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**TECHNICAL SPECIFICATION**

5G;
5G System;
Home Subscriber Server (HSS) services
for interworking with Unified Data Management (UDM);
Stage 3
(3GPP TS 29.563 version 18.6.0 Release 18)

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# Contents

# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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where:

    x   the first digit:

        1   presented to TSG for information;

        2   presented to TSG for approval;

        3   or greater indicates TSG approved document under change control.

    y   the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

    z   the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

**shall**          indicates a mandatory requirement to do something

**shall not**      indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should**         indicates a recommendation to do something

**should not**    indicates a recommendation not to do something

**may**           indicates permission to do something

**need not**      indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can**            indicates that something is possible

**cannot**        indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will**            indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not**        indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might**         indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# 1 Scope

The present document specifies the stage 3 protocol, including message flows and API specification details, for the Nhss services, as part of the 5G Service-Based Architecture, offered by the HSS for interworking with the 5G UDM Network Function.

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3].

The User Data Interworking, Coexistence and Migration stage 2 architecture and procedures are specified in 3GPP TS 23.632 [8].

The Technical Realization of the Service Based Architecture and the Principles and Guidelines for Services Definition are specified in 3GPP TS 29.500 [4] and 3GPP TS 29.501 [5].

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1]       3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2]       3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[3]       3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[4]       3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[5]       3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

[6]       3GPP TS 23.335: "User Data Convergence (UDC); Technical realization and information flows".

[7]       3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[8]       3GPP TS 23.632: "User Data Interworking, Coexistence and Migration".

[9]       IETF RFC 9113: "HTTP/2".

[10]      OpenAPI Initiative, "OpenAPI Specification Version 3.0.0", https://spec.openapis.org/oas/v3.0.0.

[11]      IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".

[12]      IETF RFC 9457: "Problem Details for HTTP APIs".

[13]      3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".

[14]      3GPP TR 21.900: "Technical Specification Group working methods".

[15]      3GPP TS 23.003: "Numbering, addressing and identification".

[16]      3GPP TS 29.303: "Domain Name System Procedures; Stage 3".

[17]      3GPP TS 29.272: "Evolved Packet System; MME and SGSN Related Interfaces Based on Diameter Protocol".

[18]     3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".

[19]     3GPP TS 29.335: "User Data Convergence (UDC); User Data Repository Access Protocol over the Ud interface".

[20]     3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[21]     3GPP TS 29.336: "Home Subscriber Server (HSS) diameter interfaces for interworking with packet data networks and applications".

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

Void.

## 3.2 Symbols

Void.

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

| | |
|---|---|
| 5GC | 5G Core Network |
| HSS | Home Subscriber Server |
| JSON | Javascript Object Notation |
| SBI | Service Based Interface |
| UDM | Unified Data Management |
| UDR | Unified Data Repository |

# 4 Overview

## 4.1 Introduction

Within the 5GC, the HSS offers services to the UDM via the Nhss service-based interface (see 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.632 [8]).

Figure 4.1-1 provides the reference model in service-based interface representation with focus on the HSS.
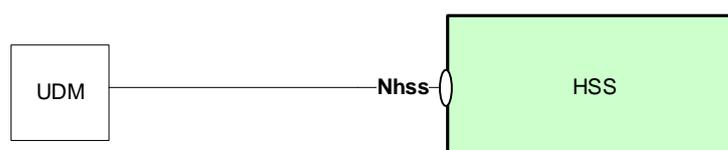


**Figure 4.1-1: Reference model – HSS**

# 5 Services offered by the HSS

## 5.1 Introduction

The HSS offers the following services via the Nhss interface:

- Nhss_UEAuthentication Service

- Nhss_SubscriberDataManagement Service

- Nhss_UEContextManagement service

All scenarios shown in the following clauses assume that the HSS is stateful and stores information in local memory. However, the HSS may be stateless and stores information externally in the EPS-UDR. If so, the stateless HSS makes use of Ud interface as specified in 3GPP TS 23.335 [6] and 3GPP TS 29.335 [19] to retrieve required data from the EPS-UDR and store them locally before processing an incoming request. Processing the incoming request may then include updating data in the EPS-UDR or subscribing to data change notifications at the EPS-UDR by using the Ud interface. After processing the incoming request, the HSS may delete the locally stored data.

Table 5.1-1 summarizes the corresponding APIs defined for this specification.

**Table 5.1-1: API Descriptions**

| Service Name | Clause | Description | OpenAPI Specification File | apiName | Annex |
|---|---|---|---|---|---|
| Nhss_UEAuthentication Service | 6.1 | HSS UE Authentication Service | TS29563_Nhss_UEAU.yaml | nhss-ueau | A.2 |
| Nhss_SubscriberDataManagement Service | 6.2 | HSS Subscriber Data Management | TS29563_Nhss_SDM.yaml | nhss-sdm | A.3 |
| Nhss_UEContextManagement Service | 6.3 | HSS UE Context Management | TS29563_Nhss_UECM.yaml | nhss-uecm | A.4 |
| Nhss_EventExposure | 6.4 | HSS Event Exposure | TS29563_Nhss_EE.yaml | nhss-ee | A.5 |

## 5.2 Nhss_UEAuthentication Service

### 5.2.1 Service Description

The Nhss_UEAuthentication service allows a NF consumer (UDM) to request calculation of a fresh Authentication Vector (AV) for 5G_AKA or EAP_AKA_PRIME and provide the calculated AV to the requesting NF.

### 5.2.2 Service Operations

#### 5.2.2.1 Introduction

For the Nhss_UEAuthentication service the following service operation is defined:

- Get

The Nhss_UEAuthentication service is used by the UDM to request the HSS to, calculate a fresh authentication vector (AV) for authentication the method 5G_AKA or EAP_AKA_PRIME, and provide it to the UDM by means of the Get service operation. See 3GPP TS 23.632 [8] clause 4.2.2.

#### 5.2.2.2 Get

##### 5.2.2.2.1 General

The following procedure using the Get service operation is supported:

- Authentication Vector Retrieval

### 5.2.2.2.2 Authentication Vector Retrieval

Figure 5.2.2.2.2-1 shows a scenario where the NF service consumer (UDM) retrieves an Authentication Vector for the UE from the HSS (see also 3GPP TS 23.632 [8] clause 4.2.2). The request contains the UE's identity (imsi), the serving network name, the authentication method (5G_AKA or EAP_AKA_PRIME) and may contain resynchronization info.
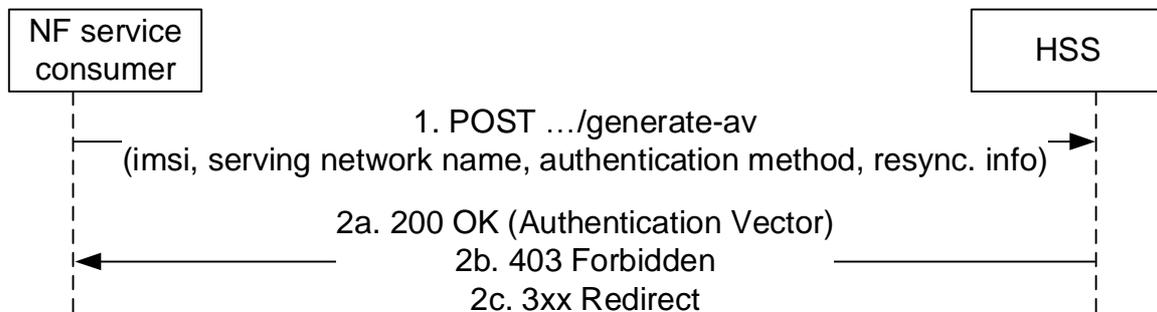


**Figure 5.2.2.2.2-1: NF service consumer requesting an Authentication Vector**

1. The NF service consumer sends a POST request (custom method: generate-av) to the HSS.

2a. The HSS responds with "200 OK" with the message body containing the authentication vector.

2b. If the operation cannot be authorized due to e.g. UE does not have required subscription data, HTTP status code "403 Forbidden" should be returned including additional error information in the response body (in "ProblemDetails" element).

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the POST response body.

In the case of redirection, the HSS shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another HSS (service) instance.

## 5.3 Nhss_SubscriberDataManagement Service

## 5.3.1 Service Description

This service is used to retrieve the subscriber data indicated by the requested data type from HSS. In this release, only the PGW-C+SMF FQDN for S5/S8 interface information is supported as requested data type. See 3GPP TS 23.632 [8], clause 6.1.4.

## 5.3.2 Service Operations

### 5.3.2.1 Introduction

For the Nhss_SubscriberDataManagement service the following service operations are defined:

- Get

- Subscribe

- ModifySubscription

- Unsubscribe

- Notification

The Nhss_SubscriberDataManagement service is used by Consumer NF (UDM) to retrieve the UE data from the HSS due to IRAT mobility by means of the Get service operation.

It is also used by consumer NFs to subscribe to notifications of data change by means of the Subscribe service operation.

It is also used by consumer NFs to modify an existing subscription by means of the ModifySubscription service operation.

It is also used by consumer NFs that have previously subscribed, to unsubscribe from notifications of data changes by means of the Unsubscribe service operation.

It is also used by Consumer NFs that have previously subscribed, to get notified by means of the Notification service operation.

### 5.3.2.2 Get

#### 5.3.2.2.1 General

The following procedure using the Get service operation is supported:

- UE Context In PGW Data Retrieval

#### 5.3.2.2.2 UE Context In PGW Data Retrieval

Figure 5.3.2.2.2-1 shows a scenario where the NF service consumer (UDM) sends a request to the HSS to retrieve the UE's Context In PGW data. The request contains the UE's identity (which shall be an IMSI) and the requested information.
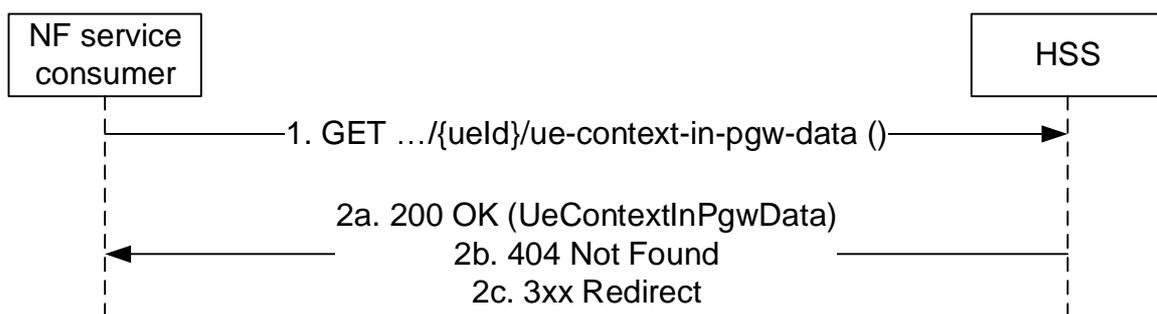


**Figure 5.3.2.2.2-1: Requesting a UE's Context in PGW Data**

1. The NF service consumer (e.g. UDM) shall send a GET request to the resource representing the UE's Context In PGW Data.

2a. On Success, the HSS shall respond with "200 OK" with the message body containing the UE's Context In PGW Data as relevant for the requesting NF service consumer.

2b. If there is no valid data for the UE, HTTP status code "404 Not Found" shall be returned including additional error information in the response body (in the "ProblemDetails" element).

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the GET response body.

In the case of redirection, the HSS shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another HSS (service) instance.

### 5.3.2.3 Subscribe

#### 5.3.2.3.1 General

The following procedures using the Subscribe service operation are supported:

- Subscription to notification of data change

### 5.3.2.3.2 Subscription to notifications of data change

Figure 5.3.2.3.2-1 shows a scenario where the NF service consumer (e.g. UDM) sends a request to the HSS to subscribe to notifications of data change. The request contains a callback URI and the URI of the monitored resource.
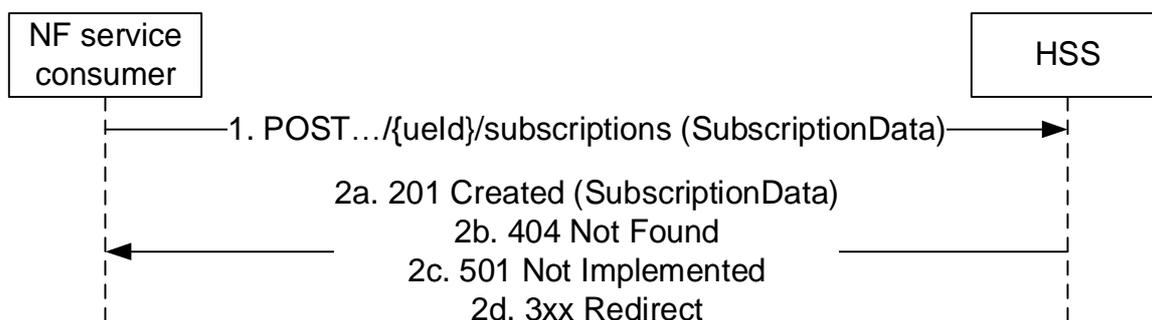


**Figure 5.3.2.3.2-1: NF service consumer subscribes to notifications**

1. The NF service consumer sends a POST request to the parent resource (collection of subscriptions) (.../{ueId}/subscriptions), to create a subscription as present in message body.

2a. On success, the HSS responds with "201 Created" with the message body containing a representation of the created subscription. The Location HTTP header shall contain the URI of the created subscription.

2b. If there is no valid subscription data for the UE, HTTP status code "404 Not Found" shall be returned including additional error information in the response body (in the "ProblemDetails" element).

2c. 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 to be monitored, contained in the SubscriptionData parameter), HTTP status code "501 Not Implemented" shall be returned including additional error information in the response body (in the "ProblemDetails" element).

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the POST response body.

In the case of redirection, the HSS shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another HSS (service) instance.

## 5.3.2.4 Unsubscribe

### 5.3.2.4.1 General

The following procedures using the Unsubscribe service operation are supported:

- Unsubscribe to notification of data change

### 5.3.2.4.2 Unsubscribe to notifications of data change

Figure 5.3.2.4.2-1 shows a scenario where the NF service consumer sends a request to the HSS to unsubscribe from notifications of data changes. The request contains the URI previously received in the Location HTTP header of the response to the subscription.
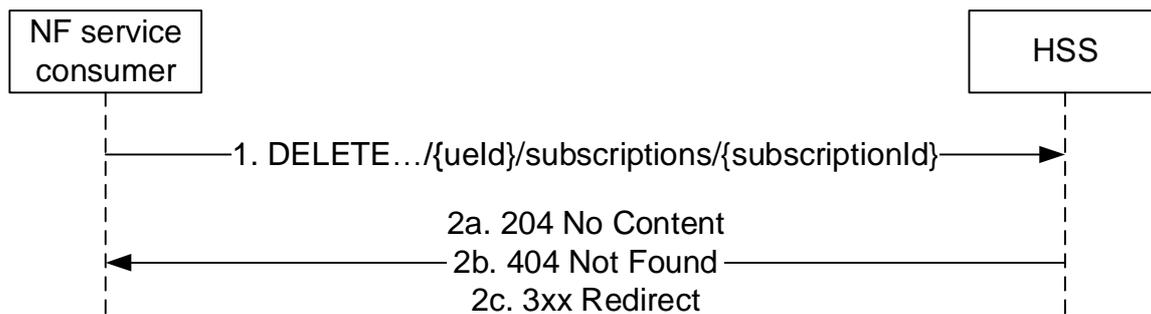
**Figure 5.3.2.4.2-1: NF service consumer unsubscribes to notifications**

1.  The NF service consumer sends a DELETE request to the resource identified by the URI previously received during subscription creation.

2a. On success, the HSS responds with "204 No Content".

2b. If there is no valid subscription available (e.g. due to an unknown subscriptionId value), HTTP status code "404 Not Found" should be returned including additional error information in the response body (in the "ProblemDetails" element).

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the DELETE response body.

In the case of redirection, the HSS shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another HSS (service) instance.

### 5.3.2.5 Notification

#### 5.3.2.5.1 General

The following procedures using the Notification service operation are supported:

-   Data change notification to NF.

#### 5.3.2.5.2 Data Change Notification To NF

Figure 5.3.2.5.2-1 shows a scenario where the HSS notifies the NF service consumer (that has subscribed to receive such notification) about subscription data change. The request contains the callbackReference URI as previously received in the SubscriptionData.
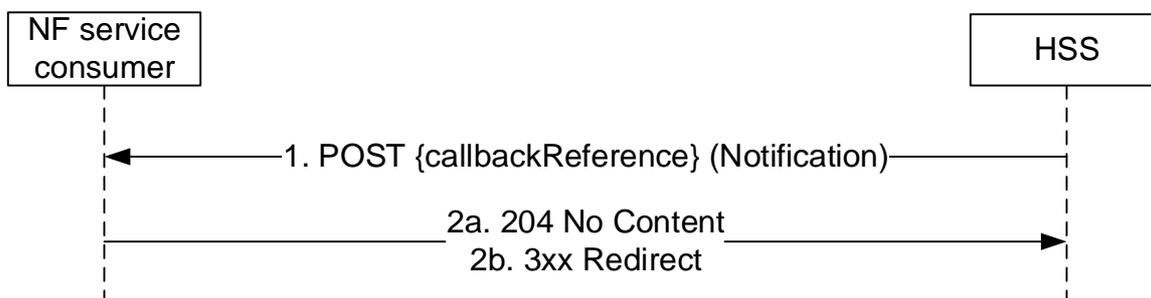


**Figure 5.3.2.5.2-1: Subscription Data Change Notification**

1.  The HSS sends a POST request to the callbackReference as provided by the NF service consumer during the subscription.

2a. The NF service consumer responds with "204 No Content".

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the POST response body.

In the case of redirection, the NF Service Consumer shall return 3xx status code, which shall contain a Location header with an URI pointing to an alternative notification endpoint.

### 5.3.2.6        ModifySubscription

#### 5.3.2.6.1        General

The following procedures using the ModifySubscription service operation are supported:

- Modification of a Subscription to notification of data change

#### 5.3.2.6.2        Modification of a subscription to notifications of data change

Figure 5.3.2.6.2-1 shows a scenario where the NF service consumer sends a request to the HSS to modify a subscription to notifications of data changes. The request contains the URI previously received in the Location HTTP header of the response to the subscription.
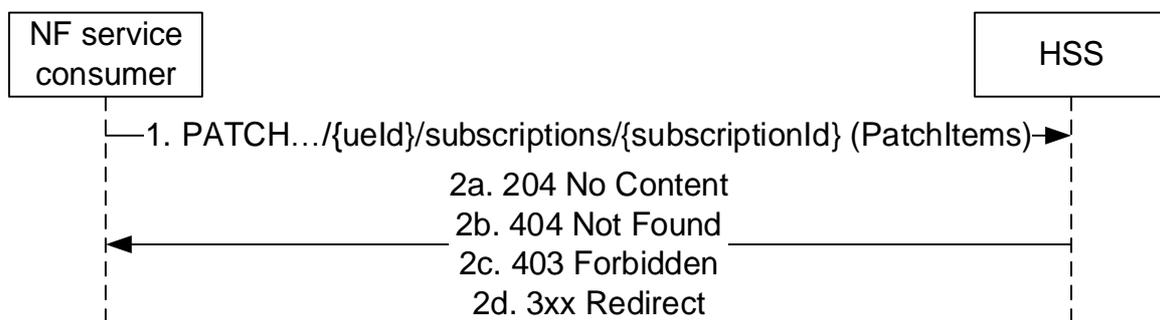


**Figure 5.3.2.6.2-1: NF service consumer modifies a subscription to notifications**

1.  The NF service consumer sends a PATCH request to the resource identified by the URI previously received during subscription creation.

2a. On success, the UDM responds with "204 No Content".

2b. If there is no valid subscription available (e.g. due to an unknown subscriptionId value), HTTP status code "404 Not Found" should be returned including additional error information in the response body (in the "ProblemDetails" element).

2c. If the operation cannot be authorized, HTTP status code "403 Forbidden" should be returned including additional error information in the response body (in "ProblemDetails" element)

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the PATCH response body.

In the case of redirection, the HSS shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another HSS (service) instance.

## 5.4        Nhss_UEContextManagement Service

### 5.4.1        Service Description

The service allows an NF consumer (UDM) to trigger the cancellation of any previous registered serving node due to IRAT mobility. See 3GPP TS 23.632 [8], clause 6.1.3.

## 5.4.2 Service Operations

### 5.4.2.1 Introduction

For the Nhss_UEContextManagement service the following service operations are defined:

- SnDeregistration

- ImeiUpdate

- RoamingStatusUpdate

The Nhss_UEContextManagement service is used by Consumer NF (UDM) to request HSS to deregister the MME/SGSN via cancel location procedure and to update the IMEI and roaming status of the UE in the HSS.

### 5.4.2.2 SnDeregistration

#### 5.4.2.2.1 General

The following procedure using the SnDeregistration service operation is supported:

- SN Deregistration

#### 5.4.2.2.2 SN Deregistration

Figure 5.4.2.2.2-1 shows a scenario where the NF service consumer (UDM) requests HSS to initiate Cancel Location procedure towards the MME/SGSN due to IRAT mobility. The request contains the UE's identity which shall be an IMSI.
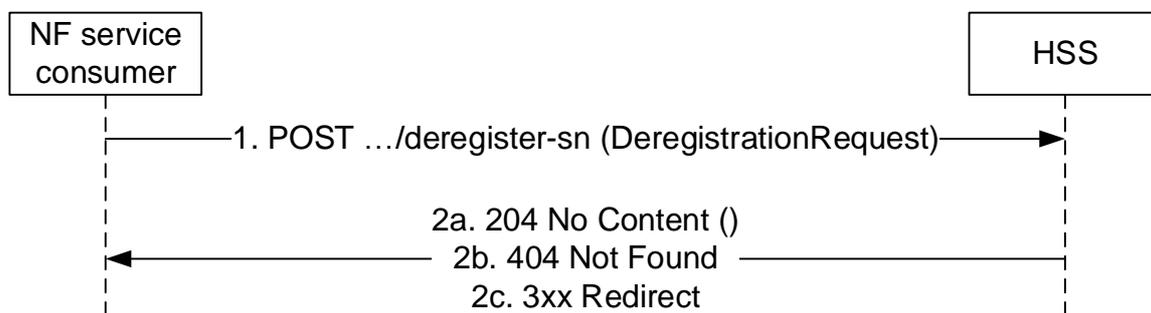


**Figure 5.4.2.2.2-1: SN Deregistration**

1. The NF service consumer sends a POST request (custom method: deregister-sn) to the HSS; the request body contains the UE identity (IMSI) and the deregistration reason.

   The HSS, based on the value indicated in the deregistration reason, initiates a Cancel Location towards the serving node, including a Cancellation Type value (see 3GPP TS 29.272 [17] and 3GPP TS 29.002 [20]) as follows:

   - "UE_INITIAL_AND_SINGLE_REGISTRATION": S6a/S6d/Gr(S4/Gn/Gp) Cancel Location sent towards MME/SGSN, with a Cancellation-Type set to MME_UPDATE_PROCEDURE/SGSN_UPDATE_PROCEDURE; the HSS shall delete the stored MME/SGSN address and MME/SGSN number.

     Additionally, a MAP D Cancel Location (IMSI) shall be sent towards MSC/VLR if a VLR number was found in the HSS/HLR for the user; the HSS/HLR shall delete the stored MSC/VLR number.

   - "UE_INITIAL_AND_DUAL_REGISTRATION": S6d/Gr(S4) Cancel Location sent towards SGSN, with a Cancellation-Type set to SGSN_UPDATE_PROCEDURE; the HSS shall delete the stored SGSN address and SGSN number.

NOTE 1:	As described in 3GPP TS 23.502 [3], a UE operating in dual-registration mode indicates that it is moving from EPS, which implies that there is an MME registered in HSS.

-	"EPS_TO_5GS_MOBILITY": S6a Cancel Location sent towards MME, with a Cancellation-Type set to MME_UPDATE_PROCEDURE; the HSS shall delete the stored MME address and MME number.

	Additionally, a MAP D Cancel Location (IMSI) shall be sent towards MSC/VLR if a VLR number was found in the HSS/HLR for the user; the HSS/HLR shall delete the stored MSC/VLR number.

-	"EPS_TO_5GS_MOBILITY": S6d/Gr(S4) Cancel Location sent towards SGSN, with a Cancellation-Type set to SGSN_UPDATE_PROCEDURE; the HSS shall delete the stored SGSN address and SGSN number.

-	"EPS_TO_5GS_MOBILITY_WITHOUT_N26_IWK": S6d/Gr(S4) Cancel Location sent towards SGSN, with a Cancellation-Type set to SGSN_UPDATE_PROCEDURE; the HSS shall delete the stored SGSN address and SGSN number. The HSS shall not send S6a Cancel Location towards MME (Clause 4.11.2.3 of 3GPP TS 23.502 [3]).

NOTE 2:	Based on operator policy, and the presence of GUAMI in the DeregistrationRequest, the HSS can decide whether a registered VLR in the VPLMN needs to be cancelled. It should be noted that keeping the VLR registration can impact terminating services (e.g. T-ADS, MT-SMS…) causing failed paging attempts.

2a.	On success, the HSS responds with "204 No Content". If the HSS has a valid subscription for the UE, but the UE is not registered in EPS network, the HSS shall respond with "204 No Content".

2b.	If there is no valid subscription data for the UE, HTTP status code "404 Not Found" should be returned including additional error information in the response body (in the "ProblemDetails" element).

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the POST response body.

In the case of redirection, the HSS shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another HSS (service) instance.

## 5.4.2.3	IMEI Update

Figure 5.4.2.3-1 shows a scenario where the NF service consumer (UDM) requests HSS to update the IMEI of the UE stored in the HSS. The request contains the UE's identity which shall be an IMSI, and the new IMEI of the UE.
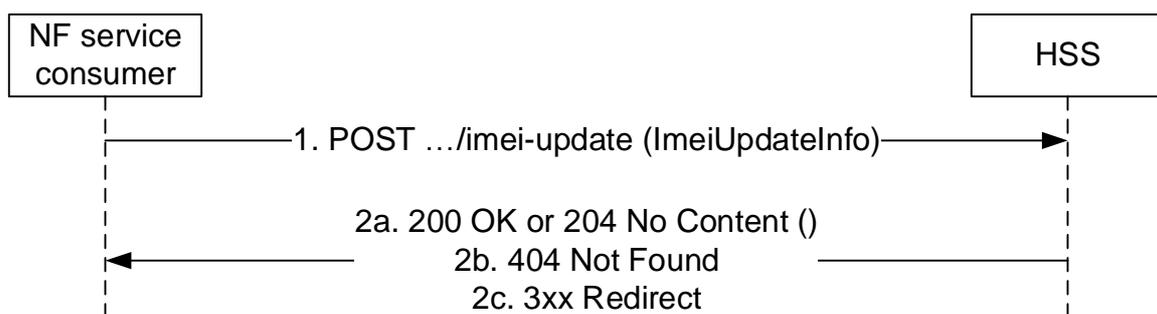


**Figure 5.4.2.3-1: IMEI Update**

1.	The NF service consumer sends a POST request (custom method: imei-update) to the HSS; the request body contains the UE identity (IMSI) and the new IMEI of the UE.

2a.	On success, the HSS responds either with "204 No Content", which indicates that the HSS does not have any stored IMEI(SV) value for the UE, or with a "200 OK", which indicates that the HSS had an IMEI value stored for the UE. In the latter case, the HSS shall update the locally stored IMEI value for the UE, and return in the response body the previous IMEI, so the NF Service Consumer (UDM) can determine whether the HSS contained a different IMEI value than the current one sent to the HSS in this IMEI Update notification.

2b.	If there is no valid subscription data for the UE, HTTP status code "404 Not Found" should be returned including additional error information in the response body (in the "ProblemDetails" element).

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the POST response body.

In the case of redirection, the HSS shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another HSS (service) instance.

### 5.4.2.4 Roaming Status Update

Figure 5.4.2.4-1 shows a scenario where the NF service consumer (UDM) requests HSS to update the Roaming Status of the UE stored in the HSS. The request contains the UE's identity which shall be an IMSI, and the new PLMN-ID where the UE is located.
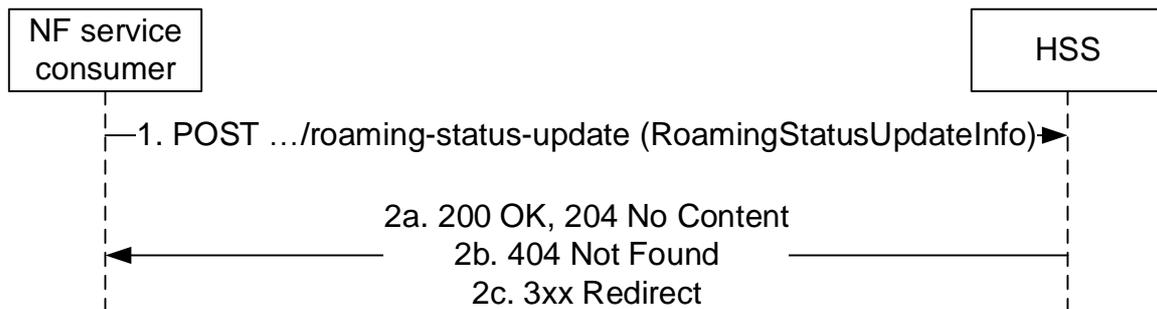


**Figure 5.4.2.4-1: Roaming Status Update**

1. The NF service consumer sends a POST request (custom method: roaming-status-update) to the HSS; the request body contains the UE identity (IMSI) and the new PLMN-ID of the UE.

2a. On success, the HSS responds with "204 No Content".

2b. If there is no valid subscription data for the UE, HTTP status code "404 Not Found" should be returned including additional error information in the response body (in the "ProblemDetails" element).

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the POST response body.

In the case of redirection, the HSS shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another HSS (service) instance.

## 5.5 Nhss_EventExposure Service

### 5.5.1 Service Description

See 3GPP TS 23.632 [8].

### 5.5.2 Service Operations

### 5.5.2.1 Introduction

For the Nhss_EventExposure service the following service operations are defined:

- Subscribe

- Unsubscribe

- Notify

- ModifySubscription

The Nhss_EventExposure service is used by consumer NFs (e.g. UDM) to subscribe to notifications of event occurrence by means of the Subscribe service operation.

The Nhss_EventExposure service is also used by the consumer NFs (e.g. UDM) that have previously subscribed to notifications, to unsubscribe by means of the Unsubscribe service operation.

The Nhss_EventExposure service is also used by the subscribed consumer NFs (e.g. UDM) to modify an existing subscription by means of the ModifySubscription service operation.

## 5.5.2.2 Subscribe

### 5.5.2.2.1 General

The following procedures using the Subscribe service operation are supported:

- Subscribe to Notification of event occurrence

### 5.5.2.2.2 Subscription to Notification of event occurrence

Figure 5.5.2.2.2-1 shows a scenario where the NF service consumer sends a request to the HSS to subscribe to notifications of event occurrence. The request contains a callback URI, the type of event that is monitored and additional information e.g. SCEF Id, event filters and reporting options.
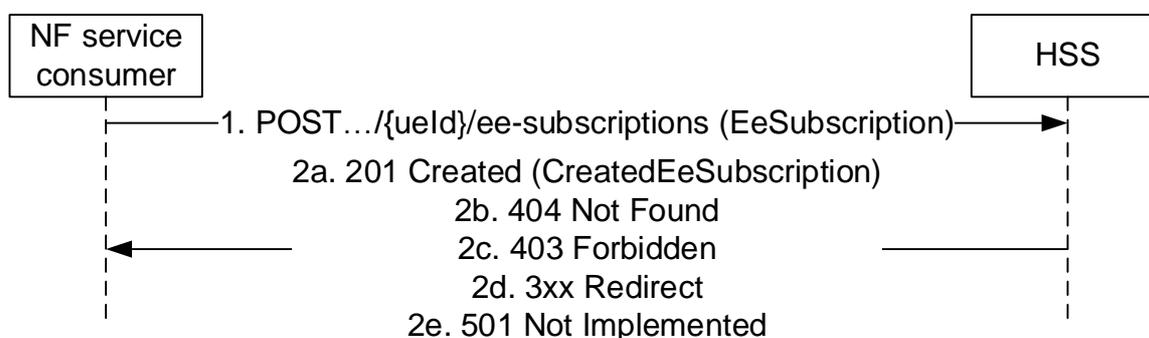


**Figure 5.5.2.2.2-1: NF service consumer subscribes to notifications**

1. The NF service consumer sends a POST request to the parent resource (collection of subscriptions) (.../{ueId}/ee-subscriptions), to create a subscription as present in message body. The request may contain an expiry time, suggested by the NF Service Consumer, representing the time upto which the subscription is desired to be kept active and the time after which the subscribed event(s) shall stop generating notifications. Additionally, the request may include an SCEF Id if Common Network Exposure is used (i.e. if combined SCEF+NEF requested the event(s) to be subscribed/monitored in EPC)

   If MTC Provider information is received in the request, the HSS shall check whether the MTC Provider is allowed to perform this operation for the UE; otherwise, the HSS shall skip the MTC provider authorization check.

2a. On success, the HSS responds with "201 Created" with the message body containing a representation of the created subscription. The Location HTTP header shall contain the URI of the created subscription.

   If immediate reporting is requested and if both HSS and NF consumer has indicated supporting of ERIR feature (see clause 6.4.8), the HSS shall include available immediate event reports, i.e. reports already received from MME, in the response body; otherwise if the HSS and/or the NF consumer cannot support the ERIR feature, the HSS shall send a notification (see clause 5.5.2.4.2) towards the NF consumer including the current status of the events requested for immediate reporting. If immediate reporting is requested but the current status of the event(s) is not available at the time of subscription, the HSS should include the current status not available indication in the response.

   If some of the requested monitoring configurations fails, the response may include the failedMonitoringConfigs to indicate the failed cause of the failed monitoring configurations.

2b. If the user does not exist, HTTP status code "404 Not Found" shall be returned including additional error information in the response body (in the "ProblemDetails" element).

2c. If there is no valid subscription data for the UE, i.e. based on the UE's subscription information monitoring of the requested EventType is not allowed, or the requested EventType is not supported, or the MTC Provider is not allowed to perform this operation for the UE, HTTP status code "403 Forbidden" shall be returned including additional error information in the response body (in the "ProblemDetails" element).

2d. In the case of redirection, the HSS shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another HSS (service) instance.

2e. If the requested monitoring event types or reporting options are not supported, HTTP status code "501 Not Implemented" shall be returned including additional error information in the response body (in the "ProblemDetails" element).

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the POST response body.

### 5.5.2.3 Unsubscribe

#### 5.5.2.3.1 General

The following procedures using the Unsubscribe service operation are supported:

- Unsubscribe to Notifications of event occurrence

#### 5.5.2.3.2 Unsubscribe to notifications of event occurrence

Figure 5.5.2.3.2-1 shows a scenario where the NF service consumer sends a request to the HSS to unsubscribe from notifications of event occurrence. The request contains the URI previously received in the Location HTTP header of the response to the subscription.
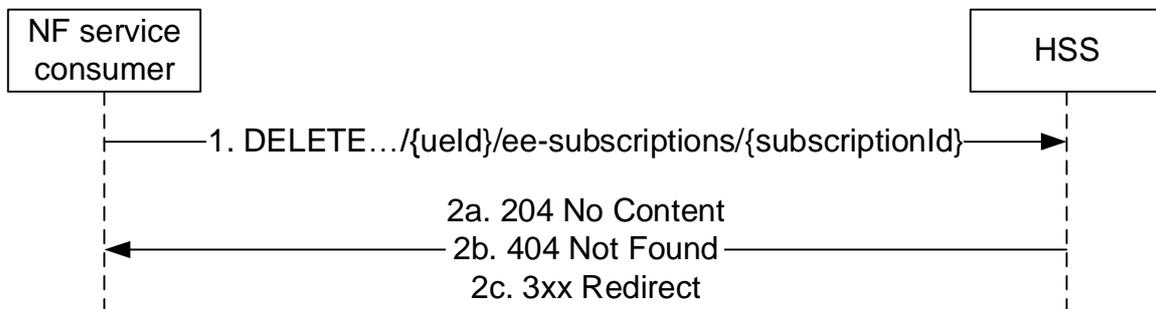


**Figure 5.5.2.3.2-1: NF service consumer unsubscribes to notifications**

1. The NF service consumer sends a DELETE request to the resource identified by the URI previously received during subscription creation.

2a. On success, the HSS responds with "204 No Content".

2b. If there is no valid subscription available (e.g. due to an unknown SubscriptionId value), HTTP status code "404 Not Found" shall be returned including additional error information in the response body (in the "ProblemDetails" element).

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the DELETE response body.

In the case of redirection, the HSS shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another HSS (service) instance.

### 5.5.2.4 Notify

#### 5.5.2.4.1 General

The following procedures using the Notify service operation are supported:

- Event Occurrence Notification

#### 5.5.2.4.2 Event Occurrence Notification

Figure 5.5.2.4.2-1 shows a scenario where the HSS notifies the NF service consumer (that has subscribed to receive such notification) about occurrence of an event or the current status of the events requested for immediate reporting if ERIR feature (see clause 6.4.8) is not supported by the HSS and/or the NF consumer. The request contains the Reference IDs as previously received in the EeSubscription.
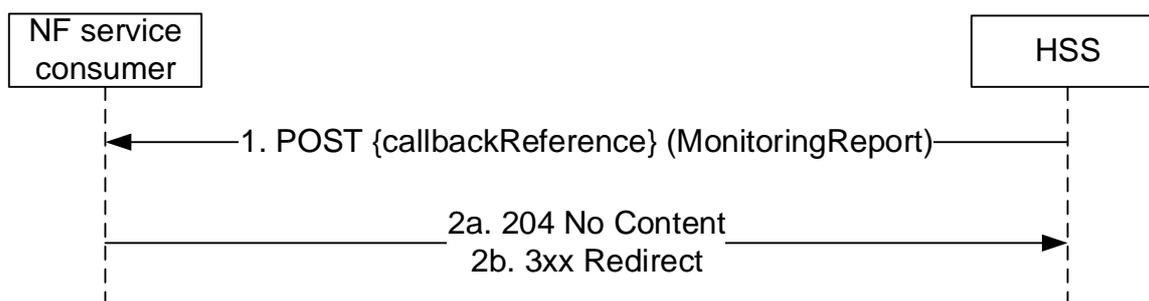


**Figure 5.5.2.4.2-1: Event Occurrence Notification**

1. The HSS sends a POST request to the callbackReference URI as provided by the NF service consumer during the subscription.

2a. The NF Service Consumer responds with "204 No Content".

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the POST response body.

In the case of redirection, the NF Service Consumer shall return 3xx status code, which shall contain a Location header with an URI pointing to an alternative notification endpoint.

### 5.5.2.5 ModifySubscription

#### 5.5.2.5.1 General

The following procedures using the ModifySubscription service operation are supported:

- Modification of an EE-Subscription to notification of events

#### 5.5.2.5.2 Modification of a subscription

The service operation is invoked by a NF Service Consumer, e.g. UDM, towards the HSS, when it needs to modify an existing subscription previously created by itself at the HSS.

The NF Service Consumer shall modify the subscription by using HTTP method PATCH with the URI of the individual subscription resource to be modified.
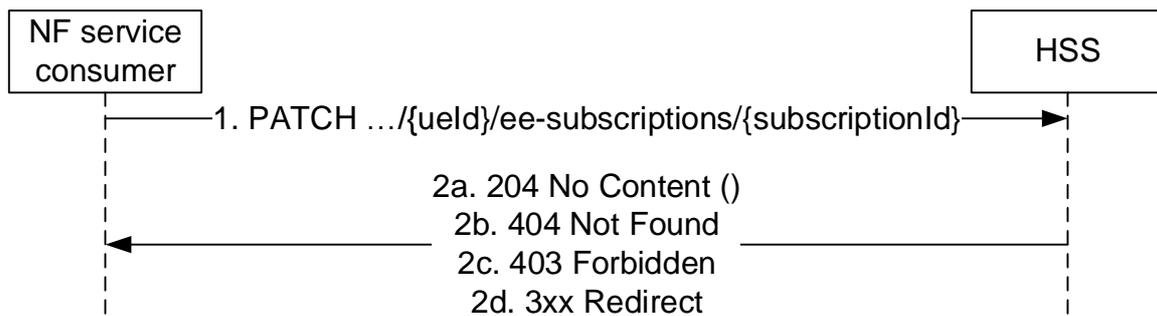
**Figure 5.5.2.5.2-1: NF service consumer updates subscription**

1. The NF service consumer (e.g. NEF) shall send a PATCH request to the resource representing a subscription. The modification may be for the events subscribed or for updating the event report options.

2a. On success, the request is accepted, the HSS shall respond with "204 No Content".

2b. If the resource does not exist e.g. the subscriptionId cannot be found, HTTP status code "404 Not Found" should be returned including additional error information in the response body (in the "ProblemDetails" element).

2c. If the modification can't be accepted, HTTP status code "403 Forbidden" should be returned including additional error information in the response body (in the "ProblemDetails" element).

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the PATCH response body.

In the case of redirection, the HSS shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another HSS (service) instance.

# 6 API Definitions

## 6.1 Nhss_UEAuthentication Service API

### 6.1.1 Introduction

The Nhss_UEAuthentication service shall use the Nhss_UEAuthentication API.

The request URI used in HTTP request from the NF service consumer towards the NF service producer shall have the structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

**{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>**

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].

- The <apiName> shall be "nhss-ueau".

- The <apiVersion> shall be "v1".

- The <apiSpecificResourceUriPart> shall be set as described in clause 6.1.

### 6.1.2 Usage of HTTP

#### 6.1.2.1 General

HTTP/2, as defined in IETF RFC 9113 [9], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

HTTP messages and bodies for the Nhss_UEAuthentication service shall comply with the OpenAPI [10] specification contained in Annex A.

## 6.1.2.2 HTTP standard headers

### 6.1.2.2.1 General

The usage of HTTP standard headers shall be supported as specified in clause 5.2.2 of 3GPP TS 29.500 [4].

### 6.1.2.2.2 Content type

The following content types shall be supported:

- JSON, as defined in IETF RFC 8259 [11], signalled by the content type "application/json".

- The Problem Details JSON Object (IETF RFC 9457 [12] signalled by the content type "application/problem+json".

## 6.1.2.3 HTTP custom headers

### 6.1.2.3.1 General

In this release of the specification, no specific custom headers are defined for the Nhss_UEAuthentication service.

For 3GPP specific HTTP custom headers used across all service based interfaces, see clause 5.2.3 of 3GPP TS 29.500 [4].

## 6.1.3 Resources

### 6.1.3.1 Overview

{apiRoot}/nhss-ueau/<apiVersion>

/generate-av
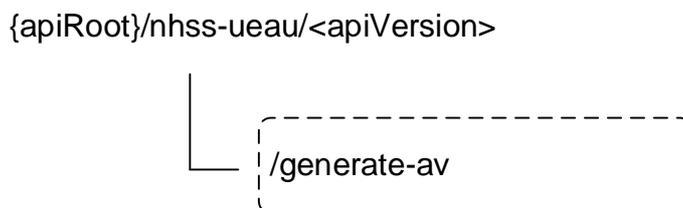
**Figure 6.1.3.1-1: Resource URI structure of the nhss-ueau API**

Table 6.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

**Table 6.1.3.1-1: Resources and methods overview**

| Resource name | Resource URI | HTTP method or custom operation | Description |
|---|---|---|---|
| n/a | generate-av | generate-av (POST) | Generate Authentication Vector |

# 6.1.4    Custom Operations without associated resources

## 6.1.4.1    Overview

**Table 6.1.4.1-1: Custom operations without associated resources**

| Custom operation URI | Mapped HTTP method | Description |
|---|---|---|
| {apiRoot}/nhss-ueau/<apiVersion>/generate-av | POST | The HSS calculates a fresh Authentication Vector taking into account the received information (imsi, serving network name, authentication method) |

## 6.1.4.2    Operation: Generate AV

### 6.1.4.2.1    Description

This custom operation is used by the NF service consumer (UDM) to request calculation of an authentication vector for the provided imsi.

### 6.1.4.2.2    Operation Definition

This operation shall support the response data structures and response codes specified in tables 6.1.4.2.2-1 and 6.1.4.2.2-2.

**Table 6.1.4.2.2-1: Data structures supported by the POST Request Body**

| Data type | P | Cardinality | Description |
|---|---|---|---|
| AvGenerationRequest | M | 1 | Contains input parameters for Authentication Vector calculation |

**Table 6.1.4.2.2-2: Data structures supported by the POST Response Body**

| Data type | P | Cardinality | Response codes | Description |
|---|---|---|---|---|
| AvGenerationResponse | M | 1 | 200 OK | Upon success, a response body containing the generated authentication vector shall be returned |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. |
| ProblemDetails | O | 0..1 | 403 Forbidden | The "cause" attribute may be used to indicate one of the following application errors:<br>- AUTHENTICATION_REJECTED |
| ProblemDetails | O | 0..1 | 404 Not Found | The "cause" attribute may be used to indicate one of the following application errors:<br>- USER_NOT_FOUND |

**Table 6.1.4.2.2-3: Headers supported by the 307 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

**Table 6.1.4.2.2-4: Headers supported by the 308 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

## 6.1.5 Notifications

In this release of this specification, no notifications are defined for the Nhss_UEAuthentication Service.

## 6.1.6 Data Model

### 6.1.6.1 General

This clause specifies the application data model supported by the API.

Table 6.1.6.1-1 specifies the data types defined for the Nhss service based interface protocol.

**Table 6.1.6.1-1: Nhss specific Data Types**

| Data type | Clause defined | Description | Applicability |
|-----------|----------------|-------------|---------------|
| AvGenerationRequest | 6.1.6.2.2 | Contains imsi, authentication method, serving network name, resynchronization info | |
| AvGenerationResponse | 6.1.6.2.3 | Contains the calculated Authentication Vector | |

Table 6.1.6.1-2 specifies data types re-used by the Nhss service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nhss service based interface.

**Table 6.1.6.1-2: Nhss re-used Data Types**

| Data type | Reference | Comments | Applicability |
|-----------|-----------|----------|---------------|
| AuthType | 3GPP TS 29.503 [13] | | |
| ServingNetworkName | 3GPP TS 29.503 [13] | | |
| ResynchronizationInfo | 3GPP TS 29.503 [13] | | |
| AvEapAkaPrime | 3GPP TS 29.503 [13] | | |
| Av5GHeAka | 3GPP TS 29.503 [13] | | |
| ProblemDetails | 3GPP TS 29.571 [7] | Response body of error response messages. | |
| RedirectResponse | 3GPP TS 29.571 [7] | Response body of redirect response messages. | |

### 6.1.6.2 Structured data types

#### 6.1.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

### 6.1.6.2.2          Type: AvGenerationRequest

**Table 6.1.6.2.2-1: Definition of type AvGenerationRequest**

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|---|---|---|---|---|---|
| imsi | string | M | 1 | pattern: "[0-9]{5,15}" | |
| authType | AuthType | M | 1 | Indicates the authentication method; "EAP_AKA_PRIME" or "5G_AKA" | |
| servingNetworkName | ServingNetworkName | M | 1 | | |
| resynchronizationInfo | ResynchronizationInfo | O | 0..1 | | |

### 6.1.6.2.3          Type: AvGenerationResponse

**Table 6.1.6.2.3-1: Definition of type AvGenerationResponse**

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|---|---|---|---|---|---|
| avEapAkaPrime | AvEapAkaPrime | C | 0..1 | shall be present if av5GHeAka is absent, otherwise shall be absent. | |
| av5GHeAka | Av5GHeAka | C | 0..1 | shall be present if avEapAkaPrime is absent, otherwise shall be absent. | |

### 6.1.6.3          Simple data types and enumerations

### 6.1.6.3.1          Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

### 6.1.6.3.2          Simple data types

The simple data types defined in table 6.1.6.3.2-1 shall be supported.

**Table 6.1.6.3.2-1: Simple data types**

| Type Name | Type Definition | Description | Applicability |
|---|---|---|---|
| | | | |

## 6.1.7     Error Handling

### 6.1.7.1          General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [4].

### 6.1.7.2          Protocol Errors

Protocol errors handling shall be supported as specified in clause 5.2.7 of 3GPP TS 29.500 [4].

### 6.1.7.3          Application Errors

The application errors defined for the Nhss_UEAuthentication service are listed in table 6.1.7.3-1.

**Table 6.1.7.3-1: Application errors**

| Application Error | HTTP status code | Description |
|---|---|---|
| AUTHENTICATION_REJECTED | 403 Forbidden | The user cannot be authenticated |
| USER_NOT_FOUND | 404 Not Found | The user does not exist in the HPLMN |

## 6.1.8    Feature negotiation

The optional features in table 6.1.8-1 are defined for the Nhss_UEAuthentication API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

**Table 6.1.8-1: Supported Features**

| Feature number | Feature Name | Description |
|---|---|---|
|  |  |  |

## 6.1.9    Security

As indicated in 3GPP TS 33.501 [6] and 3GPP TS 29.500 [4], the access to the Nhss_UEAU API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [18]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [19]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Nhss_UEAU API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [19], clause 5.4.2.2.

> NOTE:    When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Nhss_UEAU service.

The Nhss_UEAU API defines a single scope "nhss-ueau" for OAuth2 authorization (as specified in 3GPP TS 33.501 [6]) for the entire API, and it does not define any additional scopes at resource or operation level.

## 6.1.10    HTTP redirection

An HTTP request may be redirected to a different HSS service instance when using direct or indirect communications (see 3GPP TS 29.500 [4]).

An SCP that reselects a different HSS producer instance will return the NF Instance ID of the new HSS producer instance in the 3gpp-Sbi-Producer-Id header, as specified in clause 6.10.3.4 of 3GPP TS 29.500 [4].

If an HSS redirects a service request to a different HSS using an 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new HSS towards which the service request is redirected shall be indicated in the 3gpp-Sbi-Target-Nf-Id header of the 307 Temporary Redirect or 308 Permanent Redirect response as specified in clause 6.10.9.1 of 3GPP TS 29.500 [4].

# 6.2    Nhss_SubscriberDataManagement Service API

## 6.2.1    API URI

The Nhss_SubscriberDataManagement service shall use the Nhss_SubscriberDataManagement API.

The request URI used in HTTP request from the NF service consumer towards the NF service producer shall have the structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

**{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>**

with the following components:

-    The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].

- The <apiName> shall be "nhss-sdm".

- The <apiVersion> shall be "v1".

- The <apiSpecificResourceUriPart> shall be set as described in clause 6.2.3.

# 6.2.2 Usage of HTTP

## 6.2.2.1 General

HTTP/2, as defined in IETF RFC 9113 [9], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

HTTP messages and bodies for the Nhss_SubscriberDataManagement service shall comply with the OpenAPI [10] specification contained in Annex A.

## 6.2.2.2 HTTP standard headers

### 6.2.2.2.1 General

The usage of HTTP standard headers shall be supported as specified in clause 5.2.2 of 3GPP TS 29.500 [4].

### 6.2.2.2.2 Content type

The following content types shall be supported:

- JSON, as defined in IETF RFC 8259 [11], signalled by the content type "application/json".

- The Problem Details JSON Object (IETF RFC 9457 [12] signalled by the content type "application/problem+json".

## 6.2.2.3 HTTP custom headers

### 6.2.2.3.1 General

In this release of the specification, no specific custom headers are defined for the Nhss_SubscriberDataManagement service.

For 3GPP specific HTTP custom headers used across all service-based interfaces, see clause 5.2.3 of 3GPP TS 29.500 [4].

# 6.2.3     Resources

## 6.2.3.1     Overview



{apiRoot}/nhss-sdm/<apiVersion>
        └── /{ueId}
                ├── /ue-context-in-pgw-data
                └── /subscriptions
                        └── /{subscriptionId}
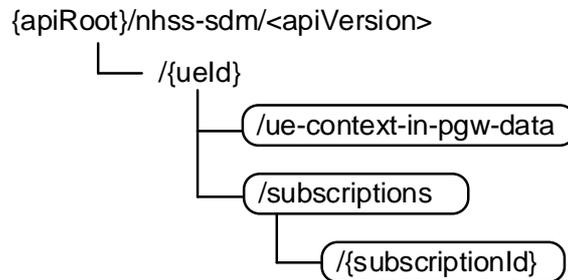
**Figure 6.2.3.1-1: Resource URI structure of the nhss-sdm API**

Table 6.2.3.1-1 provides an overview of the resources and applicable HTTP methods.

**Table 6.2.3.1-1: Resources and methods overview**

| Resource name (Archetype) | Resource URI | HTTP method or custom operation | Description |
|---|---|---|---|
| UeContextInPgwData (Document) | /{ueId}/ue-context-in-pgw-data | GET | Retrieve the UE's Context in PGW Data |
| Subscriptions (Collection) | /{ueId}/subscriptions | POST | Create a subscription |
| Individual Subscription (Document) | /{ueId}/subscriptions/{subscriptionId} | DELETE | Delete the subscription identified by {subscriptionId}, i.e. unsubscribe |
| | | PATCH | Modify the subscription identified by {subscriptionId} |

## 6.2.3.2        Resource: UeContextInPgwData

### 6.2.3.2.1        Description

This resource represents the allocated PGWs for the UE.

### 6.2.3.2.2        Resource Definition

Resource URI: {apiRoot}/nhss-sdm/<apiVersion>/{ueId}/ue-context-in-pgw-data

This resource shall support the resource URI variables defined in table 6.2.3.2.2-1.

**Table 6.2.3.2.2-1: Resource URI variables for this resource**

| Name | Definition |
|---|---|
| apiRoot | See clause 6.2.1 |
| apiVersion | See clause 6.2.1 |
| ueId | Represents the UE identifier with type IMSI.  pattern: "^(imsi-[0-9]{5,15}|.+)$" |

### 6.2.3.2.3          Resource Standard Methods

### 6.2.3.2.3.1          GET

This method shall support the URI query parameters specified in table 6.2.3.2.3.1-1.

#### Table 6.2.3.2.3.3-1: URI query parameters supported by the GET method on this resource

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| n/a  |           |   |             |             |

This method shall support the request data structures specified in table 6.2.3.2.3.1-2 and the response data structures and response codes specified in table 6.2.3.2.3.1-3.

#### Table 6.2.3.2.3.1-2: Data structures supported by the GET Request Body on this resource

| Data type | P | Cardinality | Description |
|-----------|---|-------------|-------------|
| n/a       |   |             |             |

#### Table 6.2.3.2.3.1-3: Data structures supported by the GET Response Body on this resource

| Data type | P | Cardinality | Response codes | Description |
|-----------|---|-------------|----------------|-------------|
| UeContextInPgwData | M | 1 | 200 OK | A response body containing the UeContextInPgwData shall be returned. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. |
| ProblemDetails | O | 0..1 | 404 Not Found | The "cause" attribute may be used to indicate one of the following application errors:<br>- USER_NOT_FOUND<br>- DATA_NOT_FOUND |
| NOTE:     In addition, common data structures as listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] are supported. ||||||

#### Table 6.2.3.2.3.1-4: Headers supported by the 307 Response Code on this resource

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

#### Table 6.2.3.2.3.1-5: Headers supported by the 308 Response Code on this resource

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

### 6.2.3.3 Resource: Subscriptions

#### 6.2.3.3.1 Description

This resource is used to represent subscriptions to notifications.

#### 6.2.3.3.2 Resource Definition

Resource URI: {apiRoot}/nhss-sdm/<apiVersion>/{ueId}/subscriptions

This resource shall support the resource URI variables defined in table 6.2.3.3.2-1.

**Table 6.2.3.3.2-1: Resource URI variables for this resource**

| Name | Definition |
|------|------------|
| apiRoot | See clause 6.1.1 |
| apiVersion | See clause 6.1.1 |
| ueId | Represents the IMSI of the subscriber. pattern: "^(imsi-[0-9]{5,15})$" |

#### 6.2.3.3.3 Resource Standard Methods

#### 6.2.3.3.3.1 POST

This method shall support the URI query parameters specified in table 6.2.3.3.3.1-1.

**Table 6.2.3.3.3.1-1: URI query parameters supported by the POST method on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| n/a | | | | |

This method shall support the request data structures specified in table 6.2.3.3.3.1-2 and the response data structures and response codes specified in table 6.2.3.3.3.1-3.

**Table 6.2.3.3.3.1-2: Data structures supported by the POST Request Body on this resource**

| Data type | P | Cardinality | Description |
|-----------|---|-------------|-------------|
| SubscriptionData | M | 1 | The subscription that is to be created. |

**Table 6.2.3.3.3.1-3: Data structures supported by the POST Response Body on this resource**

| Data type | P | Cardinality | Response codes | Description |
|---|---|---|---|---|
| SubscriptionData | M | 1 | 201 Created | Upon success, a response body containing a representation of the created Individual subscription resource shall be returned.<br><br>The HTTP response shall include a "Location" HTTP header that contains the resource URI of the created resource. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. |
| ProblemDetails | O | 0..1 | 404 Not Found | The "cause" attribute may be used to indicate one of the following application errors:<br><br>- USER_NOT_FOUND |
| ProblemDetails | O | 0..1 | 501 Not Implemented | The "cause" attribute may be used to indicate one of the following application errors:<br><br>- UNSUPPORTED_RESOURCE_URI<br><br>This response shall not be cached. |
| NOTE: In addition, common data structures as listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] are supported. | | | | |

**Table 6.2.3.3.3.1-4: Headers supported by the 307 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

**Table 6.2.3.3.3.1-5: Headers supported by the 308 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

### 6.2.3.4 Resource: Individual subscription

#### 6.2.3.4.1 Description

This resource is used to represent an individual subscription to notifications.

#### 6.2.3.4.2 Resource Definition

Resource URI: {apiRoot}/nhss-sdm/<apiVersion>/{ueId}/subscriptions/{subscriptionId}

This resource shall support the resource URI variables defined in table 6.2.3.4.2-1.

**Table 6.2.3.4.2-1: Resource URI variables for this resource**

| Name | Definition |
|------|------------|
| apiRoot | See clause 6.1.1 |
| apiVersion | See clause 6.1.1 |
| ueId | Represents the IMSI of the subscriber<br>    pattern: "^(imsi-[0-9]{5,15})$" |
| subscriptionId | The subscriptionId identifies an individual subscription to notifications. |

### 6.2.3.4.3 Resource Standard Methods

#### 6.2.3.4.3.1 DELETE

This method shall support the URI query parameters specified in table 6.2.3.4.3.1-1.

**Table 6.2.3.4.3.1-1: URI query parameters supported by the DELETE method on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| n/a | | | | |

This method shall support the request data structures specified in table 6.2.3.4.3.1-2 and the response data structures and response codes specified in table 6.2.3.4.3.1-3.

**Table 6.2.3.4.3.1-2: Data structures supported by the Delete Request Body on this resource**

| Data type | P | Cardinality | Description |
|-----------|---|-------------|-------------|
| n/a | | | The request body shall be empty. |

**Table 6.2.3.4.3.1-3: Data structures supported by the DELETE Response Body on this resource**

| Data type | P | Cardinality | Response codes | Description |
|-----------|---|-------------|----------------|-------------|
| n/a | | | 204 No Content | Upon success, an empty response body shall be returned. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. |
| ProblemDetails | O | 0..1 | 404 Not Found | The "cause" attribute may be used to indicate one of the following application errors:<br><br>- USER_NOT_FOUND<br>- SUBSCRIPTION_NOT_FOUND (see 3GPP TS 29.500 [4] table 5.2.7.2-1) |
| NOTE: In addition, common data structures as listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] are supported. | | | | |

**Table 6.2.3.4.3.1-4: Headers supported by the 307 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

**Table 6.2.3.4.3.1-5: Headers supported by the 308 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

6.2.3.4.3.2          PATCH

This method shall support the URI query parameters specified in table 6.2.3.4.3.2-1.

**Table 6.2.3.4.3.2-1: URI query parameters supported by the PATCH method on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| n/a | | | | |

This method shall support the request data structures specified in table 6.2.3.4.3.2-2 and the response data structures and response codes specified in table 6.2.3.4.3.2-3.

**Table 6.2.3.4.3.2-2: Data structures supported by the PATCH Request Body on this resource**

| Data type | P | Cardinality | Description |
|-----------|---|-------------|-------------|
| array(PatchItem) | M | 1 | It contains the list of changes to be made to the resource representing the individual subscription, according to the JSON PATCH format specified in IETF RFC 6902 [13]. |

**Table 6.2.3.4.3.2-3: Data structures supported by the PATCH Response Body on this resource**

| Data type | P | Cardinality | Response codes | Description |
|-----------|---|-------------|----------------|-------------|
| n/a | | | 204 No Content | Upon success, a response with no content is returned. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. |
| ProblemDetails | O | 0..1 | 404 Not Found | The "cause" attribute may be used to indicate one of the following application errors:<br><br>- USER_NOT_FOUND<br>- SUBSCRIPTION_NOT_FOUND (see 3GPP TS 29.500 [4] table 5.2.7.2-1) |
| ProblemDetails | O | 0..1 | 403 Forbidden | One or more attributes are not allowed to be modified.<br><br>The "cause" attribute may be used to indicate one of the following application errors:<br><br>- MODIFICATION_NOT_ALLOWED (see 3GPP TS 29.500 [4] table 5.2.7.2-1) |
| NOTE: In addition, common data structures as listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] are supported. | | | | |

**Table 6.2.3.4.3.2-4: Headers supported by the 307 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

**Table 6.2.3.4.3.2-5: Headers supported by the 308 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

## 6.2.4    Custom Operations without associated resources

In this release of this specification, no custom operations without associated resources are defined for the Nhss_SubscriberDataManagement Service.

## 6.2.5    Notifications

### 6.2.5.1    General

This clause specifies the use of notifications and corresponding protocol details.

### 6.2.5.2    Data Change Notification

The POST method shall be used for Data Change Notifications and the URI shall be as provided during the subscription procedure.

Resource URI: {callbackReference}

Support of URI query parameters is specified in table 6.2.5.2-1.

**Table 6.2.5.2-1: URI query parameters supported by the POST method**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| n/a | | | | |

Support of request data structures is specified in table 6.2.5.2-2 and of response data structures and response codes is specified in table 6.2.5.2-3.

**Table 6.2.5.2-2: Data structures supported by the POST Request Body**

| Data type | P | Cardinality | Description |
|-----------|---|-------------|-------------|
| ModificationNotification | M | 1 | When a modification of any attributes in UeContextInPgwData is notified to the UDM, the notification should include all the attributes including the ones that are not modified as well. For the unchanged attributes, "REPLACE" operation shall be used in changeItem with absent origValue. |

**Table 6.2.5.2-3: Data structures supported by the POST Response Body**

| Data type | P | Cardinality | Response codes | Description |
|---|---|---|---|---|
| n/a | | | 204 No Content | Upon success, an empty response body shall be returned. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. |
| ProblemDetails | O | 0..1 | 404 Not Found | The "cause" attribute may be used to indicate one of the following application errors:<br><br>- CONTEXT_NOT_FOUND<br><br>See table 6.2.7.3-1 for the description of this error. |
| NOTE: In addition, common data structures as listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] are supported. | | | | |

**Table 6.2.5.2-4: Headers supported by the 307 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| Location | string | M | 1 | A URI pointing to the endpoint of the NF service consumer to which the notification should be sent. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

**Table 6.2.5.2-5: Headers supported by the 308 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| Location | string | M | 1 | A URI pointing to the endpoint of the NF service consumer to which the notification should be sent. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

## 6.2.6     Data Model

### 6.2.6.1     General

This clause specifies the application data model supported by the API.

Table 6.2.6.1-1 specifies the data types defined for the Nhss_SubscriberDataManagement service API.

**Table 6.2.6.1-1: Nhss_SubscriberDataManagement specific Data Types**

| Data type | Clause defined | Description |
|---|---|---|
| UeContextInPgwData | 6.2.6.2.2 | |
| SubscriptionData | 6.2.6.2.3 | Subscription Data |
| SubscriptionDataSets | 6.2.6.2.4 | UE Subscription Data Sets |

Table 6.2.6.1-2 specifies data types re-used by the Nhss_SubscriberDataManagement service API from other APIs, including a reference and when needed, a short description of their use within the Nhss_SubscriberDataManagement service API.

**Table 6.2.6.1-2: Nhss_SubscriberDataManagement re-used Data Types**

| Data type | Reference | Comments |
|---|---|---|
| PgwInfo | 3GPP TS 29.503 [13] | |
| ModificationNotification | 3GPP TS 29.503 [13] | |
| NfInstanceId | 3GPP TS 29.571 [7] | Network Function Instance Identifier |
| Uri | 3GPP TS 29.571 [7] | Uniform Resource Identifier |
| DateTime | 3GPP TS 29.571 [7] | |
| ProblemDetails | 3GPP TS 29.571 [7] | Response body of error response messages. |
| RedirectResponse | 3GPP TS 29.571 [7] | Response body of redirect response messages. |
| Fqdn | 3GPP TS 29.571 [7] | Fully Qualified Domain Name |

### 6.2.6.2 Structured data types

#### 6.2.6.2.1 Introduction

This clause defines the data structures to be used in resource representations.

#### 6.2.6.2.2 Type: UeContextInPgwData

**Table 6.2.6.2.2-1: Definition of type UeContextInPgwData**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| pgwInfo | array(PgwInfo) | O | 1..N | Information about the APNs and PGW-C+SMF FQDNs used in interworking with UDM |
| emergencyFqdn | Fqdn | O | 0..1 | PGW-C+SMF FQDN for emergency session |
| emergencyPlmnId | PlmnId | O | 0..1 | PLMN where the PGW-C+SMF for emergency session is located |
| emergencyIpAddr | IpAddress | O | 0..1 | IP address of the PGW-C+SMF for emergency session |
| emergencyRegistrationTime | DateTime | O | 0..1 | Time of PGW-C+SMF for emergency session Registration. |
| Note: At least one of pgwInfo and emergencyFqdn/emergencyIPAddr shall be present. The format of PGW-C+SMF FQDN is specified in clause 5.12.3.2, 3GPP TS 29.303 [16]. | | | | |

### 6.2.6.2.3 Type: SubscriptionData

**Table 6.2.6.2.3-1: Definition of type SubscriptionData**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| nfInstanceId | NfInstanceId | M | 1 | Identity of the NF Instance creating the subscription. |
| callbackReference | Uri | M | 1 | URI provided by the NF service consumer to receive notifications |
| monitoredResourceUris | array(Uri) | M | 1..N | A set of URIs that identify the resources for which a change triggers a notification.<br>The URI shall take the form of either an absolute URI or an absolute-path reference as defined in IETF RFC 3986 [31].<br>See NOTE 1. |
| expires | DateTime | O | 0..1 | If present in a POST request, it indicates the point in time at which the subscription expires.<br><br>Within a POST request the proposed expiry time is conveyed whereas in a POST response or PATCH response the confirmed expiry time is returned. |
| immediateReport | boolean | O | 0..1 | This IE indicates whether immediate report is needed or not.<br><br>When present, this IE shall be set as following:<br>- true: immediate report is required<br>- false (default) immediate report is not required |
| report | SubscriptionDataSets | C | 0..1 | This IE shall be present in Subscribe response, if the immediateReport attribute is set to "true" in Subscribe request.<br><br>When present, this IE shall contain the representation of subscription data sets that to be monitored, i.e. listed in monitoredResourceUris attribute. |
| NOTE 1: The HSS should handle only the relative-path part (apiSpecificResourceUriPart, see 3GPP TS 29.501 [5] clause 4.4.1) and ignore possible inconsistencies (caused by e.g. an SCP) in the base URI part. | | | | |

### 6.2.6.2.4 Type: SubscriptionDataSets

**Table 6.2.6.2.4-1: Definition of type SusbcriptionDataSets**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| ueContextInPgwData | UeContextInPgwData | O | 0..1 | UE Context in PGW Data |

### 6.2.6.3 Simple data types and enumerations

### 6.2.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

### 6.2.6.3.2 Simple data types

The simple data types defined in table 6.2.6.3.2-1 shall be supported.

**Table 6.2.6.3.2-1: Simple data types**

| Type Name | Type Definition | Description |
|---|---|---|
|  |  |  |

## 6.2.7      Error Handling

### 6.2.7.1        General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [4].

### 6.2.7.2        Protocol Errors

Protocol errors handling shall be supported as specified in clause 5.2.7 of 3GPP TS 29.500 [4].

### 6.2.7.3        Application Errors

The common application errors defined in the Table 5.2.7.2-1 in 3GPP TS 29.500 [4] may also be used for the
Nhss_SubscriberDataManagement service. The following application errors listed in Table 6.2.7.3-1 are specific for the
Nhss_SubscriberDataManagement service.

**Table 6.2.7.3-1: Application errors**

| Application Error | HTTP status code | Description |
|---|---|---|
| USER_NOT_FOUND | 404 Not Found | The user does not exist. |
| DATA_NOT_FOUND | 404 Not Found | The requested data is not found/does not exist. |
| CONTEXT_NOT_FOUND | 404 Not Found | It is used during the modification of an existing subscription when no corresponding context exists. |

## 6.2.8      Feature Negotiation

The optional features in table 6.2.8-1 are defined for the Nhss_SubscriberDataManagement API. They shall be
negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

**Table 6.2.8-1: Supported Features**

| Feature number | Feature Name | Description |
|---|---|---|
|  |  |  |

## 6.2.9      Security

As indicated in 3GPP TS 33.501 [6] and 3GPP TS 29.500 [4], the access to the Nhss_SDM API may be authorized by
means of the OAuth2 protocol (see IETF RFC 6749 [18]), based on local configuration, using the "Client Credentials"
authorization grant, where the NRF (see 3GPP TS 29.510 [19]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Nhss_SDM API, shall obtain a
"token" from the authorization server, by invoking the Access Token Request service, as described in
3GPP TS 29.510 [19], clause 5.4.2.2.

    NOTE:      When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF
              that the NF Service Consumer used for discovering the Nhss_SDM service.

The Nhss_SDM API defines a single scope "nhss-sdm" for OAuth2 authorization (as specified in 3GPP TS 33.501 [6])
for the entire API, and it does not define any additional scopes at resource or operation level.

## 6.2.10    HTTP redirection

An HTTP request may be redirected to a different HSS service instance when using direct or indirect communications
(see 3GPP TS 29.500 [4]).

An SCP that reselects a different HSS producer instance will return the NF Instance ID of the new HSS producer
instance in the 3gpp-Sbi-Producer-Id header, as specified in clause 6.10.3.4 of 3GPP TS 29.500 [4].

If an HSS redirects a service request to a different HSS using an 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new HSS towards which the service request is redirected shall be indicated in the 3gpp-Sbi-Target-Nf-Id header of the 307 Temporary Redirect or 308 Permanent Redirect response as specified in clause 6.10.9.1 of 3GPP TS 29.500 [4].

# 6.3 Nhss_UEContextManagement Service API

## 6.3.1 Introduction

The Nhss_UEContextManagement service shall use the Nhss_UEContextManagement API.

The request URI used in HTTP request from the NF service consumer towards the NF service producer shall have the structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

**{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>**

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].

- The <apiName> shall be "nhss-uecm".

- The <apiVersion> shall be "v1".

- The <apiSpecificResourceUriPart> shall be set as described in clause 6.1.

## 6.3.2 Usage of HTTP

### 6.3.2.1 General

HTTP/2, as defined in IETF RFC 9113 [9], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

HTTP messages and bodies for the Nhss_UEContextManagement service shall comply with the OpenAPI [10] specification contained in Annex A.

### 6.3.2.2 HTTP standard headers

#### 6.3.2.2.1 General

The usage of HTTP standard headers shall be supported as specified in clause 5.2.2 of 3GPP TS 29.500 [4].

#### 6.3.2.2.2 Content type

The following content types shall be supported:

- JSON, as defined in IETF RFC 8259 [11], signalled by the content type "application/json".

- The Problem Details JSON Object (IETF RFC 9457 [12] signalled by the content type "application/problem+json".

### 6.3.2.3 HTTP custom headers

#### 6.3.2.3.1 General

In this release of the specification, no specific custom headers are defined for the Nhss_UEContextManagement service.

For 3GPP specific HTTP custom headers used across all service-based interfaces, see clause 5.2.3 of 3GPP TS 29.500 [4].

## 6.3.3 Resources

### 6.3.3.1 Overview

{apiRoot}/nhss-uecm/<apiVersion>
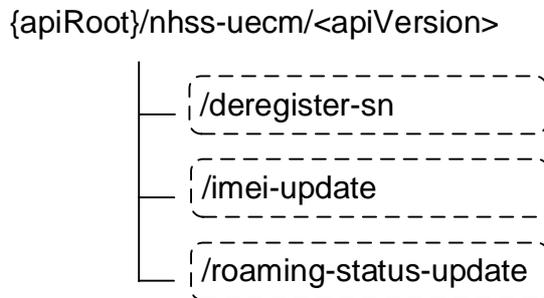


**Figure 6.3.3.1-1: Resource URI structure of the nhss-uecm API**

Table 6.3.3.1-1 provides an overview of the resources and applicable HTTP methods.

**Table 6.3.3.1-1: Resources and methods overview**

| Resource name | Resource URI | HTTP method or custom operation | Description |
|---|---|---|---|
| n/a | deregister-sn | deregister-sn (POST) | Requesting MME/SGSN deregistration |
| n/a | imei-update | imei-update (POST) | Requests the update of the IMEI of the UE stored in HSS |
| n/a | roaming-status-update | roaming-status-update (POST) | Requests the update of the roaming status of the UE stored in HSS |

## 6.3.4 Custom Operations without associated resources

### 6.3.4.1 Overview

**Table 6.3.4.1-1: Custom operations without associated resources**

| Custom operation URI | Mapped HTTP method | Description |
|---|---|---|
| {apiRoot}/nhss-uecm/<apiVersion>/deregister-sn | POST | Requesting MME/SGSN deregistration. |

### 6.3.4.2 Operation: deregister-sn

#### 6.3.4.2.1 Description

This custom operation is used by the NF service consumer (UDM) to request MME/SGSN deregistration.

#### 6.3.4.2.2 Operation Definition

This operation shall support the data structures and response codes specified in tables 6.3.4.2.2-1 and 6.3.4.2.2-2.

**Table 6.3.4.2.2-1: Data structures supported by the POST Request Body**

| Data type | P | Cardinality | Description |
|-----------|---|-------------|-------------|
| DeregistrationReq uest | M | 1 | |

**Table 6.3.4.2.2-2: Data structures supported by the POST Response Body**

| Data type | P | Cardinality | Response codes | Description |
|-----------|---|-------------|----------------|-------------|
| n/a | | | 204 No Content | Upon success, an empty response body shall be returned. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. |
| ProblemDetails | O | 0..1 | 404 Not Found | The "cause" attribute may be used to indicate one of the following application errors:<br>- USER_NOT_FOUND |

**Table 6.3.4.2.2-3: Headers supported by the 307 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

**Table 6.3.4.2.2-4: Headers supported by the 308 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

### 6.3.4.3 Operation: imei-update

#### 6.3.4.3.1 Description

This custom operation is used by the NF service consumer (UDM) to request the update of the IMEI of the UE.

#### 6.3.4.3.2 Operation Definition

This operation shall support the data structures and response codes specified in tables 6.3.4.3.2-1 and 6.3.4.3.2-2.

**Table 6.3.4.3.2-1: Data structures supported by the POST Request Body**

| Data type | P | Cardinality | Description |
|-----------|---|-------------|-------------|
| ImeiUpdateInfo | M | 1 | |

**Table 6.3.4.3.2-2: Data structures supported by the POST Response Body**

| Data type | P | Cardinality | Response codes | Description |
|---|---|---|---|---|
| ImeiUpdateRespon se | M | 1 | 200 OK | Upon success, a response body containing the IMEI(SV) stored previously in HSS shall be returned. |
| n/a | | | 204 No Content | Upon success, if the HSS does not have any IMEI(SV) values stored for the UE, an empty response body shall be returned. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. |
| ProblemDetails | O | 0..1 | 404 Not Found | The "cause" attribute may be used to indicate one of the following application errors:<br>- USER_NOT_FOUND<br>- CONTEXT_NOT_FOUND |

**Table 6.3.4.3.2-3: Headers supported by the 307 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

**Table 6.3.4.3.2-4: Headers supported by the 308 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

### 6.3.4.4        Operation: roaming-status-update

#### 6.3.4.4.1        Description

This custom operation is used by the NF service consumer (UDM) to request the update of the roaming status of the UE.

#### 6.3.4.4.2        Operation Definition

This operation shall support the data structures and response codes specified in tables 6.3.4.4.2-1 and 6.3.4.4.2-2.

**Table 6.3.4.4.2-1: Data structures supported by the POST Request Body**

| Data type | P | Cardinality | Description |
|---|---|---|---|
| RoamingStatusUp dateInfo | M | 1 | |

**Table 6.3.4.4.2-2: Data structures supported by the POST Response Body**

| Data type | P | Cardinality | Response codes | Description |
|---|---|---|---|---|
| n/a | | | 204 No Content | Upon success, an empty response body shall be returned. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. |
| ProblemDetails | O | 0..1 | 404 Not Found | The "cause" attribute may be used to indicate one of the following application errors:<br>- USER_NOT_FOUND<br>- CONTEXT_NOT_FOUND |

**Table 6.3.4.4.2-3: Headers supported by the 307 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

**Table 6.3.4.4.2-4: Headers supported by the 308 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

## 6.3.5 Notifications

In this release of this specification, no notifications are defined for the Nhss_UEContextManagement Service.

## 6.3.6 Data Model

### 6.3.6.1 General

This clause specifies the application data model supported by the API.

Table 6.3.6.1-1 specifies the structured data types defined for the Nhss_UECM service API.

**Table 6.3.6.1-1: Nhss_UECM specific Data Types**

| Data type | Clause defined | Description | Applicability |
|---|---|---|---|
| DeregistrationRequest | 6.3.6.2.2 | Contains IMSI, deregistration reason | |
| ImeiUpdateInfo | 6.3.6.2.3 | Contains IMSI, new IMEI(SV) | |
| ImeiUpdateResponse | 6.3.6.2.4 | Contains the previous IMEI(SV) stored in HSS | |
| RoamingStatusUpdateInfo | 6.3.6.2.5 | Contains PLMN-ID where the UE is located | |

Table 6.3.6.1-2 specifies data types re-used by the Nhss_UECM service API from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nhss_UECM service API.

**Table 6.3.6.1-2: Nhss_UECM re-used Data Types**

| Data type | Reference | Comments | Applicability |
|---|---|---|---|
| Guami | 3GPP TS 29.571 [7] | | |
| ProblemDetails | 3GPP TS 29.571 [7] | Response body of error response messages. | |
| RedirectResponse | 3GPP TS 29.571 [7] | Response body of redirect response messages. | |
| PlmnId | 3GPP TS 29.571 [7] | | |

## 6.3.6.2 Structured data types

### 6.3.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

### 6.3.6.2.2 Type: DeregistrationRequest

**Table 6.3.6.2.2-1: Definition of type DeregistrationRequest**

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|---|---|---|---|---|---|
| imsi | string | M | 1 | pattern: "^[0-9]{5,15}$" | |
| deregReason | DeregistrationReason | M | 1 | String, see clause 6.3.6.3.3 | |
| guami | Guami | O | 0..1 | The GUAMI identifying the AMF where the UE is registered. May be used by the HSS based on operator policy to decide whether a registered VLR shall be cancelled. | |

### 6.3.6.2.3 Type: ImeiUpdateInfo

**Table 6.3.6.2.3-1: Definition of type ImeiUpdateInfo**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| imsi | string | M | 1 | IMSI of the subscriber.<br><br>pattern: "^[0-9]{5,15}$" |
| imei | string | C | 0..1 | IMEI of the UE as described in 3GPP TS 23.003 [15], clause 6.2.1; it shall not include the Check Digit.<br><br>pattern: "^[0-9]{14}$" |
| imeisv | string | C | 0..1 | IMEISV of the UE as described in 3GPP TS 23.003 [15], clause 6.2.2.<br><br>pattern: "^[0-9]{16}$" |
| NOTE: Exactly one of attributes "imei" or "imeisv" shall be present. | | | | |

6.3.6.2.4 Type: ImeiUpdateResponse

**Table 6.3.6.2.4-1: Definition of type ImeiUpdateResponse**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| previousImei | string | C | 0..1 | Previous IMEI of the UE as described in 3GPP TS 23.003 [15], clause 6.2.1; it shall not include the Check Digit.<br><br>It shall be included if the HSS has an IMEI value stored for the UE.<br><br>pattern: "^[0-9]{14}$" |
| previousImeisv | string | C | 0..1 | IMEISV of the UE as described in 3GPP TS 23.003 [15], clause 6.2.2.<br><br>It shall be included if the HSS has an IMEISV value stored for the UE.<br><br>pattern: "^[0-9]{16}$" |
| NOTE: At least one of attributes "previousImei" or "previousImeisv" shall be present. | | | | |

6.3.6.2.5 Type: RoamingStatusUpdateInfo

**Table 6.3.6.2.5-1: Definition of type RoamingStatusUpdateInfo**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| imsi | string | M | 1 | IMSI of the subscriber.<br><br>pattern: "^[0-9]{5,15}$" |
| plmnId | PlmnId | M | 1 | PLMN-ID where the UE is located. |

## 6.3.6.3 Simple data types and enumerations

### 6.3.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

### 6.3.6.3.2 Simple data types

The simple data types defined in table 6.3.6.3.2-1 shall be supported.

**Table 6.3.6.3.2-1: Simple data types**

| Type Name | Type Definition | Description |
|---|---|---|
|  |  |  |

### 6.3.6.3.3 Enumeration: DeregistrationReason

**Table 6.3.6.3.3-1: Enumeration DeregistrationReason**

| Enumeration value | Description |
|---|---|
| "UE_INITIAL_AND_SINGLE_REGISTRATION" | This value is used when the UDM needs to indicate to HSS that the MME/SGSN, if any, shall be cancelled due to an initial registration for single registration. |
| "UE_INITIAL_AND_DUAL_REGISTRATION" | This value is used when the UDM needs to indicate to HSS that an SGSN shall be cancelled (due to initial registration), but the MME shall not be cancelled (due to dual registration). |
| "EPS_TO_5GS_MOBILITY" | This value is used when the UDM needs to indicate to HSS that the MME/SGSN, if any, shall be cancelled due to a mobility event (i.e. for single registration which is not an initial registration). |
| "EPS_TO_5GS_MOBILITY_WITHOUT_N26_IWK" | This value is used when the UDM needs to indicate to HSS that an SGSN shall be cancelled (due to mobility event), but the MME shall not be cancelled (due to mobility registration for single registration). |

## 6.3.7 Error Handling

### 6.3.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [4].

### 6.3.7.2 Protocol Errors

Protocol errors handling shall be supported as specified in clause 5.2.7 of 3GPP TS 29.500 [4].

### 6.3.7.3 Application Errors

The common application errors defined in the Table 5.2.7.2-1 in 3GPP TS 29.500 [4] may also be used for the Nudm_UEContextManagement service. The application errors defined for the Nhss_UEContextManagement service are listed in Table 6.3.7.3-1.

**Table 6.3.7.3-1: Application errors**

| Application Error | HTTP status code | Description |
|---|---|---|
| USER_NOT_FOUND | 404 Not Found | The user does not exist. |
| CONTEXT_NOT_FOUND | 404 Not Found | It is used when no corresponding UE context exists. |

## 6.3.8 Feature Negotiation

The optional features in table 6.3.8-1 are defined for the Nhss_UEContextManagement API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

**Table 6.3.8-1: Supported Features**

| Feature number | Feature Name | Description |
|---|---|---|
|  |  |  |

## 6.3.9 Security

As indicated in 3GPP TS 33.501 [6] and 3GPP TS 29.500 [4], the access to the Nhss_UECM API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [18]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [19]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Nhss_UECM API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [19], clause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Nhss_UECM service.

The Nhss_UECM API defines a single scope "nhss-uecm" for OAuth2 authorization (as specified in 3GPP TS 33.501 [6]) for the entire API, and it does not define any additional scopes at resource or operation level.

## 6.3.10 HTTP redirection

An HTTP request may be redirected to a different HSS service instance when using direct or indirect communications (see 3GPP TS 29.500 [4]).

An SCP that reselects a different HSS producer instance will return the NF Instance ID of the new HSS producer instance in the 3gpp-Sbi-Producer-Id header, as specified in clause 6.10.3.4 of 3GPP TS 29.500 [4].

If an HSS redirects a service request to a different HSS using an 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new HSS towards which the service request is redirected shall be indicated in the 3gpp-Sbi-Target-Nf-Id header of the 307 Temporary Redirect or 308 Permanent Redirect response as specified in clause 6.10.9.1 of 3GPP TS 29.500 [4].

# 6.4 Nhss_EventExposure Service API

## 6.4.1 API URI

URIs of this API shall have the following root:

{apiRoot}/<apiName>/<apiVersion>/

where "apiRoot" is defined in clause 4.4.1 of 3GPP TS 29.501 [5], the "apiName" shall be set to "nhss-ee" and the "apiVersion" shall be set to "v1" for the current version of this specification.

## 6.4.2 Usage of HTTP

### 6.4.2.1 General

HTTP/2, as defined in IETF RFC 9113 [13], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

HTTP messages and bodies for the Nhss_EE service shall comply with the OpenAPI [14] specification contained in Annex A5.

### 6.4.2.2 HTTP standard headers

#### 6.4.2.2.1 General

The usage of HTTP standard headers shall be supported as specified in clause 5.2.2 of 3GPP TS 29.500 [4].

#### 6.4.2.2.2 Content type

The following content types shall be supported:

JSON, as defined in IETF RFC 8259 [15], signalled by the content type "application/json".

The Problem Details JSON Object (IETF RFC 9457 [16] signalled by the content type "application/problem+json"

JSON Patch (IETF RFC 6902 [41]). The use of the JSON Patch format in a HTTP request body shall be signalled by the content type "application/json-patch+json".

### 6.4.2.3 HTTP custom headers

#### 6.4.2.3.1 General

The usage of HTTP custom headers shall be supported as specified in clause 5.2.3 of 3GPP TS 29.500 [4].

## 6.4.3 Resources

### 6.4.3.1 Overview

{apiRoot}/nhss-ee/<apiVersion>

/{ueId}

/ee-subscriptions

/{subscriptionId}
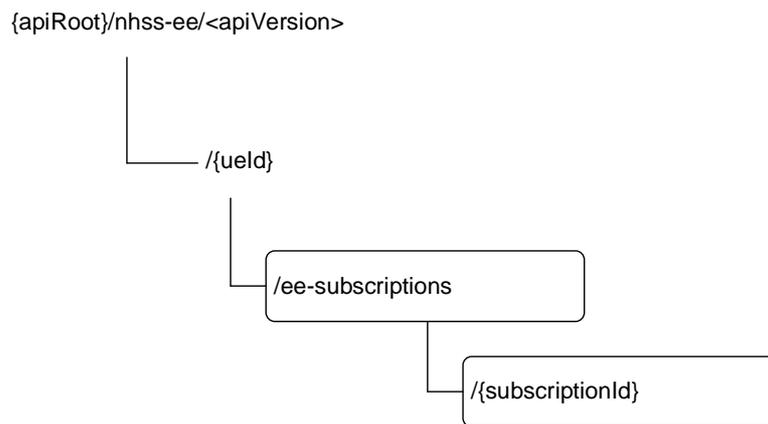
**Figure 6.4.3.1-1: Resource URI structure of the Nhss_EE API**

Table 6.4.3.1-1 provides an overview of the resources and applicable HTTP methods.

**Table 6.4.3.1-1: Resources and methods overview**

| Resource name (Archetype) | Resource URI | HTTP method or custom operation | Description |
|---|---|---|---|
| EeSubscriptions (Collection) | /{ueId}/ee-subscriptions | POST | Create a subscription |
| Individual subscription (Document) | /{ueId}/ee-subscriptions/{subscriptionId} | PATCH | Update the subscription identified by {subscriptionId} |
| | | DELETE | Delete the subscription identified by {subscriptionId}, i.e. unsubscribe |

## 6.4.3.2　　　Resource: EeSubscriptions (Collection)

### 6.4.3.2.1　　　Description

This resource is used to represent subscriptions to notifications.

### 6.4.3.2.2　　　Resource Definition

Resource URI: {apiRoot}/nhss-ee/<apiVersion>/{ueId}/ee-subscriptions

This resource shall support the resource URI variables defined in table 6.4.3.2.2-1.

**Table 6.4.3.2.2-1: Resource URI variables for this resource**

| Name | Definition |
|---|---|
| apiRoot | See clause 6.4.1 |
| ueId | Represents the identity of the UE in the HSS (IMSI) or the identity of a group of UEs.<br><br>- If representing a single UE, this parameter shall contain the IMSI of the UE.<br>  pattern: See type Imsi in clause 6.4.6.3.2 of this document.<br><br>- If representing a group of UEs, this parameter shall contain the External Group Id.<br>  pattern: "^extgroupid-[^@]+@[^@]+$"<br><br>(NOTE) |
| NOTE:　　If the HSS supports GBEE feature, the ueId can contain the External Group Id, or ueId can only contain IMSI of the UE. | |

### 6.4.3.2.3　　　Resource Standard Methods

#### 6.4.3.2.3.1　　　　POST

This method shall support the URI query parameters specified in table 6.4.3.2.3.1-1.

**Table 6.4.3.2.3.1-1: URI query parameters supported by the POST method on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| n/a | | | | |

This method shall support the request data structures specified in table 6.4.3.2.3.1-2 and the response data structures and response codes specified in table 6.4.3.2.3.1-3.

**Table 6.4.3.2.3.1-2: Data structures supported by the POST Request Body on this resource**

| Data type | P | Cardinality | Description |
|---|---|---|---|
| EeSubscription | M | 1 | The subscription that is to be created |

**Table 6.4.3.2.3.1-3: Data structures supported by the POST Response Body on this resource**

| Data type | P | Cardinality | Response codes | Description |
|---|---|---|---|---|
| CreatedEeSubscription | M | 1 | 201 Created | Upon success, a response body containing a representation of the created Individual subscription resource shall be returned, along with event reports that might be immediately available at the HSS.<br><br>The HTTP response shall include a "Location" HTTP header that contains the resource URI of the created resource. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. |
| EeSubscriptionError | O | 0..1 | 403 Forbidden | The "cause" attribute may be used to indicate one of the following application errors:<br>- MONITORING_NOT_ALLOWED<br>- MAXIMUM_RESOURCES_EXCEEDED<br>- MTC_PROVIDER_NOT_ALLOWED |
| ProblemDetails | O | 0..1 | 404 Not Found | The "cause" attribute may be used to indicate one of the following application errors:<br>- USER_NOT_FOUND |
| EeSubscriptionError | O | 0..1 | 501 Not Implemented | The "cause" attribute may be used to indicate one of the following application errors:<br>- UNSUPPORTED_MONITORING_EVENT_TYPE<br>- UNSUPPORTED_MONITORING_REPORT_OPTIONS<br><br>This response shall not be cached. |

**Table 6.4.3.2.3.1-4: Headers supported by the 307 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

**Table 6.4.3.2.3.1-5: Headers supported by the 308 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

### 6.4.3.3 Resource: Individual subscription (Document)

#### 6.4.3.3.1 Resource Definition

Resource URI: {apiRoot}/nhss-ee/<apiVersion>/{ueId}/ee-subscriptions/{subscriptionId}

This resource shall support the resource URI variables defined in table 6.4.3.3.1-1.

**Table 6.4.3.3.1-1: Resource URI variables for this resource**

| Name | Definition |
|------|-----------|
| apiRoot | See clause 6.4.1 |
| ueId | Represents the identity of the UE in the HSS (IMSI) or the identity of a group of UEs.<br><br>- If representing a single UE, this parameter shall contain the IMSI of the UE. pattern: See type Imsi in clause 6.4.6.3.2 of this document.<br><br>- If representing a group of UEs, this parameter shall contain the External Group Id. pattern: "^extgroupid-[^@]+@[^@]+$"<br><br>(NOTE) |
| subscriptionId | The subscriptionId identifies an individual subscription to notifications<br><br>The type is string. |
| NOTE: | If the HSS supports GBEE feature, the ueId can contain the External Group Id, or ueId can only contain IMSI of the UE. |

### 6.4.3.3.2 Resource Standard Methods

#### 6.4.3.3.2.1 DELETE

This method shall support the URI query parameters specified in table 6.4.3.3.2.1-1.

**Table 6.4.3.3.1.1-1: URI query parameters supported by the DELETE method on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| n/a | | | | |

This method shall support the request data structures specified in table 6.4.3.3.2.1-2 and the response data structures and response codes specified in table 6.4.3.3.2.1-3.

**Table 6.4.3.3.2.1-2: Data structures supported by the Delete Request Body on this resource**

| Data type | P | Cardinality | Description |
|-----------|---|-------------|-------------|
| n/a | | | The request body shall be empty. |

**Table 6.4.3.3.2.1-3: Data structures supported by the DELETE Response Body on this resource**

| Data type | P | Cardinality | Response codes | Description |
|-----------|---|-------------|----------------|-------------|
| n/a | | | 204 No Content | Upon success, an empty response body shall be returned. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. |
| ProblemDetails | O | 0..1 | 404 Not Found | The "cause" attribute may be used to indicate one of the following application errors:<br>- USER_NOT_FOUND<br>- SUBSCRIPTION_NOT_FOUND, see 3GPP TS 29.500 [4] table 5.2.7.2-1. |

**Table 6.4.3.3.2.1-4: Headers supported by the 307 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

**Table 6.4.3.3.2.1-5: Headers supported by the 308 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

6.4.3.3.2.2          PATCH

This method shall support the URI query parameters specified in table 6.4.3.3.2.2-1.

**Table 6.4.3.3.2.2-1: URI query parameters supported by the PATCH method on this resource**

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| supported-features | SupportedFeatures | O | 0..1 | see 3GPP TS 29.500 [4] clause 6.6 |

This method shall support the request data structures specified in table 6.4.3.3.2.2-2 and the response data structures and response codes specified in table 6.4.3.3.2.2-3.

**Table 6.4.3.3.2.2-2: Data structures supported by the PATCH Request Body on this resource**

| Data type | P | Cardinality | Description |
|-----------|---|-------------|-------------|
| array(PatchItem) | M | 1..N | Items describe the modifications to the Event Subscription |

**Table 6.4.3.3.2.2-3: Data structures supported by the PATCH Response Body on this resource**

| Data type | P | Cardinality | Response codes | Description |
|---|---|---|---|---|
| n/a | | | 204 No Content | Upon success, an empty response body shall be returned. |
| PatchResult | M | 1 | 200 OK | Upon success, the execution report is returned. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. |
| ProblemDetails | O | 0..1 | 404 Not Found | The "cause" attribute may be used to indicate one of the following application errors:<br>- USER_NOT_FOUND<br> - SUBSCRIPTION_NOT_FOUND, see 3GPP TS 29.500 [4] table 5.2.7.2-1. |
| ProblemDetails | O | 0..1 | 403 Forbidden | One or more attributes are not allowed to be modified.<br><br>The "cause" attribute may be used to indicate one of the following application errors:<br>- MODIFICATION_NOT_ALLOWED, see 3GPP TS 29.500 [4] table 5.2.7.2-1. |

**Table 6.4.3.3.2.2-4: Headers supported by the 307 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

**Table 6.4.3.3.2.2-5: Headers supported by the 308 Response Code on this resource**

| Name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative service instance within the same HSS (service) set.<br>For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

## 6.4.4    Custom Operations without associated resources

In this release of this specification, no custom operations without associated resources are defined for the Nhss_EventExposure Service.

## 6.4.5    Notifications

### 6.4.5.1    General

This clause will specify the use of notifications and corresponding protocol details if required for the specific service. When notifications are supported by the API, it will include a reference to the general description of notifications support over the 5G SBIs specified in TS 29.500 / TS 29.501.

### 6.4.5.2          Event Occurrence Notification

The POST method shall be used for Event Occurrence Notifications and the URI shall be as provided during the subscription procedure.

Resource URI: {callbackReference}

Support of URI query parameters is specified in table 6.4.5.2-1.

#### Table 6.4.5.2-1: URI query parameters supported by the POST method

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| n/a  |           |   |             |             |

Support of request data structures is specified in table 6.4.5.2-2 and of response data structures and response codes is specified in table 6.4.5.2-3.

#### Table 6.4.5.2-2: Data structures supported by the POST Request Body

| Data type | P | Cardinality | Description |
|-----------|---|-------------|-------------|
| array(MonitoringReport) | M | 1..N | A list of MonitoringReports each of which contains information regarding the occurred event |

#### Table 6.4.5.2-3: Data structures supported by the POST Response Body

| Data type | P | Cardinality | Response codes | Description |
|-----------|---|-------------|----------------|-------------|
| n/a | | | 204 No Content | Upon success, an empty response body shall be returned. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. |
| ProblemDetails | O | 0..1 | 404 Not Found | The "cause" attribute may be used to indicate one of the following application errors:<br>- CONTEXT_NOT_FOUND |
| NOTE:          In addition, common data structures as listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] are supported. | | | | |

#### Table 6.4.5.2-4: Headers supported by the 307 Response Code on this resource

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| Location | string | M | 1 | A URI pointing to the endpoint of the NF service consumer to which the notification should be sent. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

#### Table 6.4.5.2-5: Headers supported by the 308 Response Code on this resource

| Name | Data type | P | Cardinality | Description |
|------|-----------|---|-------------|-------------|
| Location | string | M | 1 | A URI pointing to the endpoint of the NF service consumer to which the notification should be sent. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4]. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the request is redirected. |

## 6.4.6 Data Model

### 6.4.6.1 General

This clause specifies the application data model supported by the API.

Table 6.4.6.1-1 specifies the data types defined for the Nhss_EE service API.

**Table 6.4.6.1-1: Nhss_EE specific Data Types**

| Data type | Clause defined | Description |
|---|---|---|
| EeSubscription | 6.4.6.2.2 | A subscription to Notifications |
| CreatedEeSubscription | 6.4.6.2.3 | |
| MonitoringConfiguration | 6.4.6.2.4 | Monitoring Configuration |
| MonitoringReport | 6.4.6.2.5 | Monitoring Report |
| Report | 6.4.6.2.6 | |
| ReportingOptions | 6.4.6.2.7 | |
| LocationReportingConfiguration | 6.4.6.2.8 | |
| ReachabilityForSmsReport | 6.4.6.2.9 | |
| LossConnectivityConfiguration | 6.4.6.2.10 | |
| ReachabilityForDataConfiguration | 6.4.6.2.11 | |
| PduSessionStatusCfg | 6.4.6.2.12 | Reporting configuration for events related to PDN connectivity Status |
| ReachabilityForDataReport | 6.4.6.2.13 | Report of "UE_REACHABILITY_FOR_DATA" event |
| FailedMonitoringConfiguration | 6.4.6.2.14 | Failed Monitoring Configuration in the EE subscription |
| EeSubscriptionErrorAddInfo | 6.4.6.2.15 | Event Exposure Subscription Error Additional Information |
| EeSubscriptionError | 6.4.6.2.16 | Event Exposure Subscription Error |
| EventType | 6.4.6.3.3 | |
| LocationAccuracy | 6.4.6.3.4 | |
| FailedCause | 6.4.6.3.5 | Failed cause of the failed Monitoring Configuration in the EE subscription |

Table 6.4.6.1-2 specifies data types re-used by the Nhss_EE service API from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nhss_EE service API.

**Table 6.4.6.1-2: Nhss_EE re-used Data Types**

| Data type | Reference | Comments |
|---|---|---|
| Uri | 3GPP TS 29.571 [7] | Uniform Resource Identifier |
| SupportedFeatures | 3GPP TS 29.571 [7] | See 3GPP TS 29.500 [4] clause 6.6 |
| DateTime | 3GPP TS 29.571 [7] | |
| PatchResult | 3GPP TS 29.571 [7] | |
| DurationSec | 3GPP TS 29.571 [7] | |
| DiameterIdentity | 3GPP TS 29.571 [7] | |
| Dnn | 3GPP TS 29.571 [7] | Data Network Name with Network Identifier only. |
| ProblemDetails | 3GPP TS 29.571 [7] | Response body of error response messages. |
| RedirectResponse | 3GPP TS 29.571 [7] | Response body of redirect response messages. |
| MtcProviderInformation | 3GPP TS 29.571 [7] | MTC Provider Information |
| DiameterIdentity | 3GPP TS 29.571 [7] | Diameter Identify (FQDN) |
| LossConnectivityReport | 3GPP TS 29.503 [13] | Report of "LOSS_OF_CONNECTIVITY" event |
| LocationReport | 3GPP TS 29.503 [13] | Report of "LOCATION_REPORTING" event |
| PdnConnectivityStatReport | 3GPP TS 29.503 [13] | Report of "PDN_CONNECTIVITY_STATUS" event |
| ReferenceId | 3GPP TS 29.503 [13] | Reference ID defined in Nudm_EE API. It shall contain a 64-bit long integer. |

### 6.4.6.2 Structured data types

#### 6.4.6.2.1 Introduction

This clause defines the data structures to be used in resource representations.

6.4.6.2.2        Type: EeSubscription

**Table 6.4.6.2.2-1: Definition of type EeSubscription**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| callbackReference | Uri | M | 1 | URI provided by the NF service consumer to receive notifications |
| monitoringConfigurations | map(MonitoringConfiguration) | O | 1..N | A map (list of key-value pairs where referenceId converted from integer to string serves as key) of MonitoringConfigurations |
| scefId | DiameterIdentity | O | 0..1 | Diameter Identify (FQDN) of the SCEF |
| scefDiamRealm | DiameterIdentity | O | 0..1 | When present, It contains the Diameter realm of the SCEF to which the monitered reports may be sent in EPC. |
| supportedFeatures | SupportedFeatures | O | 0..1 | See clause 6.4.8 |
| reportingOptions | ReportingOptions | O | 0..1 | This IE may be included if the NF service consumer wants to describe how the reports of the event are to be generated.<br>If this attribute is not present in the request, it means that the NF service consumer does not specify any maximum number of reports or any expiry time for the subscription; still, the NF service producer (HSS) may set an expiry time in the response to the subscription creation (see clause 6.4.6.2.7). |
| mtcProviderInformation | MtcProviderInformation | O | 0..1 | Indicates MTC provider information for Monitoring Configuration authorization. |
| externalIdentifier | string | O | 0..1 | Represents a single external Identifier or a group of external Identifiers:<br>- If representing a single external identifier: pattern: "^extid-[^@]+@[^@]+$"<br><br>- If representing a group of external identifiers: pattern: "^extgroupid-[^@]+@[^@]+$" |

### 6.4.6.2.3 Type: CreatedEeSubscription

**Table 6.4.6.2.3-1: Definition of type CreatedEeSubscription**

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|---|---|---|---|---|---|
| eeSubscription | EeSubscription | M | 1 | This IE shall contain the representation of the created event subscription. | |
| eventReports | array(MonitoringReport) | O | 1..N | This IE may be included when the NF consumer has indicated supporting of ERIR feature in the subscription creation request (see clause 6.4.8).<br><br>This IE when present, shall contain the status of events that are requested for immediate reporting as well, if those events are available at the time of subscription. | ERIR |
| failedMonitoringConfigs | map(FailedMonitoringConfiguration) | O | 1..N | A map (list of key-value pairs where ReferenceId converted from integer to string serves as key; see clause 6.4.6.3.2) of FailedMonitoringConfiguration; see clause 6.4.6.2.14.<br><br>This IE is used to indicate the failed subscriptions of event monitoring configuration and the failed cause for them. | |
| currentStatusNotAvailableList | array(EventType) | O | 1..N | This IE should be present if immediate reporting was requested by the NF consumer, but the current status of at least one of the subscribed events is not available at the time of subscription.<br><br>When present, this IE shall list the events for which the current status is not available for immediate reporting. | |
| supportedFeatures | SupportedFeatures | O | 0..1 | See clause 6.4.8 | |

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### 6.4.6.2.4 Type: MonitoringConfiguration

**Table 6.4.6.2.4-1: Definition of type MonitoringConfiguration**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| eventType | EventType | M | 1 | Event type |
| immediateFlag | boolean | O | 0..1 | Indicates if an immediate event report in the subscription response indicating current value / status of the event is required, if available. If the flag is not present, then immediate reporting may be skipped. |
| locationReportingConfiguration | LocationReportingConfiguration | C | 0..1 | Shall be present if eventType is "LOCATION_REPORTING" |
| lossConnectivityConfiguration | LossConnectivityConfiguration | O | 0..1 | May be present if eventType is "LOSS_OF_CONNECTIVITY". |
| reachabilityForDataConfiguration | ReachabilityForDataConfiguration | O | 0..1 | May be present if eventType is "UE_REACHABILITY_FOR_DATA" |
| pduSessionStatusCfg | PduSessionStatusCfg | O | 0..1 | may be present if eventType is "PDN_CONNECTIVITY_STATUS" |
| idleStatusInd | boolean | O | 0..1 | Idle Status Indication request.<br><br>May be present if eventType is "UE_REACHABILITY_FOR_DATA" or "AVAILABILITY_AFTER_DDN_FAILURE"<br><br>When present, this IE shall be set as following:<br>- true: Idle status indication is requested<br>- false (default): Idle status indication is not requested |

### 6.4.6.2.5 Type: MonitoringReport

**Table 6.4.6.2.5-1: Definition of type MonitoringReport**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| referenceId | ReferenceId | M | 1 | Shall contain the Reference ID which was provided as the key of the associated monitoring configuration in subscription request. The consumer can use this IE to uniquely associate the report with the corresponding event that was requested to be monitored. |
| eventType | EventType | M | 1 | String; see clause 6.4.6.3.3<br>only the following values are allowed:<br>"UE_REACHABILITY_FOR_SMS"<br>"UE_REACHABILITY_FOR_DATA"<br>"LOSS_OF_CONNECTIVITY"<br>"LOCATION_REPORTING"<br>"PDN_CONNECTIVITY_STATUS" |
| timeStamp | DateTime | M | 1 | Point in time at which the event occured |
| report | Report | O | 0..1 | Shall be present if eventType is "UE_REACHABILITY_FOR_SMS"<br>"UE_REACHABILITY_FOR_DATA"<br>"LOSS_OF_CONNECTIVITY"<br>"LOCATION_REPORTING"<br>"PDN_CONNECTIVITY_STATUS" |

6.4.6.2.6        Type: Report

**Table 6.4.6.2.6-1: Definition of type Report**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| reachabilityForSmsReport | ReachabilityForSms Report | O | 0..1 | Reports the UE reachacbility for SMS |
| reachabilityForDataReport | ReachabilityForData Report | O | 0..1 | Reports the UE reachacbility for Data |
| lossConnectivityReport | LossConnectivityRe port | O | 0..1 | Reports the Loss of Connectivity |
| locationReport | LocationReport | O | 0..1 | Reports the UE Location |
| pdnConnectivityStatReport | PdnConnectivityStat Report | O | 0..1 | Reports the PDN Connectivity Status. Absence of pdnConnectivityStatReport in MonitoringReports with EventType "PDN_CONNECTIVITY_STATUS" indicates that the requested APN is not active. |

6.4.6.2.7        Type: ReportingOptions

**Table 6.4.6.2.7-1: Definition of type ReportingOptions**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| maxNumOfReports | MaxNumOfReports | O | 0..1 | Maximum number of reports. If not present, the NF service consumer does not specify any maximum number of reports to be received. (NOTE) |
| expiry | DateTime | C | 0..1 | This IE shall be included in an event subscription response, if, based on operator policy, the HSS needs to include an expiry time, and may be included in an event subscription request. When present, this IE shall represent the time at which monitoring shall cease and the subscription becomes invalid. If the maxNumOfReports included in an event subscription response is 1 and if an event report is included in the subscription response then the value of the expiry included in the response shall be an immediate timestamp. (NOTE) |
| reportPeriod | DurationSec | C | 0..1 | Indicates the interval time between which the event notification is reported, may be present if event type is "LOCATION_REPORTING" |
| NOTE: | If parameter "maxNumOfReports" and "expiry" are included at the same time, the subscription will expire as soon as one of the conditions is met. | | | |

6.4.6.2.8        Type: LocationReportingConfiguration

**Table 6.4.6.2.8-1: Definition of type LocationReportingConfiguration**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| currentLocation | boolean | M | 1 | true: Indicates that current location is requested. false: Indicates that last known location is requested. |
| accuracy | LocationAccuracy | C | 0..1 | Indicates whether Cell-level or TA-level accuracy is requested. Shall be present when current location is requested. |

### 6.4.6.2.9          Type: ReachabilityForSmsReport

**Table 6.4.6.2.9-1: Definition of type ReachabilityForSmsReport**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| reachabilitySmsStatus | boolean | M | 1 | true: UE is reachable for SMS<br>false: UE is not reachable for SMS |
| maxAvailabilityTime | DateTime | O | 0..1 | Indicates the time (in UTC) until which the UE is expected to be reachable.<br><br>This information may be used by the SMS Service Center to prioritize the retransmission of pending Mobile Terminated Short Message to UEs using a power saving mechanism (eDRX, PSM etc.). |

### 6.4.6.2.10          Type: LossConnectivityConfiguration

**Table 6.4.6.2.10-1: Definition of type LossConnectivityConfiguration**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| maxDetectionTime | DurationSec | O | 0..1 | When present, it indicates the configured Maximum Detection Time |

### 6.4.6.2.11          Type: ReachabilityForDataConfiguration

**Table 6.4.6.2.11-1: Definition of type ReachabilityForDataConfiguration**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| maximumLatency | DurationSec | O | 0..1 | When present, it indicates the configured Maximum Latency. (NOTE) |
| maximumResponseTime | DurationSec | O | 0..1 | When present, it indicates the configured Maximum Response Time. (NOTE) |
| suggestedPacketNumDl | integer | O | 0..1 | When present, it indicates the configured Suggested number of downlink packets. (NOTE) |
| NOTE:          At least one of maximumLatency, maximumResponseTime or suggestedPacketNumDl shall be present | | | | |

### 6.4.6.2.12          Type: PduSessionStatusCfg

**Table 6.4.6.2.12-1: Definition of type PduSessionStatusCfg**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| apn | Dnn | O | 0..1 | When present, it indicates the APN for which the event is monitored. Absence indicates that monitoring of the event applies to all APNs. |

### 6.4.6.2.13        Type: ReachabilityForDataReport

**Table 6.4.6.2.13-1: Definition of type ReachabilityForDataReport**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| reachabilityDataStatus | boolean | M | 1 | true: UE is reachable for Data<br>false: UE is not reachable for Data |
| maxAvailabilityTime | DateTime | O | 0..1 | Indicates the time (in UTC) until which the UE is expected to be reachable.<br><br>This information may be used by the SMS Service Center to prioritize the retransmission of pending Mobile Terminated Short Message to UEs using a power saving mechanism (eDRX, PSM etc.). |

### 6.4.6.2.14        Type: FailedMonitoringConfiguration

**Table 6.4.6.2.14-1: Definition of type FailedMonitoringConfiguration**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| eventType | EventType | M | 1 | Contains the Event type, see clause 6.4.6.3.3 |
| failedCause | FailedCause | M | 1 | Contains the failed cause of the subscription of the event monitoring. |

### 6.4.6.2.15        Type: EeSubscriptionErrorAddInfo

**Table 6.4.6.2.15-1: Definition of type EeSubscriptionErrorAddInfo**

| Attribute name | Data type | P | Cardinality | Description |
|---|---|---|---|---|
| failedMonitoringConfigs | map(FailedMonitoringConfiguration) | O | 1..N | A map (list of key-value pairs where ReferenceId converted from integer to string serves as key; see clause 6.4.6.3.2) of FailedMonitoringConfiguration; see clause 6.4.6.2.14.<br><br>This IE is used to indicate the failed subscriptions of event monitoring configuration and the failed cause for them. |

### 6.4.6.2.16        Type: EeSubscriptionError

**Table 6.4.6.2.16-1: Definition of type EeSubscriptionError as a list of to be combined data types**

| Data type | Cardinality | Description | Applicability |
|---|---|---|---|
| ProblemDetails | 1 | Detail information of the problem | |
| EeSubscriptionErrorAddInfo | 1 | Additional information to be returned in error response. | |

## 6.4.6.3        Simple data types and enumerations

### 6.4.6.3.1        Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

### 6.4.6.3.2        Simple data types

The simple data types defined in table 6.4.6.3.2-1 shall be supported.

**Table 6.4.6.3.2-1: Simple data types**

| Type Name | Type Definition | Description |
|---|---|---|
| Imsi | string | IMSI<br>pattern: '^(imsi-[0-9]{5,15})$' |
| UeIdOrGroupId | string | Contains the UE identifier or the Group Identifier of the UE.<br>pattern: '^(imsi-[0-9]{5,15}\|extgroupid-[^@]+@[^@]+\|.+$)' |
| MaxNumOfReports | integer | Maximum number of reports.<br>Minimum: 1 |

## 6.4.6.3.3　　　Enumeration: EventType

**Table 6.4.6.3.3-1: Enumeration EventType**

| Enumeration value | Description |
|---|---|
| "LOSS_OF_CONNECTIVITY" | Loss of connectivity event |
| "UE_REACHABILITY_FOR_DATA" | UE reachability for Data, implements the "UE Reachability for Data" event as specified in 3GPP TS 23.682 [18].<br><br>When this event is subscribed by an NF service consumer, the HSS shall send an Insert Subscriber Data Request message to the MME/SGSN for the UE with the Monitoring-Type AVP set to the value UE_REACHABILITY and the Reachability-Information AVP set to the value REACHABLE_FOR_DATA, see clause 5.2.2.1.3 of 3GPP TS 29.272 [17]. |
| "UE_REACHABILITY_FOR_SMS" | UE reachability for SMS, implements the "UE Reachability for SMS Delivery" event as specified in 3GPP TS 23.682 [18].<br><br>This event only supports One-Time reporting. |
| "LOCATION_REPORTING" | Location Reporting event |
| "COMMUNICATION_FAILURE" | Communication Failure event |
| "AVAILABILITY_AFTER_DDN_FAILURE" | Availability after DDN failure event |
| "PDN_CONNECTIVITY_STATUS" | PDN Connectivity Status event |

## 6.4.6.3.4　　　Enumeration: LocationAccuracy

**Table 6.4.6.3.4-1: Enumeration LocationAccuracy**

| Enumeration value | Description |
|---|---|
| "CELL_LEVEL" | Change of cell shall be reported, equivalent to the value "CGI-ECGI (0)" of Accuracy IE of HSS Diameter interface as specified in clause 8.4.17 of 3GPP TS 29.336 [21]. |
| "RAN_NODE_LEVEL" | change of serving RAN node shall be reported, equivalent to the value "eNB (1)" of Accuracy IE of HSS Diameter interface as specified in clause 8.4.17 of 3GPP TS 29.336 [21]. |
| "TA_LEVEL" | Change of TA shall be reported, equivalent to the value " LA-TA-RA (2)" of Accuracy IE of HSS Diameter interface as specified in clause 8.4.17 of 3GPP TS 29.336 [21]. |

6.4.6.3.5        Enumeration: FailedCause

**Table 6.4.6.3.5-1: Enumeration FailedCause**

| Enumeration value | Description |
|---|---|
| "MTC_PROVIDER_NOT_ALLOWED" | MTC Provider is now allowed to perform monitoring for the requested event type. |
| "MONITORING_NOT_ALLOWED" | The subscriber does not have the necessary subscription for monitoring with the requested Event Type. |
| "UNSUPPORTED_MONITORING_EVENT_TYPE" | The required event type is unsupported. |
| "UNSUPPORTED_MONITORING_REPORT_OPTIONS" | The monitoring configuration for the required event type contains unsupported report options. |
| "UNSPECIFIED" | The failed cause is unspecified. |

## 6.4.7        Error Handling

### 6.4.7.1        General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [4].

### 6.4.7.2        Protocol Errors

Protocol errors handling shall be supported as specified in clause 5.2.7 of 3GPP TS 29.500 [4].

### 6.4.7.3        Application Errors

The common application errors defined in the Table 5.2.7.2-1 in 3GPP TS 29.500 [4] may also be used for the Nhss_EventExposure service. The following application errors listed in Table 6.4.7.3-1 are specific for the Nhss_EventExposure service.

**Table 6.4.7.3-1: Application errors**

| Application Error | HTTP status code | Description |
|---|---|---|
| MONITORING_NOT_ALLOWED | 403 Forbidden | The subscriber does not have the necessary subscription for monitoring with the requested Event Type. |
| MTC_PROVIDER_NOT_ALLOWED | 403 Forbidden | MTC Provider not authorized to perform monitoring configuration. |
| USER_NOT_FOUND | 404 Not Found | The user does not exist |
| CONTEXT_NOT_FOUND | 404 Not Found | It is used when no corresponding context exists. |
| UNSUPPORTED_MONITORING_EVENT_TYPE | 501 Not Implemented | The monitoring configuration contains unsupported event type. |
| UNSUPPORTED_MONITORING_REPORT_OPTIONS | 501 Not Implemented | The monitoring configuration contains unsupported report options. |

## 6.4.8        Feature Negotiation

The optional features in table 6.4.8-1 are defined for the Nhss_EE API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

**Table 6.4.8-1: Supported Features**

| Feature number | Feature Name | Description |
|---|---|---|
| 1 | ERIR | Event Reports in Response<br><br>An NF consumer supporting this feature shall be able to handle the event reports within the Event Subscription Create Response, as specified in clause 5.5.2.2.2. |
| 2 | GBEE | Support of Group-based Event Exposure.<br><br>This feature bit indicates whether the Nhss_EventExposure Service support Group-based Event Exposure or not. |

## 6.4.9    Security

As indicated in 3GPP TS 33.501 [6] and 3GPP TS 29.500 [4], the access to the Nhss_EE API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [18]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [19]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Nhss_EE API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [19], clause 5.4.2.2.

   NOTE:    When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Nhss_EE service.

The Nhss_EE API defines a single scope "nhss-ee" for OAuth2 authorization (as specified in 3GPP TS 33.501 [6]) for the entire API, and it does not define any additional scopes at resource or operation level.

## 6.4.10    HTTP redirection

An HTTP request may be redirected to a different HSS service instance when using direct or indirect communications (see 3GPP TS 29.500 [4]).

An SCP that reselects a different HSS producer instance will return the NF Instance ID of the new HSS producer instance in the 3gpp-Sbi-Producer-Id header, as specified in clause 6.10.3.4 of 3GPP TS 29.500 [4].

If an HSS redirects a service request to a different HSS using an 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new HSS towards which the service request is redirected shall be indicated in the 3gpp-Sbi-Target-Nf-Id header of the 307 Temporary Redirect or 308 Permanent Redirect response as specified in clause 6.10.9.1 of 3GPP TS 29.500 [4].

# Annex A (normative):
# OpenAPI specification

## A.1 General

This Annex specifies the formal definition of the Nhss Service API(s). It consists of OpenAPI 3.0.0 specifications in YAML format.

This Annex takes precedence when being discrepant to other parts of the specification with respect to the encoding of information elements and methods within the API(s).

> NOTE: The semantics and procedures, as well as conditions, e.g. for the applicability and allowed combinations of attributes or values, not expressed in the OpenAPI definitions but defined in other parts of the specification also apply.

Informative copies of the OpenAPI specification files contained in this 3GPP Technical Specification are available on a Git-based repository, that uses the GitLab software version control system (see 3GPP TS 29.501 [5] clause 5.3.1 and 3GPP TR 21.900 [14] clause 5B).

## A.2 Nhss_UEAuthentication API

```
openapi: 3.0.0
info:
  version: '1.2.0'
  title: 'NhssUEAU'
  description: |
    HSS UE Authentication Service.
    © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: 3GPP TS 29.563 HSS Services for Interworking With UDM, version 18.5.0
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.563/'

servers:
  - url: '{apiRoot}/nhss-ueau/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501.

security:
  - oAuth2ClientCredentials:
    - nhss-ueau
  - {}

paths:
  /generate-av:
    post:
      summary: Generate authentication vector for the UE
      operationId: GenerateAV
      tags:
        - Generate Auth Vector
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AvGenerationRequest'
        required: true
      responses:
        '200':
          description: Expected response to a valid request
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/AvGenerationResponse'
        '307':
```

```
              $ref: 'TS29571_CommonData.yaml#/components/responses/307'
            '308':
              $ref: 'TS29571_CommonData.yaml#/components/responses/308'
            '400':
              $ref: 'TS29571_CommonData.yaml#/components/responses/400'
            '401':
              $ref: 'TS29571_CommonData.yaml#/components/responses/401'
            '403':
              $ref: 'TS29571_CommonData.yaml#/components/responses/403'
            '404':
              $ref: 'TS29571_CommonData.yaml#/components/responses/404'
            '411':
              $ref: 'TS29571_CommonData.yaml#/components/responses/411'
            '413':
              $ref: 'TS29571_CommonData.yaml#/components/responses/413'
            '415':
              $ref: 'TS29571_CommonData.yaml#/components/responses/415'
            '429':
              $ref: 'TS29571_CommonData.yaml#/components/responses/429'
            '500':
              $ref: 'TS29571_CommonData.yaml#/components/responses/500'
            '501':
              $ref: 'TS29571_CommonData.yaml#/components/responses/501'
            '502':
              $ref: 'TS29571_CommonData.yaml#/components/responses/502'
            '503':
              $ref: 'TS29571_CommonData.yaml#/components/responses/503'
            default:
              description: Unexpected error


components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nhss-ueau: Access to the nhss-ueau API


  schemas:

# STRUCTURED TYPES:

    AvGenerationRequest:
      description: >
        It represents the request body in the Authentication Vector (AV) request sent by UDM to HSS,
        containing the IMSI of the UE, authentication type, serving network, etc.
      type: object
      required:
        - imsi
        - authType
        - servingNetworkName
      properties:
        imsi:
          type: string
          pattern: '^[0-9]{5,15}$'
        authType:
          $ref: 'TS29503_Nudm_UEAU.yaml#/components/schemas/AuthType'
        servingNetworkName:
          $ref: 'TS29503_Nudm_UEAU.yaml#/components/schemas/ServingNetworkName'
        resynchronizationInfo:
          $ref: 'TS29503_Nudm_UEAU.yaml#/components/schemas/ResynchronizationInfo'

    AvGenerationResponse:
      description: >
        It represents the response body in the AV response sent by HSS to UDM, containing the 5G-AKA
        or EAP-AKA-prime authentication vector
      type: object
      oneOf:
        - required:
          - avEapAkaPrime
        - required:
          - av5GHeAka
      properties:
        avEapAkaPrime:
```

```
              $ref: 'TS29503_Nudm_UEAU.yaml#/components/schemas/AvEapAkaPrime'
          av5GHeAka:
              $ref: 'TS29503_Nudm_UEAU.yaml#/components/schemas/Av5GHeAka'


# SIMPLE TYPES:


# ENUMS:
```

# A.3 Nhss_SubscriberDataManagement API

```
openapi: 3.0.0

info:
  version: '1.2.0'
  title: 'Nhss_SDM'
  description: |
    HSS Subscriber Data Management.
    © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: 3GPP TS 29.563 HSS Services for Interworking With UDM, version 18.5.0
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.563/'

servers:
  - url: '{apiRoot}/nhss-sdm/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501.

security:
  - oAuth2ClientCredentials:
    - nhss-sdm
  - {}

paths:
  /{ueId}/ue-context-in-pgw-data:
    get:
      summary: Retrieve the UE Context In PGW
      operationId: GetUeCtxInPgwData
      tags:
        - UE Context In PGW Data Retrieval
      parameters:
        - name: ueId
          in: path
          description: Identifier of the UE
          required: true
          schema:
            type: string
            pattern: '^(imsi-[0-9]{5,15})$'
      responses:
        '200':
          description: Expected response to a valid request
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/UeContextInPgwData'
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '406':
          $ref: 'TS29571_CommonData.yaml#/components/responses/406'
```

```
              '429':
                $ref: 'TS29571_CommonData.yaml#/components/responses/429'
              '500':
                $ref: 'TS29571_CommonData.yaml#/components/responses/500'
              '502':
                $ref: 'TS29571_CommonData.yaml#/components/responses/502'
              '503':
                $ref: 'TS29571_CommonData.yaml#/components/responses/503'
              default:
                description: Unexpected error

  /{ueId}/subscriptions:
    post:
      summary: subscribe to notifications
      operationId: Subscribe
      tags:
        - Subscription Creation
      parameters:
        - name: ueId
          in: path
          description: IMSI of the user
          required: true
          schema:
            type: string
            pattern: '^(imsi-[0-9]{5,15})$'
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/SubscriptionData'
        required: true
      responses:
        '201':
          description: Expected response to a valid request
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/SubscriptionData'
          headers:
            Location:
              description: >
                Contains the URI of the newly created resource, according to the structure:
                {apiRoot}/nhss-sdm/<apiVersion>/{ueId}/subscriptions/{subscriptionId}
              required: true
              schema:
                type: string
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '501':
          $ref: 'TS29571_CommonData.yaml#/components/responses/501'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          description: Unexpected error
      callbacks:
        datachangeNotification:
```

```
              '{$request.body#/callbackReference}':
                post:
                  requestBody:
                    required: true
                    content:
                      application/json:
                        schema:
                          $ref: 'TS29503_Nudm_SDM.yaml#/components/schemas/ModificationNotification'
                  responses:
                    '204':
                      description: Successful Notification response
                    '307':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
                    '308':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
                    '400':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
                    '401':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
                    '403':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
                    '404':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
                    '411':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
                    '413':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
                    '415':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
                    '429':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
                    '500':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
                    '502':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/502'
                    '503':
                      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
                    default:
                      description: Unexpected error

  /{ueId}/subscriptions/{subscriptionId}:
    delete:
      summary: unsubscribe from notifications
      operationId: Unsubscribe
      tags:
        - Subscription Deletion
      parameters:
        - name: ueId
          in: path
          description: IMSI of the user
          required: true
          schema:
            type: string
            pattern: '^(imsi-[0-9]{5,15})$'
        - name: subscriptionId
          in: path
          description: Id of the Subscription
          required: true
          schema:
            type: string
      responses:
        '204':
          description: Successful response
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
```

```
              $ref: 'TS29571_CommonData.yaml#/components/responses/500'
            '502':
              $ref: 'TS29571_CommonData.yaml#/components/responses/502'
            '503':
              $ref: 'TS29571_CommonData.yaml#/components/responses/503'
            default:
              description: Unexpected error
    patch:
      summary: modify the subscription
      operationId: Modify
      tags:
        - Subscription Modification
      parameters:
        - name: ueId
          in: path
          description: IMSI of the user
          required: true
          schema:
            type: string
            pattern: '^(imsi-[0-9]{5,15})$'
        - name: subscriptionId
          in: path
          description: Id of the Subscription
          required: true
          schema:
            type: string
      requestBody:
        content:
          application/json-patch+json:
            schema:
              type: array
              items:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/PatchItem'
              minItems: 1
        required: true
      responses:
        '204':
          description: Successful modification
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          description: Unexpected error

components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nhss-sdm: Access to the nhss-sdm API
```

```
    schemas:

# STRUCTURED TYPES:

    UeContextInPgwData:
      description: >
        Contains data about APNs and PGW-C+SMF FQDNs used in interworking with UDM, and the
        PGW-C+SMF FQDN to be used for emergency session
      type: object
      properties:
        pgwInfo:
          type: array
          items:
            $ref: 'TS29503_Nudm_SDM.yaml#/components/schemas/PgwInfo'
          minItems: 1
        emergencyFqdn:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Fqdn'
        emergencyPlmnId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/PlmnId'
        emergencyIpAddr:
          $ref: 'TS29503_Nudm_SDM.yaml#/components/schemas/IpAddress'
        emergencyRegistrationTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'

    SubscriptionData:
      description: >
        Contains data about a subscription request, to be created by a consumer to an URI of the
        HSS_SDM API to be monitored; it also represents the response containing data about the
        created subscription
      type: object
      required:
        - nfInstanceId
        - callbackReference
        - monitoredResourceUris
      properties:
        nfInstanceId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        callbackReference:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        monitoredResourceUris:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
          minItems: 1
        expires:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        immediateReport:
          type: boolean
          default: false
        report:
          $ref: '#/components/schemas/SubscriptionDataSets'

    SubscriptionDataSets:
      description: >
        Contains data to be reported as an immediate report in the response to a subscription
        creation request
      type: object
      properties:
        ueContextInPgwData:
          $ref: '#/components/schemas/UeContextInPgwData'

# SIMPLE TYPES:


# ENUMS:
```

# A.4     Nhss_UEContextManagement API

```
openapi: 3.0.0

info:
  version: '1.2.1'
  title: 'Nhss_UECM'
  description: |
    HSS UE Context Management.
```

```
externalDocs:
  description: 3GPP TS 29.563 HSS Services for Interworking With UDM, version 18.6.0
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.563/'

servers:
  - url: '{apiRoot}/nhss-uecm/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501.

security:
  - oAuth2ClientCredentials:
    - nhss-uecm
  - {}

paths:
  /deregister-sn:
    post:
      summary: MME/SGSN Deregistration
      operationId: DeregisterSN
      tags:
        - MME/SGSN Deregistration
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/DeregistrationRequest'
        required: true
      responses:
        '204':
          description: No content
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '501':
          $ref: 'TS29571_CommonData.yaml#/components/responses/501'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          description: Unexpected error

  /imei-update:
    post:
      summary: IMEI Update
      operationId: IMEIUpdate
      tags:
        - IMEI Update
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/ImeiUpdateInfo'
        required: true
```

```
      responses:
        '200':
          description: Expected response to a valid request
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/ImeiUpdateResponse'
        '204':
          description: No content
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '501':
          $ref: 'TS29571_CommonData.yaml#/components/responses/501'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          description: Unexpected error

  /roaming-status-update:
    post:
      summary: Roaming Status Update
      operationId: RoamingStatusUpdate
      tags:
        - Roaming Status Update
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/RoamingStatusUpdateInfo'
        required: true
      responses:
        '204':
          description: No content
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '501':
```

```
              $ref: 'TS29571_CommonData.yaml#/components/responses/501'
            '502':
              $ref: 'TS29571_CommonData.yaml#/components/responses/502'
            '503':
              $ref: 'TS29571_CommonData.yaml#/components/responses/503'
          default:
            description: Unexpected error

components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nhss-uecm: Access to the nhss-uecm API

  schemas:

# STRUCTURED TYPES:

    DeregistrationRequest:
      description: >
        It represents the request body of the deregistration request sent by UDM to HSS and contains
        the IMSI of the UE, the deregistration reason, etc.
      type: object
      required:
        - imsi
        - deregReason
      properties:
        imsi:
          type: string
          pattern: '^[0-9]{5,15}$'
        deregReason:
          $ref: '#/components/schemas/DeregistrationReason'
        guami:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Guami'

    ImeiUpdateInfo:
      description: >
        It represents the request body of the IMEI update request sent by UDM to HSS,
        and contains the IMSI of the UE and the new IMEI(SV)
      type: object
      required:
        - imsi
      oneOf:
        - required: [ imei ]
        - required: [ imeisv ]
      properties:
        imsi:
          type: string
          pattern: '^[0-9]{5,15}$'
        imei:
          type: string
          pattern: '^[0-9]{14,15}$'
        imeisv:
          type: string
          pattern: '^[0-9]{16}$'

    ImeiUpdateResponse:
      description: >
        It represents the response body of the IMEI update request sent by UDM to HSS,
        and contains the previous IMEI(SV) stored by HSS
      type: object
      anyOf:
        - required: [ previousImei ]
        - required: [ previousImeisv ]
      properties:
        previousImei:
          type: string
          pattern: '^[0-9]{14,15}$'
        previousImeisv:
          type: string
          pattern: '^[0-9]{16}$'

    RoamingStatusUpdateInfo:
      description: >
```

```
      It represents the request body of the Roaming Status Update request sent by UDM to HSS,
      and contains the IMSI of the UE and the new PLMN-ID
    type: object
    required:
      - imsi
      - plmnId
    properties:
      imsi:
        type: string
        pattern: '^[0-9]{5,15}$'
      plmnId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PlmnId'

# SIMPLE TYPES:


# ENUMS:

    DeregistrationReason:
      description: The reason that triggers that the serving node needs to be deregistered by HSS
      anyOf:
        - type: string
          enum:
            - UE_INITIAL_AND_SINGLE_REGISTRATION
            - UE_INITIAL_AND_DUAL_REGISTRATION
            - EPS_TO_5GS_MOBILITY
            - EPS_TO_5GS_MOBILITY_WITHOUT_N26_IWK
        - type: string
```

# A.5    Nhss_EE API

```
openapi: 3.0.0

info:
  version: '1.2.0'
  title: 'Nhss_EE'
  description: |
    HSS Event Exposure.
    © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: 3GPP TS 29.563 HSS Services for Interworking With UDM, version 18.5.0
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.563/'

servers:
  - url: '{apiRoot}/nhss-ee/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501.

security:
  - {}
  - oAuth2ClientCredentials:
    - nhss-ee

paths:
  /{ueId}/ee-subscriptions:
    post:
      summary: Subscribe
      operationId: CreateEeSubscription
      tags:
        - EE Subscription (Collection)
      parameters:
        - name: ueId
          in: path
          description: IMSI of the subscriber or the identity of a group of UEs
          required: true
          schema:
            $ref: '#/components/schemas/UeIdOrGroupId'
      requestBody:
        content:
          application/json:
            schema:
```

```
              $ref: '#/components/schemas/EeSubscription'
          required: true
      responses:
        '201':
          description: Expected response to a valid request
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/CreatedEeSubscription'
          headers:
            Location:
              description: >
                Contains the URI of the newly created resource, according to the structure:
                {apiRoot}/nhss-ee/v1/{ueId}/ee-subscriptions/{subscriptionId}
              required: true
              schema:
                type: string
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          description: Forbidden
          content:
            application/problem+json:
              schema:
                $ref: '#/components/schemas/EeSubscriptionError'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '501':
          description: Not Implemented
          content:
            application/problem+json:
              schema:
                $ref: '#/components/schemas/EeSubscriptionError'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          description: Unexpected error
      callbacks:
        eventOccurrenceNotification:
          '{$request.body#/callbackReference}':
            post:
              requestBody:
                required: true
                content:
                  application/json:
                    schema:
                      type: array
                      items:
                        $ref: '#/components/schemas/MonitoringReport'
                      minItems: 1
              responses:
                '204':
                  description: Successful Notification response
                '307':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/307'
                '308':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/308'
                '400':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/400'
                '401':
```

```
                          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
                        '403':
                          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
                        '404':
                          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
                        '411':
                          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
                        '413':
                          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
                        '415':
                          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
                        '429':
                          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
                        '500':
                          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
                        '502':
                          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
                        '503':
                          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
                      default:
                        description: Unexpected error

  /{ueId}/ee-subscriptions/{subscriptionId}:
    delete:
      summary: Unsubscribe
      operationId: DeleteEeSubscription
      tags:
        - Delete EE Subscription
      parameters:
        - name: ueId
          in: path
          description: IMSI of the subscriber or the identity of a group of UEs
          required: true
          schema:
            $ref: '#/components/schemas/UeIdOrGroupId'
        - name: subscriptionId
          in: path
          description: Id of the EE Subscription
          required: true
          schema:
            type: string
      responses:
        '204':
          description: Successful response
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        description: Unexpected error

    patch:
      summary: Patch
      operationId: UpdateEeSubscription
      tags:
        - Update EE Subscription
      parameters:
        - name: ueId
          in: path
          description: IMSI of the subscriber or the identity of a group of UEs
          required: true
          schema:
```

```
              $ref: '#/components/schemas/UeIdOrGroupId'
        - name: subscriptionId
          in: path
          description: Id of the EE Subscription
          required: true
          schema:
            type: string
      requestBody:
        content:
          application/json-patch+json:
            schema:
              type: array
              items:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/PatchItem'
              minItems: 1
        required: true
      responses:
        '200':
          description: Expected response to a valid request
          content:
            application/json:
              schema:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/PatchResult'
        '204':
          description: Successful response
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          description: Unexpected error

components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nhss-ee: Access to the nhss-ee API

  schemas:

# STRUCTURED TYPES:

    EeSubscription:
      description: >
        It represents the request body of the subscription request sent to HSS, containing data
        related to the subscription to be created, such as the SCEF, Monitoring Configurations and
        reporting options
      type: object
      required:
        - callbackReference
      properties:
        callbackReference:
```

```
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
          scefId:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/DiameterIdentity'
          scefDiamRealm:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/DiameterIdentity'
          monitoringConfigurations:
            description: >
              A map (list of key-value pairs where ReferenceId serves as key) of
              MonitoringConfigurations
            type: object
            additionalProperties:
              $ref: '#/components/schemas/MonitoringConfiguration'
            minProperties: 1
          supportedFeatures:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
          reportingOptions:
            $ref: '#/components/schemas/ReportingOptions'
          mtcProviderInformation:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/MtcProviderInformation'
          externalIdentifier:
            type: string

    CreatedEeSubscription:
      description: >
        It represents the response body of the subscription request, containing data of the created
        subscription in the HSS
      type: object
      required:
        - eeSubscription
      properties:
        eeSubscription:
            $ref: '#/components/schemas/EeSubscription'
        eventReports:
          type: array
          items:
            $ref: '#/components/schemas/MonitoringReport'
          minItems: 1
        failedMonitoringConfigs:
          description: >
            A map (list of key-value pairs where referenceId converted from integer to string serves
            as key; see clause 6.4.6.3.2) of FailedMonitoringConfiguration
          type: object
          additionalProperties:
            $ref: '#/components/schemas/FailedMonitoringConfiguration'
          minProperties: 1
        currentStatusNotAvailableList:
          type: array
          items:
            $ref: '#/components/schemas/EventType'
          minItems: 1
        supportedFeatures:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'

    FailedMonitoringConfiguration:
      description: >
        Contains the event type and failed cause of the failed Monitoring Configuration
        in the EE subscription
      type: object
      required:
        - eventType
        - failedCause
      properties:
        eventType:
          $ref: '#/components/schemas/EventType'
        failedCause:
          $ref: '#/components/schemas/FailedCause'

    MonitoringConfiguration:
      description: >
        Contains data for each Monitoring Configuration (such as event type, etc.) and
        the configuration data needed depending on each event type
      type: object
      required:
        - eventType
      properties:
        eventType:
          $ref: '#/components/schemas/EventType'
        immediateFlag:
```

```
          type: boolean
        locationReportingConfiguration:
          $ref: '#/components/schemas/LocationReportingConfiguration'
        lossConnectivityConfiguration:
          $ref: '#/components/schemas/LossConnectivityConfiguration'
        reachabilityForDataConfiguration:
          $ref: '#/components/schemas/ReachabilityForDataConfiguration'
        pduSessionStatusCfg:
          $ref: '#/components/schemas/PduSessionStatusCfg'
        idleStatusInd:
          type: boolean
          default: false

    MonitoringReport:
      description: Contains data for each Monitoring Event Report sent by the HSS
      type: object
      required:
        - referenceId
        - eventType
        - timeStamp
      properties:
        referenceId:
          $ref: 'TS29503_Nudm_EE.yaml#/components/schemas/ReferenceId'
        eventType:
          $ref: '#/components/schemas/EventType'
        timeStamp:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        report:
          $ref: '#/components/schemas/Report'

    ReportingOptions:
      description: >
        Contains the different reporting options associated to a given subscription created in HSS
      type: object
      properties:
        maxNumOfReports:
          $ref: '#/components/schemas/MaxNumOfReports'
        expiry:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        reportPeriod:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'

    Report:
      description: Contains data for a given Monitoring Event Report
      type: object
      properties:
        reachabilityForSmsReport:
          $ref: '#/components/schemas/ReachabilityForSmsReport'
        reachabilityForDataReport:
          $ref: '#/components/schemas/ReachabilityForDataReport'
        lossConnectivityReport:
          $ref: 'TS29503_Nudm_EE.yaml#/components/schemas/LossConnectivityReport'
        locationReport:
          $ref: 'TS29503_Nudm_EE.yaml#/components/schemas/LocationReport'
        pdnConnectivityStatReport:
          $ref: 'TS29503_Nudm_EE.yaml#/components/schemas/PdnConnectivityStatReport'

    ReachabilityForSmsReport:
      description: >
        Contains data for a Monitoring Event Report, specific to the 'Reachability For SMS'
        event type
      type: object
      required:
        - reachabilitySmsStatus
      properties:
        reachabilitySmsStatus:
          type: boolean
        maxAvailabilityTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'

    ReachabilityForDataReport:
      description: >
        Contains data for a Monitoring Event Report, specific to the 'Reachability For Data'
        event type
      type: object
      required:
        - reachabilityDataStatus
      properties:
```

```
      reachabilityDataStatus:
        type: boolean
      maxAvailabilityTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'

    LossConnectivityConfiguration:
      description: >
        Contains data needed for a Monitoring Configuration, specific to the 'Loss of Connectivity'
        event type
      type: object
      properties:
        maxDetectionTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'

    LocationReportingConfiguration:
      description: >
        Contains data needed for a Monitoring Configuration, specific to the 'Location Reporting'
        event type
      type: object
      required:
        - currentLocation
      properties:
        currentLocation:
          type: boolean
        accuracy:
          $ref: '#/components/schemas/LocationAccuracy'

    ReachabilityForDataConfiguration:
      description: >
        Contains data needed for a Monitoring Configuration, specific to the 'Reachability for Data'
        event type
      type: object
      anyOf:
        - required: [ maximumLatency ]
        - required: [ maximumResponseTime ]
        - required: [ suggestedPacketNumDl ]
      properties:
        maximumLatency:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
        maximumResponseTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
        suggestedPacketNumDl:
          type: integer
          minimum: 1

    PduSessionStatusCfg:
      description: >
        Contains data needed for a Monitoring Configuration, specific to the 'PDN Connectivity
        Status' event type
      type: object
      properties:
        apn:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'

    EeSubscriptionErrorAddInfo:
      description: Additional Information for EE Subscription Error.
      type: object
      properties:
        failedMonitoringConfigs:
          description: >
            A map (list of key-value pairs where referenceId converted from integer to string serves
            as key; see clause 6.4.6.3.2) of FailedMonitoringConfiguration
          type: object
          additionalProperties:
            $ref: '#/components/schemas/FailedMonitoringConfiguration'
          minProperties: 1

    EeSubscriptionError:
      description: EE Subscription Error.
      allOf:
        - $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
        - $ref: '#/components/schemas/EeSubscriptionErrorAddInfo'

# SIMPLE TYPES:

    Imsi:
      description: IMSI of the UE
      type: string
```

```
      pattern: '^(imsi-[0-9]{5,15})$'

   UeIdOrGroupId:
      description: Contains the UE identifier or the Group Identifier of the UE
      type: string
      pattern: '^(imsi-[0-9]{5,15}|extgroupid-[^@]+@[^@]+|.+$)'

   MaxNumOfReports:
      description: Maximum number of events to be reported for events in a given subscription
      type: integer
      minimum: 1

# ENUMS:

   EventType:
      description: Type of Monitoring Event
      anyOf:
         - type: string
           enum:
           - LOSS_OF_CONNECTIVITY
           - UE_REACHABILITY_FOR_DATA
           - UE_REACHABILITY_FOR_SMS
           - LOCATION_REPORTING
           - COMMUNICATION_FAILURE
           - AVAILABILITY_AFTER_DDN_FAILURE
           - PDN_CONNECTIVITY_STATUS
         - type: string

   LocationAccuracy:
      description: Location accuracy used in the 'Location Reporting' event type
      anyOf:
         - type: string
           enum:
           - CELL_LEVEL
           - RAN_NODE_LEVEL
           - TA_LEVEL
         - type: string

   FailedCause:
      description: >
         Indicates the Failed cause of the failed Monitoring Configuration in the EE subscription
      anyOf:
         - type: string
           enum:
           - MTC_PROVIDER_NOT_ALLOWED
           - MONITORING_NOT_ALLOWED
           - UNSUPPORTED_MONITORING_EVENT_TYPE
           - UNSUPPORTED_MONITORING_REPORT_OPTIONS
           - UNSPECIFIED
         - type: string
```

# Annex B (informative): Withdrawn API versions

# B.1 General

This Annex lists withdrawn API versions of the APIs defined in the present specification. 3GPP TS 29.501 [5] clause 4.3.1.6 describes the withdrawal of API versions.

# Annex C (informative):
# Change history

| | | | | | | **Change history** | |
|---|---|---|---|---|---|---|---|
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2019-05 | CT4#91 | C4-192407 | | | | Initial Draft. | 0.1.0 |
| 2019-09 | CT4#93 | C4-193847 | | | | Incorporation of pCRs agreed at CT4#93 in C4-193553, C4-193624. | 0.2.0 |
| 2019-10 | CT4#94 | C4-194521 | | | | Incorporation of pCRs agreed at CT4#94 in C4-194346. | 0.3.0 |
| 2019-11 | CT4#95 | C4-195636 | | | | Incorporation of pCRs agreed at CT4#95 in C4-195579. | 0.4.0 |
| 2019-12 | CT#86 | CP-193067 | | | | TS presented for information | 1.0.0 |
| 2020-03 | CT4#96 | C4-201271 | | | | Incorporation of pCRs agreed at CT4#96 in C4-200880, C4-200917, C4-200964, C4-201100. | 1.1.0 |
| 2020-03 | CT#87 | CP-200065 | | | | TS presented for approval | 2.0.0 |
| 2020-03 | CT#87 | | | | | Approved at CT#87 | 16.0.0 |
| 2020-07 | CT#88 | CP-201033 | 0001 | - | B | Storage of YAML files in ETSI Forge | 16.1.0 |
| 2020-07 | CT#88 | CP-201033 | 0002 | - | F | PGW-C+SMF FQDN for Emergency Session | 16.1.0 |
| 2020-07 | CT#88 | CP-201033 | 0003 | 1 | B | Initial Registration | 16.1.0 |
| 2020-07 | CT#88 | CP-201033 | 0004 | 1 | B | HSS Event Exposure | 16.1.0 |
| 2020-07 | CT#88 | CP-201033 | 0005 | 1 | F | Serving Node Deregistration | 16.1.0 |
| 2020-07 | CT#88 | CP-201073 | 0006 | - | F | 29.563 Rel-16 API version and External doc update | 16.1.0 |
| 2020-09 | CT#89 | CP-202111 | 0007 | - | F | UE Id Correction for EE Subscription | 16.2.0 |
| 2020-09 | CT#89 | CP-202111 | 0008 | 1 | F | Correction of HSS Event Exposure data types | 16.2.0 |
| 2020-09 | CT#89 | CP-202096 | 0009 | - | F | 29.563 Rel-16 API version and External doc update | 16.2.0 |
| 2020-12 | CT#90 | CP-205049 | 0010 | 1 | F | Config APN for PDN connectivity status | 16.3.0 |
| 2020-12 | CT#90 | CP-205049 | 0011 | 1 | F | Definition of SubscriptionData | 16.3.0 |
| 2020-12 | CT#90 | CP-205049 | 0012 | - | F | References and Cardinality errors clean up | 16.3.0 |
| 2020-12 | CT#90 | CP-205048 | 0013 | - | F | Storage of YAML files in GitLab | 16.3.0 |
| 2020-12 | CT#90 | CP-205049 | 0014 | - | F | Reference ID | 16.3.0 |
| 2020-12 | CT#90 | CP-205036 | 0015 | - | F | 29.563 Rel-16 API version and External doc update | 16.3.0 |
| 2021-03 | CT#91 | CP-210042 | 0018 | - | F | GUAMI in Deregistration Request | 16.4.0 |
| 2021-03 | CT#91 | CP-210054 | 0022 | - | F | 29.563 Rel-16 API version and External doc update | 16.4.0 |
| 2021-03 | CT#91 | CP-210042 | 0023 | - | F | Cancellation Type sent to MME/SGSN when UE registers in 5G | 16.4.0 |
| 2021-03 | CT#91 | CP-210042 | 0017 | - | F | Correction of reference | 17.0.0 |
| 2021-06 | CT#92 | CP-211064 | 0025 | - | A | Serving Node Deregistration | 17.1.0 |
| 2021-06 | CT#92 | CP-211028 | 0026 | - | F | OpenAPI Reference | 17.1.0 |
| 2021-06 | CT#92 | CP-211028 | 0027 | 1 | B | Data Type Descriptions | 17.1.0 |
| 2021-06 | CT#92 | CP-211028 | 0028 | - | F | Nhss Services | 17.1.0 |
| 2021-06 | CT#92 | CP-211047 | 0029 | 4 | F | RAN Node Level Location Accuracy | 17.1.0 |
| 2021-06 | CT#92 | CP-211065 | 0031 | 1 | A | Monitored Resource URI | 17.1.0 |
| 2021-06 | CT#92 | CP-211059 | 0033 | - | A | Redirect Responses | 17.1.0 |
| 2021-06 | CT#92 | CP-211064 | 0035 | 1 | A | VLR Cancellation | 17.1.0 |
| 2021-06 | CT#92 | CP-211054 | 0036 | 1 | B | MTC Provider in Nhss_EE | 17.1.0 |
| 2021-06 | CT#92 | CP-211050 | 0037 | - | F | 29.563 Rel-17 API version and External doc update | 17.1.0 |
| 2021-09 | CT#93 | CP-212060 | 0040 | - | A | 3xx description correction for SCP | 17.2.0 |
| 2021-09 | CT#93 | CP-212069 | 0043 | 1 | A | Immediate Report in Response | 17.2.0 |
| 2021-09 | CT#93 | CP-212069 | 0045 | - | A | Missing Event Reports | 17.2.0 |
| 2021-09 | CT#93 | CP-212056 | 0048 | 1 | F | Corrections on EventType | 17.2.0 |
| 2021-09 | CT#93 | CP-212057 | 0049 | 1 | B | Partial success on EE subscription | 17.2.0 |
| 2021-09 | CT#93 | CP-212059 | 0050 | - | F | 29.563 Rel-17 API version and External doc update | 17.2.0 |
| 2021-12 | CT#94 | CP-213085 | 0041 | 2 | F | EE subscription for a group | 17.3.0 |
| 2021-12 | CT#94 | CP-213121 | 0052 | - | F | 29.563 Rel-17 API version and External doc update | 17.3.0 |
| 2022-03 | CT#95 | CP-220023 | 0053 | - | F | 501 Not Implemented | 17.4.0 |
| 2022-03 | CT#95 | CP-220074 | 0055 | - | A | Essential Correction on Monitoring Events | 17.4.0 |
| 2022-03 | CT#95 | CP-220074 | 0057 | - | A | Idle Status Indication | 17.4.0 |
| 2022-03 | CT#95 | CP-220090 | 0058 | - | F | Editorial corrections | 17.4.0 |
| 2022-03 | CT#95 | CP-220066 | 0059 | - | F | 29.563 Rel-17 API version and External doc update | 17.4.0 |
| 2022-06 | CT#96 | CP-221029 | 0061 | 1 | F | Fqdn Data Type Definition | 17.5.0 |
| 2022-06 | CT#96 | CP-221028 | 0062 | 1 | F | UeContextInPgwData for emergency sessions | 17.5.0 |
| 2022-06 | CT#96 | CP-221029 | 0063 | 1 | F | Subscription modification | 17.5.0 |
| 2022-06 | CT#96 | CP-221051 | 0064 | - | F | 29.563 Rel-17 API version and External doc update | 17.5.0 |
| 2022-09 | CT#97 | CP-222057 | 0065 | - | F | IMEI Update | 17.6.0 |
| 2022-09 | CT#97 | CP-222057 | 0066 | - | F | Roaming Status Update | 17.6.0 |
| 2022-09 | CT#97 | CP-222058 | 0067 | - | F | 29.563 Rel-17 API version and External doc update | 17.6.0 |
| 2022-12 | CT#98 | CP-223028 | 0068 | 1 | F | Missing Mandatory Status Codes in OpenAPI | 18.0.0 |
| 2022-12 | CT#98 | CP-223033 | 0069 | - | F | 29.563 Rel-18 API version and External doc update | 18.0.0 |
| 2023-03 | CT#99 | CP-230029 | 0070 | - | F | PDN connectivity status | 18.1.0 |
| 2023-03 | CT#99 | CP-230029 | 0071 | 1 | F | Missing OAuth Security Clauses | 18.1.0 |
| 2023-06 | CT#100 | CP-231027 | 0072 | 4 | F | Location header and missing Redirection clause | 18.2.0 |
| 2023-06 | CT#100 | CP-231025 | 0074 | - | F | Roaming Status Update | 18.2.0 |
| 2023-06 | CT#100 | CP-231027 | 0075 | 1 | D | Editorial corrections for Roaming Status Update | 18.2.0 |
| 2023-09 | CT#101 | CP-232033 | 0076 | 1 | F | NEF Reference ID | 18.3.0 |
| 2023-09 | CT#101 | CP-232058 | 0077 | 1 | F | Immediate Reporting Handling | 18.3.0 |

| 2023-09 | CT#101 | CP-232060 | 0078 | - | F | 29.563 Rel-18 API version and External doc update | 18.3.0 |
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| 2023-12 | CT#102 | CP-233029 | 0079 | 1 | B | HTTP RFCs obsoleted by IETF RFC 9110, 9111 and 9113 | 18.4.0 |
| 2023-12 | CT#102 | CP-233029 | 0080 | 1 | B | ProblemDetails RFC 7807 obsoleted by 9457 | 18.4.0 |
| 2023-12 | CT#102 | CP-233027 | 0081 | - | B | Per Monitoring Configuration Failure Cause in Error Response | 18.4.0 |
| 2023-12 | CT#102 | CP-233030 | 0082 | - | F | Editorial and Style Corrections | 18.4.0 |
| 2023-12 | CT#102 | CP-233071 | 0084 | - | A | Group ID on Nhss_EE API | 18.4.0 |
| 2023-12 | CT#102 | CP-233060 | 0085 | - | F | 29.563 Rel-18 API version and External doc update | 18.4.0 |
| 2024-06 | CT#104 | CP-241028 | 0087 | 1 | F | Callbacks | 18.5.0 |
| 2024-06 | CT#104 | CP-241028 | 0088 | 3 | F | UeContextInPgw modification | 18.5.0 |
| 2024-06 | CT#104 | CP-241052 | 0089 | - | F | 29.563 Rel-18 API version and External doc update | 18.5.0 |
| 2024-09 | CT#105 | CP-242053 | 0093 | 1 | F | Not Cancelling the MME registration upon EPS to 5GS mobility | 18.6.0 |
| 2024-09 | CT#105 | CP-242054 | 0094 | - | F | 29.563 Rel-18 API version and External doc update | 18.6.0 |

# History

| Document history | | |
|---|---|---|
| V18.4.0 | May 2024 | Publication |
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