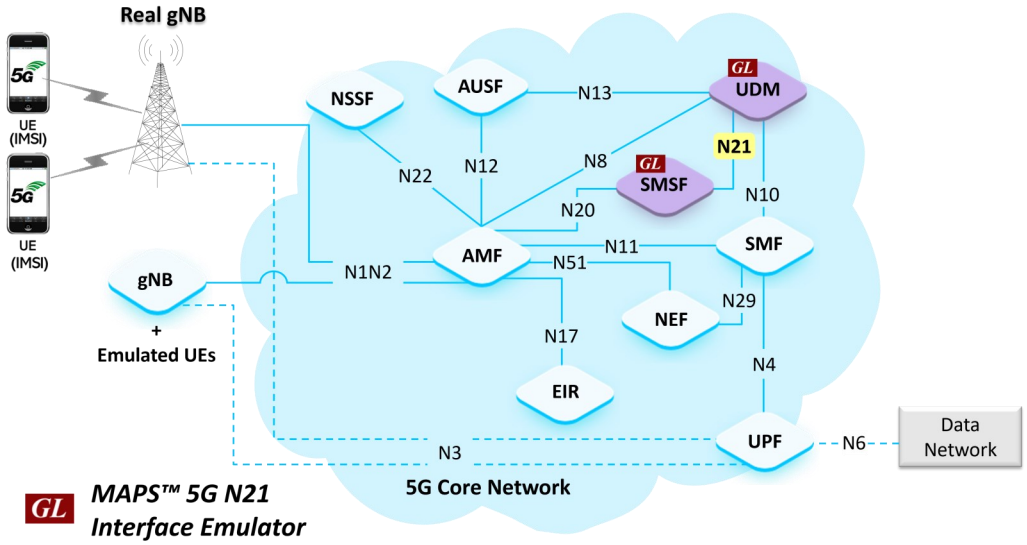
MAPS™ 5G N21 Interface Emulator



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 23.501 (Release 17). The service-based interfaces use HTTP/2 protocol with JavaScript Object Notation (JSON) as the application layer serialization protocol.

GL's MAPS™ emulate Unified Data Management (UDM) within the 5G Core offering services to the Short Message Service Function (SMSF) via the Nudm service-based N21 interface. The above network architecture represents the service-based architecture, with focus on N21 between UDM and SMSF. Here, node UDM can act as "NF Producer", which refers to TS29.503 (Release 17) Specification. The SMSF and UDM are the entities in 5G Core Network (5GC), which supports the following services

- Nudm_UEContextManagement
- Nudm_SubscriberDataManagement

Besides emulating network elements SMSF and UDM 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 N21 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 N21 JSON messages and parameters

For more information, please visit MAPS™ 5G N21 Interface Emulator webpage.

Main Features

- Emulate SMSF and UDM elements
- Supports Nudm_SubscriberDataManagement (Get, Subscribe, ModifySubscription, Unsubscribe and Notification operations) and Nudm_UEContextManagement Services (SMSF Registration and Deregistration operations)
- Services use REST APIs based on HTTP and JSON data format
- Supports Command Line Interface (CLI) through a client-server model, enabling users to control all features via Python APIs
- 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

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Testbed Configuration

The testbed setup window allow user to setup the required test configurations in N21 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 21 interface with the supported SMSF and UDM parameters.

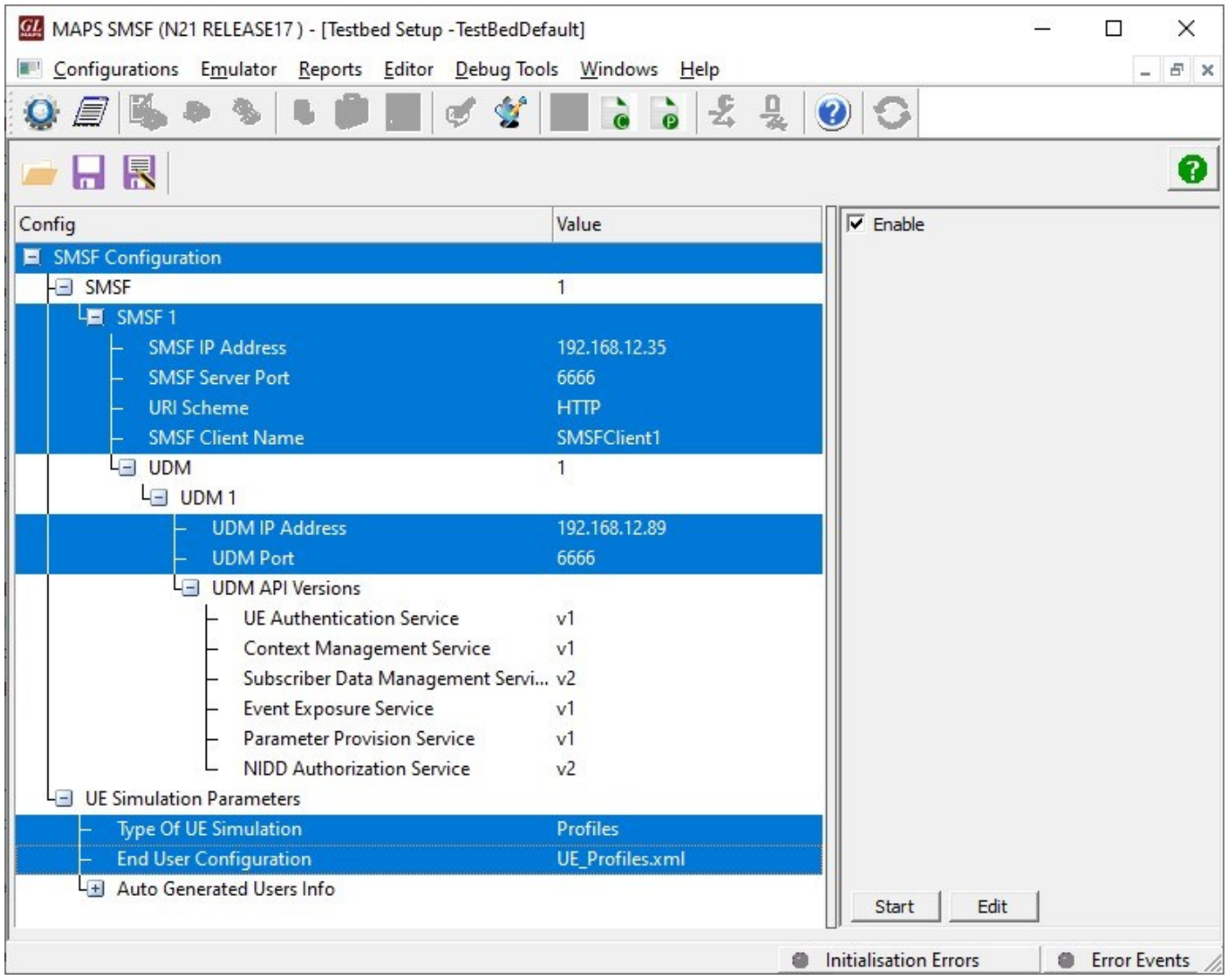


Figure: Testbed Setup

Pre-processing Tools

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.

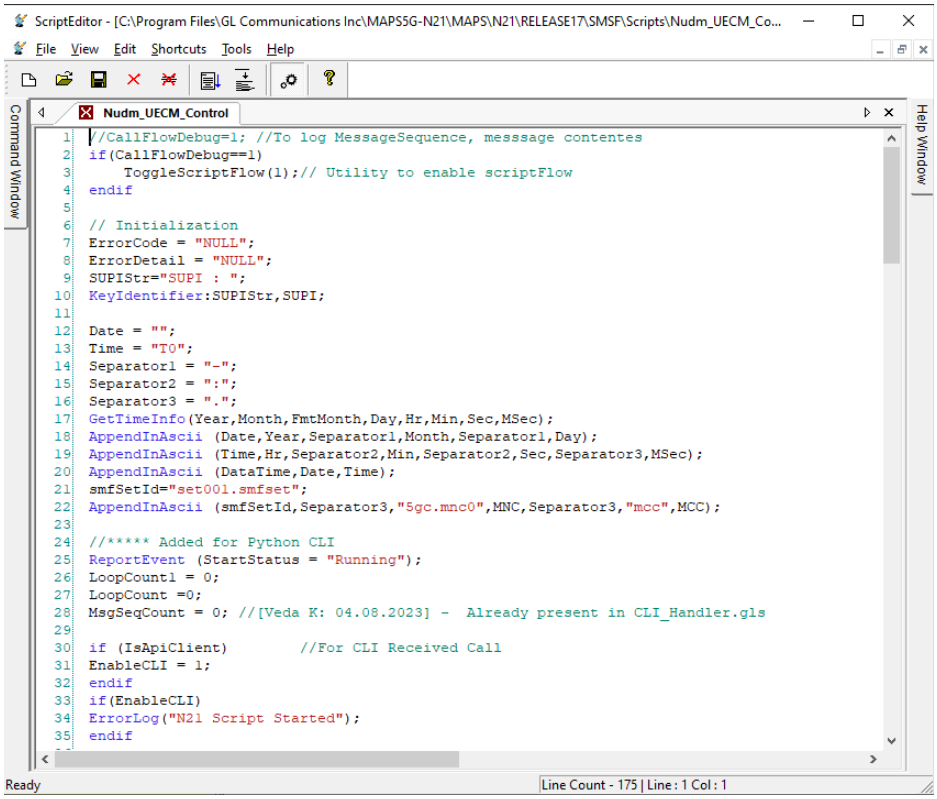


Figure: Script Editor

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 and Traffic.

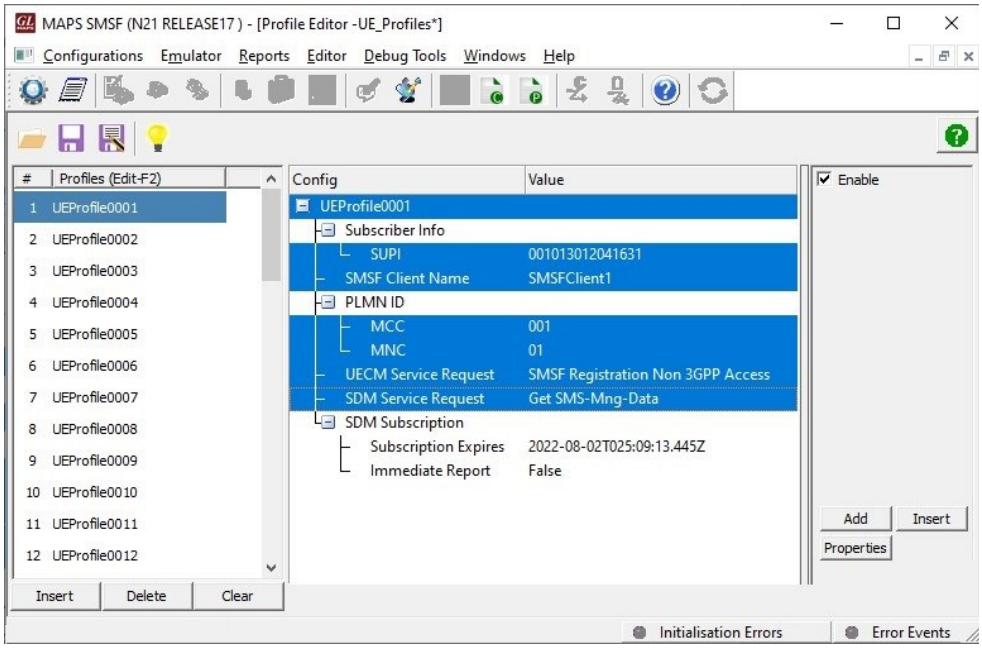


Figure: Profile Editor

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 mu ltiple 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.

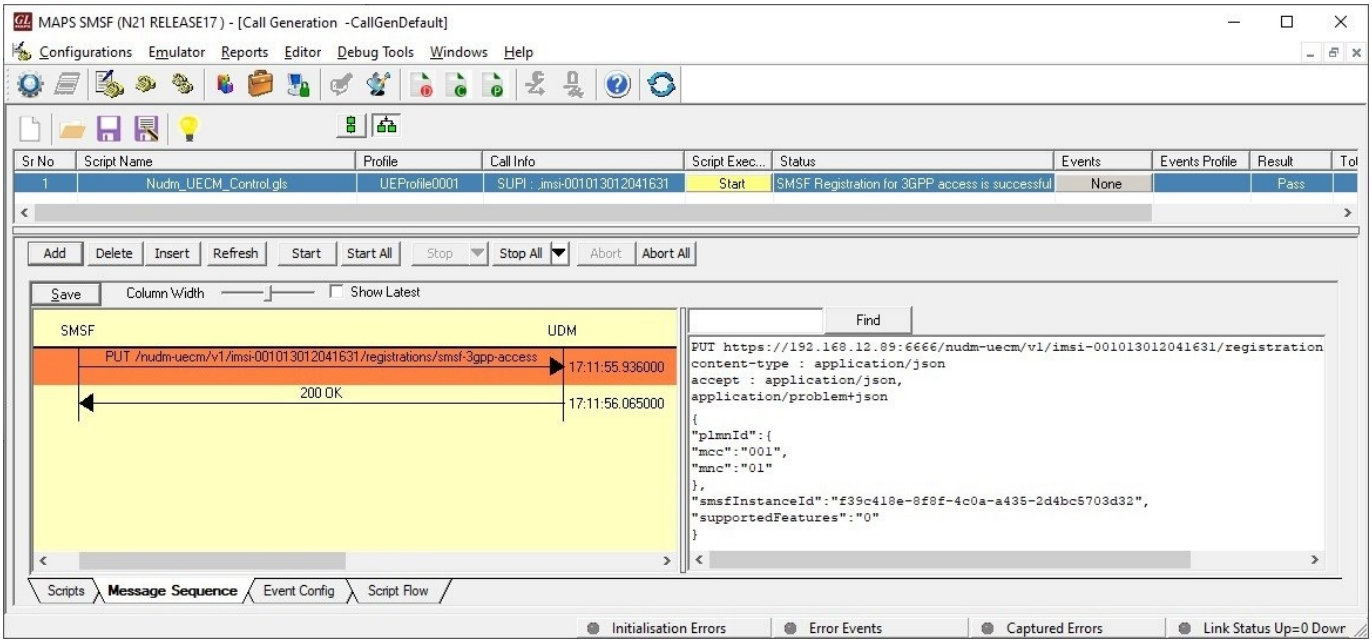


Figure: Call Generation

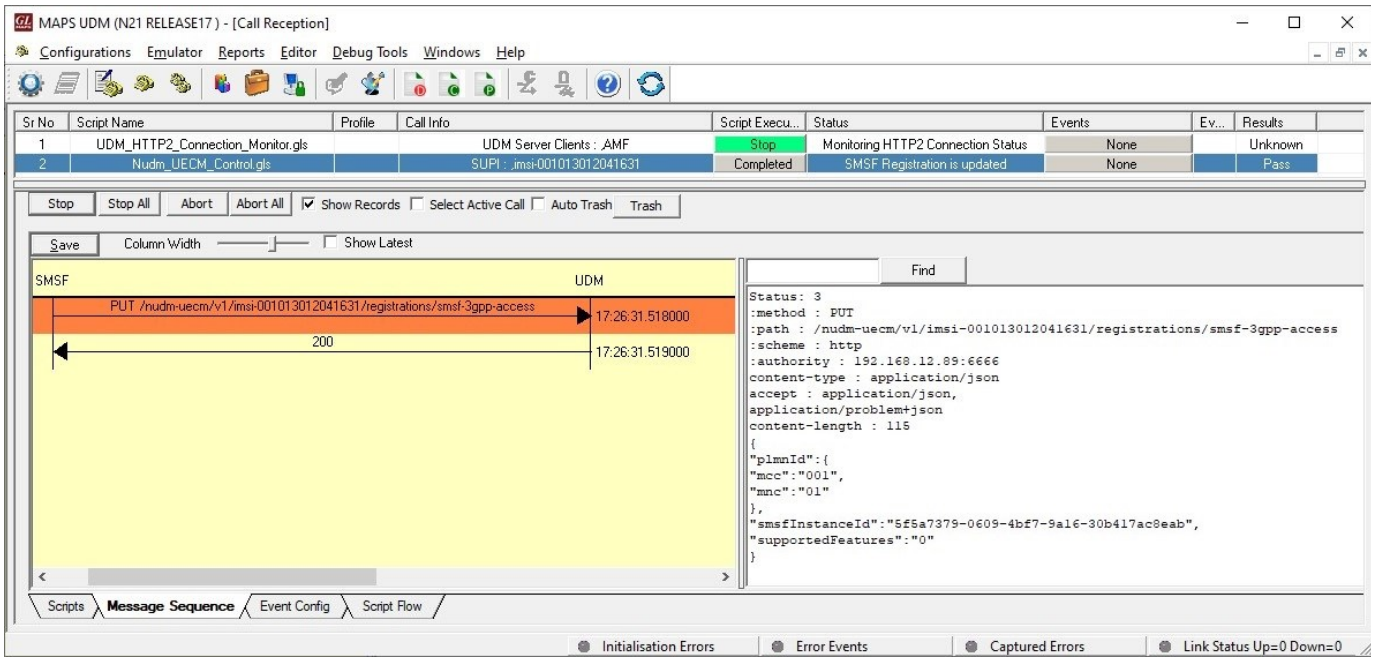


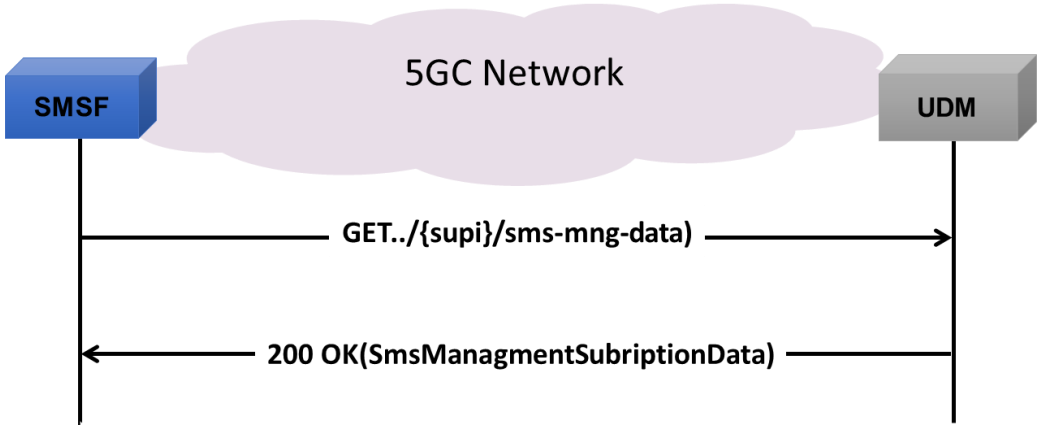
Figure: Call Reception

Nudm_SubscriberDataManagement Service

SMS Management Subscription Data Retrieval

MAPS™ for 5G N21 interface emulate services between UDM and SMSF network functions.

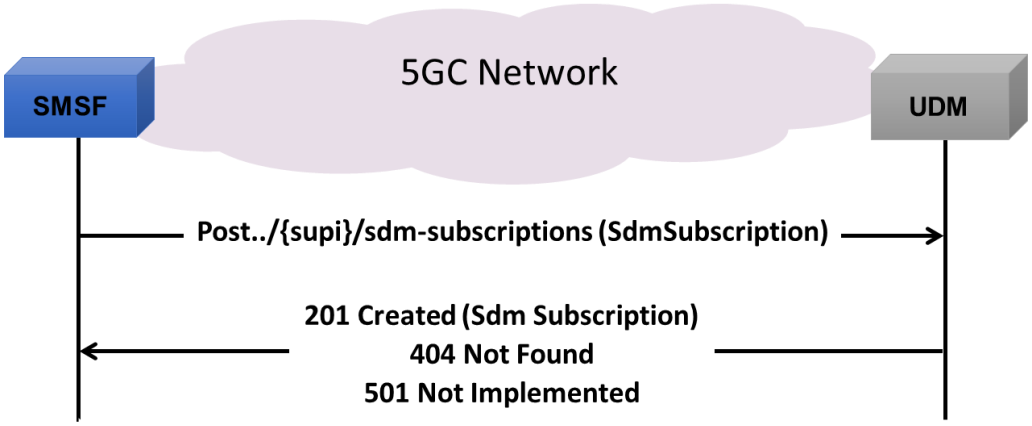
The NF service consumer (e.g., SMSF) sends a request to the UDM to receive the UE's SMS Management Subscription Data. The request contains the UE's identity (/{supi}) and the type of the requested information (/sms-mng-data).



- The SMSF sends a GET request to the UDM to receive all the UE's SMS Management Subscription Data
- On **Success**, the UDM responds with "200 OK" containing the information of the UE's SMS Management Subscription Data
- On **Failure**, the appropriate HTTP status code indicating the error shall be returned

Subscription to Notifications of Data Change

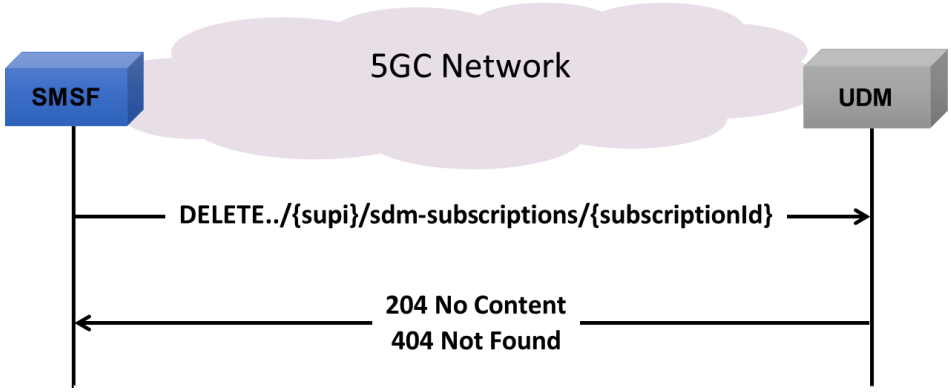
The SMSF sends a request to the UDM to subscribe to the notifications of data change of the UE's.



- The SMSF sends a POST request to create a subscription notification of data change to the UDM for the UE's
- On **Success**, the UDM responds with "201 Created"
- If there is no valid subscription data for the UE's the Status code "404 Not Found" is returned
- If the UE subscription data exist, but the requested subscription to data change notification cannot be created (e.g., due to an invalid/unsupported data reference then HTTP status code "501 Not Implemented" is returned

Unsubscribe to Notifications of Data Change

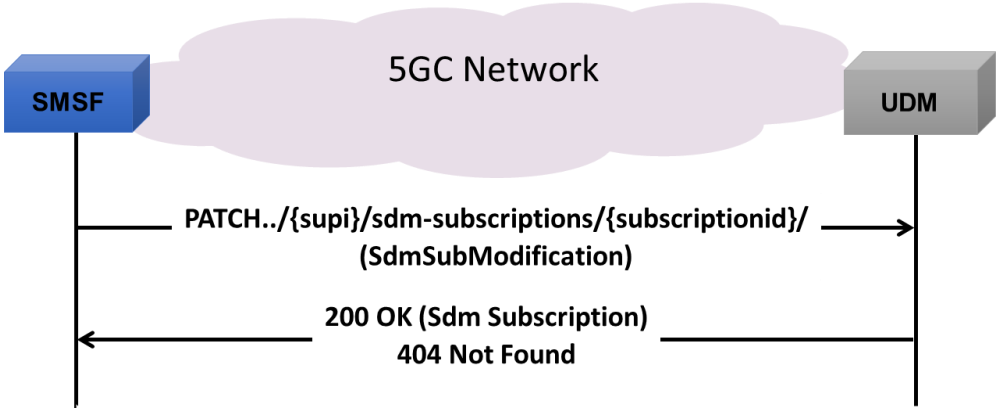
The SMSF sends a request to the UDM to unsubscribe to the notifications of data change of the subscribed UE's.



- The SMSF sends a DELETE request containing subscription id to delete a subscription to the UDM for the subscribed UE's
- On **Success**, the UDM responds with "204 No Content
- If there is no valid subscription data for the UE's the Status code "404 Not Found" is returned

Modification of a Subscription to Notifications of Data Change

The SMSF sends a request to the UDM to modify a subscription of the notifications of data changes of the subscribed UE's.

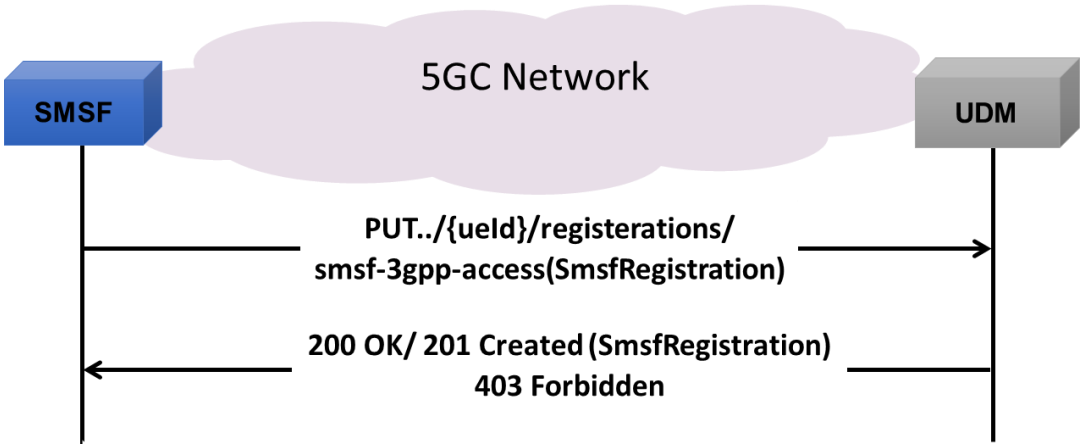


- The SMSF sends a PATCH request to the UDM of previously subscribed UE's to the notifications of the data changes
- On **Success**, the UDM responds with "200 OK"
- If there is no valid subscription available (e.g. due to an unknown subscriptionId value), HTTP status code "404 Not Found"

Nudm_UEContextManagement Service

SMSF Registration for 3GPP Access

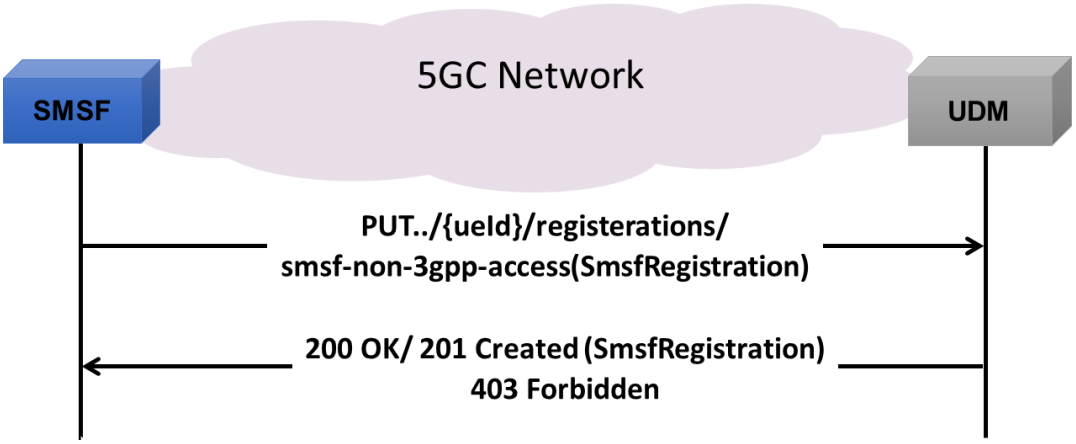
The SMSF sends a request to the UDM to create or update the SMSF registration information for 3GPP access through the UE's identity (/{ueId}) which shall be a SUPI and the SMSF Registration Information for SMS service.



- The SMSF sends a PUT request to the UDM to get the resources of the UE's registration for 3GPP Access to update or create SMSF registration information
- On **Success**, the UDM responds with "200 OK or “201 Created”
- If the operation cannot be authorized due to e.g UE does not have required subscription data, access barring or roaming restrictions, HTTP status code "403 Forbidden" should be returned

SMSF Registration for Non 3GPP Access

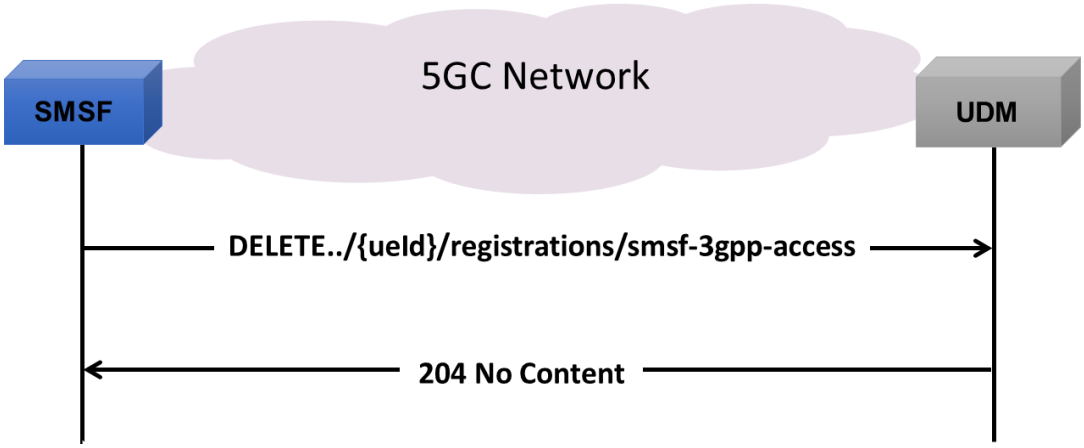
The SMSF sends a request to the UDM to create or update the SMSF registration information for non 3GPP access through the UE's identity (/{ueId}) which shall be a SUPI and the SMSF Registration Information for SMS service.



- The SMSF sends a PUT request to the UDM to get the resources of the UE's registration for non 3GPP Access to update or create SMSF registration information
- On **Success**, the UDM responds with "200 OK or “201 Created”
- If the operation cannot be authorized due to e.g UE does not have required subscription data, access barring or roaming restrictions, HTTP status code "403 Forbidden" should be returned

SMSF Deregistration for 3GPP Access

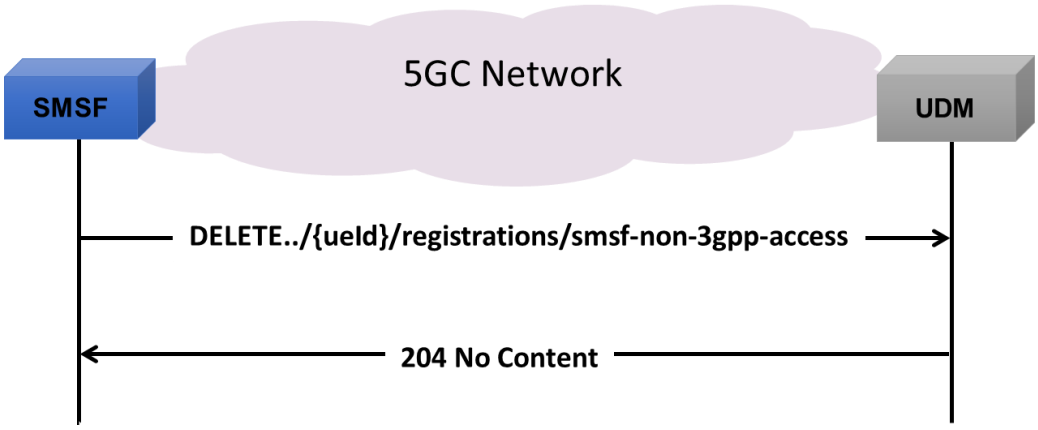
The SMSF sends a request to the UDM to delete the SMSF registration information for 3GPP access through the UE's identity (/{ueId}) which shall be a SUPI.



- The SMSF sends a DELETE request to UDM to delete the UE's SMSF registration for 3GPP access
- On **Success**, the UDM responds with "204 No Content"
- If the operation cannot be authorized due to e.g. UE does not have required subscription data, access barring or roaming restrictions, HTTP error status code should be returned

SMSF Deregistration for Non 3GPP Access

The SMSF sends a request to the UDM to delete the SMSF registration information for non 3GPP access through the UE's identity (/{ueId}) which shall be a SUPI.



- The SMSF sends a DELETE request to UDM to delete the UE's SMSF registration for non 3GPP access
- On **Success**, the UDM responds with "204 No Content"
- If the operation cannot be authorized due to e.g. UE does not have required subscription data, access barring or roaming restrictions, HTTP error status code should be returned

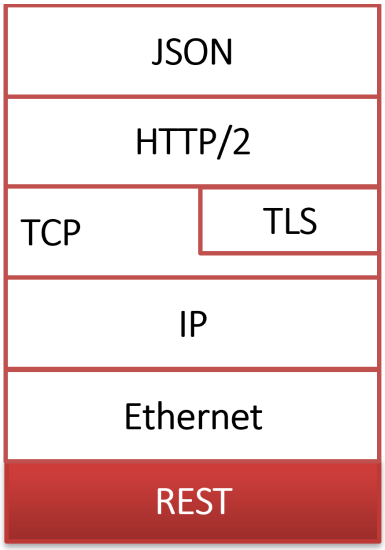
Command Line Interface (CLI)

The MAPS™ 5G N21 (SMSF) can be configured as a CLI server application for remote control via command-line clients, including Python. These clients can execute various functions remotely, such as initiating the testbed setup, loading scripts, profiles, and applying user events like call generation, termination, and traffic control. Users can generate and receive calls using commands.

Figure: Sample Python Client

Figure: MAPS™ CLI Server

Supported Protocols and Specifications



Supported Protocols	Standard / Specification
N21 Interface (UDM-SMSF)	TS29.503 (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]

Buyer's Guide

Item No	Product Description
PKS509	MAPS™ 5G N21 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)
PKS510	MAPS™ 5G N22 Interface Emulator (Requires PKS502)
PKS511	MAPS™ 5G N29 Interface Emulator (Requires PKS502)
PKS511	MAPS™ 5G N51 Interface Emulator (Requires PKS502)
PKS170	CLI Support for MAPS™

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.