

# ETSI TS 129 563 V17.5.0 (2022-07)



**5G ;  
5G System;  
Home Subscriber Server (HSS) services  
for interworking with Unified Data Management (UDM);  
Stage 3  
(3GPP TS 29.563 version 17.5.0 Release 17)**



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**Reference**

RTS/TSGC-0429563vh50

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**Keywords**

5G

**ETSI**

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- 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
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- 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

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**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.

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# 1 Scope

The present document specifies the stage 3 protocol, including message flows and API specification details, for the Nnss 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].

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# 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 7540: "Hypertext Transfer Protocol Version 2 (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 7807: "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].

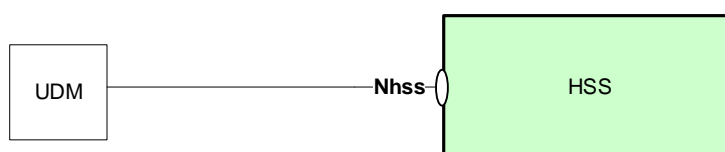
5GC	5G Core Network
HSS	Home Subscriber Server
JSON	Javascript Object Notation
SBI	Service Based Interface
UDM	Unified Data Management
UDR	Unified Data Repository

## 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

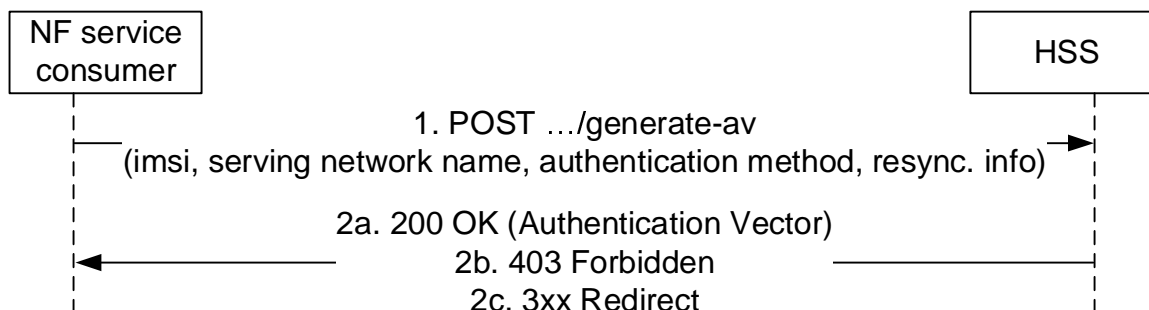
###### 5.2.2.2.1 General

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

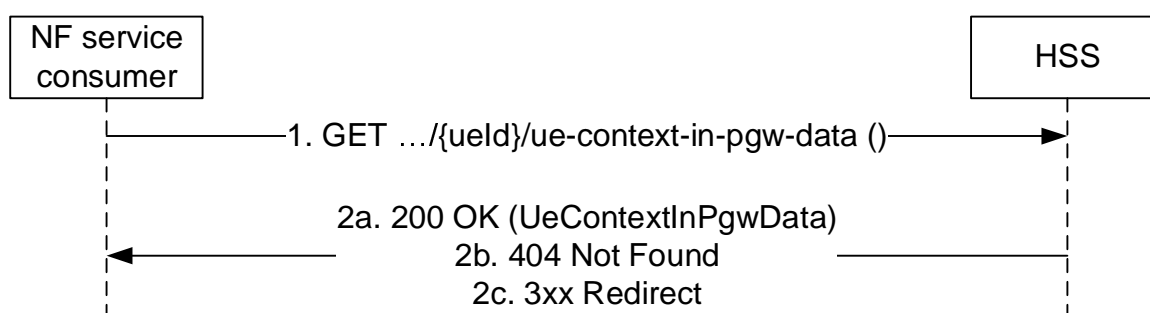
#### 5.3.2.2.1 General

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

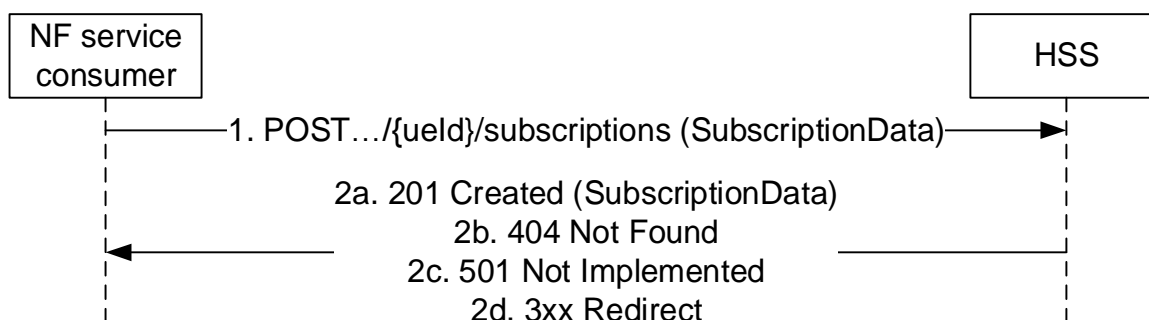
#### 5.3.2.3.1 General

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

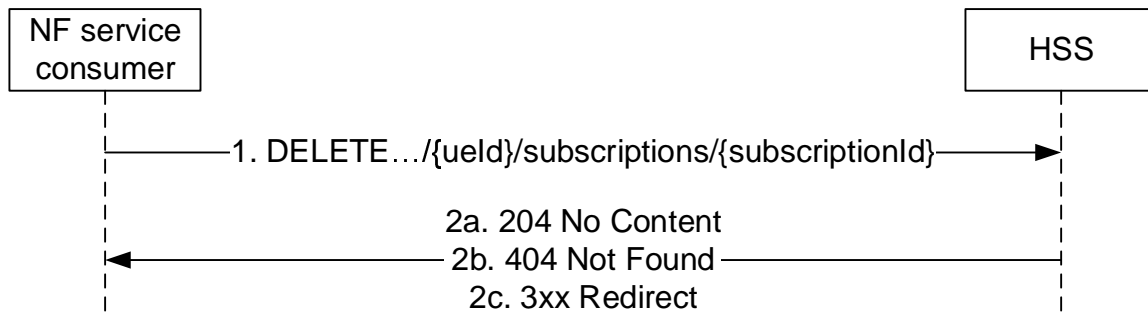
The following procedures using the Unsubscribe service operation are supported:

- 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

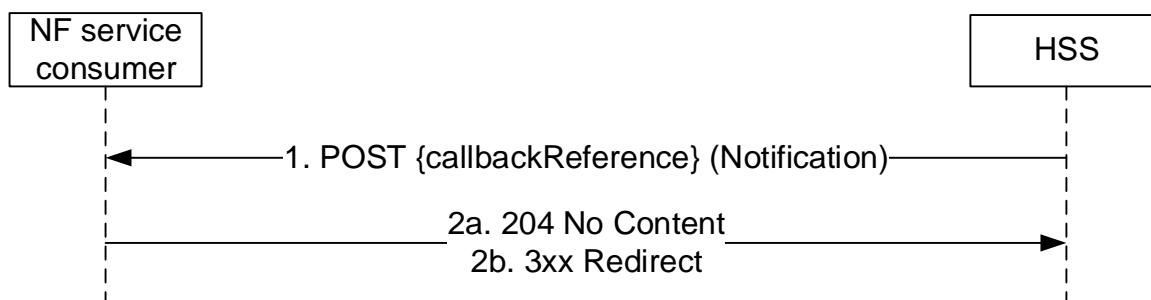
#### 5.3.2.5.1 General

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

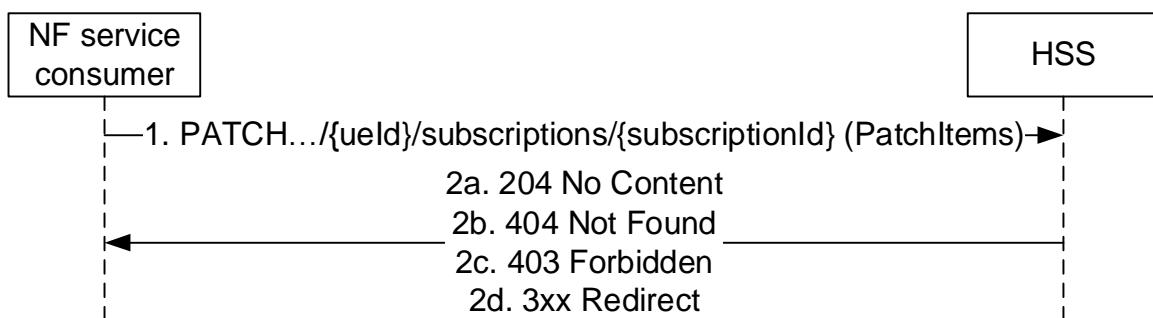
#### 5.3.2.6.1 General

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

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 of the UE in the HSS.

### 5.4.2.2 SnDeregistration

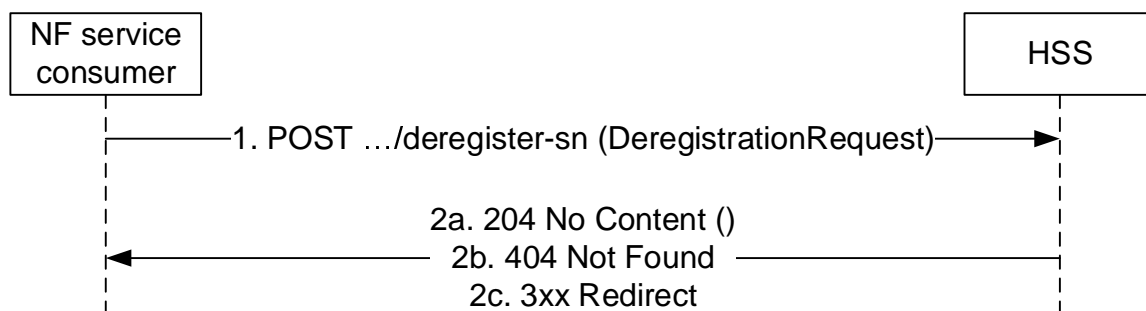
#### 5.4.2.2.1 General

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.

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".

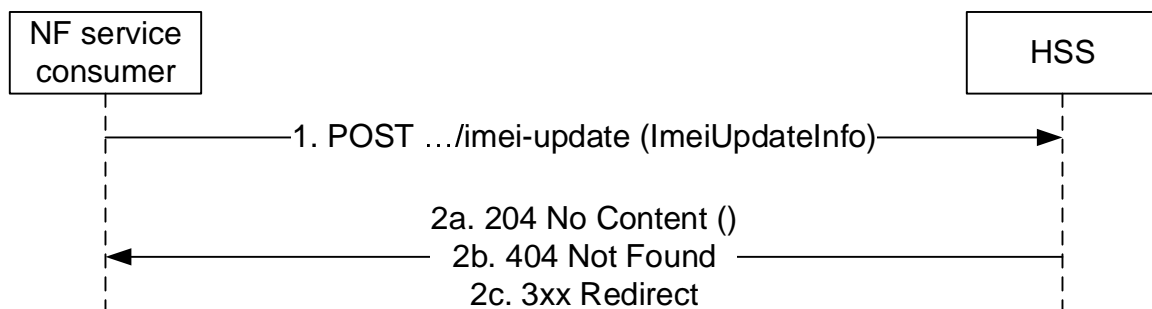
2b. If there is no valid subscription data for the UE, HTTP status code "404 Not Found" should be returned including additional error information in the response body (in the "ProblemDetails" element).

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.

#### 5.4.2.2.3 IMEI Update

Figure 5.4.2.2.3-1 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 5.4.2.2.3-1: 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 with "204 No Content".

2b. If there is no valid subscription data for the UE, or the UE is not registered in EPS network for 3GPP access, 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

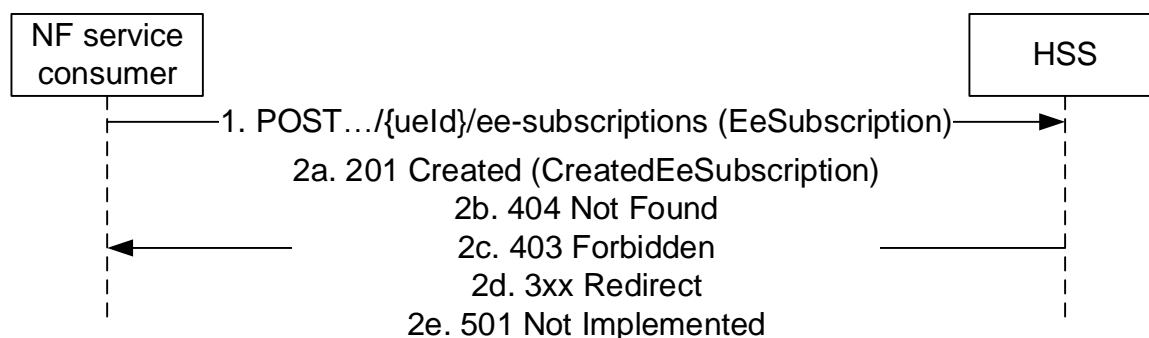
##### 5.5.2.2.1 General

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 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.

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.

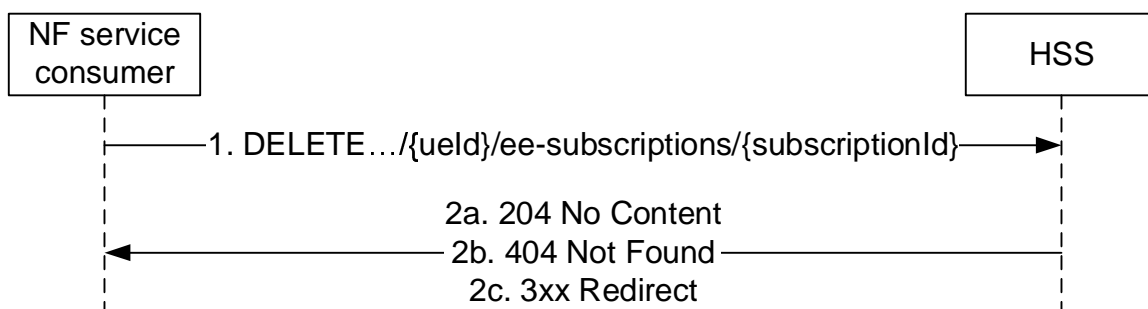


Figure 5.5.2.3.2-1: NF service consumer unsubscribes to notifications

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

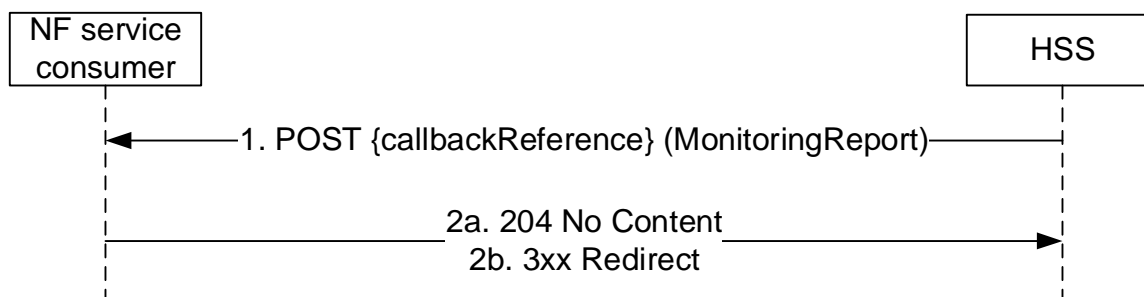
### 5.5.2.4.1 General

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. The request contains the callbackReference URI 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 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

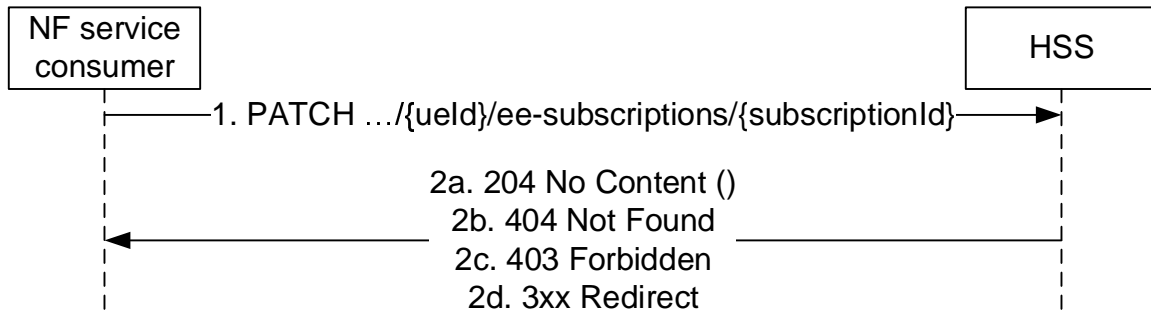
The following procedures using the ModifySubscription service operation are supported:

- 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.

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## 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 7540 [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 7807 [12] signalled by the content type "application/problem+json".

### 6.1.2.3 HTTP custom headers

#### 6.1.2.3.1 General

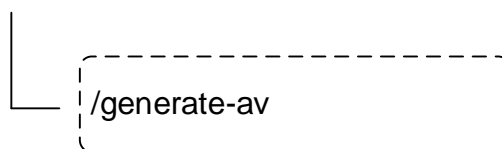
In this release of the specification, no specific custom headers are defined for the Nhss\_UEAuthentication service.

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>



**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. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be used to indicate one of the following application errors: - AUTHENTICATION_REJECTED
ProblemDetails	O	0..1	404 Not Found	The "cause" attribute may be used to indicate one of the following application errors: - 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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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

## 6.2 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 7540 [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 7807 [12]) signalled by the content type "application/problem+json".

### 6.2.2.3 HTTP custom headers

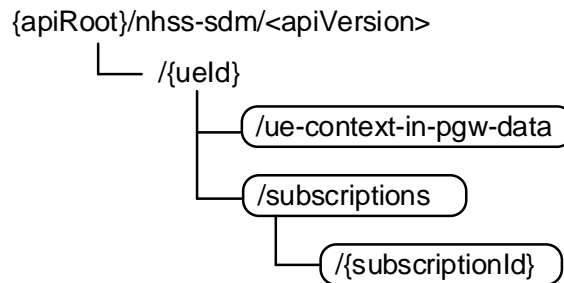
#### 6.2.2.3.1 General

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



**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 6.2.3.2.3.1-1: 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. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
ProblemDetails	O	0..1	404 Not Found	The "cause" attribute may be used to indicate one of the following application errors: - USER_NOT_FOUND - 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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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 6.2.3.3.1-3: 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.  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. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
ProblemDetails	O	0..1	404 Not Found	The "cause" attribute may be used to indicate one of the following application errors:  - USER_NOT_FOUND
ProblemDetails	O	0..1	501 Not Implemented	The "cause" attribute may be used to indicate one of the following application errors:  - UNSUPPORTED_RESOURCE_URI  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 6.2.3.3.1-4: 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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected.

**Table 6.2.3.3.1-5: 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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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 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. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
ProblemDetails	O	0..1	404 Not Found	The "cause" attribute may be used to indicate one of the following application errors:  - USER_NOT_FOUND - 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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
ProblemDetails	O	0..1	404 Not Found	The "cause" attribute may be used to indicate one of the following application errors:  - USER_NOT_FOUND - 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.  The "cause" attribute may be used to indicate one of the following application errors:  - 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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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	

**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. The response shall include a Location header field containing a different URI. The URI shall be an alternative URI of the notification endpoint of the subscribing NF Service Consumer. If an SCP redirects the message to another SCP then the location header field shall contain the same URI or a different URI pointing to the endpoint of the NF service consumer to which the notification should be sent.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI. The URI shall be an alternative URI of the notification endpoint of the subscribing NF Service Consumer. If an SCP redirects the message to another SCP then the location header field shall contain the same URI or a different URI pointing to the endpoint of the NF service consumer to which the notification should be sent.
ProblemDetails	O	0..1	404 Not Found	The "cause" attribute may be used to indicate one of the following application errors:  - CONTEXT_NOT_FOUND  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.
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.
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
emergencyIpAddress	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/emergencyIpAddress 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. The URI shall take the form of either an absolute URI or an absolute-path reference as defined in IETF RFC 3986 [31]. 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.  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.  When present, this IE shall be set as following: - true: immediate report is required - 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.  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 SubscriptionDataSets

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

## 6.3 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 7540 [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 7807 [12] signalled by the content type "application/problem+json".

#### 6.3.2.3 HTTP custom headers

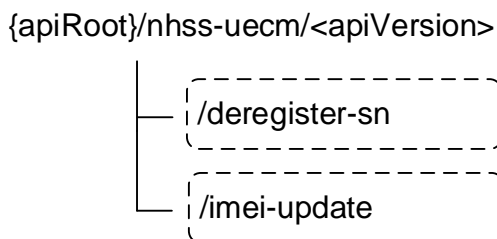
##### 6.3.2.3.1 General

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



**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

### 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
DeregistrationRequest	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. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
ProblemDetails	O	0..1	404 Not Found	The "cause" attribute may be used to indicate one of the following application errors: - 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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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
n/a			204 No Content	Upon success, an empty response body shall be returned.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
ProblemDetails	O	0..1	404 Not Found	The "cause" attribute may be used to indicate one of the following application errors: - USER_NOT_FOUND - 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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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	

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.	

## 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: " $^{\wedge}$ [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. pattern: " $^{\wedge}$ [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. pattern: " $^{\wedge}$ [0-9]{14}\$"
imeisv	string	C	0..1	IMEISV of the UE as described in 3GPP TS 23.003 [15], clause 6.2.2. pattern: " $^{\wedge}$ [0-9]{16}\$"
NOTE: Exactly one of attributes "imei" or "imeisv" shall be present.				

### 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).

### 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

## 6.4 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 7540 [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 7807 [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".



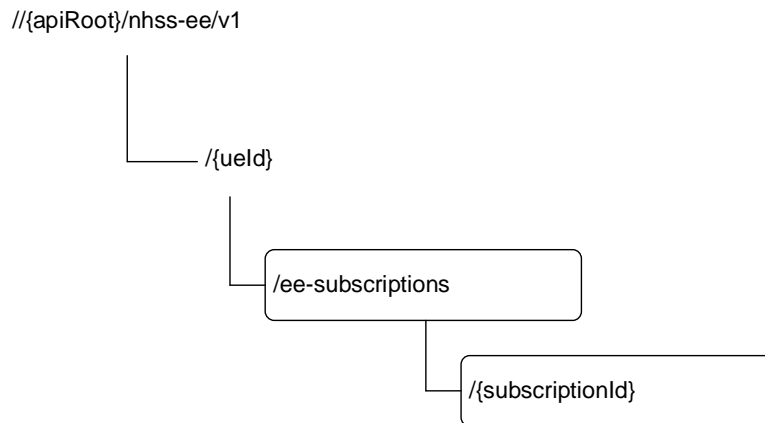
### 6.4.2.3 HTTP custom headers

#### 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



**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
ueld	<p>Represents the identity of the UE in the HSS (IMSI) or the identity of a group of UEs.</p> <ul style="list-style-type: none"> <li>- If representing a single UE, this parameter shall contain the IMSI of the UE. pattern: See type lmsi in clause 6.4.6.3.2 of this document.</li> <li>- If representing a group of UEs, this parameter shall contain the External Group Id. pattern: "^extgroupid-[^@]+@[^@]+\$"</li> </ul> <p>(NOTE)</p>
NOTE:	If the HSS supports GBEE feature, the ueld can contain the External Group Id, or ueld 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.  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. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be used to indicate one of the following application errors: - MONITORING_NOT_ALLOWED - MAXIMUM_RESOURCES_EXCEEDED - 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: - USER_NOT_FOUND
ProblemDetails	O	0..1	501 Not Implemented	The "cause" attribute may be used to indicate one of the following application errors: - UNSUPPORTED_MONITORING_EVENT_TYPE - UNSUPPORTED_MONITORING_REPORT_OPTIONS  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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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
ueld	Represents the identity of the UE in the HSS (IMSI) pattern: See type lmsi in clause 6.4.6.3.2 of this document.
subscriptionId	The subscriptionId identifies an individual subscription to notifications The type is string.

### 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. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
ProblemDetails	O	0..1	404 Not Found	The "cause" attribute may be used to indicate one of the following application errors: - USER_NOT_FOUND - 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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same HSS (service) set.
ProblemDetails	O	0..1	404 Not Found	The "cause" attribute may be used to indicate one of the following application errors: - USER_NOT_FOUND - 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.  The "cause" attribute may be used to indicate one of the following application errors: - 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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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. Or the same URI, if a request is redirected to the same target resource via a different SCP.
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. The response shall include a Location header field containing a different URI. The URI shall be an alternative URI of the notification endpoint of the subscribing NF Service Consumer. If an SCP redirects the message to another SCP then the location header field shall contain the same URI or a different URI pointing to the endpoint of the NF service consumer to which the notification should be sent.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI. The URI shall be an alternative URI of the notification endpoint of the subscribing NF Service Consumer. If an SCP redirects the message to another SCP then the location header field shall contain the same URI or a different URI pointing to the endpoint of the NF service consumer to which the notification should be sent.
ProblemDetails	O	0..1	404 Not Found	The "cause" attribute may be used to indicate one of the following application errors: - 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.
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.
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
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

## 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 referenced 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 monitored 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. 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: - If representing a single external identifier: pattern: "^extid-[^\@]+\@[^\@]+\$"  - 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).  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
failedMonitoringConfig	map(FailedMonitoringConfiguration)	O	1..N	A map (list of key-value pairs where Referenceld converted from integer to string serves as key; see clause 6.4.6.3.2) of FailedMonitoringConfiguration; see clause 6.4.6.2.14.  This IE is used to indicate the failed subscriptions of event monitoring configuration and the failed cause for them.	
supportedFeatures	SupportedFeatures	O	0..1	See clause 6.4.8	

## 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.  May be present if eventType is "UE_REACHABILITY_FOR_DATA" or "AVAILABILITY_AFTER_DDN_FAILURE"  When present, this IE shall be set as following: - true: Idle status indication is requested - 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 only the following values are allowed: "UE_REACHABILITY_FOR_SMS" "UE_REACHABILITY_FOR_DATA" "LOSS_OF_CONNECTIVITY" "LOCATION_REPORTING" "PDN_CONNECTIVITY_STATUS"
timeStamp	DateTime	M	1	Point in time at which the event occurred
report	Report	O	0..1	Shall be present if eventType is "UE_REACHABILITY_FOR_SMS" "UE_REACHABILITY_FOR_DATA" "LOSS_OF_CONNECTIVITY" "LOCATION_REPORTING" "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	ReachabilityForSmsReport	O	0..1	Reports the UE reachability for SMS
reachabilityForDataReport	ReachabilityForDataReport	O	0..1	Reports the UE reachability for Data
lossConnectivityReport	LossConnectivityReport	O	0..1	Reports the Loss of Connectivity
locationReport	LocationReport	O	0..1	Reports the UE Location
pdnConnectivityStatReport	PdnConnectivityStatReport	O	0..1	Reports the PDN Connectivity Status

## 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 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.  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.

## 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 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.  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.

### 6.4.6.3 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
Referenceld	integer	Referenceld is used as key in a map of MonitoringConfigurations; see clause 6.4.6.2.4.  Referenceld is used as key in a map of FailedMonitoringConfiguration; see clause 6.4.6.2.3.  The numeric value should not be higher than $2^{64}-1$ (i.e. it should be possible to convey it in an unsigned 64 integer Information Element, used in other protocols), if interworking with the Event Exposure framework in EPC is required.
Imsi	string	IMSI pattern: <code>^(imsi-[0-9]{5,15})\$</code>
UeldOrGroupId	string	Contains the UE identifier or the Group Identifier of the UE. pattern: <code>^(imsi-[0-9]{5,15} extgroupid-[^\@]+\@[^\@]+\.[^\@]+\.[^\@]+)\$</code>
MaxNumOfReports	integer	Maximum number of reports. 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].  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].  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  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.  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.



# 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: '1.1.0'
  title: 'NhssUEAU'
  description: |
    HSS UE Authentication Service.
    © 2022, 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 17.5.0
  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'
  '403':
    $ref: 'TS29571_CommonData.yaml#/components/responses/403'
  '404':
    $ref: 'TS29571_CommonData.yaml#/components/responses/404'
  '500':
    $ref: 'TS29571_CommonData.yaml#/components/responses/500'
  '501':
    $ref: 'TS29571_CommonData.yaml#/components/responses/501'
  '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:
```

```
# COMPLEX 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: '1.1.0'
title: 'Nhss_SDM'
description: |
  HSS Subscriber Data Management.
  © 2022, 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 17.5.0
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'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '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'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '501':
      $ref: 'TS29571_CommonData.yaml#/components/responses/501'
    '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'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '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'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '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'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '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:

# COMPLEX 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: '1.1.0'

```
title: 'Nhss_UECM'
description: |
  HSS UE Context Management.
  © 2022, 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 17.5.0
  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'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '501':
          $ref: 'TS29571_CommonData.yaml#/components/responses/501'
        '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:
      '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'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
```

```

    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '501':
      $ref: 'TS29571_CommonData.yaml#/components/responses/501'
    '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:

# COMPLEX 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}$'

# 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
      - type: string

```



## A.5 Nhss\_EE API

```

openapi: 3.0.0

info:
  version: '1.1.0'
  title: 'Nhss_EE'
  description: |
    HSS Event Exposure.
    © 2022, 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 17.5.0
  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'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '501':
          $ref: 'TS29571_CommonData.yaml#/components/responses/501'
        '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'
            '404':
              $ref: 'TS29571_CommonData.yaml#/components/responses/404'
            '500':
              $ref: 'TS29571_CommonData.yaml#/components/responses/500'
            '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
        required: true
        schema:
          $ref: '#/components/schemas/Imsi'
      - 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'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '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
    required: true
    schema:
      $ref: '#/components/schemas/Imsi'
  - 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'
  '403':
    $ref: 'TS29571_CommonData.yaml#/components/responses/403'
  '404':
    $ref: 'TS29571_CommonData.yaml#/components/responses/404'
  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:

# COMPLEX 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'
    scefidiamrealm:
      $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
    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: '#/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'

# SIMPLE TYPES:

ReferenceId:
  description: The ID to refer to a given Monitoring Event (and its corresponding Monitoring
Configuration and Monitoring Event Report)
  type: integer

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

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# History

<b>Document history</b>		
V17.4.0	May 2022	Publication
V17.5.0	July 2022	Publication