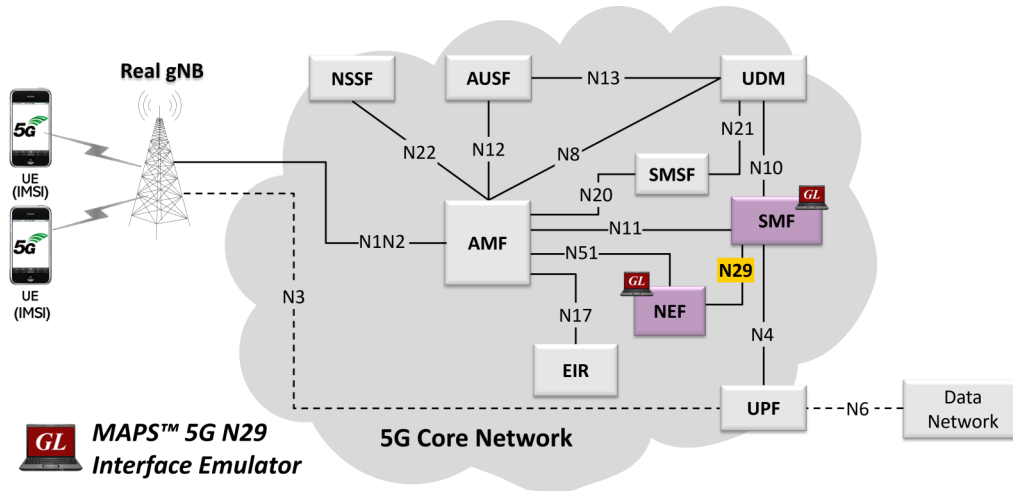# MAPS™ 5G N29 Interface Emulator

Overview

GL's MAPS™ 5G System as a service-based architecture, includes a set of Network Functions (NFs) providing services as defined in 3GPP TS 29.508. The service-based interfaces use HTTP/2 protocol with JavaScript Object Notation (JSON) as the application layer serialization protocol.

GL's MAPS™ 5G N29 Interface emulate Network Exposure Function (NEF) within the 5G Core offering services to the Session Management Function (SMF) via the Nsmf service-based N29 interface. The above network architecture represents the service-based architecture, with focus on N29 between NEF and SMF. Here, node NEF can act as "NF Producer", which refers to TS29.508 Specification.

The NEF and SMF are the entities in 5G Core Network (5GC), which supports the following services

- UE Subscription for notification of one time event detection
    - ⇒ PDU session establishment Event
    - ⇒ PDU session release Event
    - ⇒ QFI allocation Event
    - ⇒ UE IP address/prefix change Event

Besides emulating network elements NEF and SMF functions, it also supports error tracking, regression testing, load testing. It can run pre-defined test scenarios against 5G interface test objects in a controlled and deterministic manner. Easy to use script syntax allow user to create conformance test cases based on their test plan.

MAPS™ 5G N29 Interface emulator supports powerful utilities such as Script Editor and Profile Editor which allow new scenarios to be created or existing scenarios to be modified using 5G N29's JSON messages and parameters

For more information, please visit MAPS™ 5G N29 Interface Emulator webpage.

Main Features

- Emulate NEF and SMF elements
- Supports Nsmf EventExposure Service
- Services use REST APIs based on HTTP and JSON data format
- Supports TLS and TCP transports
- Supports scripted call generation and automated call reception
- Supports customization of call flow and message templates using Script and Message Editor
- Ready-to-use scripts for quick testing
- Provides Call Statistics and Events Status
- Automation, Remote access, and Schedulers to run tests 24/7

Testbed Configuration

The testbed setup window allow user to setup the required test configurations in N29 interface. It includes a list of variables that are declared and assigned before starting the script. Testbed Setup defines the MAPS™ parameters which communicates with the rest of the test network. End user configuration profile is used to configure MAPS™ 5G 29 interface with the supported NEF and SMF parameters.
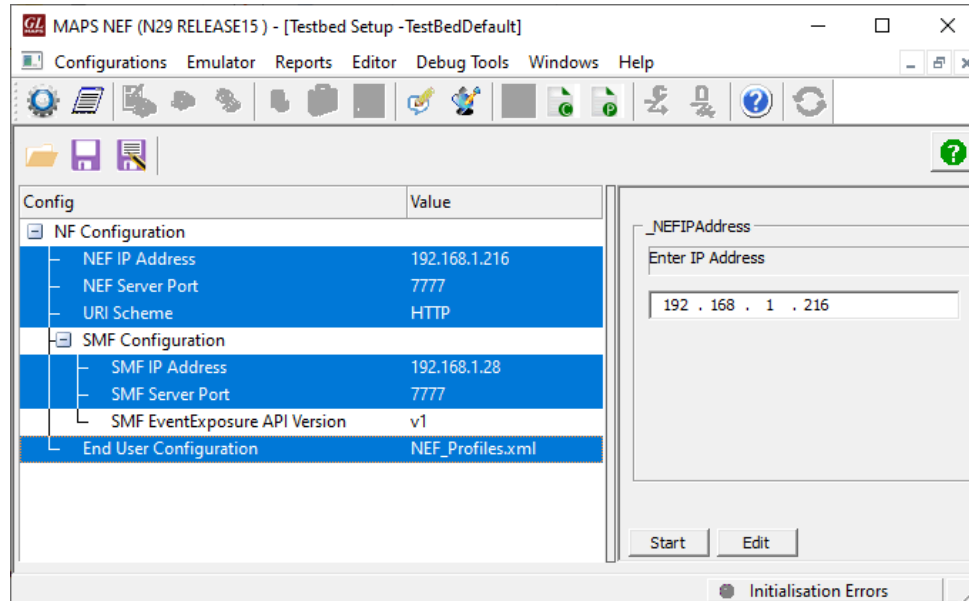

Figure: Testbed Setup

Pre-processing Tools

PROFILE EDITOR - This feature allow loading profile to edit the values of variables using GUI, replacing the original value of variables in the message template. An XML file defines a set of multiple profiles with varying parameter values which allow user to configure call instances in call generation to receive calls. The **UE_Profiles** include 5G parameters, that is required to configure multiple UEs to emulate Signaling.
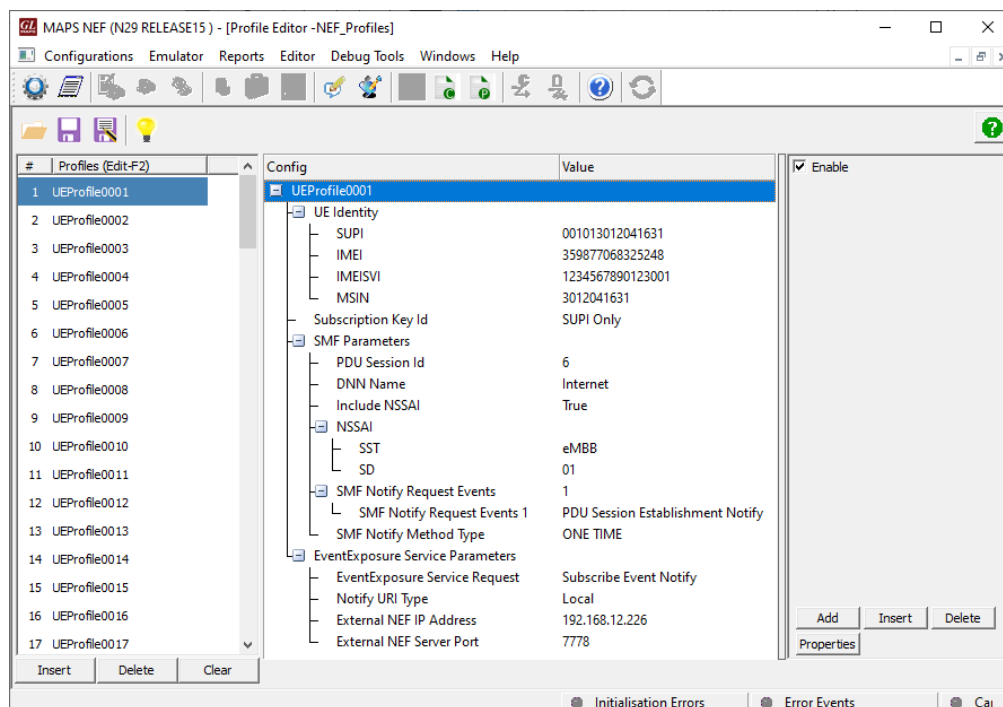

Figure: Profile Editor

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Pre-processing Tools *(Contd.)*

SCRIPT EDITOR - The script editor allow user to create/edit scripts and access protocol fields as variables for the message template parameters. The script uses pre-defined message templates, to perform send and receive actions.
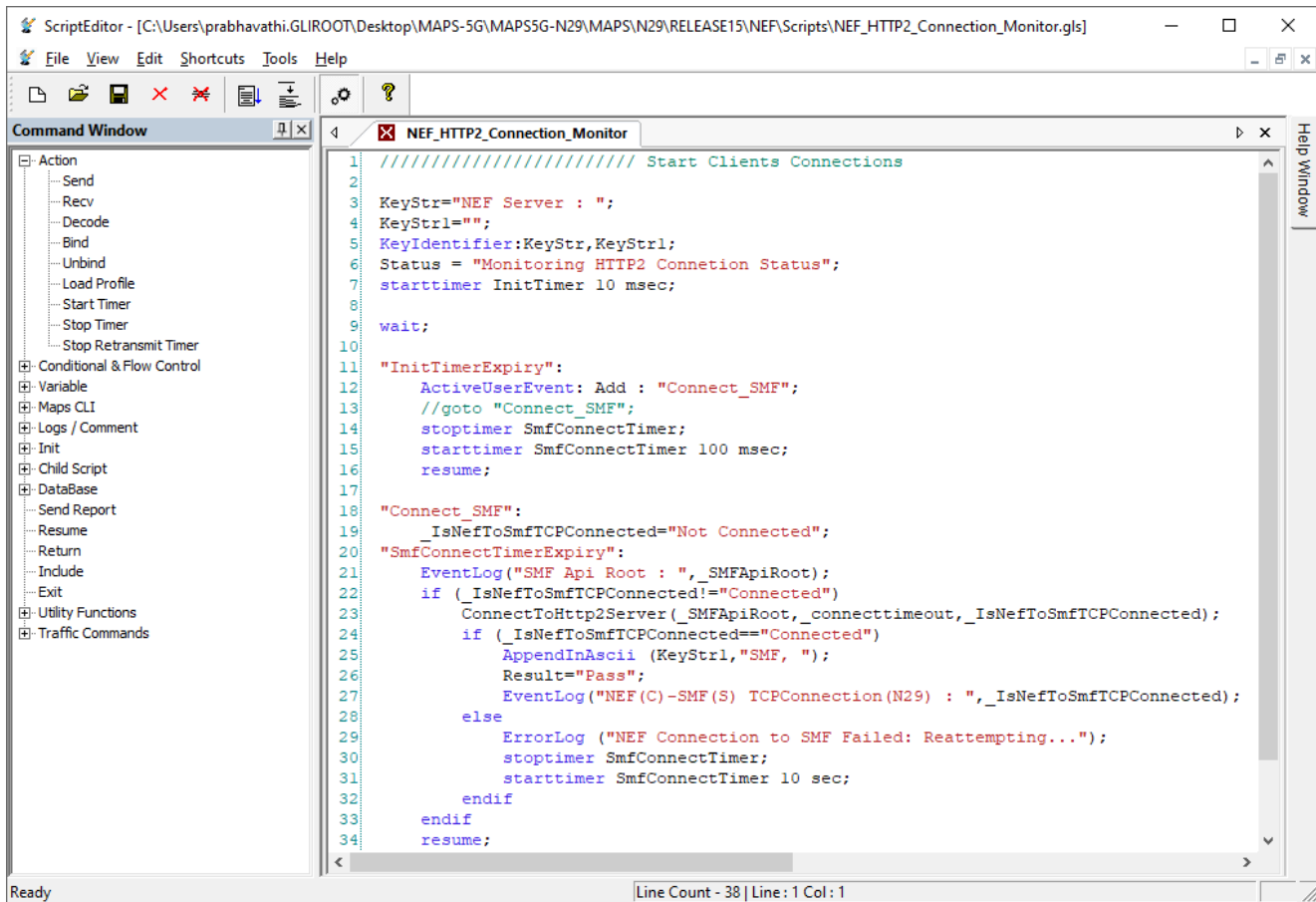

Figure: Script Editor

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Call Generation and Reception

In call generation mode, MAPS™ is configured for the outgoing messages, while in call receive mode, it is configured to respond to the incoming messages. Tests can be configured to run once, multiple iterations and continuously. Also, allow user to create multiple entries using quick configuration feature. The editor allow to run the added scripts sequentially (order in which the scripts are added in the window) or randomly (any script from the list of added script as per the call flow requirements). The test scripts are started manually at call generation, and at the call reception the script is automatically triggered by incoming messages.

Figure: Call Generation

Figure: Call Reception

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Nsmf_EventExposure

Creation of Subscription

MAPS™ for 5G N29 interface emulates services between NEF and SMF network functions. The subscribe service operation is used to create subscription to an event for one UE or group of UE's. The below figure shows the NEF (as Service Consumer) sends the subscription request through HTTP post method to SMF.
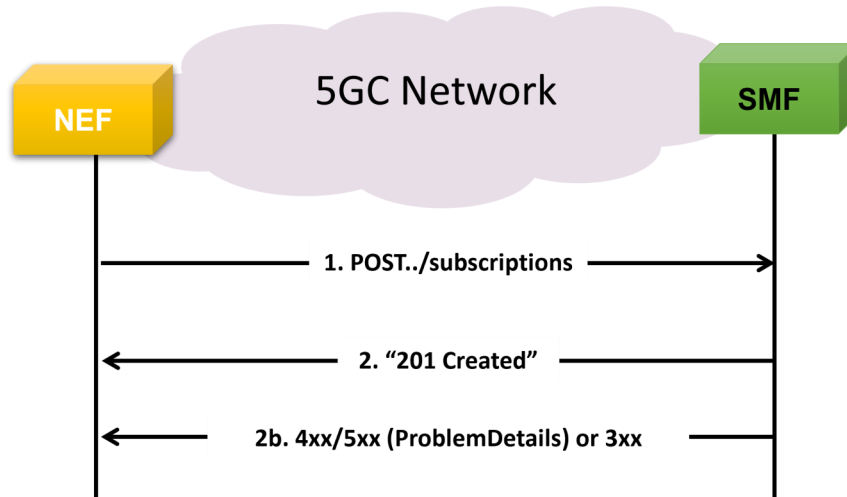

Figure: Creation of Subscription

- In this procedure, NEF sends POST request to create new subscription event to the AMF
- On success, "201 Created"
- On failure, 403 Forbidden indicates the creation of subscription has failed due to application error as UE_NOT_SERVED_BY_SMF

Unsubscription

To unsubscribe from event notifications, the NF service consumer (NEF) shall send an HTTP DELETE request with the subscription correlation ID of the existing subscription that is to be deleted.

Figure: Unsubscription

- To unsubscribe from an event notifications, the NF service consumer (NEF) shall send an HTTP DELETE request with the subscription correlation ID of the existing subscription that is to be deleted to SMF
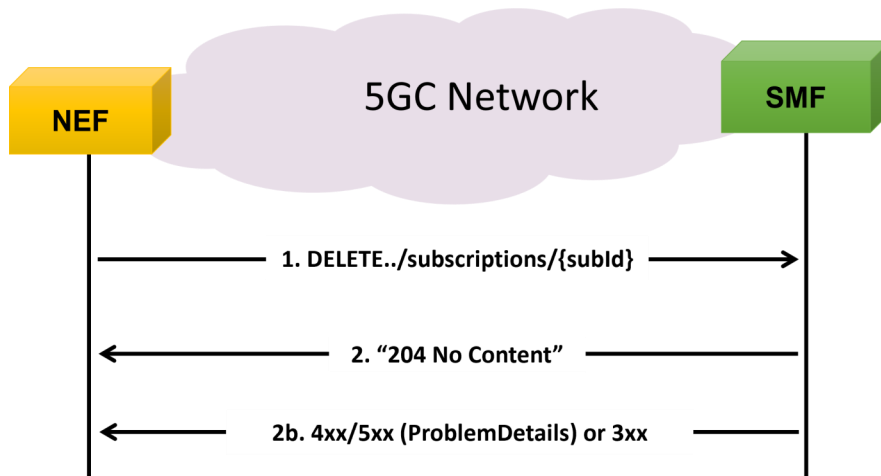- On success, "204 No Content" returned indicating the resource identified by subscription ID is successfully deleted
- On failure, the HTTP status 4xx/5xx response code in the message body containing a ProblemDetails is returned

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Nsmf_EventExposure (*Contd.*)

Notify

This procedure provides an acknowledgement of notification about the subscribed events.
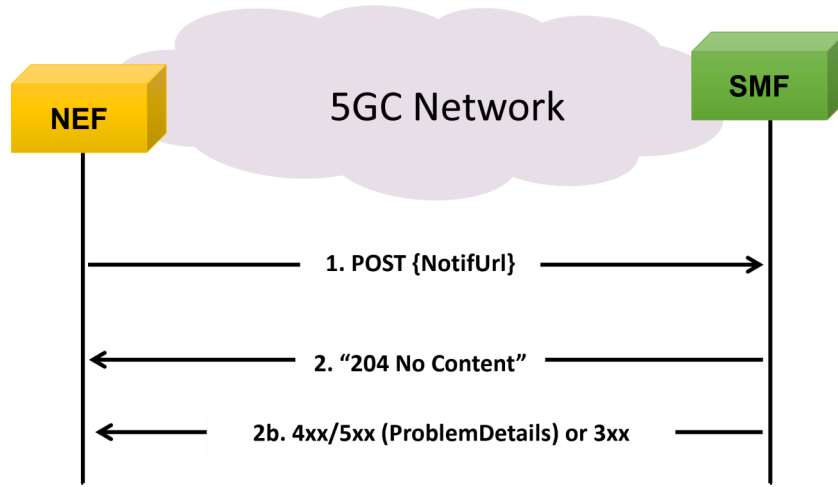
Figure: Notify

- In order to acknowledge the SMF of the application relocation information after the handling of a notification about UP path change event, an NF service consumer (NEF) shall send an HTTP POST request to the callback URI as previously provided by the SMF
- On success, the SMF returns a "204 No Content"
- On failure, the HTTP status 4xx/5xx response code in the message body containing a ProblemDetails is returned

UE Subscription for Notification of One-time Event Detection

UE subscription for notification of one time event detection service includes the following procedures:

- PDU session establishment Event
- PDU session release Event
- QFI allocation Event
- UE IP address/prefix change Event

Figure: UE Subscription for Notification of One-time Event Detection

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Supported Protocols and Specifications

```
┌─────────────────────────────────┐
│              JSON               │
├─────────────────────────────────┤
│             HTTP/2              │
├──────────────────┬──────────────┤
│   TCP            │     TLS      │
├──────────────────┴──────────────┤
│               IP                │
├─────────────────────────────────┤
│            Ethernet             │
├─────────────────────────────────┤
│              REST               │
└─────────────────────────────────┘
```
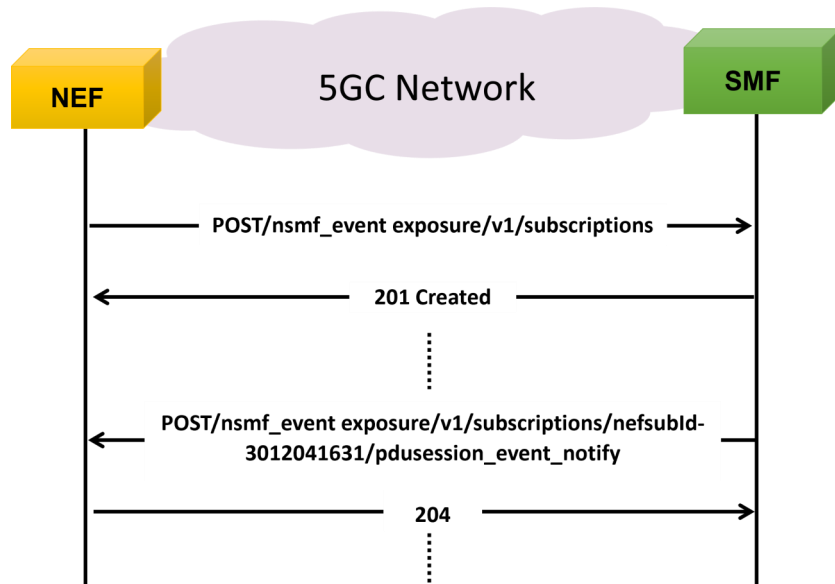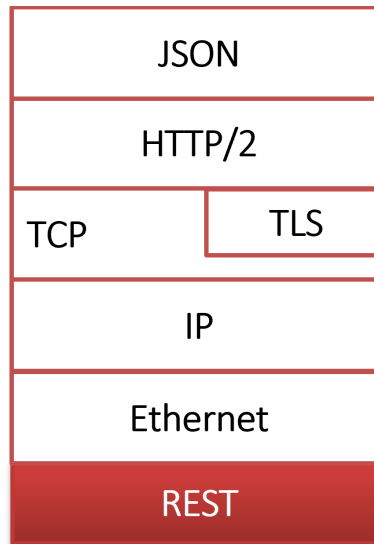
Supported Protocols	Standard / Specification
N29 Interface (NEF-SMF)	TS29.508 Release 17
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP/2	IETF RFC 7231 IETF RFC 7540/RFC 7541
TLS	IETF RFC 8446
TCP	IETF RFC 793
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

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Buyer's Guide

Item No	Product Description
PKS511	MAPS™ 5G N29 Interface Emulator (Requires PKS502)
PKS305	MAPS™ 5G Multi-Interface Emulation

Item No	Related Software
PKS500	MAPS™ 5G N1/N2 Interface Emulator
PKS501	MAPS™ 5G N4 Interface Emulator
PKS502	5G service-based Emulation (Prerequisite base license for all service-based (Open API) interface emulations)
PKS503	MAPS™ 5G N8 Interface Emulator (Requires PKS502)
PKS504	MAPS™ 5G N10 Interface Emulator (Requires PKS502)
PKS505	MAPS™ 5G N11 Interface Emulator (Requires PKS502)
PKS506	MAPS™ 5G N12 Interface Emulator (Requires PKS502)
PKS507	MAPS™ 5G N13 Interface Emulation (Requires PKS502)
PKS502	MAPS™ 5G N17 Interface Emulator
PKS508	MAPS™ 5G N20 Interface Emulator (Requires PKS502)
PKS509	MAPS™ 5G N21 Interface Emulator (Requires PKS502)
PKS510	MAPS™ 5G N22 Interface Emulator (Requires PKS502)
PKS511	MAPS™ 5G N51 Interface Emulator (Requires PKS502)

For complete list of MAPS™ products, refer to Message Automation & Protocol Simulation (MAPS™) webpage.

For more details on supported MAPS™ 5G interfaces, refer to 5G Core (5GC) Network Test Solution webpage.

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