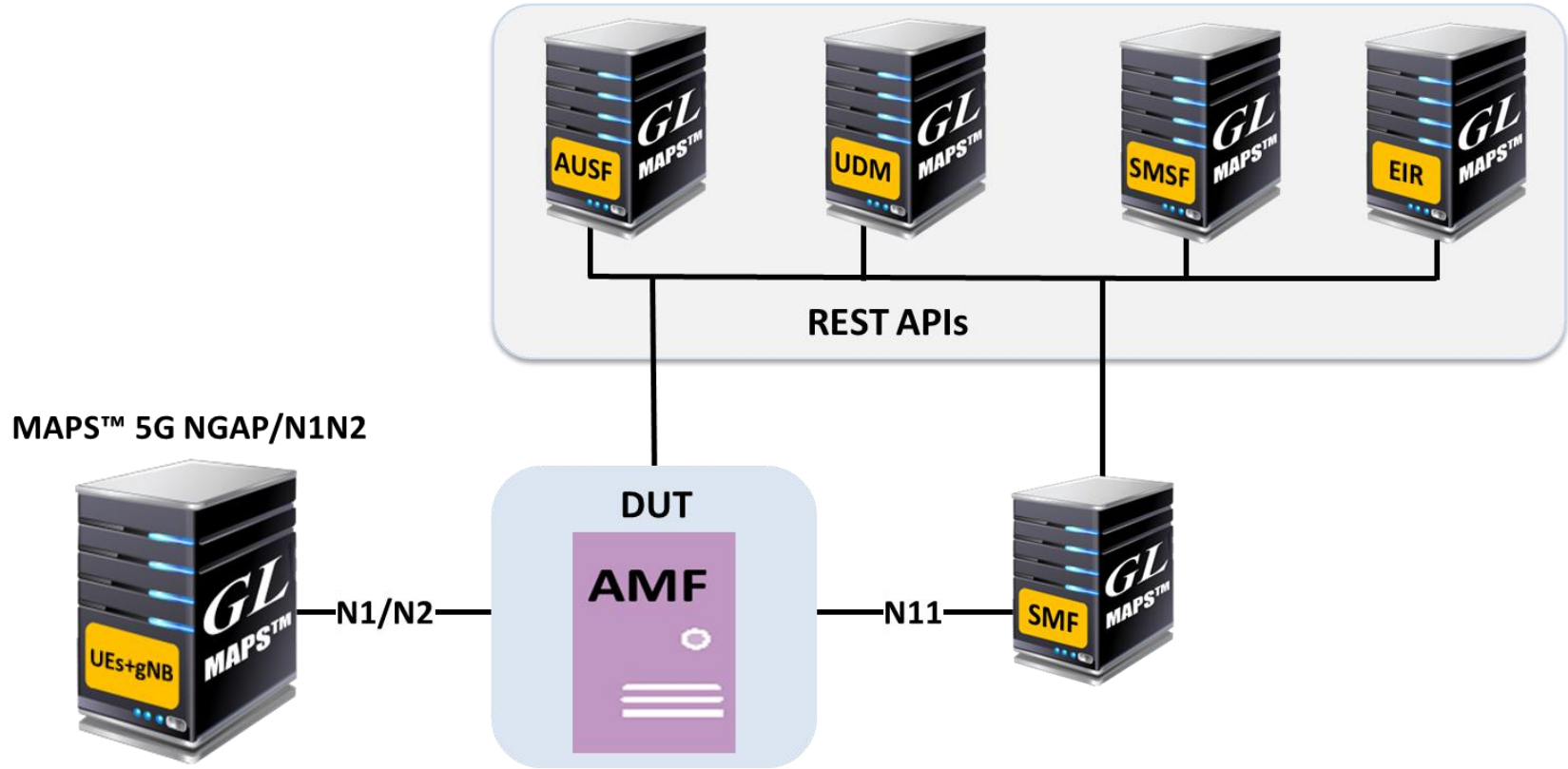
MAPS™ 5GC Emulation (Testing gNodeB)



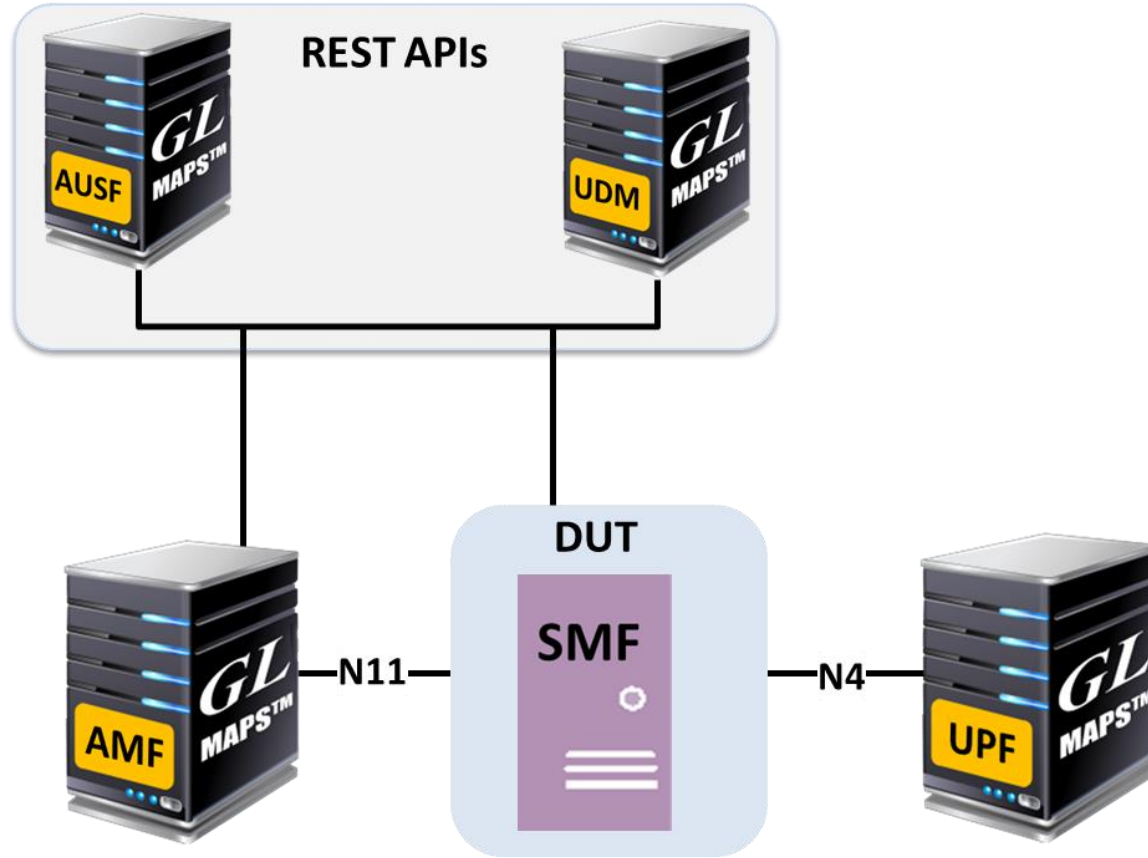
MAPS™ gNB Emulator (Testing 5G Core Network)



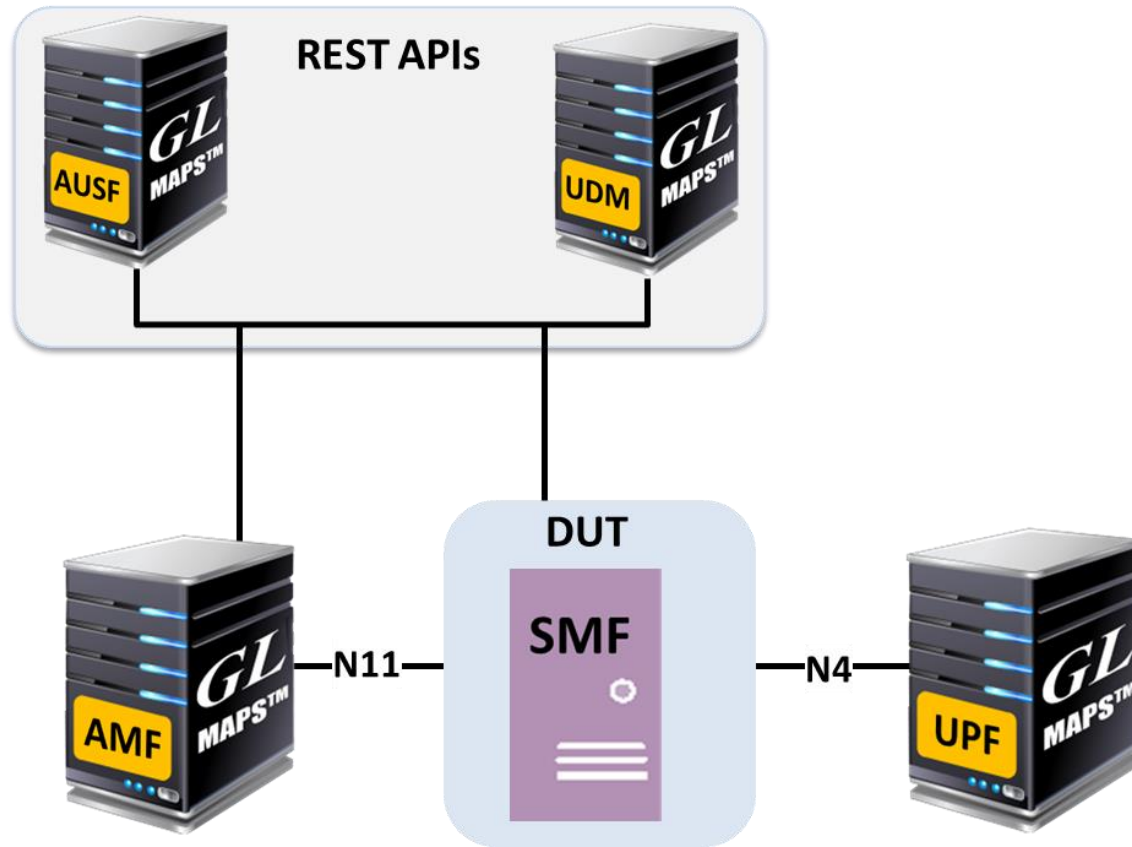
Wrap Around Testing of AMF



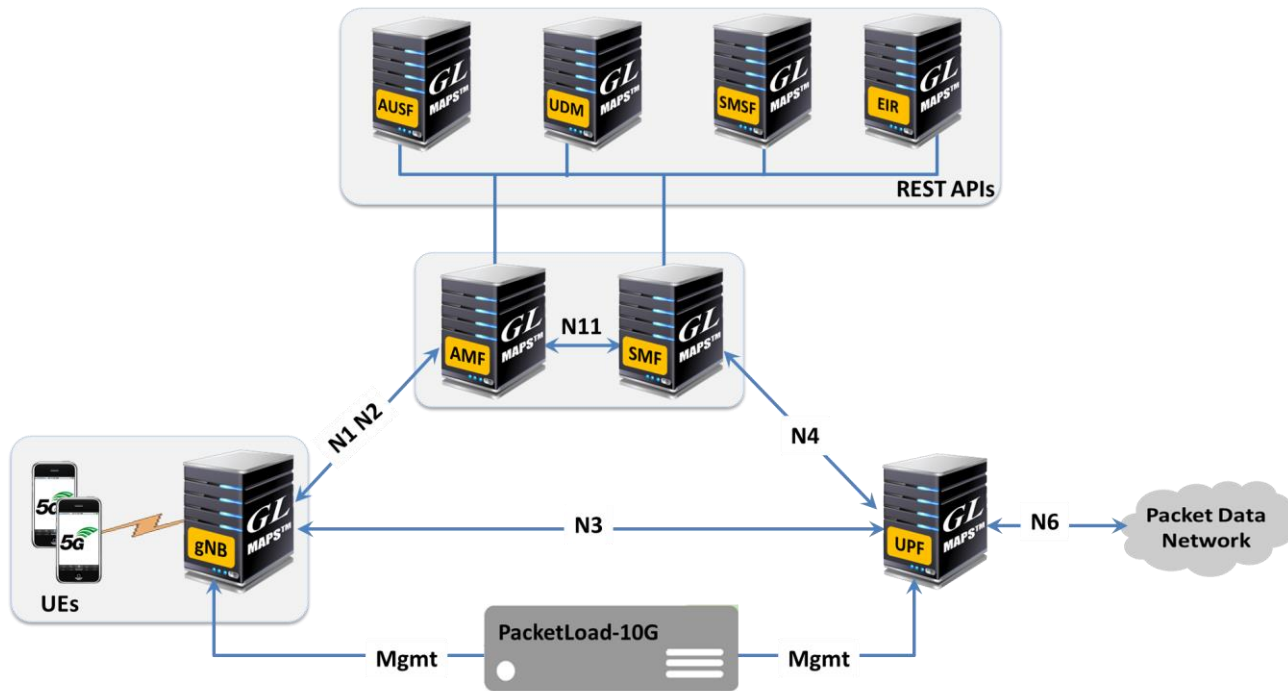
Wrap Around Testing of SMF



Wrap Around Testing of AUSF and UDM



Complete 5G Network Emulation Test Suite w/ Emulated gNodeB



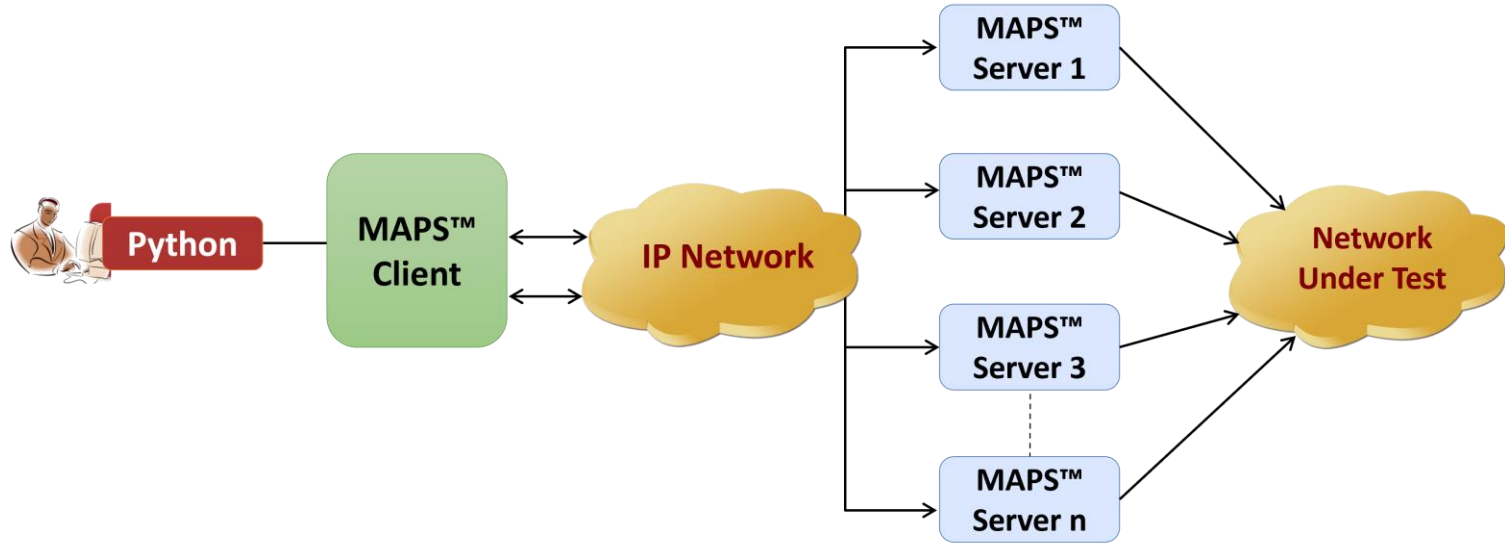
 **MAPS™ 5G Network LAB Test Suite**

Packet Data Traffic Generation Appliance PacketLoad™ 10G



- PacketLoad 4 x 10Gbps (PKS174) is a Data Traffic Generator 2U Rack Appliance with 4 x 10Gbps NIC interfaces: total capacity of up to 40 Gbits/sec Stateful TCP/HTTP Traffic
- It supports massive simulation of UEs (up to 500,000) with high density (up to 4 Gbps or 40 Gbps) mobile data traffic simulation for both UMTS, and LTE networks

MAPS™ API Architecture



- API wraps our proprietary scripting language in standard languages familiar to the user:
 - Python
- Clients and Servers support a “Many-to-Many” relationship, making it very easy for users to develop complex test cases involving multiple signaling protocols

Thank you