ETSI TS 129 518 V15.0.0 (2018-09)

5G;
5G System;
Access and Mobility Management Services;
Stage 3
(3GPP TS 29.518 version 15.0.0 Release 15)

Reference
RTS/TSGC-0429518vf00

Keywords
5G

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Foreword

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

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under http://webapp.etsi.org/key/queryform.asp.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Foreword

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

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies the stage 3 protocol and data model for the Namf Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the AMF.

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

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

2 References

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

[7] 3GPP TS 23.503: "Policy and Charging Control Framework for the 5G System; Stage 2".

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

[9] IETF RFC 2387: "The MIME Multipart/Related Content-type".

[10] IETF RFC 2045: "Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies".

[11] 3GPP TS 24.501: "Non-Access-Stratum (NAS) Protocol for 5G System (5GS); Stage 3".

[12] 3GPP TS 38.413: "NG Radio Access Network (NG-RAN); NG Application Protocol (NGAP)".

[13] 3GPP TS 36.355: "Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP)".

[14] 3GPP TS 29.510: "Network Function Repository Services; Stage 3".

[15] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General Aspects".

[16] 3GPP TS 29.502: "5G System, Session Management Services; Stage 3".

[17] 3GPP TS 38.455: "NR Positioning Protocol A (NRPPa)".

[18] 3GPP TS 29.531: "Network Slice Selection Services; Stage 3".

[19] IETF RFC 7540: "Hypertext Transfer Protocol Version 2 (HTTP/2)".

[20] 3GPP TS 23.041: "Technical realization of Cell Broadcast Service (CBS)"

[21] 3GPP TS 29.168: "Cell Broadcast Centre interfaces with the Evolved Packet Core; Stage 3"

[22] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3"

[23] OpenAPI Initiative, "OpenAPI 3.0.0 Specification", https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md

[24] 3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)"

[25] 3GPP TS 29.572: "5G System, Location Management Services; Stage 3".

[26] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

[27] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

[28] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".

[29] 3GPP TS 29.510: "Network Function Repository Services; Stage 3".

3 Definitions and abbreviations

3.1 Definitions

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

example: text used to clarify abstract rules by applying them literally.

3.2 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
5GS	5G System
5G-AN	5G Access Network
5G-GUTI	5G Globally Unique Temporary Identifier
5QI	5G QoS Identifier
AMF	Access and Mobility Management Function
EBI	EPS Bearer Identity
GAD	Universal Geographical Area Description
GPSI	Generic Public Subscription Identifier
GUAMI	Globally Unique AMF Identifier
JSON	JavaScript Object Notation
LADN	Local Area Data Network
LMF	Location Management Function
MM	Mobility Management
N3IWF	Non-3GPP InterWorking Function
NEF	Network Exposure Function
NR	New Radio
NRF	Network Repository Function
NRPPa	NR Positioning Protocol A
NSI ID	Network Slice Instance Identifier
NSSAI	Network Slice Selection Assistance Information
PCF	Policy Control Function
PEI	Permanent Equipment Identifier
RAT	Radio Access Type
RFSP	RAT/Frequency Selection Priority
SARI	Service Area Restriction Information
SBI	Service Based Interface
SM	Session Management
SMF	Session Management Function
SMSF	Short Message Service Function
S-NSSAI	Single Network Slice Selection Assistance Information
SUCI	Subscription Concealed Identifier
SUPI	Subscription Permanent Identifier
TA	Tracking Area
TAI	Tracking Area Identity
UDM	Unified Data Management
UDSF	Unstructured Data Storage Function

4 Overview

4.1 Introduction

Within the 5GC, the AMF offers services to the SMF, other AMF, PCF, SMSF, LMF, GMLC, CBCF, PWS-IWF and NEF via the Namf service based interface (see 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3]).

Figure 4.1-1 provides the reference model (in service based interface representation and in reference point representation), with focus on the AMF and the scope of the present specification.

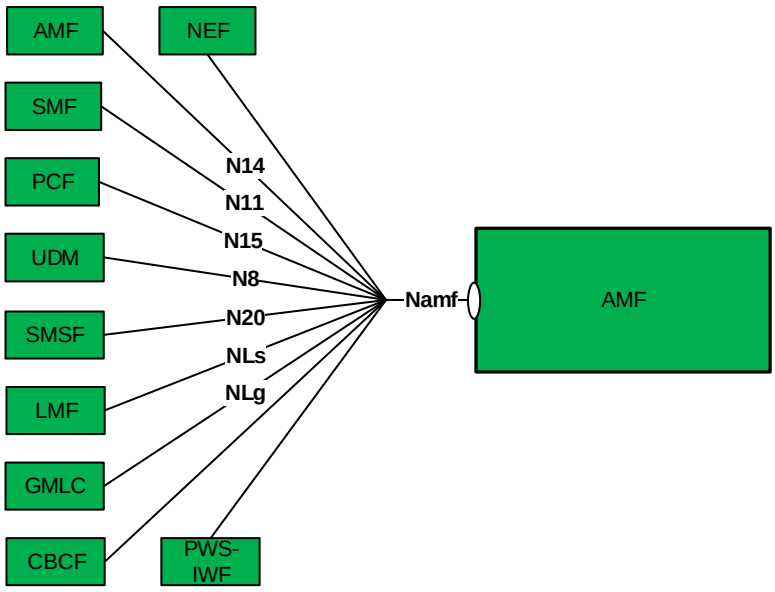

Figure 4.1-1: Reference model – AMF

The functionalities supported by the AMF are listed in subclause 6.2.1 of 3GPP TS 23.501 [2].

5 Services offered by the AMF

5.1 Introduction

The table 5.1-1 shows the AMF Services and AMF Service Operations:

Table 5.1-1 List of AMF Services

Service Name	Service Operations	Operation Semantics	Example Consumer(s)
Namf_Communication	UEContextTransfer	Request/Response	Peer AMF
	RegistrationCompleteNotify	Subscribe/Notify	Peer AMF
	N1MessageNotify	Subscribe/Notify	AMF, LMF,
	N1N2MessageSubscribe		
	N1N2MessageUnSubscribe		
	N1N2MessageTransfer	Request/Response	SMF, SMSF, LMF
	NonUeN2MessageTransfer	Request/Response	LMF, CBCF, PWS-IWF
	NonUeN2InfoSubscribe	Subscribe/Notify	CBCF, PWS-IWF
	NonUeN2InfoUnSubscribe		
	N2InfoNotify		LMF, AMF
	NonUeN2InfoNotify		LMF, CBCF, PWS-IWF
	EBIAssignment	Request/Response	SMF
	AMFStatusChangeSubscribe	Subscribe / Notify	SMF, PCF, NEF, SMSF, UDM
	AMFStatusChangeUnSubscribe	Subscribe / Notify	SMF, PCF, NEF, SMSF, UDM
	AMFStatusChangeNotify	Subscribe / Notify	SMF, PCF, NEF, SMSF, UDM
Namf_EventExposure	Subscribe (see NOTE 1)	Subscribe/Notify	NEF, SMF, PCF, UDM
	Unsubscribe (see NOTE 1)	Subscribe/Notify	NEF, SMF, PCF, UDM
	Notify	Subscribe/Notify	NEF, SMF, PCF, UDM
Namf_MT	EnableUEReachability	Request/Response	SMSF
Namf_Location	ProvideLocation	Request/Response	GMLC
	EventNotify	Subscribe / Notify	GMLC
NOTE 1: A subscription applies for one UE, group of UE(s) or any UE.			

5.2 Namf_Communication Service

5.2.1 Service Description

This service enables an NF to communicate with the UE through N1 NAS messages or with the AN (both UE and non UE specific). The service operations defined below allow the NF to communicate with the UE and the AN. The following are the key functionalities of this NF service.

- Provide service operations for transporting N1 messages to the UE;
- Allow NFs to subscribe and unsubscribe for notifications of specific N1 messages from the UE;
- Allow NFs to subscribe and unsubscribe for notifications about specific information from AN;
- Provide service operations for initiating N2 messages towards the AN;
- Security Context Management; and
- UE information management and transfer (including its security context).

5.2.2 Service Operations

5.2.2.1 Introduction

The Namf_Communication service supports following service operations:

- UEContextTransfer
- RegistrationCompleteNotify
- N1N2MessageTransfer (UE Specific)
- N1N2MessageSubscribe (UE Specific)
- N1N2MessageUnsubscribe (UE Specific)
- N1MessageNotify (UE Specific)

- N2InfoNotify (UE Specific)
- NonUeN2MessageTransfer
- NonUeN2InfoSubscribe
- NonUeN2INfoUnsubscribe
- N2InfoNotify
- EBIAssignment
- CreateUEContext
- ReleaseUEContext
- AMFStatusChangeSubscribe
- AMFStatusChangeUnsubscribe
- AMFStatusChangeNotify

5.2.2.2 UE Context Operations

5.2.2.2.1 UEContextTransfer

5.2.2.2.1.1 General

The UEContextTransfer service operation is used during the following procedure:

- General Registration procedure (see 3GPP TS 23.502 [3], subclause 4.2.2.2.2)

The UEContextTransfer service operation is invoked by a NF Service Consumer, e.g. a target AMF, towards the AMF (acting as source AMF), when the target AMF receives a Registration Request with the UE's 5G-GUTI included and the serving AMF has changed since last registration, to retrieve the UE Context, e.g. the UE's SUPI and MM Context, in the source AMF.

The NF Service Consumer (e.g. the target AMF) shall retrieve the UE Context by invoking the "transfer" custom method on the URI of an "Individual ueContext" resource, see subclause 6.1.3.2.4. See also Figure 5.2.2.2.1.1-1.

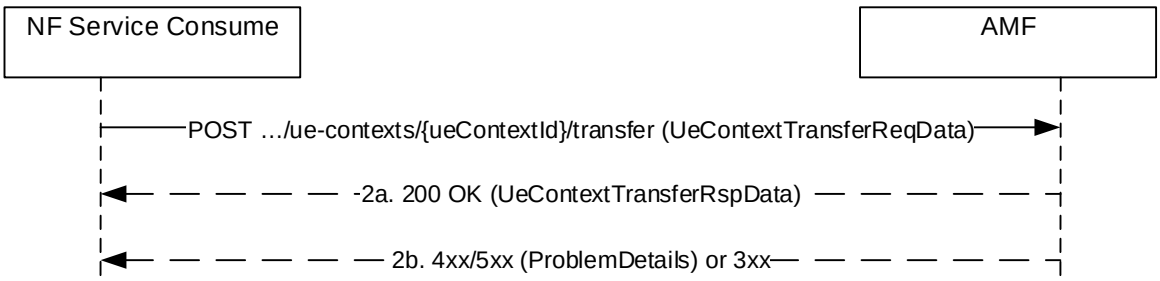

Figure 5.2.2.2.1.1-1 UE Context Transfer

1. The NF Service Consumer, e.g. target AMF, shall send a HTTP POST request to invoke "transfer" custom method on an "Individual ueContext" resource URI. The payload of the request shall be an object of "UeContextTranferReqData" data type.

   If UE Context Transfer is triggered by UE initial registration or mobility registration, the NF Service Consumer, e.g. target AMF, shall set the reason attribute to "INIT_REG" or "MOBI_REG" and include the integrity protected registration request message which triggers the UE context transfer in the payload.

   If the UE has already been authenticated, the NF Service Consumer, e.g. target AMF, shall set the reason attribute to "MOBI_REG_UE_VALIDATED".

2a. On success:

- if the reason attribute is "INIT_REG" and integrity check is successful, the (source) AMF shall respond with the status code "200 OK". The payload of the response shall be an object of "UeContextTransferRspData" data type, containing the representation of the requested UE Context without PDU Session Contexts.

- If the reason attribute is "MOBI_REG" and integrity check is successful, or if the reason attribute is "MOBI_REG_UE_VALIDATED", the (source) AMF shall respond with the status code "200 OK". The payload of the response shall be an object of "UeContextTransferRspData" data type, containing the representation of the complete UE Context including available PDU Session Contexts.

The response payload shall also include a callback URI to receive the notification of RegistrationCompleteNotity service operation (see subclause 5.2.2.3).

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.2.4.4.2-2 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.3.2.4.4.2-2.

5.2.2.2.2 RegistrationCompleteNotify

5.2.2.2.2.1 General

The RegistrationCompleteNotify service operation is used during the following procedure:

- General Registration procedure (see 3GPP TS 23.502 [3], subclause 4.2.2.2.2)

- Registration with AMF re-allocation procedure (see 3GPP TS 23.502 [3], subclause 4.2.2.2.3)

The RegistrationCompleteNotify service operation is invoked by a NF Service Producer, i.e. the target AMF, towards the NF Service Consumer, e.g. the source AMF, to notify the status of UE registration at the target AMF, thereby indicating the result of previous UE Context transfer for a given UE (see subclause 5.2.2.2.1.1).

The target AMF shall notify the NF Service Consumer (e.g. source AMF) the status of the UE registration at the target AMF due to a previous UE Context transfer. The target AMF shall use the HTTP method POST on the notification callback URI provided by the NF Service Consumer (e.g. source AMF) during a previous UE context transfer (see subclause 5.2.2.2.1.1). See also Figure 5.2.2.2.2.1-1.

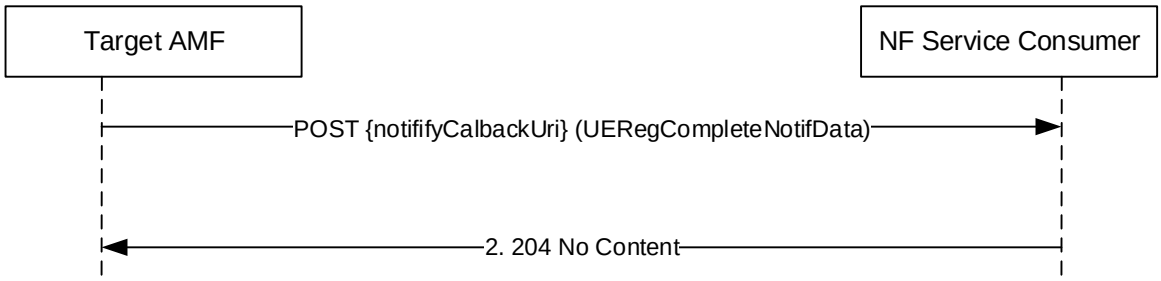

Figure 5.2.2.2.2.1-1 Registration Complete Notify

1. The target AMF, shall send a POST request on the notification callback URI obtained during an earlier UE context transfer request, to notify the NF Service Consumer of the status of the UE registration at the target AMF. The UE's 5G-GUTI is included as the UE identity, in the notification payload. Once the notification is received, the NF Service Consumer (e.g. AMF) shall:

   - remove the individual ueContext resource if the ueContextTransferStatus attribute included in the notification is set to "TRANSFERRED". The source AMF may choose to start a timer to supervise the release of the UE context resource and may keep the individual ueContext resource until the timer expires.

   - shall keep the UE Context as if the context transfer procedure had not happened if the ueContextTransferStatus attribute included in the notification is set to "NOT_TRANSFERRED".

2. The NF Service Consumer (e.g. source AMF) shall respond with the status code "204 No Content" if the request is accepted.

5.2.2.2.3 CreateUEContext

5.2.2.2.3.1 General

The CreateUEContext service operation is used during the following procedure:

- Inter NG-RAN node N2 based handover (see 3GPP TS 23.502 [3], subclause 4.9.1.3)

The CreateUEContext service operation is invoked by a NF Service Consumer, e.g. a source AMF, towards the AMF (acting as target AMF), when the source AMF can't serve the UE and selects the target AMF during the handover procedure, to create the UE Context in the target AMF.

The NF Service Consumer (e.g. the source AMF) shall create the UE Context by using the HTTP PUT method with the URI of the "Individual UeContext" resource (See subclause 6.1.3.2.3.1). See also Figure 5.2.2.2.3.1-1.

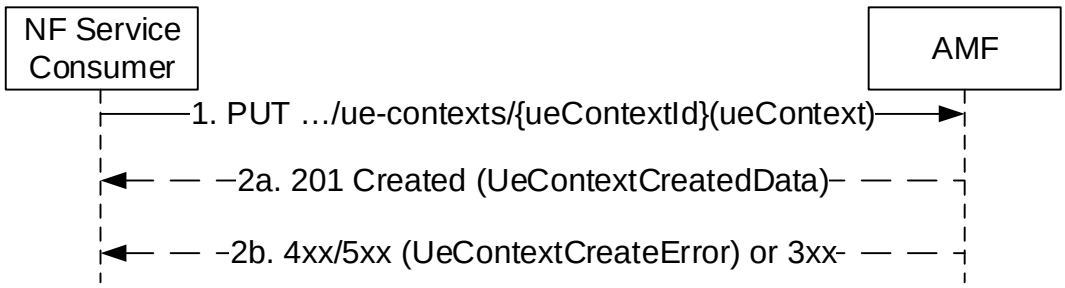

Figure 5.2.2.2.3.1-1 Create UE Context

1. The NF Service Consumer, e.g. source AMF, shall send a PUT request, to create the ueContext in the target AMF. The payload body of the PUT request shall contain a callback URI.

2a. On success, the target AMF shall respond with the status code "201 Created" if the request is accepted, together with a HTTP Location header to provide the location of a newly created resource. The payload body of the PUT response shall contain the representation of the created UE Context.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.2.3.1-3 shall be returned. For a 4xx/5xx response, the message body shall contain a UeContextCreateError structure, including:

- a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.3.2.3.1-3;
- NgAPCause, if available.

5.2.2.2.4 ReleaseUEContext

5.2.2.2.4.1 General

The ReleaseUEContext service operation is used during the following procedure:

- Inter NG-RAN node N2 based handover, Cancel procedure (see 3GPP TS 23.502 [3], subclause 4.9.1.4)

The ReleaseUEContext service operation is invoked by a NF Service Consumer, e.g. a source AMF, towards the AMF (acting as target AMF), when the source AMF receives the Handover Cancel from the 5G-AN during the handover procedure, to release the UE Context in the target AMF.

The NF Service Consumer (e.g. the source AMF) shall release the UE Context by using the HTTP "release" custom operation with the URI of the "Individual UeContext" resource (See subclause 6.1.3.2.4.2). See also Figure 5.2.2.2.4.1-1.

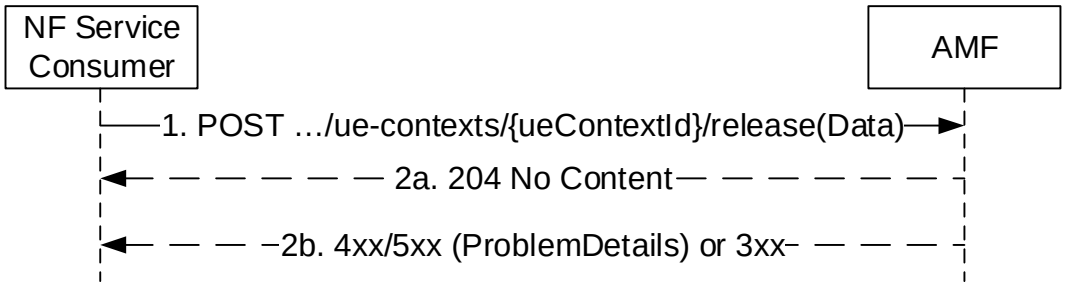

Figure 5.2.2.2.4.1-1 Release UE Context

1. The NF Service Consumer, e.g. source AMF, shall send a POST request, to release the ueContext in the target AMF. The payload body of the POST request shall contain any data that needs to be passed to the target AMF.

2a. On success, the target AMF shall return "204 No Content" with an empty payload body in the POST response.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.2.4.2.2-2 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.3.2.4.2.2-2.

5.2.2.3 UE Specific N1N2 Message Operations

5.2.2.3.1 N1N2MessageTransfer

5.2.2.3.1.1 General

The N1N2MessageTransfer service operation is used by a NF Service Consumer to transfer N1 and/or N2 information to the UE and/or 5G-AN through the AMF in the following procedures:

- Network triggered Service Request (see subclause 4.2.3.4 in 3GPP TS 23.502 [3]
- PDU Session establishment (See subclause 4.3.2 in 3GPP TS 23.502 [3])
- PDU Session modification (See subclause 4.3.3 in 3GPP TS 23.502 [3])
- PDU Session release (See subclause 4.3.4 in 3GPP TS 23.502 [3])
- Session continuity, service continuity and UP path management (See subclause 4.3.4 in 3GPP TS 23.502 [3])
- SMS over NAS procedures (See subclause 4.13.3 in 3GPP TS 23.502 [3]
- UE assisted and UE based positioning procedure (See subclause 4.13.5.4 in 3GPP TS 23.502 [3])
- Network assisted positioning procedure (See subclause 4.13.5.5 in 3GPP TS 23.502 [3])

The NF Service Consumer shall invoke the service operation by using HTTP method POST, to request the AMF to transfer N1 and/or N2 information for a UE and/or 5G-AN, with the URI of "N1 N2 Messages Collection" resource (See subclause 6.1.3.10.3.1).

The NF Service Consumer may include the following information in the HTTP Request message body:

- SUPI
- PDU Session ID or LCS Co-relation ID depending on the N1/N2 message class to be transferred
- N2 SM Information (PDU Session ID, QoS profile, CN N3 Tunnel Info, S-NSSAI)
- N1 SM Information
- N1 Message Container (e.g. LPP message, SMS)
- N2 Information Container (e.g. NRPPa message)
- Allocation and Retention Priority (ARP)
- Paging Policy Indication

- 5QI- Notification URL (used for receiving Paging Failure Indication)
- RAT and/or AN type for the PDU Session
- Last Message Indication

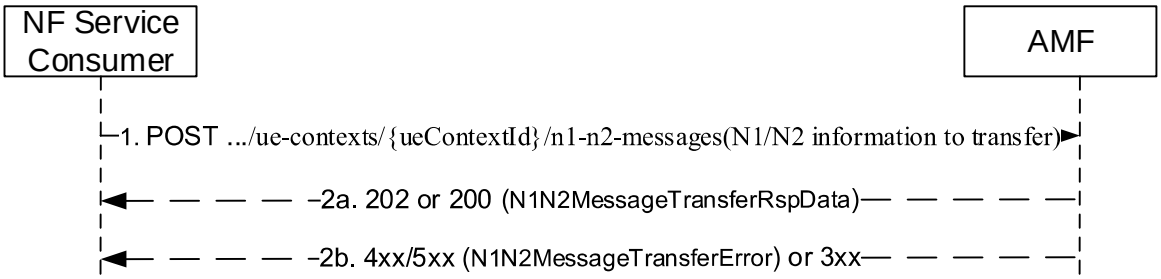

Figure 5.2.2.3.1.1-1 N1N2MessageTransfer for UE related signalling

1. The NF Service Consumer shall send a POST request to transfer N1 and N2 information. The NF Service Consumer may include a N1N2MessageTransfer Notification URI to AMF in the request message.

2a. On success, i.e. if the request is accepted and the AMF is able to transfer the N1/N2 message to the UE and/or the AN, the AMF shall respond with a "200 OK" status code. The AMF shall set the cause IE in the N1N2MessageTransferRspData as "N1_N2_TRANSFER_INITIATED" in this case.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.5.3.1-3 shall be returned. For a 4xx/5xx response, the message body shall contain a N1N2MessageTransferError structure, including:

- a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.3.5.3.1-3;

5.2.2.3.1.2 When the UE is in CM-IDLE

When the N1N2MessageTransfer service operation is invoked by a NF Service Consumer for a UE in CM-IDLE state, the requirements specified in subclause 5.2.2.3.1.1 shall apply with the following modifications and definitions:

- Same as step 2a of Figure 5.2.2.3.1.1-1, the AMF shall respond with the status code "202 Accepted", if the asynchronous type communication is invoked and hence the UE is not paged, update the UE context and store N1 and/or N2 information and initiate communication with the UE and/or 5G-AN when the UE becomes reachable. In this case the AMF shall provide the URI of the resource in the AMF in the "Location" header of the response, which holds the status of the N1/N2 message transfer and a pointer to the stored N1/N2 message. The AMF shall also provide a response body containing the cause, "WAITING_FOR_ASYNCHRONOUS_TRANSFER" that represents the current status of the N1/N2 message transfer;

- Same as step 2a of Figure 5.2.2.3.1.1-1, the AMF shall respond with the status code "202 Accepted", if the UE is in 3GPP access and paging is issued, with a response body that carries a cause ATTEMPTING_TO_REACH_UE as specified in subclause 4.2.3.3 and 5.2.2.2.7 of 3GPP TS 23.502 [3]. The NF Service Consumer shall not send any further signalling for the UE if it receives a POST response body ATTEMPTING_TO_REACH_UE unless it has higher priority signalling. The response shall include the "Location" header containing the URI of the resource created in the AMF, which holds the status of the N1/N2 message transfer, e.g. ".../n1-n2-messages/{n1N2MessageId}". The AMF:

  - shall store the N1 and/or N2 information and, when the UE responds with a Service Request, shall initiate communication with the UE and/or 5G-AN using the stored N1 and/or N2 information; or

  - shall notify the NF which invoked the service operation, as specified in subclause 5.2.2.3.2, when the AMF determines that the paging has failed and if the Notification URI is provided,

- Same as step 2b of Figure 5.2.2.3.1.1-1, the AMF shall respond with status code "409 Conflict", if the UE is in 3GPP access and there is already an ongoing paging procedure with higher or same priority. The AMF shall set the application error as " HIGHER_PRIORITY_REQUEST_ONGOING" in the cause attribute of the ProblemDetails structure of the POST response body. The AMF may provide a retry timer value to the NF Service Consumer in order for the NF Service Consumer to retry the request after the expiry of the timer. When

the retry timer is provided, the NF Service Consumer shall not initiate the downlink messaging until the timer expires. The AMF may also provide the ARP value of the QoS flow that has triggered the currently ongoing highest priority paging, so that the NF Service Consumer (e.g SMF) knows that if any subsequent trigger initiating downlink messaging for a QoS flow with the same or lower priority happens.

- Same as step 2b of Figure 5.2.2.3.1.1-1, the AMF shall respond with the status code "504 Gateway Timeout", if the paging is not performed. The AMF shall set the POST response body as specified in subclause 6.1.3.10.3.1.

5.2.2.3.2 N1N2MessageTransfer Failure Notification

The AMF uses this notification to inform the NF service consumer that initiated an earlier Namf_Communication_N1N2MessageTransfer, that the AMF failed to deliver the N1 message to the UE as the UE failed to respond to paging. The HTTP POST method shall be used on the notification callback URI provided by the NF service consumer as specified in subclause 5.2.2.3.1.2.

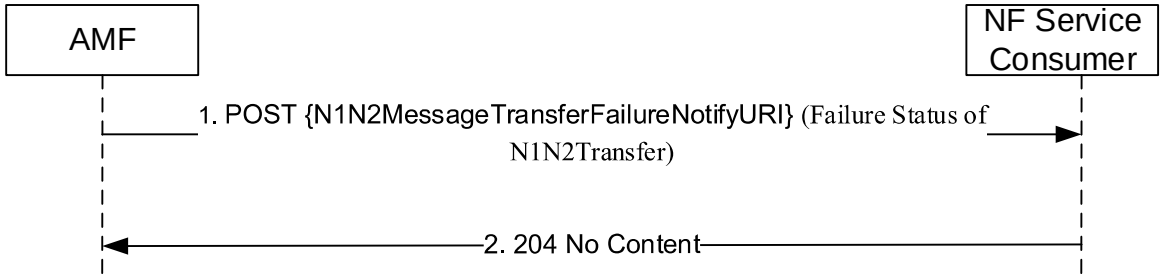

Figure 5.2.2.3.2-1 N1N2MessageTransfer Failure Notification for UE related signalling

1. When the AMF determines that the paging has failed and if the NF service consumer had provided a notification URI (see subclause 5.2.2.3.1.2), the AMF shall send a POST request to the NF Service Consumer on that Notification URI. The AMF shall include the N1N2MessageTransfer request resource URI returned earlier (see 5.2.2.3.1.3) in the POST request body. The AMF shall also include a N1/N2 message transfer cause information in the POST request body. The NF Service Consumer shall delete any stored representation of the N1N2MessageTransfer request resource URI upon receiving this notification.

2. The NF Service Consumer shall send a response with “204 No Content” status code.

5.2.2.3.3 N1N2MessageSubscribe

5.2.2.3.3.1 General

The N1N2MessageSubscribe service operation is used by a NF Service Consumer (e.g. LMF) to subscribe to the AMF for notifying N1 messages of a specific type (e.g. LPP) or N2 information of a specific type (e.g. NRPPa).

An NF Service Consumer (e.g. LMF) may subscribe to notifications of specific N1 message type (e,g LPP) or N2 information type (e.g. NRPPa). In this case the NF Service Consumer shall subscribe by using the HTTP POST method with the URI of the "N1N2 Subscriptions Collection for Individual UE Contexts" resource (See subclause 6.1.3.6.3.1). See also Figure 5.2.2.3.3.1-1.

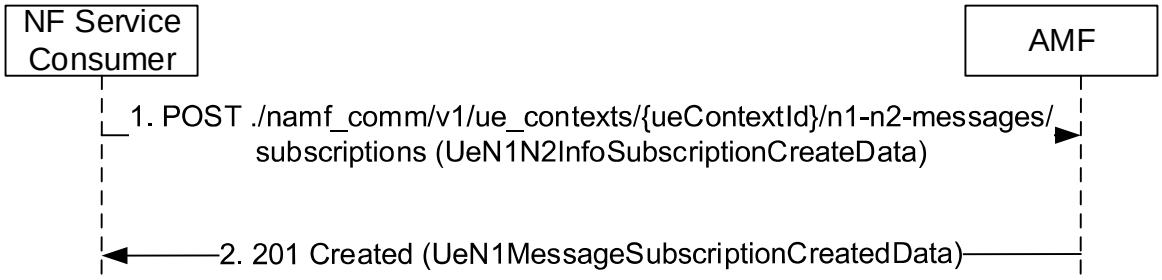

Figure 5.2.2.3.3.1-1 N1N2 Message Subscribe

1. The NF Service Consumer shall send a POST request to create a subscription resource in the AMF for a UE specific N1/N2 message notification. The payload body of the POST request shall contain:

- N1 and/or N2 Message Type, identifying the type of N1 and/or N2 message to be notified
- A callback URI for the notification

2. If the request is accepted, the AMF shall include a HTTP Location header to provide the location of a newly created resource (subscription) together with the status code 201 indicating the requested resource is created in the response message.

5.2.2.3.4 N1N2MessageUnSubscribe

5.2.2.3.4.1 General

The N1N2MessageUnSubscribe service operation is used by a NF Service Consumer (e.g. LMF) to unsubscribe to the AMF to stop notifying N1 messages of a specific type (e.g. LPP).

The NF Service Consumer shall use the HTTP method DELETE with the URI of the " N1N2 Individual Subscription" resource (See subclause 6.1.3.7.3.1), to request the deletion of the subscription for the N1 / N2 message towards the AMF. See also Figure 5.2.2.3.4.1-1.

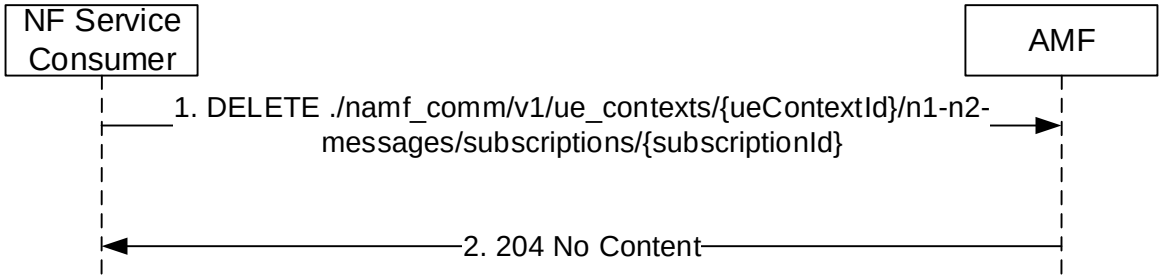

Figure 5.2.2.3.4.1-1 N1N2 Message UnSubscribe

1. The NF Service Consumer shall send a DELETE request to delete an existing subscription resource in the AMF.
2. If the request is accepted, the AMF shall reply with the status code 204 indicating the resource identified by subscription ID is successfully deleted, in the response message.

5.2.2.3.5 N1MessageNotify

5.2.2.3.5.1 General

The N1MessageNotify service operation is used by a AMF notifying the N1 message received from the UE to a destination CN NF, and it is used in the following procedures:

- Registration with AMF re-allocation (See subclause 4.2.2.2.3 in 3GPP TS 23.502 [3])
- UE assisted and UE based positioning procedure (See subclause 4.13.5.4 in 3GPP TS 23.502 [3])

The AMF shall use HTTP POST method to the N1 Notification URI provided by the NF Service Consumer via N1N2MessageSubscribe service operation (See subclause 5.2.2.3.3). See also figure 5.2.2.3.5.1-1.

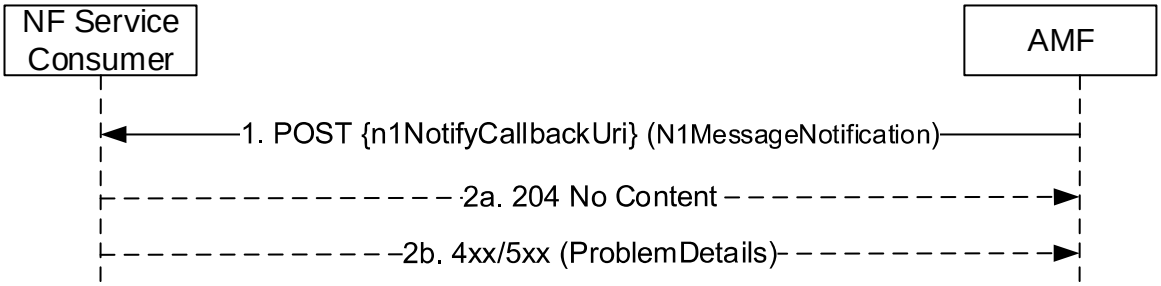

Figure 5.2.2.3.5.1-1 N1 Message Notify

1. The AMF shall send a HTTP POST request to the N1 Notification URI, and the payload body of the POST request shall contain an N1MessageNotificatoin data structure with the subscribed N1 message.

2a. On success, "204 No Content" shall be returned and the payload body of the POST response shall be empty.

2b. On failure, one of the HTTP status code listed in Table 6.1.5.6.3.1-2 shall be returned. The message body shall contain a ProblemDetails object with "cause" set to one of the corresponding application errors listed in Table 6.1.5.6.3.1-2.

5.2.2.3.5.2 Using N1MessageNotify in the Registration with AMF Re-allocation Procedure

In the Registration with AMF re-allocation procedure, the N1MessageNotify service operation is invoked by a NF Service Producer, i.e. an Initial AMF, towards a NF Service Consumer, e.g. the target AMF, which is selected to serve the UE, by the initial AMF.

The requirements specified in subclause 5.2.2.3.5.1 shall apply with the following modifications:

1. The initial AMF discovers the N1 Notification URI of the NF Service Consumer (e.g. the target AMF) from the NRF (See subclause 6.1.6.2.4 of 3GPP TS 29.510 [14]).

NOTE: The alternate AMF is expected to have registered a callback URI with the NRF.

2. Same as step 1 of Figure 5.2.2.3.5.1-1, the request payload shall include the following information in the HTTP POST Request message body:

   - RAN NGAP ID and; (the information enabling (R)AN to identify the N2 terminating point)
   - the N1 message;
   - the UE's SUPI and MM Context;
   - the Allowed NSSAI together with the corresponding NSI IDs (if network slicing is used and the initial AMF has obtained).

5.2.2.3.5.3 Using N1MessageNotify in the UE Assisted and UE Based Positioning Procedure

In the UE assisted and UE based positioning procedure, the N1MessageNotify service operation is invoked by the AMF, towards the LMF, which had subscribed for delivering the N1 UE positioning messages for the UE to be notified.

The requirements specified in subclause 5.2.2.3.5.1 shall apply with the following modifications:

1. Same as step 1 of Figure 5.2.2.3.5.1-1, the request payload shall include the following information:

   - the N1 Uplink Positioning Message;
   - LCS co-relation identifier.

Figure 5.2.2.3.5.3-1 N1 Message Notify

1.

5.2.2.3.6 N2InfoNotify

5.2.2.3.6.1 General

The N2InfoNotify service operation is used during the following procedure:

- Inter NG-RAN node N2 based handover procedure (see 3GPP TS 23.502 [3], subclause 4.9.1.3.3)
- Network assisted positioning procedure (See subclause 4.13.5.5 in 3GPP TS 23.502 [3])

The N2InfoNotify service operation is invoked by AMF, to notify a NF Service Consumer that subscribed N2 information has been received from access network.

The AMF shall use HTTP POST method to the N2Info Notification URI provided by the NF Service Consumer via N1N2MessageSubscribe service operation (See subclause 5.2.2.3.3). See also figure 5.2.2.3.6.1-1.

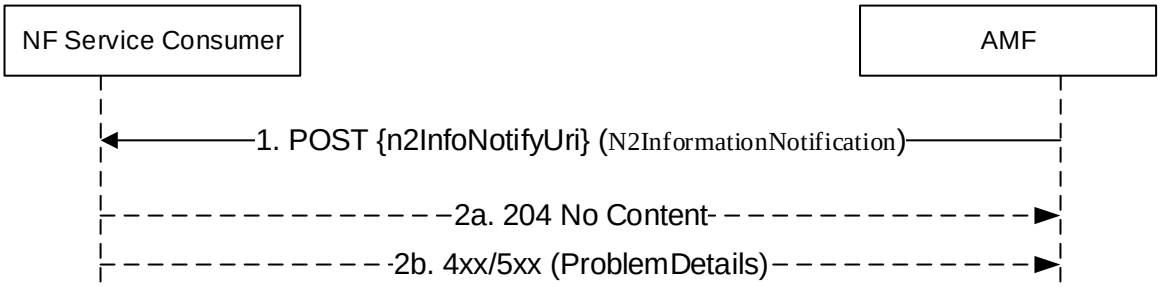

Figure 5.2.2.3.6.1-1 N2 Information Notify

1. The AMF shall send a HTTP POST request to the n2InfoNotifyUrl, and the payload body of the POST request shall contain a N2InformationNotification data structure, containing the N2 information that was subscribed by the NF Service Consumer.

2a. On success, "204 No Content" shall be returned and the payload body of the POST response shall be empty.

2b. On failure, one of the HTTP status code listed in Table 6.1.5.6.3.1-2 shall be returned. The message body shall contain a ProblemDetails object with "cause" set to one of the corresponding application errors listed in Table 6.1.5.6.3.1-2.

5.2.2.3.6.2 Using N2InfoNotify during Inter NG-RAN node N2 based handover procedure

The N2InfoNotify service operation is invoked by a NF Service Producer, e.g. the target AMF, towards the NF Service Consumer, i.e. the source AMF, to notify that the handover procedure has been successful in the target side, for a given UE.

The requirements specified in subclause 5.2.2.3.6.1 shall apply with the following modifications:

1. During inter AMF handover procedure, the source AMF, which is served as a NF Service Consumer, when consuming the CreateUEContext service operation (See subclause 5.2.2.2.3), shall include a N2Info Notification URI to the target AMF in the HTTP request message.

2. Same as step 1 of Figure 5.2.2.3.6.1-1, the request payload shall contain shall contain the notification payload (see subclause 6.1.5.5), with the information that the handover is complete. The n2NotifySubscriptionId included in the notification payload shall be the UE context Id.

NOTE: This notification is due to an implicit subscription and hence no explicit subscription Id is created. UE context Id is included as the notification subscription Id for the NF Service Consumer (e.g. Source AMF) to co-relate the notification to an earlier initiated UE context transfer during a handover procedure.

5.2.2.3.6.3 Using N2InfoNotify during Location Services procedures

The N2InfoNotify service operation is invoked by a NF Service Producer, i.e. the AMF, towards the NF Service Consumer, e.g. the LMF, to notify the positioning parameters received from the 5G-AN in the NRPPa message.

The requirements specified in subclause 5.2.2.3.6.1 shall apply with the following modifications:

1. Same as step 1 of Figure 5.2.2.3.6.1-1, the request payload shall contain N2 information of type NRPPa.

5.2.2.4 Non-UE N2 Message Operations

5.2.2.4.1 NonUeN2MessageTransfer

5.2.2.4.1.1 General

The NonUeN2MessageTransfer service operation is used by a NF Service Consumer to transfer N2 information to the 5G-AN through the AMF in the following procedures:

- Obtaining non-UE associated network assistance data (See subclause 4.13.5.6 in 3GPP TS 23.502 [3])

- Warning Request Transfer procedures (See subclause 9A in 3GPP TS 23.041 [20])

The NF Service Consumer shall invoke the service operation by sending POST to the URI of the "transfer" customer operation on the "Non UE N2Messages Collection" resource (See subclause 6.1.3.8.4.2) on the AMF. See also figure 5.2.2.4.1.1-1.

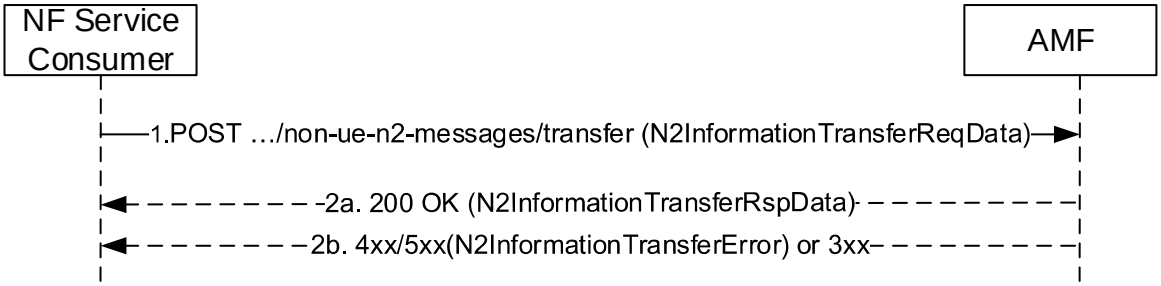

Figure 5.2.2.4.1.1-1 Non-UE N2 Message Transfer

1. The NF Service Consumer shall invoke the custom operation for non UE associated N2 message transfer by sending a HTTP POST request, and the request body shall carry the N2 information to be transferred.

2a. On success, AMF shall respond a "200 OK" status code with N2InformationTransferRspData data structure.

2b. On failure, one of the HTTP status code listed in Table 6.1.3.58.4.2.2-2shall be returned with the message body containing a N2InformationTransferError structure, including a ProblemDetails attribute with the "cause" attribute set to one of the application errors listed in Table 6.1.3.58.4.2.2-2.

5.2.2.4.1.2 Obtaining Non UE Associated Network Assistance Data Procedure

The NonUeN2MessageTransfer service operation shall be invoked by a NF Service Consumer, e.g. LMF to transfer non UE associated N2 information of N2 information class LMF to NG-RAN for obtaining the network assistance data.

The requirements specified in subclause 5.2.2.4.1.1 shall apply with the following modifications:

1. Same as step 1 of Figure 5.2.2.4.1.1-1, the POST request body shall carry the N2 information to be transferred together with the NG RAN node identifier(s) to which the transfer needs to be initiated. The POST request body shall also contain a callback URI of the NF Service Consumer, which is used by the AMF to later notify the NF Service Consumer when a non UE N2 message of class (e.g. NRPPa) that is requested to be transferred is received.

5.2.2.4.1.3 Warning Request Transfer Procedure

The NonUeN2MessageTransfer service operation shall be invoked by the NF Service Consumer, e.g. CBCF/PWS-IWF, to send non-UE specific messages of N2 information class PWS to the NG-RAN.

The requirements specified in subclause 5.2.2.4.1.1 shall apply with the following modifications:

1. Same as step 1 of Figure 5.2.2.4.1.1-1, the request body shall include the N2 Message Container and optionally the *List of TAIs* IE, the *OMC ID* IE, the *Send-Write-Replace-Warning Indication* IE or the *Send-Stop-Warning Indication* IE.

   The AMF shall forward the N2 Message Container to the RAN Nodes that serve Tracking Areas as listed in the *List of TAIs* IE. If the *List of TAIs* IE is not present, the AMF shall forward the N2 Message Container to all attached RAN Nodes.

2a. Same as step 2a of Figure 5.2.2.4.1.1-1, and the POST response body shall contain the mandatory elements from the Write-Replace-Warning Confirm response (see subclause 9.2.17 in TS 23.041 [20]) or the mandatory elements and optionally the *Unknown Tracking Area List* IE from the Stop-Warning Confirm response (see subclause 9.2.19 in TS 23.041 [20]).

2b. Same as step 2b of Figure 5.2.2.4.1.1-1, and the POST response body shall contain following additional information:

   - PWS specific information, if any, e.g. PWS Cause information

5.2.2.4.2 NonUeN2InfoSubscribe

5.2.2.4.2.1 General

The NonUeN2InfoSubscribe service operation is used by a NF Service Consumer (e.g. LMF, CBCF or PWS-IWF) to subscribe to the AMF for notifying non UE specific N2 information of a specific type (e.g. NRPPa or PWS Indications).

An NF Service Consumer (e.g. LMF, CBCF or PWS-IWF) may subscribe to notifications of specific N2 information type (e,g NRPPa or PWS Indications) that are not associated with any UE. In this case, the NF Service Consumer shall subscribe by using the HTTP POST method with the URI of the "Non UE N2Messages Subscriptions Collection" resource (See subclause 6.1.3.9.3.1). See also Figure 5.2.2.4.2.1-1.

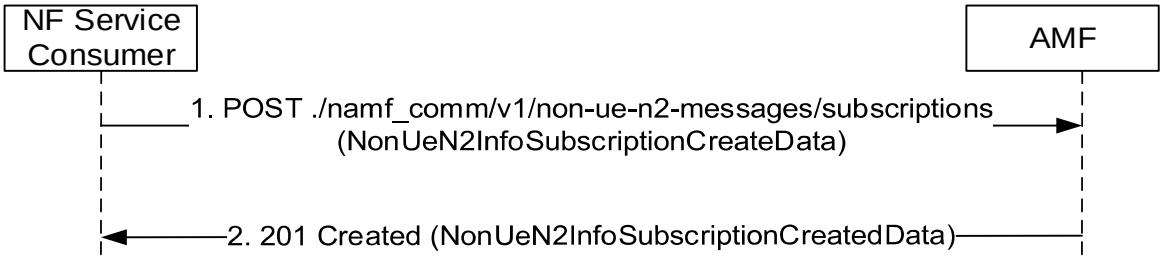

Figure 5.2.2.4.2.1-1 N2 Information Subscription for Non UE Information

1. The NF Service Consumer shall send a POST request to create a subscription resource in the AMF for a non UE specific N2 information notification. The payload body of the POST request shall contain:

   - N2 Information Type, identifying the type of N2 information to be notified
   - A callback URI for the notification

2. If the request is accepted, the AMF shall include a HTTP Location header to provide the location of a newly created resource (subscription) together with the status code 201 indicating the requested resource is created in the response message.

5.2.2.4.3 NonUeN2InfoUnSubscribe

5.2.2.4.3.1 General

The NonUeN2InfoUnSubscribe service operation is used by a NF Service Consumer (e.g. LMF) to unsubscribe to the AMF to stop notifying N2 information of a specific type (e.g. NRPPa).

The NF Service Consumer shall use the HTTP method DELETE with the URI of the "Non UE N2 Message Notification Individual Subscription" resource (See subclause 6.1.3.10.3.1), to request the deletion of the subscription for non UE specific N2 information notification, towards the AMF. See also Figure 5.2.2.4.3.1-1.

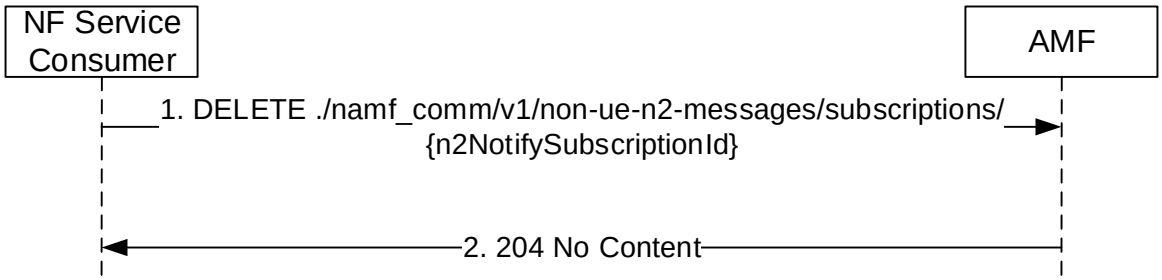

Figure 5.2.2.4.3.1-1 NonUeN2InfoUnSubscribe for Non UE Specific Information

1. The NF Service Consumer shall send a DELETE request to delete an existing subscription resource in the AMF.

2. If the request is accepted, the AMF shall reply with the status code 204 indicating the resource identified by subscription ID is successfully deleted, in the response message.

5.2.2.4.4 NonUeN2InfoNotify

5.2.2.4.4.1 General

The NonUeN2InfoNotify service operation is used during the following procedures:

- Obtaining non-UE associated network assistance data (See subclause 4.13.5.6 in 3GPP TS 23.502 [3])
- Receiving PWS related events from the NG-RAN

The NonUeN2InfoNotify service operation is invoked by the AMF to notify a NF Service Consumer that subscribed Non-UE N2 information has been received from the 5G-AN.

The AMF shall use HTTP POST method to the N2Info Notification URI provided by the NF Service Consumer via NonUeN2InfoSubscribe service operation (See subclause 5.2.2.4.2). See also Figure 5.2.2.4.4.1-1.

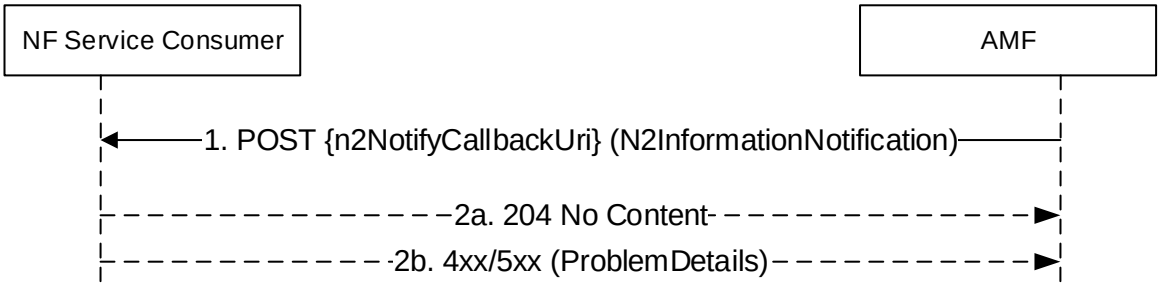

Figure 5.2.2.4.4.1-1 Non-UE N2 Information Notify

1. The AMF shall send a HTTP POST request to the N2Info Notification URI, and the payload body of the POST request shall contain a N2INformationNotification data structure, with the N2 information that was subscribed by the NF Service Consumer.

2a. On success, "204 No Content" shall be returned and the payload body of the POST response shall be empty.

2b. On failure, one of the HTTP status code listed in Table 6.1.5.3.3.1-2 shall be returned. The message body shall contain a ProblemDetails object with "cause" set to one of the corresponding application errors listed in Table 6.1.5.3.3.1-2.

5.2.2.4.4.2 Using NonUeN2InfoNotify during Location Services procedures

The NonUeN2InfoNotify service operation is invoked by a NF Service Producer, i.e. the AMF, towards the NF Service Consumer, e.g. the LMF, to notify the assistance data received from the 5G-AN.

The requirements specified in subclause 5.2.2.4.4.1 shall apply with the following modifications:

1. Same as step 1 of Figure 5.2.2.4.4.1-1, the payload shall contain network assistance data.

5.2.2.4.4.3 Use of NonUeN2InfoNotify for PWS related events

The NonUeN2InfoNotify service operation shall be used during the following PWS related events:

1) The AMF has received a Write-Replace-Warning-Confirm response or a PWS-Cancel-Confirm response from the NG-RAN over N2.

   Upon receiving the N2 Message Content the RAN Nodes return a response which may include the *Broadcast Completed Area List* IE or the *Broadcast Cancelled Area List* IE, depending on the *Message Type* IE. The AMF may aggregate the lists it receives from the RAN Nodes for the same request.

   If the *Send-Write-Replace-Warning Indication* IE was present in the Write-Replace-Warning Request message, then the AMF may forward the *Broadcast Completed Area List* IE(s) to the NF Service Consumer.

   If the *Send-Stop-Warning Indication* IE was present in the Stop-Warning-Request message, then the AMF may forward the *Broadcast Cancelled Area List* IE(s) to the NF Service Consumer. If the NG-RAN node has responded without including the *Broadcast Cancelled Area List* IE then the AMF shall populate the *Broadcast Empty Area List* IE with the NG-RAN node ID and send the (aggregated) Broadcast Empty Area List to the NF Service Consumer.

2) The AMF has received a Restart Indication or a Failure Indication from a NG-RAN Node. The AMF shall forward the Restart Indication or Failure Indication to the NF Service Consumer.

The requirements specified in subclause 5.2.2.4.4.1 shall apply with the following modifications:

1. Same as step 1 of Figure 5.2.2.4.4.1-1, the request body shall include the PWS related N2 information.

5.2.2.5 AMF Status Change Operations

5.2.2.5.1 AMFStatusChangeSubscribe

5.2.2.5.1.1 General

This service operation is used by a NF Service Consumer to subscribe the status change of the AMF.

The AMFStatusChangeSubscribe service operation is used during the following procedure:

- AMF planned removal procedure (see 3GPP TS 23.501 [2], subclause 5.21.2.2)

5.2.2.5.1.2 Creation of a subscription

This service operation creates a subscription so a NF Service Consumer can request to be notified when the status of the AMF is changed.

It is executed by creating a new individual resource under the collection resource "subscriptions". The operation shall be invoked by issuing a POST request on the URI of the "subscriptions collection" resource (See subclause 6.1.3.6.3.1).

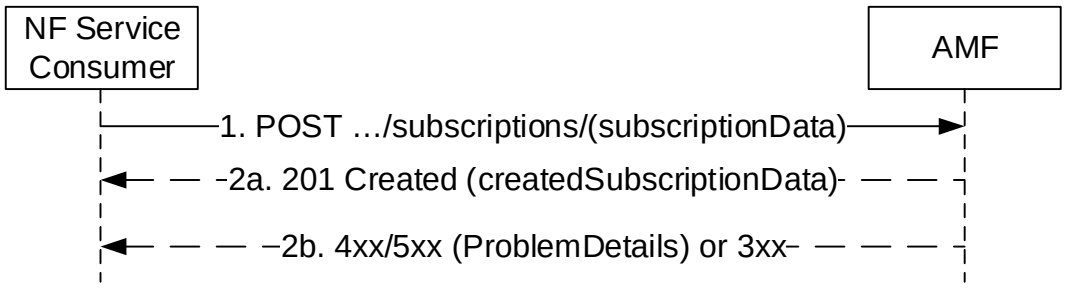

Figure 5.2.2.5.1.1-1 NF Service Consumer Subscription to Notifications

1. The NF Service Consumer shall send a POST request to the resource URI representing the "subscriptions" collection resource. The request body shall include the data indicating the GUAMI(s) supported by the AMF that the NF Service Consumer is interested in receiving the related status change notification. The request body also contains a callback URI, where the NF Service Consumer shall be prepared to receive the actual notification from the AMF (see AMFStatusChangeNotify operation in subclause 5.2.2.5.3).

2a. On success, the AMF shall include a HTTP Location header to provide the location of a newly created resource (subscription) together with the status code 201 indicating the requested resource is created in the response message.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.6.3.1-3 shall be returned. For a 4xx/5xx response, the message body containing a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.3.6.3.1-3.

5.2.2.5.1.3 Modification of a subscription

This service operation updates the subscription data of an NF Service Consumer previously subscribed in the AMF by providing the updated subscription data to the AMF. The update operation shall apply to the whole subscription data (complete replacement of the existing subscription data by a new subscription data).

The NF Service Consumer shall issue an HTTP PUT request, towards the URI of the "individual subscription" resource (See subclause 6.1.3.7.3.2), as shown in Figure 5.2.2.5.1.3-1:

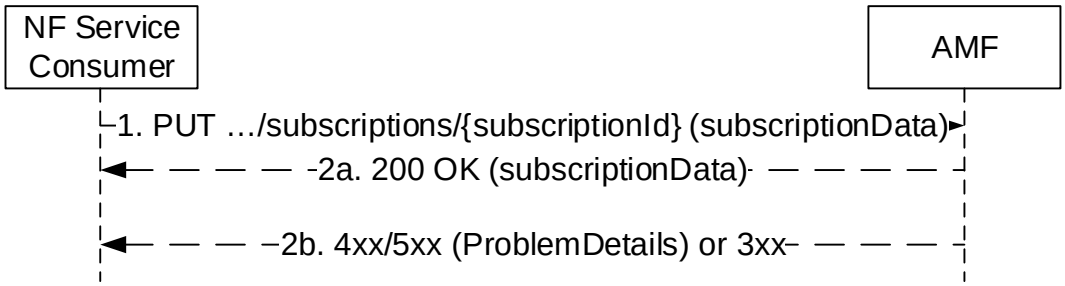

Figure 5.2.2.5.1.3-1 Subscription Data Complete Replacement

1. The NF Service Consumer shall send a PUT request to the resource URI representing the individual subscription. The request body shall include a representation of subscription data to replace the previous subscription data in the AMF.

2a. On success, "200 OK" shall be returned, the payload body of the PUT response shall contain the representation of the replaced resource.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.7.3.2-3 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.3.7.3.2-3.

5.2.2.5.2 AMFStatusChangeUnSubscribe

5.2.2.5.2.1 General

This service operation removes an existing subscription to notifications.

The AMFStatusChangeUnSubscribe service operation is used during the following procedure:

- AMF planned removal procedure (see 3GPP TS 23.501 [2], subclause 5.21.2.2)

It is executed by deleting a given resource identified by a "subscriptionId". The operation is invoked by issuing a DELETE request on the URI of the specific " individual subscription" resource (See subclause 6.1.3.7.3.1).

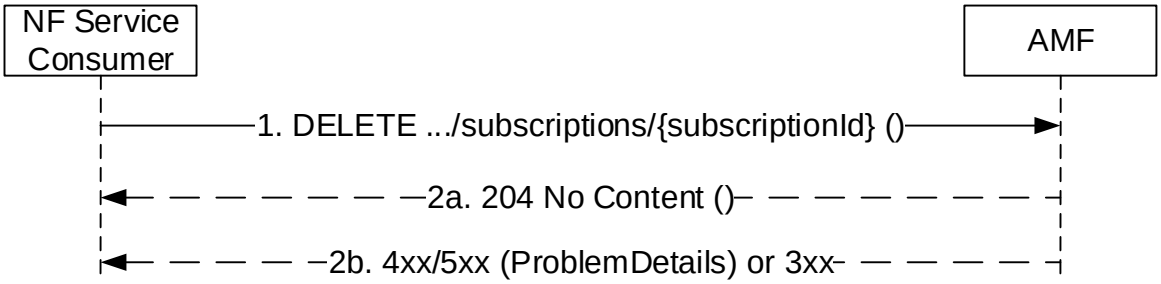

Figure 5.2.2.5.2.1-1: NF Service Consumer Unsubscription to Notifications

1. The NF Service Consumer shall send a DELETE request to the resource URI representing the individual subscription. The request body shall be empty.

2a. On success, "204 No Content" shall be returned. The response body shall be empty.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.7.3.1-3 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.3.7.3.1-3.

5.2.2.5.3 AMFStatusChangeNotify

5.2.2.5.3.1 General

This service operation notifies each NF Service Consumer that was previously subscribed to receiving notifications of the status change of the AMF (e.g. AMF unavailable). The notification is sent to a callback URI that each NF Service Consumer provided during the subscription (see AMFStatusChangeSubscribe operation in 5.2.2.5.1).

The AMFStatusChangeNotify service operation is used during the following procedure:

- AMF planned removal procedure (see 3GPP TS 23.501 [2], subclause 5.21.2.2)

The operation is invoked by issuing a POST request to each callback URI of the different NF Service Consumer.

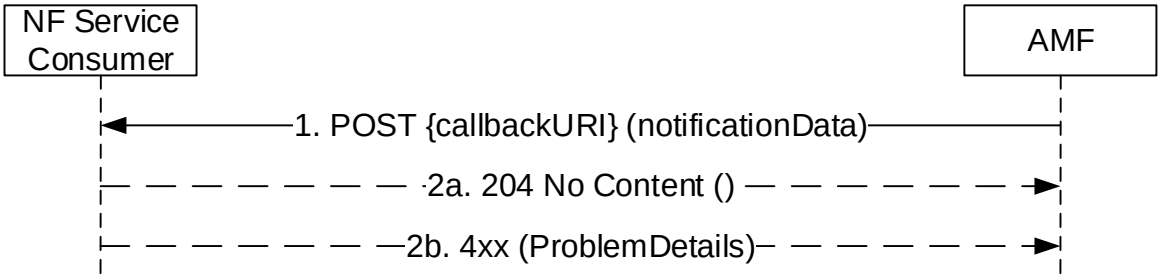

Figure 5.2.2.5.3.1-1: AMF Notifications

1. The AMF shall send a POST request to the callback URI. The request body shall include the GUAMI(s) and the related status change, GUAMI(s) is indicated by the NF Service Consumer during the subscription operation. For network deployment without UDSF case, the target AMF Name which is to serve the user of the indicated GUAMI(s) is also included.

2a. On success, "204 No content" shall be returned by the NF Service Consumer.

2b. On failure, one of the HTTP status code listed in Table 6.1.5.2.3.1-2-3shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.5.2.3.1-2.

5.2.2.6 EBIAssignment

5.2.2.6.1 General

The EBIAssignment service operation is used during the following procedures (see 3GPP TS 23.502 [3], subclause 4.11.1.4):

- UE requested PDU Session Establishment (Non-roaming and Roaming with Local Breakout (see 3GPP TS 23.502 [3], subclause 4.3.2.2.1).

- UE requested PDU Session Establishment (Home-routed Roaming (see 3GPP TS 23.502 [3], subclause 4.3.2.2.2).

- UE or network requested PDU Session Modification (non-roaming and roaming with local breakout) (see 3GPP TS 23.502 [3], subclause 4.3.3.2).

- UE or network requested PDU Session Modification (home-routed roaming) (see 3GPP TS 23.502 [3], subclause 4.3.3.3).

- Network requested PDU Session Modification, when the SMF needs to release the assigned EBI from a QoS flow (see 3GPP TS 23.502 [3], subclause 4.11.1.4.3).

The EBIAssignment service operation is invoked by a NF Service Consumer, e.g. a SMF, towards the NF Service Producer, i.e. the AMF, to request the AMF to allocate EPS bearer ID(s) towards EPS bearer(s) mapped from QoS flow(s) for an existing PDU Session for a given UE.

The NF Service Consumer (e.g. the SMF) shall perform EBIAssignment service operation by invoking "assignEbi" custom operation on the "individual ueContext" resource (See subclause 6.1.3.2.4.3). See also Figure 5.2.2.6.1-1.

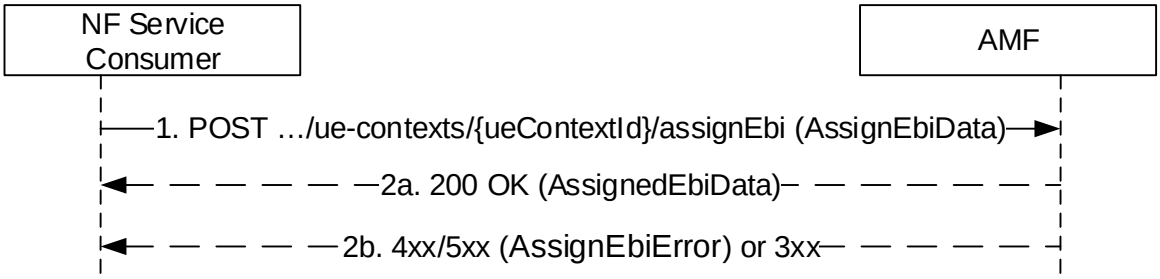

Figure 5.2.2.6.1-1 EBI Assignment

1. The NF Service Consumer, e.g. the SMF, shall invoke "assignEbi" custom method on individual ueContext resource, which is identified by the UE's SUPI or PEI in the AMF. The NF Service consumer shall provide PDU Session ID, ARP list and S-NSSAI as input for the service operation.

2a. On success, the AMF shall assign EBI for each ARP in received ARP list, if enough EBI(s) are available. If there is not enough EBI(s) available, the AMF may revoke already assigned EBI(s) based on the ARP(s) and S-NSSAI received, EBIs information in the UE context and local policies. The AMF may only assign a subset of the requested EPS Bearer ID(s), e.g. when other PDU Sessions with higher ARP have occupied other available EPS Bearer IDs. If AMF has successfully assigned all or part of the requested EBI(s), the AMF shall respond with the status code 200 OK, together with the assigned EBI to ARP mapping(s) and list of ARPs for which the AMF failed to allocate an EBI (if any).

   If the request contains "releasedEbiList", the AMF shall release the requested EBI(s). The AMF shall respond with the status code 200 OK and shall include the EBI(s) released in the "releasedEbiList" IE of the POST response body.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.2.4.3.2-2 shall be returned. For a 4xx/5xx response, the message body shall contain a N1N2MessageTransferError structure, including:

   - a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.3.2.4.3.2-2;

   - a failureDetails which describes the detailed cause phrase why the request has failed.

5.3 Namf_EventExposure Service

5.3.1 Service Description

The AMF may offer this service as a Service Producer to enable an NF to subscribe and get notified about an event. The known Service Consumers are NEF, SMF, PCF, UDM. See also subclauses 4.1.5.3.2, 4.15.4.2 and 5.2.2.3.1 of 3GPP TS 23.502 [3] and subclause 6.1.3.4 of 3GPP TS 23.503 [7].

The following events are provided by Namf_EventExposure Service:

Event: Location-Report

A NF subscribes to this event to receive the Last Known Location of a UE or a group of UEs, and Updated Location of the UE or any UE in the group when AMF becomes aware of a location change of the UE.

UE Type: One UE, Group of UEs

Report Type: One-Time Report (See NOTE 1), Continuous Report (See NOTE 2)

Input: UE-ID(s), Optionally Filters: TAI, Cell-ID, N3IWF, UE-IP, UDP-PORT

Notification; UE-ID, filtered updated location (TAI, Cell-ID for 3GPP access, most recent N3IWF node, UE local IP address and UDP source port number for non-3GPP access).

NOTE 1: For One-time report, only Last Known Location is supported.

NOTE 2: Support of Continuous Report should be controlled by operator policy.

Event: Presence-In-AOI-Report

A NF subscribe to this event to receive the current present state of a UE in a specific Area of Interest (AOI), and notification when a specified UE enters or leaves the specified area. The area could be identified by a TA list, an area ID or specific interested area name like "LADN".

UE Type: One UE, Group of UEs

Report Type: One-Time Report, Continuously Report

Input: UE ID(s), Area identifier (a TA list, an area Id or "LADN").

Notification: UE-ID, Area identifier, Presence Status (IN/OUT/UNKNOWN)

Event: Time-Zone-Report

A NF subscribes to this event to receive the current time zone of a UE or a group of UEs, and updated time zone of the UE or any UE in the group when AMF becomes aware of a time zone change of the UE.

UE Type: One UE, Group of UEs

Report Type: One-Time Report, Continuous Report

Input: UE ID(s)

Notification; UE-ID, most recent time-zone

Event: Access-Type-Report

A NF subscribes to this event to receive the current access type(s) of a UE or a group of UEs, and updated access type(s) of the UE or any UE in the group when AMF becomes aware of the access type change of the UE.

UE Type: One UE, Group of UEs

Report Type: One-Time Report, Continuous Report

Input: UE ID(s)

Notification; UE ID, most recent access-types (3GPP, Non-3GPP)

Event: Registration-State-Report

A NF subscribes to this event to receive the current registration state of a UE or a group of UEs, and report for updated registration state of a UE or any UE in the group when AMF becomes aware of a registration state change of the UE.

UE Type: One UE, Group of UEs

Report Type: One-Time Report, Continuous Report

Input: UE ID(s)

Notification; UE ID, most recent registration state (REGISTERED/DEREGISTERED) with access type

Event: Connectivity-State-Report

A NF subscribes to this event to receive the current connectivity state of a UE or a group of UEs, and report for updated connectivity state of a UE or any UE in the group when AMF becomes aware of a connectivity state change of the UE.

UE Type: One UE, Group of UEs

Report Type: One-Time Report, Continuous Report

Input: UE ID(s)

Notification; UE ID, most recent connectivity state (IDLE/CONNECTED) with access type

Event: Reachability-Report

A NF subscribes to this event to receive the current reachability of a UE or a group of UEs, and report for updated reachability of a UE or any UE in the group when AMF becomes aware of a reachability change of the UE.

UE Type: One UE, Group of UEs

Report Type: One-Time Report, Continuous Report

Input: UE ID(s)

Notification; UE ID, AMF Id, most recent reachability state (REACHABLE/UNRACHABLE/REGULATORY-ONLY); Optionally, list of sessions to be activated.

Event: Subscribed-Data-Report

A NF subscribes to this event to receive the current Subscribed Data for the UE(s) received from UDM, and notification when AMF received updated subscribed data for the UE(s) from UDM.

UE Type: One UE, Group of UEs

Report Type: One-Time Report, Continuous Report

Input: UE ID(s), filters (SARI/RFSPI)

Notification; UE ID, most recent subscribed data according to the filter, Service Area Restriction Information/RFSP-Index.

Event: Communication-Failure-Report

A NF subscribes to this event to receive the Communication failure report of a UE or group of UEs or any UE.

UE Type: One UE, Group of UEs, any UE

Report Type: One-Time Report, Continuous Report

Input: UE ID(s), "ANY_UE"

Notification; UE ID, RAN/NAS release code.

Event: UEs-In-Area-Report

A NF subscribes to this event to receive the number of UEs in a specific area. A NF may ask AMF for the UEs within the area based on Last Known Location or it may request AMF to actively look for the UEs within the area based on Current Location.

UE Type: any UE

Report Type: One-Time Report (See NOTE 3), Continuous Report (See NOTE 4)

Input: Area identified in a TA List

Notification: Number of UEs in the area

NOTE 3: For One-time Report, UE Last Known Location is used to count the UEs within the area

NOTE 4: Support of Continuous Report should be controlled by operator.

5.3.2 Service Operations

5.3.2.1 Introduction

For the Namf_EventExposure service the following service operations are defined:

- Subscribe;
- Unsubscribe;

- Notify.

5.3.2.2 Subscribe

5.3.2.2.1 General

The Service Operation is used by a NF Service Consumer (e.g. NEF) to subscribe to an event(s) for one UE, group of UE(s) or any UE.

5.3.2.2.2 Creation of a subscription

The Subscribe service operation is invoked by a NF Service Consumer, e.g. NEF, towards the AMF, when it needs to create a subscription to monitor at least one event relevant to the AMF. The NF Service Consumer may subscribe to multiple events in a subscription. A subscription may be associated with one UE, a group of UEs or any UE.

The NF Service Consumer shall request to create a new subscription by using HTTP method POST with URI of the subscriptions collection, see subclause 6.2.3.2.

The NF Service Consumer shall include the following information in the HTTP message body:

- NF ID, indicates the identity of the network function instance initiating the subscription;
- Subscription Target, indicates the target(s) to be monitored, as one of the following types:
  - A specific UE, identified with a SUPI, a PEI or a GPSI;
  - A group of UEs, identified with a group identity;
  - Any UE, identified by the "anyUE" flag.
- Notification URI, indicates the address to deliver the event notifications generated by the subscription;
- Notification Correlation ID, indicates the correlation identity to be carried in the event notifications generated by the subscription;
- Event Types(s), indicate the event(s) to be subscribed, from supported events specified in subclause 5.3.1;
- Event Trigger per Event Type, indicates how the event to be reported (One-time Reporting or Continuously Reporting).

The NF Service Consumer may include the following information in the HTTP message body:

- Immediate Report Flag per Event Type, indicates an immediate report to be generated with current event status;
- Maximum Number of Reports per Event Type, defines the maximum number of reports after which the event subscription ceases to exist;
- Maximum Duration of Reporting per Event Type, defines maximum duration after which the event subscription ceases to exist;
- Event Filter per applicable Event Type, defines further options on how the event be reported.

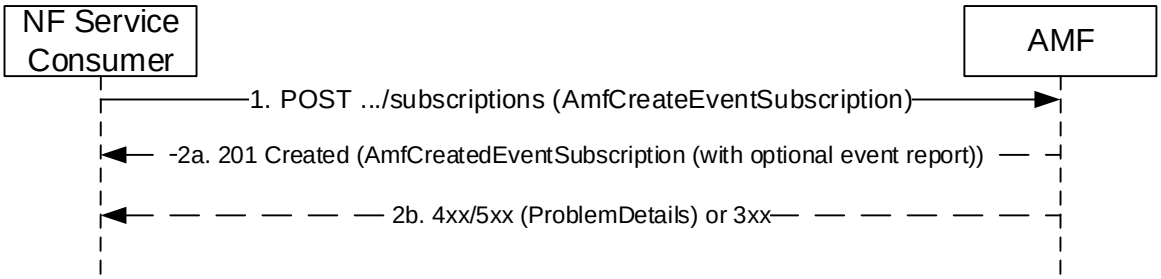

Figure 5.3.2.2.2-1 Subscribe for Creation

1. The NF Service Consumer shall send a POST request to create a subscription resource in the AMF. The payload body of the POST request shall contain a representation of the individual subscription resource to be created.

2a. On success, the request is accepted, the AMF shall include a HTTP Location header to provide the location of a newly created resource (subscription) together with the status code 201 indicating the requested resource is created in the response message. If the NF Service Consumer has included the immediateFlag with value as "true" in the event subscription, the AMF shall include the current status of the events subscribed, if available (e.g. current location information is included if the subscribed event is LOCATION_REPORT). If the NF Service Consumer has set the event reporting option as ONE_TIME and if the AMF has included the current status of the events subscribed in the response, then the AMF shall not do any subsequent event notification for the events given in the AmfCreateEventSubscription parameter.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.2.3.2.3.1-3 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.2.3.2.3.1-3.

5.3.2.2.3 Modification of a subscription

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

The NF Service Consumer shall modify the subscription by using HTTP method PATCH with the URI of the individual subscription resource (see subclause 6.2.3.3) to be modified.

See also Figure 5.3.2.2.3-1 below.

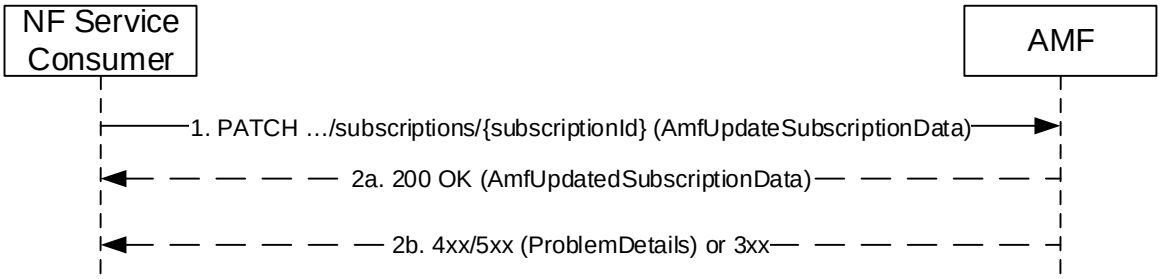

Figure 5.3.2.2.3-1 Modification of a Subscription

1. The NF Service Consumer shall send a PATCH request to modify a subscription resource in the AMF.

2a. On success, the request is accepted, the AMF shall the representation of the modified subscription resource or its sub- resource together with the status code 200.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.2.3.3.3.1-3 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.2.3.3.3.1-3.

5.3.2.3 Unsubscribe

5.3.2.3.1 General

The Unsubscribe service operation is invoked by a NF Service Consumer, e.g. NEF, towards the AMF, to remove an existing subscription previously created by itself at the AMF.

The NF Service Consumer shall unsubscribe to the subscription by using HTTP method PATCH with the URI of the individual subscription resource (see subclause 6.2.3.3) to be deleted.

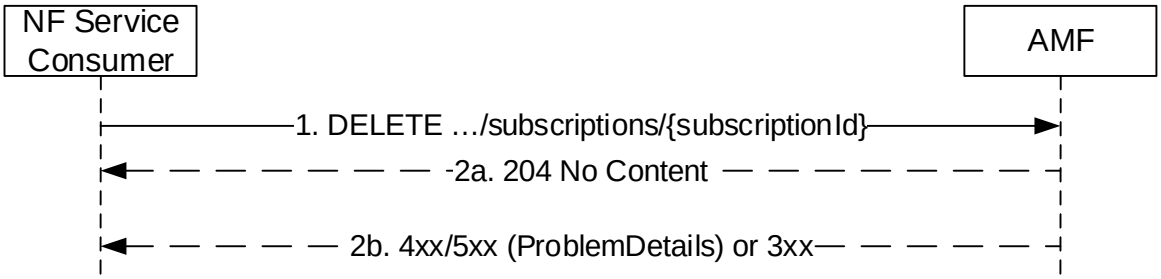

Figure 5.3.2.3.1-1 Unsubscribe a subscription

1. The NF Service Consumer shall send a DELETE request to delete an existing subscription resource in the AMF.

2a. On success, the request is accepted, the AMF shall reply with the status code 204 indicating the resource identified by subscription ID is successfully deleted in the response message.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.2.3.3.3.1-3 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.2.3.3.3.1-3.

5.3.2.4 Notify

5.3.2.4.1 General

The Notify service operation is invoked by the AMF, to send a notification, towards the notification URI, when certain event included in the subscription has taken place.

The AMF shall use the HTTP method POST, using the notification URI received in the subscription creation as specified in subclause 5.3.2.2.2, including e.g. the subscription ID, Event ID(s) for which event has happened, notification co-relation ID provided by the NF service consumer at the time of event subscription, to send a notification. See Figure 5.3.2.4.1-1.

Additionally, the Notify service operation shall also be invoked by the AMF, when there is a change of AMF during UE mobility procedures and if the subscription Id changes (i.e. Registration procedures and Handover procedures).

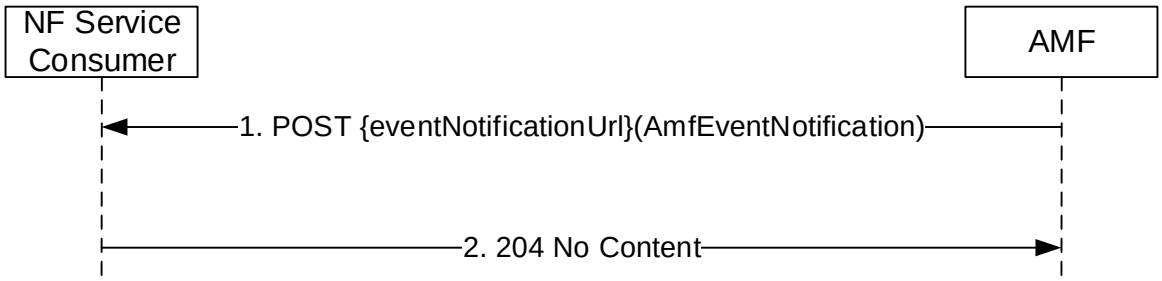

Figure 5.3.2.4.1-1 Notify

1. The AMF shall send a POST request to send a notification.

2. If the notification is received, the NF Service Consumer shall reply with the status code 204 indicating the notification is received, in the response message.

5.4 Namf_MT Service

5.4.1 Service Description

Namf_MT service allows a NF to request information related to capabilities to send MT signalling or data to a target UE. The following are the key functionalities of this NF service

- paging UE if UE is in IDLE state and respond other NF after the UE enters CM-CONNECTED state.

- response to the requester NF if UE is in CONNECTED state.
- providing the terminating domain selection information for IMS voice to the consumer NF.

5.4.2 Service Operations

5.4.2.1 Introduction

For the Namf_MT Service the following service operations are defined:

- EnableUEReachability
- ProvideDomainSelectionInfo

5.4.2.2 EnableUEReachability

5.4.2.2.1 General

The EnableUEReachability service operation is used in the following procedure:

- MT SMS over NAS in CM-IDLE state (see 3GPP TS 23.502 [3], subclause 4.13.3.6)

The EnableUEReachability service operation shall be invoked by the NF Service Consumer (e.g. SMSF) to enable the reachability of the UE.

The NF Service Consumer shall invoke the service by using the HTTP method PUT, towards the URI of a "ueReachInd" resource as specified in subclause 6.3.3.2. See also figure 5.4.2.2.1-1.

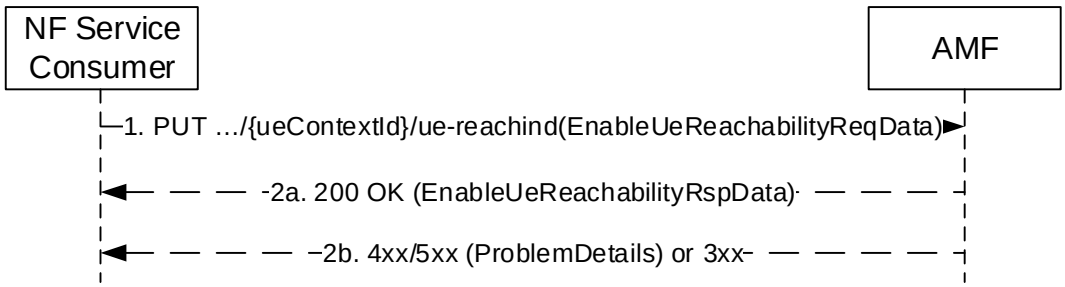

Figure 5.4.2.2.2-1: NF Service Consumer enables the reachability of the UE

1. The NF Service Consumer sends a PUT request to the resource representing the ueReachInd resource of the AMF. The payload body of the PUT request shall contain an "EnableUeReachabilityReqData" object.

2a. On success:

- if the UE is in CM-CONNECTED state, the AMF shall immediately respond using "200 OK" status code, with payload containing an "EnableUeReachabilityRspData" object.
- if the UE is in CM-IDLE state and the NAS message is to be sent over via 3GPP access, the AMF shall page the UE. When UE becomes CM-CONNECTED, "200 OK" shall be returned with payload containing an "EnableUeReachabilityRspData" object.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.3.3.2.3.1-3 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.3.3.2.3.1-3.

5.4.2.3 ProvideDomainSelectionInfo

5.4.2.3.1 General

The ProvideDomainSelectionInfo service operation shall be invoked by the NF Service Consumer (e.g. UDM) to get the UE information for terminating domain selection of IMS voice, including following information:

- Indication of supporting IMS voice over PS Session;

- Time stamp of the last radio contact with the UE;
- Current RAT type

The NF Service Consumer shall invoke the service by using the HTTP GET towards the URI of the "UeContext" resource (See subclause 6.3.3.x.3.1). See also figure 5.4.2.x.1-1.

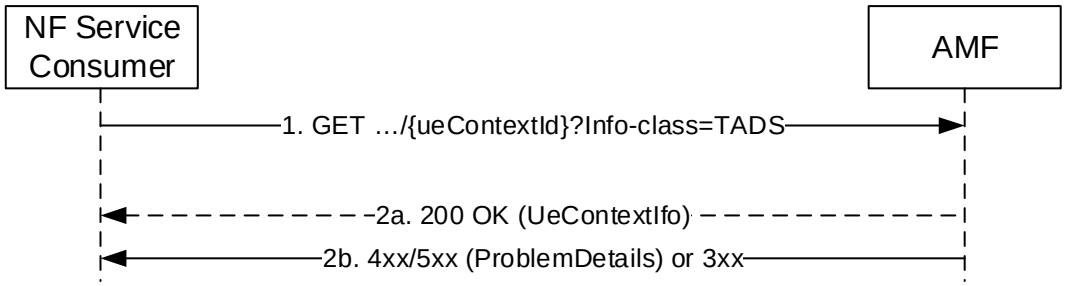

Figure 5.4.2.3.1-1: Provide UE Information for Terminating Domain Selection

1. The NF Service Consumer shall send a GET request to the URI of the "UeContext" resource on the AMF, with query parameter "info-class" set to value "TADS".

2a. On success, the AMF shall return "200 OK" status code with payload containing an "UeContextInfo" data structure including UE information for terminating domain selection for IMS voice.

2b. On failure, one of the HTTP status code listed in Table 6.1.3.3.3.1-3 shall be returned. The message body shall contain a ProblemDetails object with "detail" set to one of the corresponding application errors listed in Table 6.1.3.3.3.1-3.

5.5 Namf_Location Service

5.5.1 Service Description

The Namf_Location service is used by NF service consumers to request the AMF for initiating positioning requests and provide the location information. It is also used to subsequently notify the location change events towards the NF service consumers.

5.5.2 Service Operations

For the Namf_Location Service the following service operations are defined:

- ProvideLocation
- EventNotify

5.5.2.1 Introduction

5.5.2.2 ProvideLocation

5.5.2.2.1 General

The ProvideLocation service operation is used in the following procedure:

- 5GC-MT-LR Procedure without UDM Query (see 3GPP TS 23.502 [3], subclause 4.13.5.2)
- 5GC-MT-LR Procedure (see 3GPP TS 23.502 [3], subclause 4.13.5.3)
- Location Continuity for Handover of an Emergency session from NG-RAN (see 3GPP TS 23.502 [3], subclause 4.13.5.7)

The ProvideLocation service operation shall be invoked by the NF Service Consumer (e.g. GMLC) to request the current location of the UE. The service operation triggers the AMF to invoke the service towards the LMF.

The NF Service Consumer shall invoke the service operation by sending POST to the URI of the "provide" custom operation on the "Individual UE Context" resource (See subclause 6.4.3.2.4.2). See also figure 5.5.2.2.1-1.

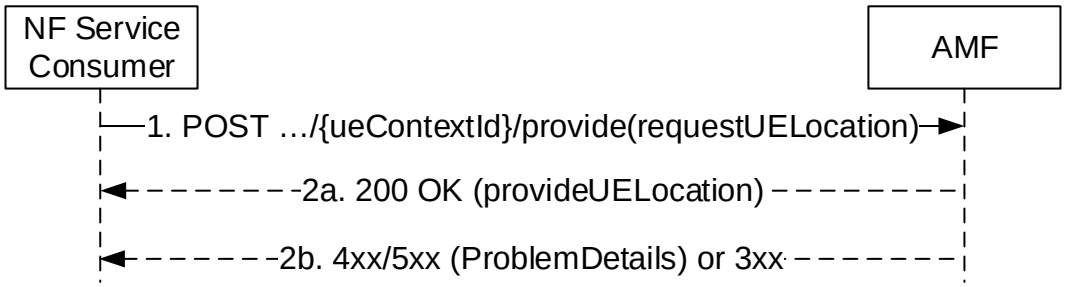

Figure 5.5.2.2.1-1: NF Service Consumer requests the location of the UE

1. The NF Service Consumer sends a POST request to the resource representing the locationInformation resource of the AMF. The payload body of the POST request may contain an indication of a location request from an emergency services client, the required QoS and Supported GAD shapes. If the NF service consumer wants the location change information to be notified (e.g. during a handover procedure), it also provides a callback URI on which the EventNotify service operation is executed (see clause 5.5.2.3).

2a. On success, "200 OK" shall be returned, the payload body containing the LCS correlation identifier, the location estimate, its age and accuracy and the information about the positioning method. If the request is invoked during a handover the response body shall also include the target AMF node identifier as specified in clause 4.13.5.7 of 3GPP TS 23.502 [3].

2b. On failure, one of the HTTP status code listed in Table 6.4.3.2.4.2.2-2 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.4.3.2.4.2.2-2.

5.5.2.3 EventNotify

5.5.2.3.1 General

The EventNotify service operation is used in the following procedure:

- 5GC-NI-LR Procedure (see 3GPP TS 23.502 [3], subclause 4.13.5.1)
- Location Continuity for Handover of an Emergency session from NG-RAN (see 3GPP TS 23.502 [3], subclause 4.13.5.7)

The EventNotify service operation notifies the NF Service Consumer (e.g. GMLC) the UE location related event information related to emergency sessions, i.e. when the emergency session is initiated, when a handover procedure takes place and the emergency session is ongoing, or when the emergency session is released. The notification is delivered on the callback URI provided by the NF Service Consumer.

NOTE: During a handover procedure, both the source AMF and the target AMF can invoke the EventNotify service operation, based on the local configuration.

The operation is invoked by issuing a POST request to the callback URI of the NF Service Consumer (See subclause 6.4.5.2.3.1). See also figure 5.5.2.3.1-1.

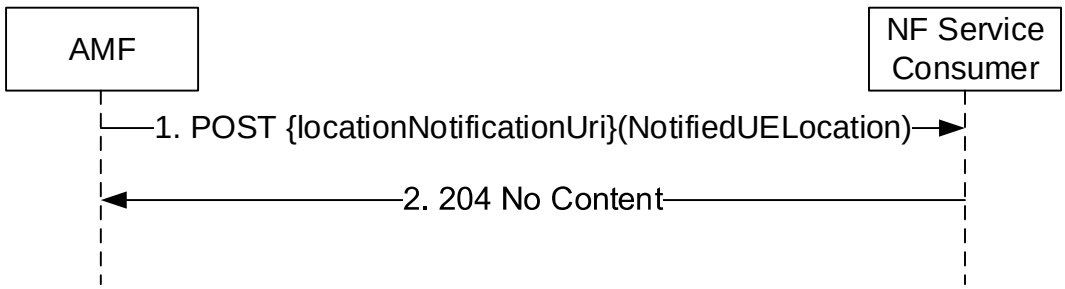

Figure 5.5.2.3.1-1: UE Location Notification

1. The AMF shall send a POST request to the callback URI provided by the NF service consumer. The request body shall include the type of location related event and UE Identification (SUPI or PEI), and may include the GPSI, Geodetic Location, Civic Location and the Position methods used.

2. On success, "204 No content" shall be returned by the NF Service Consumer.

   On failure, the appropriate HTTP status code (e.g. "403 Forbidden") indicating the error shall be returned and appropriate additional error information should be returned.

6 API Definitions

6.1 Namf_Communication Service API

6.1.1 API URI

URIs of this API shall have the following root:

{apiRoot}/{apiName}/{apiVersion}/

where the "apiName" shall be set to "namf-comm" and the "apiVersion" shall be set to "v1" for the current version of this specification.

6.1.2 Usage of HTTP

6.1.2.1 General

HTTP/2, as defined in IETF RFC 7540 [19], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

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

HTTP messages and bodies for the Namf_Communication service shall comply with the OpenAPI [23] 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 subclause 5.2.2 of 3GPP TS 29.500 [4].

6.1.2.2.2 Content type

The JSON format shall be supported. The use of the JSON format (IETF RFC 8259 [8]) shall be signalled by the content type "application/json" or "application/problem+json". See also subclause 5.4 of 3GPP TS 29.500 [4].

Multipart messages shall also be supported (see subclause 6.1.2.4) using the content type "multipart/related", comprising:

- one JSON body part with the "application/json" content type; and
- one or two binary body parts with 3gpp vendor specific content subtypes.

The 3gpp vendor specific content subtypes defined in Table 6.1.2.2.2-1 shall be supported.

Table 6.1.2.2.2-1: 3GPP vendor specific content subtypes

content subtype	Description
vnd.3gpp.ngap	Binary encoded payload, encoding NG Application Protocol (NGAP) IEs, as specified in subclause 9.4 of 3GPP TS 38.413 [12] (ASN.1 encoded).
vnd.3gpp.5gnas	Binary encoded payload, encoding a 5GS NAS message, as specified in 3GPP TS 24.501 [11].
NOTE: Using 3GPP vendor content subtypes allows to describe the nature of the opaque payload (e.g. NGAP or 5GS NAS information) without having to rely on metadata in the JSON payload.	

See subclause 6.1.2.4 for the binary payloads supported in the binary body part of multipart messages.

6.1.2.3 HTTP custom headers

6.1.2.3.1 General

In this release of this specification, no custom headers specific to the Namf_Communication service are defined. For 3GPP specific HTTP custom headers used across all service based interfaces, see clause 5.2.3 of 3GPP TS 29.500 [4].

6.1.2.4 HTTP multipart messages

HTTP multipart messages shall be supported, to transfer opaque N1 Information (e.g. SM, LPP) and/or N2 Information (e.g. SM, NRPPa, PWS), in the following service operations (and HTTP messages):

- N1N2MessageTransfer Request and Response (POST);
- NonUeN2MessageTransfer Request and Response (POST);
- N1MessageNotify (POST);
- N2InfoNotify (POST);
- NonUeN2InfoNotify (POST).

HTTP multipart messages shall include one JSON body part and one or two binary body parts comprising:

- an N1payload, an N2 payload or both (see subclause 6.1.6.4).

The JSON body part shall be the "root" body part of the multipart message. It shall be encoded as the first body part of the multipart message. The "Start" parameter does not need to be included.

The multipart message shall include a "type" parameter (see IETF RFC 2387 [9]) specifying the media type of the root body part, i.e. "application/json".

NOTE: The "root" body part (or "root" object) is the first body part the application processes when receiving a multipart/related message, see IETF RFC 2387 [9]. The default root is the first body within the multipart/related message. The "Start" parameter indicates the root body part, e.g. when this is not the first body part in the message.

For each binary body part in a HTTP multipart message, the binary body part shall include a Content-ID header (see IETF RFC 2045 [10]), and the JSON body part shall include an attribute, defined with the RefToBinaryData type, that contains the value of the Content-ID header field of the referenced binary body part.

6.1.3 Resources

6.1.3.1 Overview

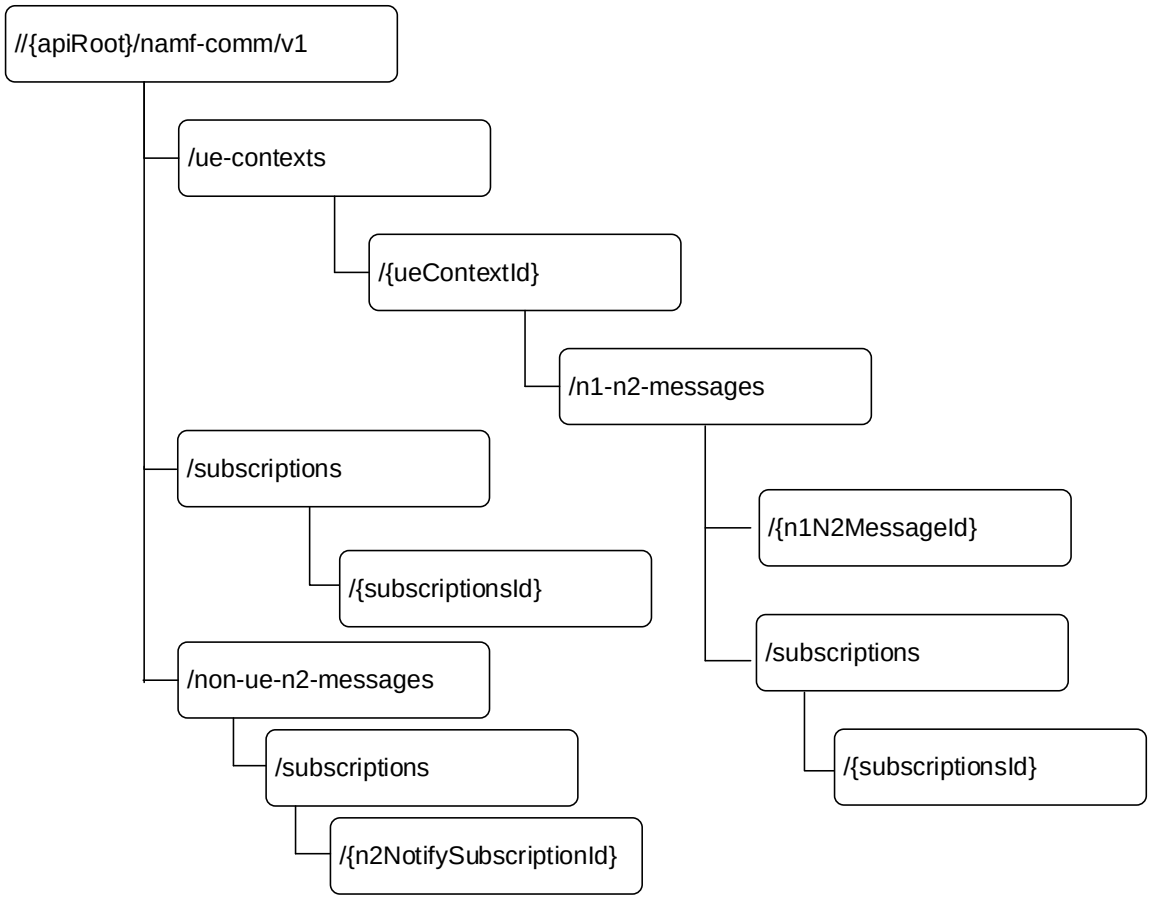

Figure 6.1.3.1-1: Resource URI structure of the Namf_Communication API

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 (Mapped Service Operations)
Individual ueContext	…/ue-contexts/{ueContextId}	PATCH	UEContextTransfer, RegistrationCompleteNotify, N2InfoNotify
		PUT	CreateUEContext
	…/ue-contexts/{ueContextId}/release	(POST) release	ReleaseUEContext
	…/ue-contexts/{ueContextId}/assignEbi	(POST) assignEbi	EBIAssignment
	…/ue-contexts/{ueContextId}/transfer	(POST) transfer	UEContextTransfer
n1N2Message collection	…/ue-contexts/{ueContextId}/n1-n2-messages	POST	N1N2MessageTransfer
N1N2 Subscriptions Collection for Individual UE Contexts	../ue-contexts/{ueContextId}/n1-n2-messages/subscriptions	POST	N1MessageSubscribe, N2InfoSubscribe.
N1N2 Individual Subscription	../ue-contexts/{ueContextId}/n1-n2-messages/subscriptions/{subscriptionId}	PUT	AMFStatusChangeSubscribe
		DELETE	N1MessageUnSubscribe, N2InfoUnsubscribe
n1N2Message transfer status notification callback	{n1N2MessageTransferNotificationUrl} (NF Service Consumer provided callback reference)	POST	Notify n1N2MessageTransfer status
subscriptions collection	…/subscriptions	POST	AMFStatusChangeSubscribe
individual subscription	…/subscriptions/{subscriptionId}	DELETE	AMFStatusChangeUnSubscribe
Non UE N2Messages collection	../non-ue-n2-messages	(POST) transfer	NonUEN2MessageTransfer
Non UE N2Messages Subscriptions collection	../non-ue-n2-messages/subscriptions	POST	NonUEN2InfoSubscribe
Non UE N2 Message Notification Individual Subscription	../non-ue-n2-messages/subscriptions/{n2NotifySubscriptionId}	DELETE	NonUEN2InfoUnsubscribe

6.1.3.2 Resource: Individual ueContext

6.1.3.2.1 Description

This resource represents the an individual ueContext identified by the ueContextId.

This resource is modelled as the Document resource archetype (see subclause C.1 of 3GPP TS 29.501 [5]).

6.1.3.2.2 Resource Definition

Resource URI:{apiRoot}/namf-comm/v1/ue-contexts/{ueContextId}

This resource shall support the resource URI variables defined in table 6.1.3.2.2-1.

Table 6.1.3.2.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 6.1.1
ueContextId	Represents the 5G Globally Unique Temporary Identifier (See 3GPP TS 23.501 [2] clause 5.9.4) Pattern: "5g-guti-[0-9]{5,6}[0-9a-fA-F]{14}" Or represents the Subscription Permanent Identifier (see 3GPP TS 23.501 [2] clause 5.9.2) pattern: "(imsi-[0-9]{5,15}|nai-.+)" Or represents the Permanent Equipment Identifier (see 3GPP TS 23.501 [2] clause 5.9.3) pattern: "(imei-[0-9]{15})"

When the ueContextId is composed by UE's SUPI or PEI, UE's PEI shall be used for the case:

- If the UE is emergency registration and the UE is UICCless;
- If the UE is emergency registration but SUPI is not authenticated.

For other cases, UE's SUPI shall be used.

6.1.3.2.3 Resource Standard Methods

6.1.3.2.3.1 PUT

This ueContextId identifies the individual ueContext resource is composed by UE's SUPI or PEI, See table 6.1.3.2.2-1.

This method shall support the URI query parameters specified in table 6.1.3.2.3.1-1.

Table 6.1.3.2.3.1-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.1.3.2.3.1-2 and the response data structures and response codes specified in table 6.1.3.2.3.1-3.

Table 6.1.3.2.3.1-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
UeContextCreate Data	M	1	Defines the UE Context to be created.

Table 6.1.3.2.3.1-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
UeContextCreatedData	M	1	201 Created	This case represents the successful creation of a new UE Context. Upon success, a response body is returned containing the newly created UE Context.
UeContextCreateError	M	1	403 Forbidden	This case represents the creation of a new UE Context is not successful. The "cause" attribute of the ProblemDetails shall be set to: - HANDOVER_FAILURE

6.1.3.2.4 Resource Custom Operations

6.1.3.2.4.1 Overview

Table 6.1.3.2.4.1-1: Custom operations

Custom operation URI	Mapped HTTP method	Description
{apiRoot}/namf-comm/v1/ue-contexts/{ueContextId}/release	POST	Release an existing individual ueContext resource. It is used for the Release UE Context service operation.
{apiRoot}/namf-comm/v1/ue-contexts/{ueContextId}/assignEbi	POST	Assign EPS bearer ID(s) towards EPS bearer(s) mapped from QoS Flow(s), for a PDU session for the UE. It is used for EBIAssignment service operation.
{apiRoot}/namf-comm/v1/ue-contexts/{ueContextId}/transfer	POST	Transfer an existing individual ueContext resource from old AMF to new AMF. It is used for the UEContextTransfer service operation.

6.1.3.2.4.2 Operation: (POST) release

6.1.3.2.4.2.1 Description

This ueContextId identifies the individual ueContext resource is composed by UE's SUPI or PEI, See table 6.1.3.2.2-1.

6.1.3.2.4.2.2 Operation Definition

This operation shall support the request data structures specified in table 6.1.3.2.4.2.2-1 and the response data structure and response codes specified in table 6.1.3.2.4.2.2-2.

Table 6.1.3.2.4.2.2-1: Data structures supported by the (POST) release Request Body on this resource

Data type	P	Cardinality	Description
UEContextRelease	M	1	The information used for releasing of the UE Context

Table 6.1.3.2.4.2.2-2: Data structures supported by the (POST) release Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents the handover is cancelled successfully.
ProblemDetails	M	1	400 Bad Request	The "cause" attribute shall be set to one of the following application errors: - INVALID_MSG_FORMAT - MANDAT_IE_INCORRECT - MANDAT_IE_MISSING See table 6.1.7.3-1 for the description of these errors.
ProblemDetails	M	1	403 Forbidden	The "cause" attribute shall be set to one of the following application errors: - UNSPECIFIED - SUPI_OR_PEI_UNKNOWN See table 6.1.7.3-1 for the description of this error.
ProblemDetails	M	1	404 Not Found	The "cause" attribute shall be set to the following application error: - CONTEXT_NOT_FOUND See table 6.1.7.3-1 for the description of this error.
ProblemDetails	M	1	500 Internal Server Error	The "cause" attribute shall be set to the following application error: - SYSTEM_FAILURE See table 6.1.7.3-1 for the description of this error.
ProblemDetails	M	1	503 Service Unavailable	The "cause" attribute shall be set to the following application error: - NF_CONGESTION See table 6.1.7.3-1 for the description of this error.

6.1.3.2.4.3 Operation: (POST) assignEbi

6.1.3.2.4.3.1 Description

This ueContextId identifies the individual ueContext resource is composed by UE's SUPI or PEI, see Table 6.1.3.2.2-1.

6.1.3.2.4.3.2 Operation Definition

This operation shall support the request data structures specified in table 6.1.3.2.4.3.2-1 and the response data structure and response codes specified in table 6.1.3.2.4.3.2-2.

Table 6.1.3.2.4.3.2-1: Data structures supported by the (POST) assignEbi Request Body on this resource

Data type	P	Cardinality	Description
AssignEbiData	M	1	The information required for AMF to allocate EPS bearer ID(s).

Table 6.1.3.2.4.3.2-2: Data structures supported by the (POST) assignEbi Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AssignedEbiData	M	1	200 OK	Represent successful assignment of EPS bearer ID service operation, with the assigned EBIs included. AMF may allocate only a subset of the requested EBIs, when not enough available EBI(s) can be allocated, e.g. when other PDU sessions with higher ARP have occupied too many EBIs. If the POST request body contained "releasedEbiList" the AMF shall release those EBI(s) and shall include the "releaseEbiList" IE in the POST response body.
AssignEbiError	M	1	403 Forbidden	This represents the case when none of the requested EBI(s) can be assigned by the AMF. The "cause" attribute of the ProblemDetails shall be set to: - EBI_EXHAUSTED, if the number of EBIs allocated for the UE has already reached the maximum limit.

6.1.3.2.4.4 Operation: (POST) transfer

6.1.3.2.4.4.1 Description

This ueContextId identifies the individual ueContext resource is composed by UE's 5G-GUTI, see Table 6.1.3.2.2-1.

6.1.3.2.4.4.2 Operation Definition

This operation shall support the request data structures specified in table 6.1.3.2.4.4.2-1 and the response data structure and response codes specified in table 6.1.3.2.4.4.2-2.

Table 6.1.3.2.4.4.2-1: Data structures supported by the (POST) transfer Request Body on this resource

Data type	P	Cardinality	Description
UeContextTransferReqData	M	1	Represents to start transferring of an individual ueContext resource from old AMF to new AMF.

Table 6.1.3.2.4.4.2-2: Data structures supported by the (POST) transfer Response Body on this resource

Data type	P	Cardinality	Response codes	Description
UeContextTransferRspData	M	1	200 OK	Indicates the transferring of the individual ueContext resource is started successfully.
ProblemDetails	M	1	403 Forbidden	Indicates that AMF can understand the request but cannot fulfil the request due to errors. If the integrity check of the included complete registration message fails at the source AMF the "cause" attribute is set to: - INTEGRITY_CHECK_FAIL.
ProblemDetails	M	1	404 Not Found	If the AMF does not have the requested UE context, the AMF shall return this status code. The "cause" attribute is set to: - CONTEXT_NOT_FOUND

6.1.3.3 Resource: N1N2 Subscriptions Collection for Individual UE Contexts

6.1.3.3.1 Description

This resource represents the collection under an individual UE context for storing the subscriptions for notifications of UE specific N1 and N2 message types. This resource is modelled as the Collection resource archetype (see subclause C.2 of 3GPP TS 29.501 [5]).

6.1.3.3.2 Resource Definition

Resource URI: **{apiRoot}/namf-comm/v1/{ueContextId}/n1-n2-messages/subscriptions**

This resource shall support the resource URI variables defined in table 6.1.3.3.2-1.

Table 6.1.3.8.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 6.1.1
ueContextId	Represents the Subscription Permanent Identifier (see 3GPP TS 23.501 [2] clause 5.9.2) pattern: "(imsi-[0-9]{5,15}|nai-.+)" Or represents the Permanent Equipment Identifier (see 3GPP TS 23.501 [2] clause 5.9.3) pattern: "(imei-[0-9]{15})"

6.1.3.3.3.1 POST

This method creates an individual N1/N2 information subscription resource for UE related N1/N2 information. This method is used by NF Service Consumers (e.g. LMF) to subscribe for notifications about UE related N1/N2 Information.

This method shall support the request data structures specified in table 6.1.3.3.3.1-2 and the response data structures and response codes specified in table 6.1.3.3.3.1-3.

Table 6.1.3.3.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
UeN1N2InfoSubscriptionCreateData	C	0..1	Representation of the subscription for N1 and/or N2 information notification. It shall contain the information regarding N1 and/or N2 information to be notified and the callback URI for the respective notifications.

Table 6.1.3.3.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
UeN1N2InfoSubscriptionCreatedData	C	0..1	201 Created	This case represents the successful creation of the subscription for N1 and/or N2 information notification. Upon success, a response body is returned containing the representation describing the status of the request. The Location header shall contain the location (URI) of the created subscription resource.

6.1.3.3.4 Resource Custom Operations

There are no custom operations supported on this resource.

6.1.3.4 Resource: N1N2 Individual Subscription

6.1.3.4.1 Description

This resource represents the individual subscription for the subscription for notifications of UE specific N1 and N2 message types. This resource is modelled as the Document resource archetype (see subclause C.2 of 3GPP TS 29.501 [5]).

6.1.3.4.2 Resource Definition

Resource URI: **{apiRoot}/namf-comm/v1/{ueContextId}/n1-n2-messages/subscriptions/{subscriptionId}**

This resource shall support the resource URI variables defined in table 6.1.3.4.2-1.

Table 6.1.3.4.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 6.1.1
ueContextId	Represents the Subscription Permanent Identifier (see 3GPP TS 23.501 [2] clause 5.9.2) pattern: "(imsi-[0-9]{5,15}|nai-.+)" Or represents the Permanent Equipment Identifier (see 3GPP TS 23.501 [2] clause 5.9.3) pattern: "(imei-[0-9]{15})"
subscriptionId	Represents the individual subscription to the UE specific N1/N2 message notification.

6.1.3.4.3.1 DELETE

This method deletes an individual N1/N2 message notification subscription resource for an individual UE. This method is used by NF Service Consumers (e.g. LMF) to unsubscribe for notifications about UE related N1/N2 information.

This method shall support the request data structures specified in table 6.1.3.4.3.1-2 and the response data structures and response codes specified in table 6.1.3.4.3.1-3.

Table 6.1.3.4.3.1-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.1.3.4.3.1-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	

6.1.3.4.4 Resource Custom Operations

There are no custom operations supported on this resource.

6.1.3.5 Resource: N1 N2 Messages Collection

6.1.3.5.1 Description

This resource represents the collection on which UE related N1 messages and N2 information transfer are initiated and the N1 information for the UE is stored temporarily until the UE is reachable. This resource is modelled with the Collection resource archetype (see subclause C.2 of 3GPP TS 29.501 [5]).

6.1.3.5.2 Resource Definition

Resource URI: {apiRoot}/namf-comm/v1/ue-contexts/{ueContextId}/n1-n2-messages

This resource shall support the resource URI variables defined in table 6.1.3.5.2-1.

Table 6.1.3.5.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 6.1.1
ueContextId	Represents the Subscription Permanent Identifier (see 3GPP TS 23.501 [2] clause 5.9.2) pattern: "(imsi-[0-9]{5,15}|nai-.+)" Or represents the Permanent Equipment Identifier (see 3GPP TS 23.501 [2] clause 5.9.3) pattern: "(imei-[0-9]{15})"

6.1.3.5.3 Resource Standard Methods

6.1.3.5.3.1 POST

This method initiates a N1 message and/or N2 message transfer at the AMF and may create a resource to store the N1 message if the UE is not reachable or if the UE is paged.

This method shall support the request data structures specified in table 6.1.3.5.3.1-2 and the response data structures and response codes specified in table 6.1.3.5.3.1-3.

Table 6.1.3.5.3.1-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
N1N2MessageData	M	1	This contains: - N1 message, if the NF Service Consumer requests to transfer an N1 message to the UE or; - N2 information, if the NF Service Consumer requests to transfer an N2 information to the 5G-AN or; - both, if the NF Service Consumer requests to transfer both an N1 message to the UE and an N2 information to the 5G-AN.

Table 6.1.3.5.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
N1N2MessageTransferRspData	M	1	202 Accepted	This case represents the successful storage of the N1/N2 information at the AMF when asynchronous communication is invoked or when the AMF pages the UE. If the AMF pages the UE, it shall store the N1/N2 message information until the UE responds to paging. The HTTP response shall include a "Location" HTTP header that contains the resource URI of the created resource.
N1N2MessageTransferRspData	M	1	200 OK	This represents the case where the AMF is able to successfully transfer the N1/N2 message to the UE and/or the AN. The cause included in the response body shall be "N1_N2_TRANSFER_INITIATED" in this case.
ProblemDetails	M	1	307 Temporary Redirect	This represents the case when the related UE context is not fully available at the target NF Service Consumer (e.g. AMF) during a planned maintenance case (e.g. AMF planned maintenance without UDSF case). The "cause" attribute shall be set to one of the following application error: - NF_CONSUMER_REDIRECT_ONE_TXN See table 6.1.7.3-1 for the description of these errors The Location header of the response shall be set to the target NF Service Consumer (e.g. AMF) to which the request is redirected.
ProblemDetails	M	1	404 Not Found	This represents the case when the related UE is not found in the NF Service Consumer (e.g. AMF). The "cause" attribute shall be set to one of the following application error: - CONTEXT_NOT_FOUND See table 6.1.7.3-1 for the description of these errors
N1N2MessageTransferError	M	1	409 Conflict	This represents the case where the AMF rejects the N1N2MessageTransfer request due to an ongoing paging for the same or higher priority request. The cause attribute of the ProblemDetails structure shall be set to: - HIGHER_PRIORITY_REQUEST_ONGOING
N1N2MessageTransferError	M	1	504 Gateway Timeout	This represents the case where the UE is not reachable at the AMF and the AMF is unable to page the UE. The cause attribute of the ProblemDetails structure shall be set to: - UE_NOT_REACHABLE, if the paging fails or the UE is not reachable for paging; - UE_IN_NON_ALLOWED_AREA, if the UE is in a non-allowed area

6.1.3.6 Resource: subscriptions collection

6.1.3.6.1 Description

This resource represents a collection of subscriptions of NF service consumers to the status change of the AMF identified by the GUAMI(s).

This resource is modelled as the Collection resource archetype (see subclause C.2 of 3GPP TS 29.501 [5]).

6.1.3.6.2 Resource Definition

Resource URI:{apiRoot}/namf-comm/v1/subscriptions

This resource shall support the resource URI variables defined in table 6.1.3.6.2-1.

Table 6.1.3.6.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 6.1.1

6.1.3.6.3 Resource Standard Methods

6.1.3.6.3.1 POST

This method creates a new subscription. This method shall support the URI query parameters specified in table 6.1.3.6.3.1-1.

Table 6.1.3.6.3.1-1: 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 6.1.3.6.3.1-2 and the response data structures and response codes specified in table 6.1.3.3.3.1-3.

Table 6.1.3.6.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
SubscriptionData	M	1	The request body contains the input parameters for the subscription. These parameters include, e.g.: - GUAMI(s) - amfStatusUri

Table 6.1.3.6.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
SubscriptionData	M	1	201 Created	This case represents the successful creation of a subscription. Upon success, the HTTP response shall include a "Location" HTTP header that contains the resource URI of the created resource.
ProblemDetails	M	1	400 Bad Request	The "cause" attribute shall be set to one of the following application errors: - INVALID_MSG_FORMAT - MANDAT_IE_INCORRECT - MANDAT_IE_MISSING See table 6.1.7.3-1 for the description of these errors.
ProblemDetails	M	1	403 Forbidden	The "cause" attribute shall be set to the following application error: - UNSPECIFIED See table 6.1.7.3-1 for the description of this error.
ProblemDetails	M	1	500 Internal Server Error	The "cause" attribute shall be set to the following application error: - SYSTEM_FAILURE See table 6.1.7.3-1 for the description of this error.
ProblemDetails	M	1	503 Service Unavailable	The "cause" attribute shall be set to the following application error: - NF_CONGESTION See table 6.1.7.3-1 for the description of this error.

6.1.3.7 Resource: individual subscription

6.1.3.7.1 Description

This resource represents an individual subscription of a NF service consumer to the status change of the AMF identified by the GUAMI(s).

This resource is modelled as the Document resource archetype (see subclause C.1 of 3GPP TS 29.501 [5]).

6.1.3.7.2 Resource Definition

Resource URI: {apiRoot}/namf-comm/v1/subscriptions/{subscriptionId}

This resource shall support the resource URI variables defined in table 6.1.3.7.2-1.

Table 6.1.3.7.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 6.1.1
subscriptionId	Represents a specific subscription

6.1.3.7.3 Resource Standard Methods

6.1.3.7.3.1 DELETE

This method terminates an existing subscription. This method shall support the URI query parameters specified in table 6.1.3.7.3.1-1.

Table 6.1.3.4.3.1-1: 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 6.1.3.7.3.1-2 and the response data structures and response codes specified in table 6.1.3.7.3.1-3.

Table 6.1.3.7.3.1-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.1.3.7.3.1-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
			204 No Content	This case represents a successful deletion of the subscription.
FFS				
ProblemDetails	M	1	404 Not Found	If the AMF does not have the requested subscription, the AMF shall return this status code. The "cause" attribute is set to: - CONTEXT_NOT_FOUND

6.1.3.7.3.2 PUT

This method replaces an existing subscription completely. This method shall support the URI query parameters specified in table 6.1.3.7.3.2-1.

Table 6.1.3.7.3.2-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.1.3.7.3.2-2 and the response data structures and response codes specified in table 6.1.3.7.3.2-3.

Table 6.1.3.7.3.2-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
SubscriptionData	M	1	The request body contains the input parameters for the subscription. These parameters include, e.g.: - GUAMI(s) - amfStatusUri

Table 6.1.3.7.3.2-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
SubscriptionData	M	1	200 OK	This case represents a successful replacement of the subscription.
ProblemDetails	M	1	403 Forbidden	This case represents the failure update of an existing subscription.

6.1.3.8 Resource: Non UE N2Messages Collection

6.1.3.8.1 Description

This resource represents the collection on which custom operations to transfer the N2 message towards the 5G-AN are specified. This resource is modelled with the Collection resource archetype (see subclause C.2 of 3GPP TS 29.501 [5]).

6.1.3.8.2 Resource Definition

Resource URI: **{apiRoot}/namf-comm/v1/non-ue-n2-messages**

This resource shall support the resource URI variables defined in table 6.1.3.8.2-1.

Table 6.1.3.5.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 6.1.1

6.1.3.8.3 Resource Standard Methods

There are no resource standard methods for the non-ue-n2-messages collection resource in this release of this specification.

6.1.3.8.4 Resource Custom Operations

6.1.3.8.4.1 Overview

Table 6.1.3.8.4.1-1: Custom operations

Custom operaration URI	Mapped HTTP method	Description
{resourceUri}/transfer	POST	Transfer the N2 message to 5G-AN.

6.1.3.8.4.2 Operation: transfer

6.1.3.8.4.2.1 Description

The {resourceUri}/transfer custom operation is used to initiate a non UE associated N2 information transfer to the identified 5G-AN nodes. This custom operation uses the HTTP POST method.

6.1.3.8.4.2.2 Operation Definition

This operation shall support the request data structures specified in table 6.1.3.8.4.2.2-1 and the response data structure and response codes specified in table 6.1.3.8.4.2.2-2.

Table 6.1.3.8.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
N2InformationTransferReqData	M	1	Representation of the data to be sent to the 5G-AN node(s) by the AMF.

Table 6.1.3.8.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
N2InformationTransferRspData	M	1	200 OK	Indicates AMF has successfully initiated the transferring of N2 Information to the AN..
N2InformationTransferError	M	1	400 Bad Request	The "cause" attribute shall be set to one of the following application errors: - INVALID_MSG_FORMAT - MANDAT_IE_INCORRECT - MANDAT_IE_MISSING See table 6.1.7.3-1 for the description of these errors.
N2InformationTransferError	M	1	403 Forbidden	The "cause" attribute shall be set to one of the following application errors: - UNSPECIFIED See table 6.1.7.3-1 for the description of these errors.
N2InformationTransferError	M	1	404 Not Found	The "cause" attribute shall be set to one of the following application errors: - CONTEXT_NOT_FOUND See table 6.1.7.3-1 for the description of these errors.
N2InformationTransferError	M	1	500 Internal Server Error	The "cause" attribute shall be set to one of the following application errors: - SYSTEM_FAILURE - INSUFFIC_RES See table 6.1.7.3-1 for the description of these errors.
N2InformationTransferError	M	1	503 Service Unavailable	The "cause" attribute shall be set to one of the following application errors: - NF_CONGESTION See table 6.1.7.3-1 for the description of these errors.

6.1.3.9 Resource: Non UE N2Messages Subscriptions Collection

6.1.3.9.1 Description

This resource represents the collection on which individual subscriptions for non UE N2 messages from the 5G-AN are stored. This resource is modelled with the Collection resource archetype (see subclause C.2 of 3GPP TS 29.501 [5]).

6.1.3.9.2 Resource Definition

Resource URI: **{apiRoot}/namf-comm/v1/non-ue-n2-messages/subscriptions**

This resource shall support the resource URI variables defined in table 6.1.3.9.2-1.

Table 6.1.3.9.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 6.1.1

6.1.3.9.3 Resource Standard Methods

6.1.3.9.3.1 POST

This method creates an individual N2 information subscription resource for non UE related N2 information. This method is used by NF Service Consumers (e.g. LMF, CBCF/PWS-IWF) to subscribe for notifications about non UE related N2 Information from a specific 5G-AN node, or from any 5G-AN node.

This method shall support the request data structures specified in table 6.1.3.9.3.1-2 and the response data structures and response codes specified in table 6.1.3.9.3.1-3.

Table 6.1.3.9.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
NonUeN2InfoSubscriptionCreateData	M	1	Representation of the subscription for N2 information notification.

Table 6.1.3.9.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NonUeN2InfoSubscriptionCreatedData	M	1	201 Created	This case represents the successful creation of the subscription for N2 information notification. Upon success, a response body is returned containing the representation describing the status of the request. The Location header shall carry the location (URI) of the created subscription resource.
ProblemDetails	M	1	403 Forbidden	If the NF Service Consumer is not authorized to subscribe for non UE N2 message notifications, the AMF shall return this status code with the ProblemDetails

6.1.3.9.4 Resource Custom Operations

There are no custom operations supported on this resource.

6.1.3.10 Resource: Non UE N2 Message Notification Individual Subscription

6.1.3.10.1 Description

This resource represents the individual subscription for the notifications of non UE specific N2 message types (e.g. NRPPa, PWS Notifications). This resource is modelled with the Store resource archetype (see subclause C.3 of 3GPP TS 29.501 [5]).

6.1.3.10.2 Resource Definition

Resource URI: **{apiRoot}/namf-comm/v1/non-ue-n2-messages/subscriptions/{n2NotifySubscriptionId}**

This resource shall support the resource URI variables defined in table 6.1.3.10.2-1.

Table 6.1.3.7.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 6.1.1
n2NotifySubscriptionId	Represents the individual subscription to the non UE specific N2 message notification.

6.1.3.10.3 Resource Standard Methods

6.1.3.10.3.1 DELETE

This method deletes an individual N2 message notification subscription resource for non UE associated N2 information. This method is used by NF Service Consumers (e.g. LMF) to unsubscribe for notifications about non UE related N2 information.

This method shall support the request data structures specified in table 6.1.3.10.3.1-2 and the response data structures and response codes specified in table 6.1.3.10.3.1-3.

Table 6.1.3.10.3.1-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.1.3.10.3.1-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	

6.1.3.10.4 Resource Custom Operations

There are no custom operations supported on this resource.

6.1.4 Custom Operations without associated resources

There are no custom operations without associated resources supported on Namf_Communication Service.

6.1.5 Notifications

6.1.5.1 General

The notifications provided by the Namf_Communication service are specified in this clause.

6.1.5.2 AMF Status Change Notification

6.1.5.2.1 Description

If a NF service consumer (e.g. SMF) has subscribed to AMF Status Change on Namf_Communication Service, when AMF aware of a change of its own status, AMF shall create a notification including the current state, and shall deliver the notification to the call-back URI, following Subscribe/Notify mechanism defined in 3GPP TS 29.501 [2].

6.1.5.2.2 Notification Definition

Call-back URI: {amfStatusCallbackUri}

Call-back URI is provided by NF Service Consumer during creation of the subscription.

6.1.5.2.3 Notification Standard Methods

6.1.5.2.3.1 POST

This method shall support the request data structures specified in table 6.1.5.2.3.1-1 and the response data structures and response codes specified in table 6.1.5.2.3.1-2.

Table 6.1.5.2.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
AmfStatusChangeNotification	M	1	Representation of the AMF status change notification.

Table 6.1.5.2.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents a successful notification of the AMF status change.
ProblemDetails	M	1	404 Not Found	This case represents the failure of the notification due to the context is not found. The "cause" attribute shall be set to: - CONTEXT_NOT_FOUND

6.1.5.3 Non UE N2 Information Notification

6.1.5.3.1 Description

This resource represents the callback reference provided by the NF Service Consumer (e.g. LMF, CBCF/PWS-IWF) to receive notifications about N2 information that are not related to a UE.

6.1.5.3.2 Notification Definition

Callback URI: {n2NotifyCallbackUri}

This notification shall support the resource URI variables defined in table 6.1.5.2.2-1.

Table 6.1.5.3.2-1: Resource URI variables for this notification

Name	Definition
n2NotifyCallbackUri	Callback reference provided by the NF Service Consumer during the subscription to this notification.

6.1.5.3.3 Notification Standard Methods

6.1.5.3.3.1 POST

This method sends an N2 information notification to the NF Service Consumer (e.g. LMF, CBCF/PWS-IWF).

This method shall support the request data structures specified in table 6.1.5.3.3.1-2 and the response data structures and response codes specified in table 6.1.5.3.3.1-3.

Table 6.1.5.3.3.1-2: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
N2InformationNotification	M	1	Representation of the N2 information notification.

Table 6.1.5.3.3.1-3: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents a successful notification of the N2 information to the NF service consumer.

6.1.5.4 N1 Message Notification

6.1.5.4.1 Description

This resource represents the callback reference provided by the NF Service Consumer (e.g. LMF) to receive notifications about N1 message from the UE (e.g. NRPP messages).

6.1.5.4.2 Notification Definition

Callback URI: { n1NotifyCallbackUri }

Callback URI is provided by the NF Service Consumer during the subscription to this notification. . The callback URI for N1 message notification may also be obtained from the NRF, if the NF Service Consumer has registered it in the NF Profile with the NRF.

6.1.5.4.3 Notification Standard Methods

6.1.5.4.3.1 POST

This method sends an N1 message notification to the NF Service Consumer (e.g. LMF).

This method shall support the request data structures specified in table 6.1.5.4.3.1-2 and the response data structures and response codes specified in table 6.1.5.4.3.1-3.

Table 6.1.5.4.3.1-2: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
N1MessageNotification	M	1	Representation of the N1 message notification.

Table 6.1.5.4.3.1-3: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents a successful notification of the N1 message to the NF service consumer.
ProblemDetails	M	1	403 Forbidden	This case represents, the NF service consumer failing to accept the processing of the notified N1 message. The detailed information shall be provided in the ProblemDetails structure.

6.1.5.5 UE Specific N2 Information Notification

6.1.5.5.1 Description

This resource represents the callback reference provided by the NF Service Consumer (e.g. LMF) to receive notifications about UE specific N2 information.

6.1.5.5.2 Notification Definition

Resource URI: {n2NotifyCallbackUri}

Callback URI is provided by the NF Service Consumer during the subscription to this notification.

6.1.5.5.3 Notification Standard Methods

6.1.5.5.3.1 POST

This method sends an N2 information notification to the NF Service Consumer (e.g. LMF).

This method shall support the request data structures specified in table 6.1.5.5.3.1-2 and the response data structures and response codes specified in table 6.1.5.5.3.1-3.

Table 6.1.5.5.3.1-2: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
N2InformationNotification	M	1	Representation of the N2 information notification.

Table 6.1.5.5.3.1-3: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents a successful notification of the N2 information to the NF service consumer.

6.1.5.6 N1N2 Message Transfer Failure Notification

6.1.5.6.1 Description

This resource represents the callback reference provided by the NF Service Consumer (e.g. SMF) to receive notifications about failure to deliver N1 / N2 message.

6.1.5.6.2 Notification Definition

Resource URI: {n1n2TransferFailureCallbackUri}

Callback URI is provided by the NF Service Consumer during the UE specific N1N2MessageTransfer operation (see subclause 6.1.3.5.3.1.

6.1.5.6.3 Notification Standard Methods

6.1.5.6.3.1 POST

This method sends an N1/N2 message transfer failure notification to the NF Service Consumer (e.g. SMF).

This method shall support the request data structures specified in table 6.1.5.6.3.1-1 and the response data structures and response codes specified in table 6.1.5.6.3.1-3.

Table 6.1.5.6.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
N1N2MsgTxfrFailureNotification	M	1	Representation of the N1/N2 message transfer failure notification.

Table 6.1.5.6.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents a successful notification of the N1 / N2 message transfer to the NF service consumer.

6.1.5.7 Registration Complete Notification

6.1.5.7.1 Description

This resource represents the callback reference provided by the NF Service Consumer (e.g. Source AMF) to receive notifications about completion of UE registration at the AMF.

6.1.5.7.2 Notification Definition

Resource URI: {notifyCallbackUri}.

Callback URI is provided by the NF Service Consumer during an earlier UE context transfer.

6.1.5.7.3 Notification Standard Methods

6.1.5.7.3.1 POST

This method sends an UE context registration complete notification to the NF Service Consumer (e.g. Source AMF).

This method shall support the request data structures specified in table 6.1.5.7.3.1-2 and the response data structures and response codes specified in table 6.1.5.7.3.1-3.

Table 6.1.5.7.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
UERegComplete NotifData	M	1	Information about completed UE context transfer.

Table 6.1.5.7.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents a successful notification of the UE registration completion to the NF service consumer.

6.1.6 Data Model

6.1.6.1 General

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

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

Table 6.1.6.1-1: Namf_Communication specific Data Types

Data type	Section defined	Description
SubscriptionData	6.1.6.2.2	Information within AMFStatusChangeSubscribe
AmfStatusChangeNotification	6.1.6.2.3	Information within AMFStatusChangeNotify
AmfStatusInfo	6.1.6.2.4	Information within AMFStatusChangeNotify
AssignEbiData	6.1.6.2.5	Represents information needed for AMF to assign EBIs.
AssignedEbiData	6.1.6.2.6	Represents successful assignment of EBI(s).
AssignEbiFailed	6.1.6.2.7	Represents failed assignment of EBI(s)
UEContextRelease	6.1.6.2.8	Information within ReleaseUeContext
N2InformationTransferReqData	6.1.6.2.9	N2 information requested to be transferred to 5G AN.
NonUeN2InfoSubscriptionCreateData	6.1.6.2.10	Subscription information for non UE specific N2 information notification.
NonUeN2InfoSubscriptionCreatedData	6.1.6.2.11	The created subscription for non UE specific N2 information notification.
UeN1N2InfoSubscriptionCreateData	6.1.6.2.12	Subscription information for UE specific N1 and/or N2 information notification.
UeN1N2InfoSubscriptionCreatedData	6.1.6.2.13	The created subscription for UE specific N1 and/or N2 information notification.
N2InformationNotification	6.1.6.2.14	N2 information for notification.
N2InfoContainer	6.1.6.2.15	N2 information container.
N1MessageNotification	6.1.6.2.16	N1 message notification data structure.
N1MessageContainer	6.1.6.2.17	N1 Message Container
N1N2MessageData	6.1.6.2.18	N1/N2 message container
N1N2MessageTransferRspData	6.1.6.2.19	N1/N2 message transfer response
RegistrationContextContainer	6.1.6.2.20	Registration Context Container used to send the UE context information, N1 message from UE, AN address etc during Registration with AMF re-allocation procedure.
AreaOfValidity	6.1.6.2.21	Area of validity information for N2 information transfer
RefToBinaryData	6.1.6.2.22	Cross-Reference to binary data encoded within a binary body part in an HTTP multipart message.
UeContextTransferReqData	6.1.6.2.23	Represents to start transferring of an individual ueContext resource from old AMF to new AMF.
UeContextTransferRspData	6.1.6.2.24	Indicates the transferring of the individual ueContext resource is started successfully.
UeContext	6.1.6.2.25	Represents an individual ueContext resource
N2SmInformation	6.1.6.2.26	Represents the session management SMF related N2 information data part.
N2InfoContent	6.1.6.2.27	Represents a transparent N2 information content to be relayed by AMF.
NrppaInformation	6.1.6.2.28	Represents a NRPPa related N2 information data part.
PwsInformation	6.1.6.2.29	Represents a PWS related information data part.
N1N2MsgTxfrFailureNotification	6.1.6.2.30	N1/N2 Message Transfer Failure Notification
N1N2MessageTransferError	6.1.6.2.31	N1/N2 Message Transfer Error
N2N2MsgTxfrErrDetail	6.1.6.2.32	N1/N2 Message Transfer Error Details
N2InformationTransferRspData	6.1.6.2.33	Indicates a successful delivery of N2 Information to the AN.
MmContext	6.1.6.2.34	Represents a Mobility Management Context in UE Context
SeafData	6.1.6.2.35	Represents SEAF data derived from data received from AUSF
NasSecurityMode	6.1.6.2.36	Indicates the NAS Security Mode
PduSessionContext	6.1.6.2.37	Represents a PDU Session Context in UE Context
NssaiMapping	6.1.6.2.38	Represents a map of a S-NSSAI in serving PLMN to a S-NSSAI in home PLMN.
UERegCompleteNotifData	6.1.6.2.39	Provides information on the UE registration completion at a target AMF.
AssignEbiError	6.1.6.3.40	Represents the details regarding EBI assignment failure.
UeContextCreateData	6.1.6.2.41	Indicates a request to create an individual ueContext resource

UeContextCreatedData	6.1.6.2.42	Indicates a successful creation of an individual ueContext resource
UeContextCreateError	6.1.6.2.43	Represents an error when creating a UE context
NgRanTargetId	6.1.6.2.44	Indicates a NG RAN as target of the handover
N2InformationTransferError	6.1.6.2.45	Error within NonUeN2MessageTransfer response
PWSResponseData	6.1.6.2.46	Represents the type of PWS
PWSErrorData	6.1.6.2.47	Represents the type of PWS error
GlobalRanNodeId	6.1.6.2.48	Represents the type of Global Ran Node Id
NgKsi	6.1.6.2.49	Represents the ngKSI (see 3GPP TS 33.501 [x1])
KeyAmf	6.1.6.2.50	Represents the K_{amf} or $K'_{amf.}$ (see 3GPP TS 33.501 [x1]).
EpsBearerId	6.1.6.3.2	EPS Bearer Identifier
NgApCause	6.1.6.3.2	Represents the NG AP cause code values
GlobalRanNodeId	6.1.6.2.51	Represents the identifier of the NG RAN node
Ppi	6.1.6.3.2	Paging Policy Indicator
NasCount	6.1.6.3.2	Represents a NAS COUNT
5gmmCapability	6.1.6.3.2	Represents a 5GMM capability
UeSecurityCapability	6.1.6.3.2	Represents a UE Security Capability
S1UeNetworkCapability	6.1.6.3.2	Represents a S1 UE Network Capability
DrxParameter	6.1.6.3.2	Indicates the UE DRX Parameters
OmcIdentifier	6.1.6.3.2	Represents the OMC Identifier
StatusChange	6.1.6.3.3	
N2InformationClass	6.1.6.3.4	
N1MessageClass	6.1.6.3.5	
N1N2MessageTransferCause	6.1.6.3.6	
UeContextTransferStatus	6.1.6.3.7	Describes the status of an individual ueContext resource in UE Context Transfer procedures
N2InformationTransferResult	6.1.6.3.8	Describes the result of N2 information transfer by AMF to the AN.
CipheringAlgorithm	6.1.6.3.9	Indicates the supported Ciphering Algorithm
IntegrityAlgorithm	6.1.6.3.10	Indicates the supported Integrity Algorithm
SmsSupport	6.1.6.3.11	Indicates the supported SMS delivery of a UE.
ScType	6.1.6.3.12	Indicates the security context type.
KeyAmfType	6.1.6.3.13	Indicates the K_{amf} type.
TransferReason	6.1.6.3.14	Indicates UE Context Transfer Reason

Table 6.1.6.1-2 specifies data types re-used by the Namf 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 Namf service based interface.

Table 6.1.6.1-2: Namf re-used Data Types

Data type	Reference	Comments
Snssai	3GPP TS 29.571 [6]	
Arp	3GPP TS 29.571 [6]	
PduSesisonId	3GPP TS 29.571 [6]	
Guami	3GPP TS 29.571 [6]	Globally Unique AMF Identifier
AmfName	3GPP TS 29.571 [6]	The name of the AMF
Supi	3GPP TS 29.571 [6]	Subscription Permanent Identifier
IndicationFlags	3GPP TS 29.502 [16]	Indication Flags
Cause	3GPP TS 29.571 [6]	5G-AN Cause
ProblemDetails	3GPP TS 29.571 [6]	Detailed problems in failure case
supportedFeatures	3GPP TS 29.571 [6]	Supported Features
TimeZone	3GPP TS 29.571 [6]	
UserLocation	3GPP TS 29.571 [6]	
AccessType	3GPP TS 29.571 [6]	
AllowedNssai	3GPP TS 29.531 [18]	
NfInstanceId	3GPP TS 29.571 [6]	
Uri	3GPP TS 29.571 [6]	
Ecgi	3GPP TS 29.571 [6]	EUTRA Cell Identifier
Ncgi	3GPP TS 29.571 [6]	NR Cell Identifier
Uint16	3GPP TS 29.571 [6]	
5qi	3GPP TS 29.571 [6]	5G QoS Identifier
CorrelationID	3GPP TS 29.572 [25]	LCS Correlation ID
Pei	3GPP TS 29.571 [6]	
Dnn	3GPP TS 29.571 [6]	
Gpsi	3GPP TS 29.571 [6]	
GroupId	3GPP TS 29.571 [6]	
PlmnId	3GPP TS 29.571 [6]	
MobilityRestrictions	3GPP TS 29.571 [6]	
RfspIndex	3GPP TS 29.571 [6]	
EbiArpMapping	3GPP TS 29.502 [16]	EBI - ARP mapping
NsiId	3GPP TS 29.531 [18]	

6.1.6.2 Structured data types

6.1.6.2.1 Introduction

Structured data types used in Namf_Communication service are specified in this clause.

6.1.6.2.2 Type: SubscriptionData

Table 6.1.6.2.2-1: Definition of type SubscriptionData

Attribute name	Data type	P	Cardinality	Description
amfStatusUri	Uri	M	1	This IE shall include the callback URI to receive notification of AMF status change.
guamis	Guami	C	0..N	This IE shall be absent for subscribing to status change for any GUAMI supported by the AMF, it shall be present for subscribing to specific GUAMIs supported by the AMF.

6.1.6.2.3 Type: AmfStatusChangeNotification

Table 6.1.6.2.3-1: Definition of type AmfStatusChangeNotification

Attribute name	Data type	P	Cardinality	Description
amfStatusInfo	AmfStatusInfo	M	1..N	This IE shall contain the status change information about the AMF

6.1.6.2.4 Type: AmfStatusInfo

Table 6.1.6.2.4-1: Definition of type AmfStatusInfo

Attribute name	Data type	P	Cardinality	Description
guamis	Guami	M	1..N	This IE shall contain the GUAMIs
statusChange	StatusChange	M	1	This IE shall contain the Status change of the related GUAMIs
targetamfName	AmfName	C	0..1	This IE shall contain the target AMF name in the AMF planned removal without UDSF scenario

6.1.6.2.5 Type: AssignEbiData

Table 6.1.6.2.5-1: Definition of type AssignEbi

Attribute name	Data type	P	Cardinality	Description
pduSessionId	PduSessionId	M	1	Represents the identifier of the PDU Session requesting EBI(s) to be assigned.
arps	array(Arp)	C	1..N	Represents a ARP list mapped to the QoS flow(s)
releasedEbiList	array(EpsBearerId)	C	0..N	This IE shall be present if the SMF needs to release the assigned EBI(s) from QoS flows (e.g. when the QoS flow is released).

6.1.6.2.6 Type: AssignedEbiData

Table 6.1.6.2.6-1: Definition of type AssignedEbi

Attribute name	Data type	P	Cardinality	Description
pduSessionId	PduSessionId	M	1	Represents the identifier of the PDU Session requesting EBI(s) to be assigned.
assignedEbis	array(EbiArpMapping)	M	0..N	This IE shall be present if the AMF assigned the requested EBI(s). This IE shall contain the successfully assigned EBIs.
failedArpList	array(Arp)	C	0..N	This IE shall be present if the AMF fails to allocate EBIs for a set of ARP(s).
releasedEbiList	array(EpsBearerId)	C	0..N	This IE shall be present if the NF Service Consumer requested the release of EBI(s). This IE shall contain the list of EBI(s) released at the AMF.

6.1.6.2.7 Type: AssignEbiFailed

Table 6.1.6.2.7-1: Definition of type AssignEbiFailed

Attribute name	Data type	P	Cardinality	Description
pduSessionId	PduSessionId	M	1	Represents the identifier of the PDU Session requesting EBI(s) to be assigned.
failedArpList	array(Arp)	C	0..N	This IE shall be present if the AMF fails to allocate EBIs for a set of ARPs.

6.1.6.2.8 Type: UEContextRelease

Table 6.1.6.2.8-1: Definition of type UEContextRelease

Attribute name	Data type	P	Cardinality	Description
supi	Supi	C	0..1	This IE shall be present if the UE is emergency registered and the SUPI is not authenticated.
unauthenticatedSupi	boolean	C	0..1	When present, this IE shall be set as follows: - true: unauthenticated SUPI; - false (default): authenticated SUPI. This IE shall be present if the SUPI is present in the message but is not authenticated and is for an emergency registered UE.
ngapCause	NgApCause	M	1	This IE shall contain the cause value received from the source 5G-AN in the handover Cancel message received over the NGAP interface.

6.1.6.2.9 Type: N2InformationTransferReqData

Table 6.1.6.2.9-1: Definition of type N2InformationTransferReqDataTransfer

Attribute name	Data type	P	Cardinality	Description
tai	Tai	C	0..N	This IE shall be included if the N2 information needs to be sent to the 5G-AN nodes that serve the list of tracking areas provided.
ecgi	Ecgi	C	0..N	This IE shall be included if the N2 information needs to be sent to the 5G-AN nodes that correspond to the list of EUTRA cell Ids provided.
ncgi	Ncgi	C	0..N	This IE shall be included if the N2 information needs to be sent to the 5G-AN nodes that correspond to the list of NR cell Ids provided.
globalRanNodeId	array(GlobalRanNodeId)	C	0..N	This IE shall be included if the N2 information needs to be sent to the list of RAN nodes provided.
n2Information	N2InfoContainer	M	1	This IE includes the information to be sent on the N2 interface to the identified 5G-AN nodes and additional information required for the processing of the message by the AMF.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.1.8 is supported.

6.1.6.2.10 Type: NonUeN2InfoSubscriptionCreateData

Table 6.1.6.2.10-1: Definition of type NonUeN2InfoSubscriptionCreateData

Attribute name	Data type	P	Cardinality	Description
globalRanNodeId	array(GlobalRanNodeId))	C	0..N	This IE shall be included if the subscription is for N2 information from RAN node(s) for which the N2 information notification is subscribed (i.e N3IWF identifier or gNB identifier or Ng-eNB identifier).
anType	array(AccessType)	C	0..N	This IE shall be included, if the globalRanNodeId IE is not included and if the N2 information from a specific access network needs to be subscribed. When included this IE shall contain the access type of the access network from which Non UE specific N2 information is to be notified.
n2InformationClass	N2InformationClass	M	1	This IE represents the class of N2 information that the NF Service Consumer requires to be notified.
n2NotifyCallbackUri	Uri	M	1	This IE represents the callback URI on which the N2 information shall be notified.
lmfId	NfInstanceId	C	0..1	This IE shall be present if the subscription is for "NRPPa" N2 information class and/or "LPP" N1 information class. When present, this IE shall carry the value to be used for NGAP "Routing ID" IE, which identifies the LMF handling the NRPPa and/or LPP data.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.1.8 is supported.

6.1.6.2.11 Type: NonUeN2InfoSubscriptionCreatedData

Table 6.1.6.2.11-1: Definition of type NonUeN2InfoSubscriptionCreatedData

Attribute name	Data type	P	Cardinality	Description
n2NotifySubscriptionId	string	M	1	Represents the Id created by the AMF for the subscription to notify a non UE related N2 information.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.1.8 is supported.

6.1.6.2.12 Type: UeN1N2InfoSubscriptionCreateData

Table 6.1.6.2.12-1: Definition of type UeN1N2InfoSubscriptionCreateData

Attribute name	Data type	P	Cardinality	Description
n2InformationClass	N2InformationClass	C	1	This IE shall be present if the NF service consumer subscribes for a N2 information notification. This IE represents the class of N2 information that the NF Service Consumer requires to be notified.
n2NotifyCallbackUri	Uri	C	1	This IE shall be present if the NF service consumer subscribes for a N2 information notification. This IE represents the callback URI on which the N2 information shall be notified.
n1MessageClass	N1MessageClass	C	1	This IE shall be present if the NF service consumer subscribes for a N1 message notification. This IE represents the class of N1 message that the NF Service Consumer requires to be notified.
n1NotifyCallbackUri	Uri	C	1	This IE shall be present if the NF service consumer subscribes for a N1 message notification. This IE represents the callback URI on which the N1 message shall be notified.
lmfId	NfInstanceId	C	0..1	This IE shall be present if the subscription is for "NRPPa" N2 information class and/or "LPP" N1 information class. When present, this IE shall carry the value to be used for NGAP "Routing ID" IE, which identifies the LMF handling the NRPPa and/or LPP data.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.1.8 is supported.

6.1.6.2.13 Type: UeN1N2InfoSubscriptionCreatedData

Table 6.1.6.2.13-1: Definition of type UeN1N2InfoSubscriptionCreatedData

Attribute name	Data type	P	Cardinality	Description
n1n2NotifySubscriptionId	string	M	1	Represents the Id created by the AMF for the subscription to notify a UE related N1/N2 information.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.1.8 is supported.

6.1.6.2.14 Type: N2InformationNotification

Table 6.1.6.2.14-1: Definition of type N2InformationNotification

Attribute name	Data type	P	Cardinality	Description
n2NotifySubscriptionId	string	M	1	Represents the subscription Id for which the notification is generated. The NF Service Consumer uses this to co-relate the notification against a corresponding subscription.
n2InfoContainer	N2InfoContainer	M	1	Contains the N2 information related to the corresponding N2 information class.
lcsCorrelationId	CorelationID	O	0..1	If the N2 information notified is for LCS procedures, the NF Service Producer (e.g. AMF) may include an LCS co-relation identifier.

6.1.6.2.15 Type: N2InfoContainer

Table 6.1.6.2.15-1: Definition of type N2InfoContainer

Attribute name	Data type	P	Cardinality	Description
n2InformationClass	N2InformationClass	M	1	This IE represents the class of N2 information to be transferred.
smInfo	array(N2SmInformation)	C	0..N	This IE shall be present if session management N2 information is to be transferred. When present, it represents a session management SMF related N2 information data part.
nrppaInfo	NrppaInformation	C	0..1	This IE shall be present if location service related N2 information is to be transferred. When present, it represents a NRPPa related N2 information data part.
pwsInfo	PwsInformation	C	0..1	This IE shall be present if PWS related N2 information is to be transferred.
areaOfValidity	AreaOfValidity	O	0..1	This IE represents the list of TAs where the provided N2 information is valid. See subclause 5.2.2.2.7 and 4.2.3.3 of 3GPP TS 23.502 [3].

6.1.6.2.16 Type: N1MessageNotification

Table 6.1.6.2.16-1: Definition of type N1MessageNotification

Attribute name	Data type	P	Cardinality	Description
n1NotifySubscriptionId	string	M	1	Represents the subscription Id for which the notification is generated. The NF Service Consumer uses this to co-relate the notification against a corresponding subscription.
n1MessageContainer	N1MessageContainer	M	1	Contains the N1 message class and N1 message content.
lcsCorrelationId	CorelationID	O	0..1	If the N1 message notified is for LCS procedures, the NF Service Producer (e.g. AMF) may include an LCS co-relation identifier.
registrationCtxtContainer	RegistrationContextContainer	C	0..1	If the N1 message notified is of type 5GMM (i.e. during Registration with AMF re-allocation procedure), the NF Service Producer (e.g. AMF) shall include this IE, if available.

6.1.6.2.17 Type: N1MessageContainer

Table 6.1.6.2.17-1: Definition of type N1MessageContainer

Attribute name	Data type	P	Cardinality	Description
n1MessageClass	N1MessageClass	M	1	This IE shall contain the N1 message class for the message content specified in n1MessageContent.
n1MessageContent	RefToBinaryData	M	1	This IE shall reference the N1 message binary data corresponding to the n1MessageClass. See 3GPP TS 24.501 [11]. See subclause 6.1.6.4.2.
lmfId	NfInstanceId	C	0..1	This IE shall be present when the n1MessageClass IE is set to "LPP". When present, this IE shall carry the identifier of the LMF sending or receiving the LPP data.

6.1.6.2.18 Type: N1N2MessageData

Table 6.1.6.2.18-1: Definition of type N1N2MessageData

Attribute name	Data type	P	Cardinality	Description
n1MessageContainer	N1MessageContainer	C	0..1	This IE shall be included if a N1 message needs to be transferred.
n2InfoContainer	N2InfoContainer	C	0..1	This IE shall be included if a N2 information needs to be transferred.
lastMsgIndication	boolean	O	0..1	This flag when present shall indicate that the message transferred is the last message. (See subclause 4.13.3.3 of 3GPP TS 23.502 [2].
sessionId	string	O	0..1	This IE when present shall indicate the session Id for which the N1 / N2 message is initiated. The Session Id shall be set to the following depending on type of N1 / N2 message class: - PDU Session ID if the N1 / N2 message class is SM; - LCS Co-relation ID if the N1 message class is LPP (see subclause 4.13.5.4 of 3GPP TS 23.502 [2]);
anType	AccessType	O	0..1	This IE when present shall indicate the access network towards which the N1 / N2 message need to be transferred.
ppi	Ppi	O	0..1	This IE when present shall indicate the Paging policy to be applied. The paging policies are configured at the AMF. This IE shall not be present if the anType IE is “NON_3GPP_ACCESS”.
arp	Arp	O	0..1	This IE when present shall indicate the Allocation and Retention Priority of the PDU session for which the N1/N2 message transfer is initiated. This IE shall not be present when the N1/N2 message class is not SM.
5qi	5qi	O	0..1	This IE when present shall indicate the 5QI associated with the PDU session for which the N1 / N2 message transfer is initiated. This IE shall not be present when the N1/N2 message class is not SM.
n1n2FailureTxfNotifURI	Uri	O	0..1	If included, this IE represents the callback URI on which the AMF shall notify the N1/N2 message transfer failure.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.1.8 is supported.

6.1.6.2.19 Type: N1N2MessageTransferRspData

Table 6.1.6.2.19-1: Definition of type N1N2MessageTransferRspData

Attribute name	Data type	P	Cardinality	Description
cause	N1N2MessageTransferCause	M	1	This IE shall provide the result of the N1/N2 message transfer processing at the AMF.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.1.8 is supported.

6.1.6.2.20 Type: RegistrationContextContainer

Table 6.1.6.2.20-1: Definition of type RegistrationContextContainer

Attribute name	Data type	P	Cardinality	Description
ueContext	UeContext	M	1	This IE shall contain the UE Context information.
localTimeZone	TimeZone	O	0..1	This IE contains the time zone UE is currently located.
anType	AccessType	M	0..1	This IE shall contain the current access type of the UE.
anN2IPv4Address	Ipv4Addr	C	0..1	If the Access Network N2 interface is using IPv4 address, this IE shall be included.
anN2IPv6Addr	Ipv6Addr	C	0..1	If the Access Network N2 interface is using IPv6 address, this IE shall be included.
allowedNssai	AllowedNssai	O	0..1	This IE contains the allowed NSSAI of the UE. This IE also contains the mapped home network S-NSSAI for each allowed S-NSSAI.

6.1.6.2.21 Type: AreaOfValidity

Table 6.1.6.2.21-1: Definition of type AreaOfValidity

Attribute name	Data type	P	Cardinality	Description
taList	Tai	M	0..N	An array of TAI representing the area of validity of the associated N2 information provided.

6.1.6.2.22 Type: RefToBinaryData

Table 6.1.6.2.22-1: Definition of type RefToBinaryData

Attribute name	Data type	P	Cardinality	Description
contentId	string	M	1	This IE shall contain the value of the Content-ID header of the referenced binary body part.

6.1.6.2.23 Type: UeContextTransferReqData

Table 6.1.6.2.23-1: Definition of type UeContextTransferReqData

Attribute name	Data type	P	Cardinality	Description
reason	TransferReason	M	1	Indicate the reason for the UEContextTransfer service request
regRequest	N1MessageContainer	O	0..1	If present, this IE shall refer to the registration request message which triggers the UE Context Transfer. The message class shall be "5GMM" and message content shall be reference to N1 Message Content binary data, See subclause 6.1.6.4.2.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.1.8 is supported.

6.1.6.2.24 Type: UeContextTransferRspData

Table 6.1.6.2.24-1: Definition of type UeContextTransferRspData

Attribute name	Data type	P	Cardinality	Description
ueContext	UeContext	M	1	Represents an individual ueContext resource after the modification is applied.
regCompleteNotifyUri	Uri	M	1	Indicates the callback URI to deliver the notification for completion of UE registration on new AMF, which indicates UE context transfer is successful.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.1.8 is supported.

6.1.6.2.25 Type: UeContext

Table 6.1.6.2.25-1: Definition of type UeContext

Attribute name	Data type	P	Cardinality	Description
supi	Supi	C	0..1	This IE shall be present if available. When present, this IE contains SUPI of the UE.
supiUnauthInd	boolean	C	0..1	This IE shall be present if SUPI is present. When present, it shall indicate whether the SUPI is unauthenticated.
gpsi	array(Gpsi)	C	0..N	This IE shall be present if available. When present, this IE shall contain the GPSI(s) of the UE.
pei	Pei	C	0..1	This IE shall be present if available. When present, this IE shall contain Mobile Equipment Identity of the UE.
groups	array(GroupId)	C	0..N	This IE shall be present if the UE belongs to any subscribed internal group(s). When present, this IE shall list the subscribed internal group(s) to which the UE belongs to.
drxParameter	DrxParameter	C	0..1	This IE shall be present if available. When present, this IE shall contain the DRX parameter of the UE.
subRfsp	RfspIndex	C	0..1	This IE shall be present if available. When present, it shall indicate the subscribed RFSP Index of the UE.
usedRfsp	RfspIndex	C	0..1	This IE shall be present if available. When present, it shall indicate the used RFSP Index of the UE.
smsSupport	SmsSupport	M	1	Indicates whether the UE supports SMS delivery over NAS via 3GPP access, or via non-3GPP access, or via both the 3GPP and non-3GPP access.
smsfId	NfInstanceId	C	0..1	This IE shall be present if the SMS service for UE is activated. When present, it indicates the identifier of the SMSF network function instance serving the UE.
seafData	SeafData	C	0..1	This IE shall be present if available. When present, this IE contains the security data derived from data received from AUSF of the UE.
pcfId	NfInstanceId	C	0..1	This IE shall be present if available. When present, this IE indicates the identity PCF for AM Policy.
hpcfId	NfInstanceId	O	0..1	This IE indicates the identity of PCF for AM Policy in home PLMN, when the UE is roaming.
eventSubscriptions	array(AmfEventSubscription)	C	0..N	This IE shall be present if available. When present, it shall indicate the event subscription(s) targeting the UE.
mmContexts	array(MmContext)	C	0..2	This IE shall be present if available. When present, this IE contains the MM Contexts of the UE.
sessionContexts	array(PduSessionContext)	C	0..N	This IE shall be present if available. When present, this IE contains the PDU Session Contexts of the UE.

6.1.6.2.26 Type: N2SmInformation

Table 6.1.6.2.26-1: Definition of type N2SmInformation

Attribute name	Data type	P	Cardinality	Description
pduSessionId	PduSessionId	M	1	Indicates the PDU Session Identity
n2InfoContent	N2InfoContent	C	0..1	This IE shall be present if a SMF related IE should be transferred. When present, the IE contains one of NGAP SMF related IEs specified in subclause 9.3.4 of 3GPP TS 38.413 [12].
nasPdu	N1MessageContainer	C	0..1	This IE shall be present if NAS messages should be transfer between UE and SMF for session management function. When present, it represents the NAS PDU to be carried over N2 between SMF and AN/UE.
sNssai	Snssai	C	0..1	This IE shall be present if network slice information to be transferred for session management. When present, the IE indicates the network slice the PDU session belongs to.
subjectToHo	boolean	C	0..1	This IE shall be present if n2InfoContent carries a " Handover Required Transfer" IE. When present, it Indicates whether the PDU session shall be subject to handover to the target node.

6.1.6.2.27 Type: N2InfoContent

Table 6.1.6.2.27-1: Definition of type N2InfoContent

Attribute name	Data type	P	Cardinality	Description
ngapMessageType	Uinteger	C	0..1	This IE shall be present if PWS related N2 information is to be transferred. When present, it shall indicate the NGAP Message type of the ngapData. Its value is numeric code of the NGAP Message Type IE type defined in ASN.1.
ngapIeType	Uinteger	C	0..1	This IE shall be present if SM or NRPPa related N2 information is to be transferred. When present, it shall indicate the NGAP IE type of the ngapData. Its value is numeric code of the NGAP IE type defined in ASN.1.
ngapData	RefToBinaryData	M	1	This IE reference the N2 information binary data corresponding to the N2 information class. See subclause 6.1.6.4.3.

6.1.6.2.28 Type: NrppaInformation

Table 6.1.6.2.28-1: Definition of type NrppaInformation

Attribute name	Data type	P	Cardinality	Description
lmfId	NfInstanceId	M	1	This IE shall carry the identifier of the LMF that is sending or receiving the NRPPa data..
nrppaPdu	N2InfoContent	M	1	This IE represents the encoded NGAP NRPPa-PDU IE, which is transparent to AMF.

6.1.6.2.29 Type: PwsInformation

Table 6.1.6.2.29-1: Definition of type PwsInformation

Attribute name	Data type	P	Cardinality	Description
messageIdentifier	Uint16	M	1	Identifies the warning message
serialNumber	Uint16	M	1	identifies a particular message from the source and type indicated by the Message Identifier
pwsContainer	N2InfoContent	M	1	This IE represents the PWS N2 information data part to be relayed between CBCF and AN.
sendN2Container	boolean	O	0..1	This IE shall be present if the AMF is expected to send the n2Information it has received from the RAN nodes to the Service Consumer. When present, it represents the value of *Send-Broadcast-Completed-Area-List* IE or the *Send-Broadcast-Cancelled-Area-List* IE.
omcId	OmcIdentifier	O	0..1	IE shall be present if the AMF is required to write the n2Information it has received from the RAN nodes into trace records on the OMC. When present, it indicates the identifier of OMC.

6.1.6.2.30 Type: N1N2MsgTxfrFailureNotification

Table 6.1.6.2.30-1: Definition of type N1N2MsgTxfrFailureNotification

Attribute name	Data type	P	Cardinality	Description
cause	N1N2MessageTransferCause	M	1	This IE shall provide the result of the N1/N2 message transfer at the AMF.
n1n2MsgDataUri	Uri	M	1	This IE shall contain the N1N2MessageTransfer request resource URI returned in Location header when the message transfer was initiated (See subclause 6.1.3.6.1.3), This IE shall be used by the NF Service Consumer to co-relate the notification against the UE / session for which the earlier N1/N2 message transfer was initiated.

6.1.6.2.31 Type: N1N2MessageTransferError

Table 6.1.6.2.31-1: Definition of type N1N2MessageTransferError

Attribute name	Data type	P	Cardinality	Description
error	ProblemDetails	M	1	This IE shall provide the result of the N1/N2 message transfer processing at the AMF.
errInfo	N2N2MsgTxfrErrDetail	O	0..1	This IE may be included to provide additional information related to the error.

6.1.6.2.32 Type: N1N2MsgTxfrErrDetail

Table 6.1.6.2.32-1: Definition of type N2N2MsgTxfrErrDetail

Attribute name	Data type	P	Cardinality	Description
retryAfter	Uinteger	O	0..1	This IE may be included if the AMF requests the NF Service Consumer to stop sending the N1/N2 message before timeout, and to retry the N1/N2 message transfer request that was rejected after a timeout. The value shall be in seconds. When included, the value shall be set to an estimate of the AMF on how long it will take before the AMF considers paging procedure as completed.
highestPrioArp	Arp	O	0..1	This IE may be included if the "cause" attribute in the ProblemDetails is set to "HIGHER_PRIORITY_REQUEST_ONGOING". When included this IE shall contain the ARP value of the highest priority QoS flow for which currently paging is ongoing. The NF Service Consumer shall not initiate an Namf_Communication_N1N2MessageTransfer operation for the same UE with an ARP value having a lower priority than this or the same priority as this, until the retryAfter timer expires.

6.1.6.2.33 Type: N2InformationTransferRspData

Table 6.1.6.2.33-1: Definition of type N2InformationTransferRspData

Attribute name	Data type	P	Cardinality	Description
result	N2InformationTransferResult	M	1	This IE shall provide the result of the N2 information transfer processing at the AMF.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.1.8 is supported.
pwsRspData	PWSResponseData	C	0..1	This IE shall be present if the n2InformationClass is "PWS" in N2InformationTransferReqData.

6.1.6.2.34 Type: MmContext

Table 6.1.6.2.34-1: Definition of type MmContext

Attribute name	Data type	P	Cardinality	Description
accessType	AccessType	M	1	This IE shall contain the access type of the MM context.
nasSecurityMode	NasSecurityMode	C	0..1	This IE shall be present if available in 3GPP access MM context. When present, this IE shall contain the used NAS security mode of the UE.
nasDownlinkCount	NasCount	C	0..1	This IE shall be present if available in 3GPP access MM context. When present, this IE shall contain the NAS downlink count of the UE.
nasUplinkCount	NasCount	C	0..1	This IE shall be present if available in 3GPP access MM context. When present, this IE shall contain the NAS uplink count of the UE.
5gmmCapability	5gmmCapability	C	0..1	This IE shall be present if available in 3GPP access MM context. When present, this IE shall contain 5G MM capability of the UE.
mobilityRestrictions	MobilityRestrictions	C	0..1	This IE shall be present if available. When present, this IE shall contain the mobility restrictions information of the UE.
ueSecurityCapability	UeSecurityCapability	C	0..1	This IE shall be present if available in 3GPP access MM context. When present, this IE shall contain the UE security capability
s1UeNetworkCapability	S1UeNetworkCapability	C	0..1	This IE shall be present if available in 3GPP access MM context. When present, this IE shall contain the S1 UE network capabilities.
allowedNssai	array(Snssai)	C	0..N	This IE shall be present if available. When present, this IE shall contain the allowed NSSAI for the access type.
nssaiMapping	array(NssaiMapping)	C	0..N	This IE shall be present if available. When present, this IE shall contain the mapping of the allowed NSSAI for the UE.
nsInstances	array(NsiId)	C	0..N	This IE shall be present if available. When present, it shall indicate the Network Slice Instances selected for the UE.

6.1.6.2.35 Type: SeafData

Table 6.1.6.2.35-1: Definition of type SeafData

Attribute name	Data type	P	Cardinality	Description
ngKsi	NgKsi	M	1	Indicates the KSI used for the derivation of the keyAmf sent.
nh	string	M	1	Indicates the Next Hop value used for the key derivation. The value is encoded as a string of hexadecimal characters. Pattern: '^[A-Fa-f0-9]$'
ncc	Uinteger	M	1	Indicates the NH Chaining Counter. Minimum is 0 and Maximum is 7.
keyAmf	KeyAmf	M	1	Indicates the K_{amf} or K'_{amf}
keyAmfChangeInd	boolean	C	0..1	This IE shall be included, with a value "true", if the source AMF has activated a new 5G NAS security context with a new K_{AMF}, different from the 5G NAS security context on which the currently active 5G AS security context is based, but has not yet successfully performed a UE Context Modification procedure.
Input (FFS)	Input (FFS)	C	0..1	Indicates the <Input> when keyAmf is K'_{amf}

Editor's Note: The <Input> parameter should be aligned with 33.501[x] which is FFS.

6.1.6.2.36 Type: NasSecurityMode

Table 6.1.6.2.36-1: Definition of type NasSecurityMode

Attribute name	Data type	P	Cardinality	Description
integrityAlgorithm	IntegrityAlgorithm	M	1	Indicates the integrity protection algorithm
cipheringAlgorithm	CipheringAlgorithm	M	1	Indicates the ciphering algorithm

6.1.6.2.37 Type: PduSessionContext

Table 6.1.6.2.37-1: Definition of type PduSessionContext

Attribute name	Data type	P	Cardinality	Description
pduSessionId	PduSessionId	M	1	Indicates the identifier of the PDU Session.
smContextRef	Uri	M	1	Indicates the SM context reference.
sNssai	Snssai	M	1	Indicates the associated S-NSSAI for the PDU Session.
dnn	Dnn	M	1	Indicates the Data Network Name.
accessType	AccessType	M	1	Indicates the access type of the PDU session.
allocatedEbiList	array(EpsArpMapping)	M	1..N	This IE shall contain the EBIs currently allocated to the PDU session.
hsmfId	NfInstanceId	C	0..1	This IE shall be present for non-roaming and home-routed PDU sessions. When present, it shall indicate the associated home SMF for the PDU Session.
vsmfId	NfInstanceId	C	0..1	This IE shall be present if roaming PDU sessions. When present, it shall indicate the associated visit SMF for the PDU Session.
nsInstance	NsiId	C	1	This IE shall be present if available. When present, this IE shall Indicate Network Slice Instance for the PDU Session

6.1.6.2.38 Type: NssaiMapping

Table 6.1.6.2.38-1: Definition of type NssaiMapping

Attribute name	Data type	P	Cardinality	Description
mappedSnssai	Snssai	M	1	Indicates the mapped S-NSSAI in the serving PLMN
hSnssai	Snssai	M	1	Indicates the S-NSSAI in home PLMN

6.1.6.2.39 Type: UERegCompleteNotifData

Table 6.1.6.2.39-1: Definition of type UERegCompleteNotifData

Attribute name	Data type	P	Cardinality	Description
transferStatus	UeContextTransferStatus	M	1	This IE shall indicate if the previous UE context transfer was completed.

6.1.6.2.40 Type: AssignEbiError

Table 6.1.6.2.40-1: Definition of type AssignEbiError

Attribute name	Data type	P	Cardinality	Description
error	ProblemDetails	M	1	Represents the application error information. The application level error cause shall be encoded in the "cause" attribute.
failureDetails	AssignEbiFailed	M	1	Describes the details of the failure including the list of ARPs for which the EBI assignment failed.

6.1.6.2.41 Type: UeContextCreateData

Table 6.1.6.2.41-1: Definition of type UeContextCreateData

Attribute name	Data type	P	Cardinality	Description
ueContext	UeContext	M	1	Represents an individual ueContext resource to be created
targetId	NgRanTargetId	M	1	Represents the identification of target RAN
sourceToTargetData	N2InfoContainer	M	1	This IE shall be included to contain the "Source to Target Transparent Container" if the message is used for N2 based handover procedure
pduSessions	N2SmInformation	M	1..N	This IE shall represent the information of PDN session(s) for handover
ngapCause	NgApCause	C	0..1	This IE shall be present, if available. When present, it shall represent the NGAP Cause received from RAN.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.1.8 is supported.

6.1.6.2.42 Type: UeContextCreatedData

Table 6.1.6.2.42-1: Definition of type UeContextCreatedData

Attribute name	Data type	P	Cardinality	Description
ueContext	UeContext	M	1	Represents the newly created individual ueContext resource
targetToSourceData	N2InfoContainer	M	1	This IE shall contain the "Target to Source Transparent Container".
pduSessions	array(N2SmInformation)	M	1..N	This IE shall indicate the information of PDN Session(s) for handover.
ngapCause	NgApCause	C	0..1	This IE shall be present, if available. When present, it shall represent the NGAP cause received from RAN.
failedSessions	array(PduSessionId)	C	0..N	This IE shall be included to contain the PDN Session Id list of PDU Sessions failed to be setup, if any.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.1.8 is supported.

6.1.6.2.43 Type: UeContextCreateError

Table 6.1.6.2.43-1: Definition of type UeContextCreateError

Attribute name	Data type	P	Cardinality	Description
error	ProblemDetails	M	1	Represents the detailed application error information. The application level error cause shall be encoded in the "cause" attribute.
ngapCause	NgApCause	C	0..1	This IE shall be present, if available. When present, it shall represent the NGAP Cause received from RAN.

6.1.6.2.44 Type: NgRanTargetId

Table 6.1.6.2.44-1: Definition of type NgRanTargetId

Attribute name	Data type	P	Cardinality	Description
ranNodeId	NgRanIdentifier	M	1	Indicates the identity of the RAN node.

Editor's Note: Regular expression pattern should be provided for "ranNodeId".

6.1.6.2.45 Type: N2InformationTransferError

Table 6.1.6.2.45-1: Definition of type N2InformationTransferError

Attribute name	Data type	P	Cardinality	Description
error	ProblemDetails	M	1	More information on the error shall be provided in the "cause" attribute of the "ProblemDetails" structure.
pwsErrorInfo	PWSErrorData	C	0..1	This IE shall be present if the n2InformationClass is "PWS" in N2InformationTransferReqData.

6.1.6.2.46 Type: PWSResponseData

Table 6.1.6.2.46-1: Definition of type PWSResponseData

Attribute name	Data type	P	Cardinality	Description
ngapMessageType	Uinteger	M	1	This IE shall identify the message type of the message being sent. See 3GPP TS 38.413 [12]. Its value is the numeric code of the NGAP Message Type IE type defined in ASN.1.
serialNumber	Uint16	M	1	This IE shall contain the Serial Number of the associated PWS response message.
messageIdentifier	Integer	M	1	This IE shall contain the Message Identifier of the associated PWS response message.
unknownTAIList	array(Tai)	O	0..N	This IE shall contain the Unknown Tracking Area List which may be present in the associated PWS response message.

6.1.6.2.47 Type: PWSErrorData

Table 6.1.6.2.47-1: Definition of type PWSErrorData

Attribute name	Data type	P	Cardinality	Description
namfCause	Integer	M	1	Represents the cause value for the error that the AMF detected. See subclause 4.3.4.3.2 of 3GPP TS 29.168 [21].

6.1.6.2.48 Type: GlobalRanNodeId

Table 6.1.6.2.48-1: Definition of type GlobalRanNodeId

Attribute name	Data type	P	Cardinality	Description
plmnId	PlmnId	M	1	Indicates the identity of the PLMN that the RAN node belongs to.
n3IwfId	string	C	0..1	This IE shall be included if the RAN node belongs to non 3GPP access (i.e a N3IWF). If included, this IE shall contain the FQDN of the N3IWF.
ngRanNodeId	NgRanIdentifier	C	0..1	This IE shall be included if the RAN node belongs to 3GPP access type (i.e gNB / Ng-eNB). If included, this IE shall include the identity of the RAN node.

6.1.6.2.49 Type: NgKsi

Table 6.1.6.2.49-1: Definition of type NgKsi

Attribute name	Data type	P	Cardinality	Description
tsc	ScType	M	1	Indicates whether the security context type is native or mapped.
ksi	Uinteger	M	1	Indicates the key set identifier value. Minimum is 0 and Maximum is 6.

6.1.6.2.50 Type: KeyAmf

Table 6.1.6.2.50-1: Definition of type KeyAmf

Attribute name	Data type	P	Cardinality	Description
keyType	KeyAmfType	M	1	Indicates whether the keyAmf represents K_{amf} or $K'_{amf.}$
keyVal	string	M	1	Indicates the key value. The key value is encoded as a string of hexadecimal characters. Pattern: '^[A-Fa-f0-9]$'

6.1.6.3 Simple data types and enumerations

6.1.6.3.1 Introduction

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

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
EpsBearerId	Uinteger	Unsigned integer identifying an EPS bearer, within the range 0 to 15, as specified in 3GPP TS 24.007 [15].
NgApCause	Uinteger	This represents the NG AP cause code values as specified in 3GPP TS 38.413 [12].
NgRanIdentifier	string	This represents the identifier of the NG RAN node. The string shall be formatted with following pattern: 'gNB-[A-Fa-f0-9]{6,8}| Macro-[A-Fa-f0-9]{5}| LMacro-[A-Fa-f0-9]{6}| SMacro-[A-Fa-f0-9]{5}' The value of the RAN Node ID shall be encoded in hexadecimal representation. Each character in the string shall take a value of "0" to "9" or "A" to "F" and shall represent 4 bits. The most significant character representing the 4 most significant bits of the RAN Node ID shall appear first in the string, and the character representing the 4 least significant bit of the RAN Node ID shall appear last in the string. Examples: "gNB-382A3F47" indicates a gNB ID with value 0x382A3F47 "sMacro-F4B89" indicates a Short Macro Ng-eNB ID with value 0xF4B89
Ppi	Uinteger	This represents the Paging Policy Indication. The value is within the range 0 – 63.
NasCount	Uinteger	Unsigned integer identifying the NAS COUNT as specified in 3GPP TS 33.501[x]
5gmmCapability	Bytes	String with format "byte" as defined in OpenAPI Specification [23], i.e. base64-encoded characters, encoding the "5GMM capability" IE as specified in subclause 9.8.3.1 of 3GPP TS 24.501 [11].
UeSecurityCapability	Bytes	String with format "byte" as defined in OpenAPI Specification [23], i.e. base64-encoded characters, encoding the " UE security capability" IE as specified in subclause 9.8.3.55 of 3GPP TS 24.501 [11].
S1UeNetworkCapability	Bytes	String with format "byte" as defined in OpenAPI Specification [23], i.e. base64-encoded characters, encoding the " S1 UE network capability" IE as specified in subclause 9.8.3.44 of 3GPP TS 24.501 [11].
DrxParameter	Bytes	String with format "byte" as defined in OpenAPI Specification [23], i.e. base64-encoded characters, encoding the "DRX Parameters" IE as specified in subclause 10.5.5.6 of 3GPP TS 24.008 [22]
OmcIdentifier	String minLength: 1 maxLength: 20	The OMC Identifier indicates the identity of an Operation and Maintenance Centre to which Trace Records shall be sent.

6.1.6.3.3 Enumeration: StatusChange

Table 6.1.6.3.3-1: Enumeration StatusChange

Enumeration value	Description
"AMF_UNAVAILABLE"	The AMF is unavailable to serve the UEs identified by the GUAMI(s).
"AMF_AVAILABLE"	The AMF is available to serve the UEs identified by the GUAMI(s).

6.1.6.3.4 Enumeration: N2InformationClass

Table 6.1.6.3.4-1: Enumeration N2InformationClass

Enumeration value	Description
"SM"	N2 SM information.
"NRPPa"	N2 NRPPa information.
"PWS"	N2 PWS information of PWS type.
"PWS-BCAL"	N2 Broadcast Completed Area List or the Broadcast Cancelled Area List.
"PWS-RF"	N2 Restart Indication or Failure Indication

6.1.6.3.5 Enumeration: N1MessageClass

Table 6.1.6.3.5-1: Enumeration N1MessageClass

Enumeration value	Description
"5GMM"	The whole NAS message as received (for e.g. used in forwarding the Registration message to target AMF during Registration procedure with AMF redirection).
"SM"	The N1 message of SM type
"LPP"	The N1 message of LPP type.
"SMS"	The N1 message of SMS type.

6.1.6.3.6 Enumeration: N1N2MessageTransferCause

Table 6.1.6.3.6-1: Enumeration N1N2MessageTransferCause

Enumeration value	Description
"ATTEMPTING_TO_REACH_UE"	This cause code represents the case where the AMF has initiated paging to reach the UE in order to deliver the N1 message.
"N1_N2_TRANSFER_INITIATED"	This cause code represents the case where the AMF has initiated the N1/N2 message transfer towards the UE and/or the AN.
"WAITING_FOR_ASYNCHRONOUS_TRANSFER"	This cause code represents the case where the AMF has stored the N1/N2 message due to Asynchronous Transfer.

6.1.6.3.7 Enumeration: UeContextTransferStatus

Table 6.1.6.3.7-1: Enumeration UeContextTransferStatus

Enumeration value	Description
"TRANSFERRED"	Indicates a UE Context Transfer procedure is completed successful for the individual ueContext resource
"NOT_TRANSFERRED"	Indicates a UE Context Transfer procedure either did not complete successfully or the Registration request from the UE is redirected to another NF Service Consumer (e.g. AMF).

6.1.6.3.8 Enumeration: N2InformationTransferResult

Table 6.1.6.3.8-1: Enumeration N2InformationTransferResult

Enumeration value	Description
"N2_INFO_TRANSFER_INITIATED"	This cause code represents the case where the AMF has initiated the N2 information transfer towards the AN.

6.1.6.3.9 Enumeration: CipheringAlgorithm

Table 6.1.6.3.9-1: Enumeration CipheringAlgorithm

Enumeration value	Description
"NEA0"	Null ciphering algorithm
"NEA1"	128-bit SNOW 3G based algorithm
"NEA2"	128-bit AES based algorithm
"NEA3"	128-bit ZUC based algorithm

6.1.6.3.10 Enumeration: IntegrityAlgorithm

Table 6.1.6.3.10-1: Enumeration IntegrityAlgorithm

Enumeration value	Description
"NIA0"	Null Integrity Protection algorithm
"NIA1"	128-bit SNOW 3G based algorithm
"NIA2"	128-bit AES based algorithm
"NIA3"	128-bit ZUC based algorithm

6.1.6.3.11 Enumeration: SmsSupport

Table 6.1.6.3.11-1: Enumeration SmsSupport

Enumeration value	Description
"3GPP"	Support SMS delivery over NAS in 3GPP access
"NON_3GPP"	Support SMS delivery via non-3GPP access
"BOTH"	Support SMS delivery over NAS or via non-3GPP access
"NONE"	Don't support SMS delivery

6.1.6.3.12 ScType

Table 6.1.6.3.y1-1: Enumeration ScType

Enumeration value	Description
"NATIVE"	Native security context (for KSI_{AMF})
"MAPPED"	Mapped security context (for KSI_{ASME})

6.1.6.3.13 KeyAmfType

Table 6.1.6.3.y2-1: Enumeration KeyAmfType

Enumeration value	Description
"KAMF"	The K_{amf} value is sent.
"KPRIMEAMF"	The $K'_{amf.}$ value is sent.

6.1.6.3.14 Enumeration: TransferReason

Table 6.1.6.3.x-1: Enumeration TransferReason

Enumeration value	Description
"INIT_REG"	It indicates the AMF requests UE context for initial registration.
"MOBI_REG"	It indicates the AMF requests UE context for mobility registration.
"MOBI_REG_UE_VALIDATED"	It indicates the AMF requests UE context for mobility registration of a validated UE.

6.1.6.4 Binary data

6.1.6.4.1 Introduction

This subclause defines the binary data that shall be supported in a binary body part in an HTTP multipart message (see subclauses 6.1.2.2.2 and 6.1.2.4).

6.1.6.4.2 N1 Message Content

N1 Message shall encode a 5GS NAS message of a specified type (e.g. SM, LPP) as specified in 3GPP TS 24.501 [11], using the vnd.3gpp.5gnas content-type.

N1 Message may encode e.g. the following 5GS NAS messages:

- For message class SM
  - PDU Session Modification Command (see subclause 8.3.8 of 3GPP TS 24.501 [11]) during network initiated PDU session modification procedure (see subclause 4.3.3 of 3GPP TS 23.502 [3]);
  - PDU Session Release Command (see subclause 8.3.13 of 3GPP TS 24.501 [11]) during network initiated PDU session release procedure (see subclause 4.3.4 of 3GPP TS 23.502 [3]).
- For message class LPP
  - UE Positioning Request messages as specified in 3GPP TS 36.355 [13] during UE assisted and UE based positioning procedure (see subclause 4.13.5.4 of 3GPP TS 23.502 [3]).
- For message class 5GMM
  - REGISTRATION REQUEST message as specified in see subclause 8.2.5 of 3GPP TS 24.501 [11], during registration procedures (see subclause 4.2.2.2 of 3GPP TS 23.502 [3]).

6.1.6.4.3 N2 Information Content

6.1.6.4.3.1 Introduction

N2 Information shall encode NG Application Protocol (NGAP) IEs, as specified in subclause 9.4 of 3GPP TS 38.413 [12] (ASN.1 encoded), using the vnd.3gpp.ngap content-type.

6.1.6.4.3.2 NGAP IEs

For N2 information class SM, N2 Information may encode following NGAP SMF related IE specified in 3GPP TS 38.413 [12], as summarized in Table 6.1.6.4.3-1.

Table 6.1.6.4.3-1: N2 Information content for class SM

NGAP IE	Reference (3GPP TS 38.413 [12])	Related NGAP message
PDU Session Resource Setup Request Transfer	9.3.4.1	PDU SESSION RESOURCE SETUP REQUEST
PDU Session Resource Release Command Transfer	9.3.4.3	PDU SESSION RESOURCE RELEASE COMMAND
PDU Session Resource Modify Request Transfer	9.3.4.5	PDU SESSION RESOURCE MODIFY REQUEST
PDU Session Resource Modify Confirm Transfer	9.3.4.9	PDU SESSION RESOURCE MODIFY CONFIRM
Path Switch Request Acknowledge Transfer	9.3.4.11	PATH SWITCH REQUEST ACKNOWLEDGE
Handover Command Transfer	9.3.4.12	HANDOVER COMMAND
Handover Request Transfer	9.3.4.1	HANDOVER REQUEST

For N2 information class RAN, N2 Information may encode one of the following NGAP Transparent Container IEs specified in 3GPP TS 38.413 [12], as summarized in Table 6.1.6.4.3-2.

Table 6.1.6.4.3-2: N2 Information content for class RAN

NGAP IE	Reference (3GPP TS 38.413 [12])	Related NGAP message
Source to Target Transparent Container	9.3.1.20	HANDOVER REQUIRED, HANDOVER REQUEST
Target to Source Transparent Container	9.3.1.21	HANDOVER COMMAND, HANDOVER REQUEST ACKNOWLEDGE

For N2 information class NRPPa, N2 Information may encode the following NGAP NRPPA Transport related IE specified in 3GPP TS 38.413 [12], as summarized in Table 6.1.6.4.3-3

Table 6.1.6.4.3-3: N2 Information content for class NRPPa

NGAP IE	Reference (3GPP TS 38.413 [12])	Related NGAP message
NRPPa-PDU	9.3.3.14	DOWNLINK UE ASSOCIATED NRPPA TRANSPORT UPLINK UE ASSOCIATED NRPPA TRANSPORT DOWNLINK NON UE ASSOCIATED NRPPA TRANSPORT UPLINK NON UE ASSOCIATED NRPPA TRANSPORT

6.1.6.4.3.3 NGAP Messages

For N2 information class PWS, N2 Information shall encode NGAP Messages specified in 3GPP TS 38.413 [12].

Table 6.1.6.4.3.3-1: N2 PWS Request Information content

NGAP message	Reference (3GPP TS 38.413 [12])
WRITE-REPLACE WARNING REQUEST	9.2.8.1
PWS CANCEL REQUEST	9.2.8.3

N2 Information received by the AMF for PWS may be processed by the AMF before re-encoding and transferring to the Service Consumer:

- If a subscription exists for N2InformationClass "PWS-BCAL" and the received N2 Message Type is a WRITE-REPLACE-WARNING-RESPONSE, then the AMF may aggregate the Broadcast Completed Area Lists it has received from the NG-RAN nodes for a message identified by its Serial Number and Message Identifier (see table 6.1.6.4.3-1).

- If a subscription exists for N2InformationClass "PWS-BCAL" and the received N2 Message Type is a PWS-CANCEL-RESPONSE, then the AMF may aggregate the Broadcast Cancelled Area Lists it has received from the NG-RAN nodes for a message identified by its Serial Number and Message Identifier (see table 6.1.6.4.3-1). If an NG-RAN node has responded without a Broadcast Cancelled Area List, then the AMF shall populate the Broadcast Empty Area List with the ngRanId of that NG-RAN node.

Table 6.1.6.4.3.3-2: N2 PWS Response Information content

NGAP message	Reference (3GPP TS 38.413 [12])
WRITE-REPLACE WARNING RESPONSE	9.2.8.2
PWS CANCEL RESPONSE	9.2.8.4

If a subscription exists for N2InformationClass "PWS-BCAL" and the received N2 Message Type is a WRITE-REPLACE-WARNING-RESPONSE, then the AMF may transfer the ASN.1 (re-)encoded Message Type, Message Identifier, Serial Number and the (aggregated) Broadcast Completed Area List in the N2 Info Container in the N2InfoNotify.

If a subscription exists for N2InformationClass "PWS-BCAL" and the received N2 Message Type is a PWS-CANCEL-RESPONSE, then the AMF may transfer the ASN.1 (re-)encoded the Message Type, Message Identifier, Serial Number, the (aggregated) Broadcast Cancelled Area List and Broadcast Empty Area List in the N2 Info Container in the N2InfoNotify.

For the ASN.1 definition for encoding the WRITE-REPLACE-WARNING-RESPONSE and the PWS-CANCEL-RESPONSE, see subclause 9.4 of 3GPP TS 38.413 [12].

If a subscription exists for N2InformationClass "PWS-RF" and the received N2 Message Type is a PWS-RESTART-INDICATION, then the AMF may transfer the ASN.1 encoded string from the PWS-RESTART-INDICATION (see table 6.1.6.4.3-2) in the N2 Info Container in the N2InfoNotify.

If a subscription exists for N2InformationClass "PWS-RF" and the received N2 Message Type is a PWS-FAILURE-INDICATION (see table 6.1.6.4.3-2), then the AMF may transfer the ASN1 encoded string from the PWS-FAILURE-INDICATION in the N2 Info Container in the N2InfoNotify.

Table 6.1.6.4.3.3-3: N2 PWS Indication Information content

NGAP message	Reference (3GPP TS 38.413 [x])
PWS RESTART INDICATION	9.2.8.5
PWS FAILURE INDICATION	9.2.8.6

The Message Type shall be present and encoded as the first N2 PWS Indication IE in any NonUeN2InfoNotify for PWS messages to enable the receiver to decode the N2 PWS IEs

6.1.7 Error Handling

6.1.7.1 General

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

6.1.7.2 Protocol Errors

Protocol Error Handling shall be supported as specified in subclause 5.2.7.2 of 3GPP TS 29.500 [4].

6.1.7.3 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 Namf_Communication service. The following application errors listed in Table 6.1.7.3-1 are specific for the Namf_Communication service.

Table 6.1.7.3-1: Application errors

Application Error	HTTP status code	Description
NF_CONSUMER_REDIRECT_ONE_TXN	307 Temporary Redirect	The request has been asked to be redirected to a specified target.
HANDOVER_FAILURE	403 Forbidden	Creation of UE context in the target AMF failed during Handover procedure causing a failure of handover.
INTEGRITY_CHECK_FAIL	403 Forbidden	Integrity check of the complete registration message included in the UE context transfer request failed.
EBI_EXHAUSTED	403 Forbidden	Allocation of EPS Bearer ID failed due to exhaustion of EBI as the maximum number of EBIs has already been allocated to the UE.
HIGHER_PRIORITY_REQUEST_ONGOING	409 Conflict	Paging triggered N1/N2 transfer cannot be initiated since already there is a paging due to a higher priority session ongoing.
UE_NOT_REACHABLE	504 Gateway Timeout	Paging failed or the UE is not reachable for paging.
UE_IN_NON_ALLOWED_AREA	504 Gateway Timeout	UE is currently in a non-allowed area and hence the N1/N2 message transfer cannot be completed and the N1/N2 message transfer is not related to priority associated with a regulatory prioritized service.
UNSPECIFIED	403 Forbidden	The request is rejected due to unspecified reasons.
CONTEXT_NOT_FOUND	404 Not Found	It is used during the mobility of an existing PDN connection when no corresponding context exist in the SMF.
SUPI_OR_PEI_UNKNOWN	403 Forbidden	The SUPI or PEI included in the message is unknown.

6.1.8 Feature Negotiation

The feature negotiation mechanism specified in subclause 6.6 of 3GPP TS 29.500 [4] shall be used to negotiate the optional features applicable between the AMF and the NF Service Consumer, for the Namf_Communication service, if any.

The NF Service Consumer shall indicate the optional features it supports for the Namf_Communication service, if any, by including the supportedFeatures attribute in payload of the HTTP Request Message for following service operations:

- N1N2MessgeTransfer, as specified in subclause 5.2.2.3.1;
- N1N2MessageSubscribe, as specified in subclause 5.2.2.3.3;
- NonUeN2InfoSubscribe, as specified in subclause 5.2.2.4.2;
- UeContextTransfer, as specified in subclause 5.2.2.2.1;
- CreateUEContext, as specified in subclause 5.2.2.2.3

The AMF shall determine the supported features for the service operations as specified in subclause 6.6 of 3GPP TS 29.500 [4] and shall indicate the supported features by including the supportedFeatures attribute in payload of the HTTP response for the service operation.

The syntax of the supportedFeatures attribute is defined in subclause 5.2.2 of 3GPP TS 29.571 [13].

The following features are defined for the Namf_Communication service.

Table 6.1.8-1: Features of supportedFeatures attribute used by Namf_Communication service

Feature Number	Feature	M/O	Description
Feature number: The order number of the feature within the supportedFeatures attribute (starting with 1). Feature: A short name that can be used to refer to the bit and to the feature. M/O: Defines if the implementation of the feature is mandatory ("M") or optional ("O"). Description: A clear textual description of the feature.			

6.1.9 Security

As indicated in 3GPP TS 33.501 [27], the access to the Namf_Communication API shall be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [28]), using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [29]) plays the role of the authorization server.

An NF Service Consumer, prior to consuming services offered by the Namf_Communication API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [29], subclause 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 Namf_Communication service.

The Namf_Communication API does not define any scopes for OAuth2 authorization.

6.2 Namf_EventExposure Service API

6.2.1 API URI

URIs of this API shall have the following root:

{apiRoot}/{apiName}/{apiVersion}/

where the "apiName" shall be set to "namf-evts" and the "apiVersion" shall be set to "v1" for the current version of this specification.

6.2.2 Usage of HTTP

6.2.2.1 General

HTTP/2, as defined in IETF RFC 7540 [19], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

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

HTTP messages and bodies for the Namf_EventExposure service shall comply with the OpenAPI [23] 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 subclause 5.2.2 of 3GPP TS 29.500 [4].

6.2.2.2.2 Content type

JSON, IETF RFC 8259 [8], shall be used as content type of the HTTP bodies specified in the present specification as specified in subclause 5.4 of 3GPP TS 29.500 [4].

6.2.2.3 HTTP custom headers

6.2.2.3.1 General

In this release of this specification, no custom headers specific to the Namf_EventExposure service are defined. 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

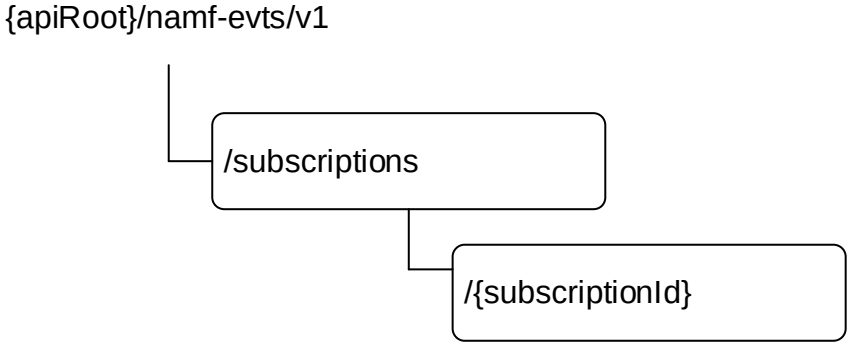

Figure 6.2.3.1-1: Resource URI structure of the Namf_EventExposure API

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	Resource URI	HTTP method or custom operation	Description
Subscriptions collection	.../subscriptions	POST	Mapped to the service operation Subscribe, when to create a subscription
Individual subscription	… /subscriptions/{subscriptionId}	PATCH	Mapped to the service operation Subscribe, when to modify
		DELETE	Mapped to the service operation Unsubscribe

6.2.3.2 Resource: Subscriptions collection

6.2.3.2.1 Description

This resource represents a collection of subscriptions created by NF service consumers of Namf_EventExposure service.

This resource is modelled as the Collection resource archetype (see subclause C.2 of 3GPP TS 29.501 [5]).

6.2.3.2.2 Resource Definition

Resource URI: **{apiRoot}/namf-evts/v1/subscriptions**

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 subclause 6.2.1

6.2.3.2.3 Resource Standard Methods

6.2.3.2.3.1 POST

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 POST method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.2.3.2.3.1-2 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 POST Request Body on this resource

Data type	P	Cardinality	Description
AmfCreateEventSubscription	M	1	Describes of an AMF Event Subscription to be created

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

Data type	P	Cardinality	Response codes	Description
AmfCreatedEventSubscription	M	1	201 Created	Represents successful creation of an AMF Event Subscription
ProblemDetails	M	1	403 Forbidden	Indicates the creation of subscription has failed due to application error. The "cause" attribute shall be set to: - UE_NOT_SERVED_BY_AMF

6.2.3.2.4 Resource Custom Operations

None.

6.2.3.3 Resource: Individual subscription

6.2.3.3.1 Description

This resource represents an individual of subscription created by NF service consumers of Namf_EventExposure service.

This resource is modelled as the Document resource archetype (see subclause C.1 of 3GPP TS 29.501 [5]).

6.2.3.3.2 Resource Definition

Resource URI: **{apiRoot}/namf-evts/v1/subscriptions/{subscriptionId}**

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 subclause 6.2.1
subscriptionId	String identifies an individual subscription to the AMF event exposure service

6.2.3.3.3 Resource Standard Methods

6.2.3.3.3.1 PATCH

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 PATCH method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.2.3.3.3.1-2 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 PATCH Request Body on this resource

Data type	P	Cardinality	Description
AmfUpdateEventSubscriptionItem	M	1..N	Document describes the modification(s) to a AMF Event Subscription

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

Data type	P	Cardinality	Response codes	Description
AmfUpdatedEventSubscription	M	1	200 OK	Represents a successful update on AMF Event Subscription
ProblemDetails	M	1	403 Forbidden	Indicates the modification of subscription has failed due to application error. The "cause" attribute shall be set to: - UE_NOT_SERVED_BY_AMF
ProblemDetails	M	1	404 Not Found	Indicates the modification of subscription has failed due to application error. The "cause" attribute shall be set to: - SUBSCRIPTION_NOT_FOUND

6.2.3.3.3.2 DELETE

This method shall support the URI query parameters specified in table 6.2.3.3.3.2-1.

Table 6.2.3.3.3.2-1: 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 6.2.3.3.3.2-2 and the response data structures and response codes specified in table 6.2.3.3.3.2-3.

Table 6.2.3.3.3.2-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.2.3.3.3.2-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			200 OK	
ProblemDetails	M	1	404 Not Found	Indicates the modification of subscription has failed due to application error. The "cause" attribute shall be set to: - SUBSCRIPTION_NOT_FOUND.

6.2.3.3.4 Resource Custom Operations

None.

6.2.4 Custom Operations without associated resources

There are no custom operations without associated resources supported on Namf_EventExposure Service.

6.2.5 Notifications

6.2.5.1 General

6.2.5.2 AMF Event Notification

If a NF service consumer has subscribed to an event(s) supported by Namf_EventExposure service, when AMF aware of a state change of the event, AMF shall create a notification including the event state report, and shall deliver the notification to the call-back URI, following Subscribe/Notify mechanism defined in 3GPP TS 29.501 [2].

6.2.5.2.1 Notification Definition

Call-back URI: **{callbackUri}**

Call-back URI is provided by NF Service Consumer during creation of the subscription. If the notification is to inform the change of subscription ID and if the "subsChangeNotifyUri" was provided in the AmfEventSubscription, then this callback URI shall be the "subsChangeNotifyUri" provided in the AmfEventSubscription. Otherwise, this callback URI shall be the "eventNotifyUri" provided in the AmfEventSubscription.

6.2.5.2.3 Notification Standard Methods

6.2.5.2.3.1 POST

This method shall support the request data structures specified in table 6.2.5.2.3.1-1 and the response data structures and response codes specified in table 6.2.5.2.3.1-2.

Table 6.2.5.2.3.1-2: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
AmfEventNotification	M	1	Represents the notification to be delivered

Table 6.2.5.2.3.1-3: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	

6.2.6 Data Model

6.2.6.2 General

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

Table 6.2.6.2-1 specifies the data types defined for the Namf_EventExposure service based interface protocol.

Table 6.2.6.2-1: Namf_EventExposure specific Data Types

Data type	Section defined	Description
AmfEventSubscription	6.2.6.2.2	Represents an individual event subscription resource on AMF
AmfEvent	6.2.6.2.3	Describes an event to be subscribed
AmfEventNotification	6.2.6.2.4	Represents a notification generated by AMF to be delivered
AmfEventReport	6.2.6.2.5	Represents a report triggered by a subscribed event type, except the report triggered by UES_IN_AREA_REPORT event type
AmfEventMode	6.2.6.2.6	Describes how the reports shall be generated by a subscribed event
AmfEventState	6.2.6.2.7	Represents the state of a subscribed event
RmInfo	6.2.6.2.9	Represents the registration state of a UE for an access type
CmInfo	6.2.6.2.10	Represents the connectivity state of a UE for an access type
SubscribedData	6.2.6.2.11	Represents the subscribed data received from UDM
CommunicationFailure	6.2.6.2.12	Describes a communication failure detected by AMF
AmfCreateEventSubscription	6.2.6.2.13	Describes of an AMF Event Subscription to be created
AmfCreatedEventSubscription	6.2.6.2.14	Represents successful creation of an AMF Event Subscription
AmfUpdateEventSubscriptionItem	6.2.6.2.15	Document describes the modification(s) to an AMF Event Subscription
AmfUpdatedEventSubscription	6.2.6.2.16	Represents a successful update on an AMF Event Subscription
AmfEventArea	6.2.6.2.17	Represents an area to be monitored by an AMF event.
AmfEventType	6.2.6.3.3	Describes the supported event types of Namf_EventExposure Service
AmfEventTrigger	6.2.6.3.4	Describes how AMF should generate the report for the event
LocationFilter	6.2.6.3.5	Describes the supported filters of LOCATION_REPORT event type
SubscribedDataFilter	6.2.6.3.6	Describes the supported filters of SUBSCRIBED_DATA_REPORT event type
UeReachability	6.2.6.3.7	Describes the reachability of the UE
PresenceState	6.2.6.3.8	Describes the presence state of the UE to a specified area of interest
RmState	6.2.6.3.9	Describes the registration management state of a UE
CmState	6.2.6.3.10	Describes the connectivity management state of a UE

Table 6.2.6.2-2 specifies data types re-used by the Namf_EventExposure 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 Namf_EventExposure service based interface.

Table 6.2.6.2-2: Namf_EventExposure re-used Data Types

Data type	Reference	Comments
Supi	3GPP TS 29.571 [6]	
GroupId	3GPP TS 29.571 [6]	
DurationSec	3GPP TS 29.571 [6]	
Gpsi	3GPP TS 29.571 [6]	
Uri	3GPP TS 29.571 [6]	
Pei	3GPP TS 29.571 [6]	
UserLocation	3GPP TS 29.571 [6]	
TaI	3GPP TS 29.571 [6]	
GlobalRanNodeId	6.1.6.2.51	
TimeZone	3GPP TS 29.571 [6]	
AccessType	3GPP TS 29.571 [6]	
Ecgi	3GPP TS 29.571 [6]	EUTRA Cell Identifier
Ncgi	3GPP TS 29.571 [6]	NR Cell Identifier
NfInstanceId	3GPP TS 29.571 [6]	
ProblemDetails	3GPP TS 29.571 [6]	Problem Details
SupportedFeatures	3GPP TS 29.571 [6]	Supported Features
NgApCause	6.1.6.3.2	

6.2.6.2 Structured data types

6.2.6.2.1 Introduction

Structured data types used in Namf_EventExposure service are specified in this clause.

6.2.6.2.2 Type: AmfEventSubscription

Table 6.2.6.2.2-1: Definition of type AmfEventSubscription

Attribute name	Data type	P	Cardinality	Description
events	array(AmfEvent)	M	1..N	Describes the events to be subscribed for this subscription.
notifyUri	Uri	M	1	Identifies the recipient of notifications sent by AMF for this subscription
notifyCorelationId	string	M	1	Identifies the notification co-relation ID. The AMF shall include this ID in the notifications.
nfId	NfInstanceId	M	1	Indicates the instance identity of the network function creating the subscription.
subsChangeNotifyUri	Uri	C	1	This IE shall be present if the subscription is created by an NF service consumer on behalf of another NF (e.g UDM creating event subscription at AMF for event notifications towards NEF). When present, this IE Identifies the recipient of notifications sent by AMF for change of subscription ID (e.g during mobility procedures involving AMF change).
supi	Supi	C	0..1	Subscription Permanent Identifier (NOTE)
groupId	GroupId	C	0..1	Identifies a group of UEs. (NOTE)
gpsi	Gpsi	C	0..1	Generic Public Subscription Identifier (NOTE)
pei	Pei	C	0..1	Permanent Equipment Identifier (NOTE)
anyUE	boolean	C	0..1	This IE shall be present if the event subscription is applicable to any UE. Default value "FALSE" is used, if not present (NOTE)
NOTE: Either information about a single UE (i.e. SUPI, GPSI, PEI) or groupId, or anyUE set to "TRUE" shall be included.				

6.2.6.2.3 Type: AmfEvent

Table 6.2.6.2.3-1: Definition of type AmfEvent

Attribute name	Data type	P	Cardinality	Description
type	AmfEventType	M	1	Describes the AMF event type to be reported
options	AmfEventMode	M	1	Describes how the reports of the event to be generated.
immediateFlag	boolean	O	0..1	Indicates if an immediate event report in the subscription response indicating current value / status of the event is required or not. If the flag is not present then immediate reporting shall not be done.
area	array(AmfEventArea)	O	0..N	Identifiers the area to be applied to PRESENT_IN_AOI_REPORT and UES_IN_AREA_REPORT event types. More than one instance of AmfEventArea IE shall be used only when the AmfEventArea is provided during event subscription for Presence Reporting Area subscription.
locationFilters	LocationFilter	O	0..N	Describes the filters to be applied for LOCATION_REPORT event type.
subscribedDataFilters	SubscribedDataFilter	O	0..N	Describes the filters to be applied for SUBSCRIBED_DATA_REPORT event type.

6.2.6.2.4 Type: AmfEventNotification

Table 6.2.6.2.4-1: Definition of type AmfEventNotification

Attribute name	Data type	P	Cardinality	Description
subscriptionId	string	M	1	Indicates which subscription generated the event notificaiton. This parameter is generated by the AMF and returned in the "Location" header in HTTP responses during the event subscription. If the event notification is generated by the AMF due to a change of AMF, this parameter shall contain the subscription Id at the new AMF.
notifCorelationId	string	M	1	Indicates the notification co-relation ID provided by the NF service consumer during event subscription. This parameter can be useful if the NF service consumer uses a common call-back URI for multiple subscriptions.
reports	array(AmfEventReport)	C	1..N	This IE shall be present if a event is reported. When present, this IE represents the event reports to be delivered.

6.2.6.2.5 Type: AmfEventReport

Table 6.2.6.2.5-1: Definition of type AmfEventReport

Attribute name	Data type	P	Cardinality	Description
type	AmfEventType	M	1	Describes the type of the event which triggers the report
state	AmfEventState	M	1	Describes the state of the event which triggered the report
anyUe	boolean	C	0..1	This IE shall be included and shall be set to "true", if the event subscription is a bulk subscription for number of UEs and the event reported is for one of those UEs.
supi	Supi	C	0..1	This IE shall be included if the event reported is for a particular UE or any UE. This IE identifies the UE associated to the report (NOTE).
area	array(AmfEventArea)	C	0..N	This IE shall be present when the AMF event type is "PRESENCE_IN_AOI_REPORT". When present, this IE represents the specified Area(s) of Interest the UE is currently IN / OUT / UNKNOWN.
gpsi	Gpsi	O	0..1	This IE may be included if the event reported is for a particular UE or any UE. This IE identifies the GPSI of the UE associated to the report (NOTE).
pei	Pei	O	0..1	This IE may be included if the event reported is for a particular UE or any UE. This IE identifies the PEI of the UE associated to the report (NOTE).
location	UserLocation	O	0..1	Represents the location information of the UE
timezone	TimeZone	O	0..1	Describes the time zone of the UE
accessTypes	AccessType	O	0..N	Describes the access type(s) of the UE
rmInfos	RmInfo	O	0..N	Describes the registration management state of the UE
cmInfos	CmInfo	O	0..N	Describes the connectivity state of the UE
reachability	UeReachability	O	0..1	Describes the reachability of the UE
subscribedData	SubscribedData	O	0..1	Represents the subscribed data of the UE received from UDM
commFailure	CommunicationFailure	O	0..1	Describes a communication failure for the UE.
numberOfUes	integer	O	0..1	Represents the number of UEs in the specified area
NOTE: If the event report corresponds to an event subscription of a single UE, then the same UE identifier (i.e. SUPI and/or GPSI and/or PEI) shall be included in the report. If the event report corresponds to an event subscription for group of UEs or any UE, then the SUPI shall be included in the event report. SUPI, PEI and GPSI shall not be present in report for UES_IN_AREA_REPORT event type.				

6.2.6.2.6 Type: AmfEventMode

Table 6.2.6.2.6-1: Definition of type AmfEventMode

Attribute name	Data type	P	Cardinality	Description
trigger	AmfEventTrigger	M	1	Describes how the reports are triggered.
maxReports	integer	C	0..1	This IE shall be present if the trigger is set to “CONTINUOUS”. When present, this IE describes the maximum number of reports that can be generated by the subscribed event.
duration	DurationSec	O	0..1	Describes the maximum duration after which the subscribed event shall stop generating report. If not present, the subscribed event shall continue generating reports until it is unsubscribed.

6.2.6.2.7 Type: AmfEventState

Table 6.2.6.2.7-1: Definition of type AmfEventState

Attribute name	Data type	P	Cardinality	Description
active	boolean	M	1	Represents the active state of the subscribe event. "TRUE" value indicates the event will continue generating reports; "FALSE" value indicates the event will not generate further report.
remainReports	integer	O	0..1	Represents the number of remain reports to be generated by the subscribed event.
remainDuration	DurationSec	O	0..1	Represents how long the subscribed event will continue generating reports.

6.2.6.2.8 Type: RmInfo

Table 6.2.6.2.8-1: Definition of type RmInfo

Attribute name	Data type	P	Cardinality	Description
rmState	RmState	M	1	Describes the registration management state of the UE
accessType	AccessType	M	1	Describes the access type of the UE that applies to the registration management state reported.

6.2.6.2.9 Type: CmInfo

Table 6.2.6.2.9-1: Definition of type CmInfo

Attribute name	Data type	P	Cardinality	Description
cmState	CmState	M	1	Describes the Connectivity management state of the UE
accessType	AccessType	M	1	Describes the access type of the UE that applies to the Connectivity management state reported.

6.2.6.2.10 Type: SubscribedData

Table 6.2.6.2.10-1: Definition of type SubscribedData

Attribute name	Data type	P	Cardinality	Description
sari	Sari	O	0..1	Represents the Service Area Restriction Information data of the UE received from UDM
rfspIndex	RfspIndex	O	0..1	Represents the RFSP Index of the UE received from UDM

6.2.6.2.11 Type: CommunicationFailure

Table 6.2.6.2.11-1: Definition of type CommunicationFailure

Attribute name	Data type	P	Cardinality	Description
nasReleaseCode	string	O	0..1	Describes the NAS release code for the communication failure. This IE shall be formatted following the regular expression pattern: "^(MM|SM)-[0-9]{1,3}$" Examples: MM-7 SM-27
ranReleaseCode	NgApCause	O	0..1	Describes the RAN release code for the communication failure. If present, this IE shall contain the decimal value of the NG AP cause code values as specified in 3GPP TS 38.413 [12].

6.2.6.2.12 Type: AmfCreateEventSubscription

Table 6.2.6.2.12-1: Definition of type AmfCreateEventSubscription

Attribute name	Data type	P	Cardinality	Description
subscription	AmfEventSubscription	M	1	Represents the AMF Event Subscription resource to be created.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.2.8 is supported.

6.2.6.2.13 Type: AmfCreatedEventSubscription

Table 6.2.6.2.13-1: Definition of type AmfCreatedEventSubscription

Attribute name	Data type	P	Cardinality	Description
subscription	AmfEventSubscription	M	1	Represents the newly created AMF Event Subscription resource.
reports	AmfEventReport	O	0..N	Represents the immediate event reports (i.e. the current value / status of the events subscribed), if available.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.2.8 is supported.

6.2.6.2.14 Type: AmfUpdateEventSubscriptionItem

Table 6.2.6.2.14-1: Definition of type AmfUpdateEventSubscription

Attribute name	Data type	P	Cardinality	Description
op	string	M	1	This IE indicates the patch operation as defined in IETF RFC 6902 [14] to be performed on resource. This IE shall support the following values: - "add" - "replace" - "remove"
path	string	M	1	This IE contains a JSON pointer value (as defined in IETF RFC 6901 [12]) that references a location of a resource on which the patch operation shall be performed. This IE shall contain the JSON pointer to a valid index of the "/events" array in the AMF Event Subscription, formatted with following pattern: '\/events\/[0-]$\|\/events\/[1-9][0-9]*$' Example: "/events/0" stands for the first member of the array; "/events/10" stands for the 11th member of the array; "/event/-" stands for a new (non-existent) member after the last existing array element. Only allowed with "add" operation.
value	AmfEvent	C	0..1	This IE indicates a new AMF event to be added or updated value of an existing AMF event to be modified. It shall be present if the patch operation is "add" or "replace"

6.2.6.2.15 Type: AmfUpdatedEventSubscription

Table 6.2.6.2.15-1: Definition of type AmfUpdatedEventSubscription

Attribute name	Data type	P	Cardinality	Description
subscription	AmfEventSubscription	M	1	Represents the updated AMF Event Subscription resource.

6.2.6.2.16 Type: AmfEventArea

Table 6.2.6.2.16-1: Definition of type AmfEventArea

Attribute name	Data type	P	Cardinality	Description
presence	PresenceState	C	0..1	This IE shall be included when the UE presence in area of interest is reported. When present, this IE contains the status of UE presence within the Area of Interest (IN / OUT / UNKNOWN).
trackingAreas	Tai	C	0..N	Represents the list of tracking areas that constitutes the area. This IE shall be present if the subscription is for tracking UE presence in the tracking areas. For non 3GPP access the TAI shall be the N3GPP TAI.
areaId	string	C	0..1	Represents an identifier to the specified area. This IE shall be present if the Area of Interest subscribed is a Presence Reporting Area. (See NOTE)
ladn	string	C	0..1	Represents the Local Access Data Network DNN. This IE shall be present if the Area of Interest subscribed is a LADN service area. The AMF shall identify the list of tracking areas corresponding to the LADN DNN based on local configuration.
ecgi	array(Ecgi)	C	0..N	This IE shall be present if the Area of Interest subscribed is a list of EUTRAN cell Ids.
ncgi	array(Ncgi)	C	0..N	This IE shall be present if the Area of Interest subscribed is a list of NR cell Ids.
globalRanNodeId	array(GlobalRanNodeId)	C	0..N	This IE shall be present if the Area of Interest subscribed is a list of NG RAN node identifiers.
NOTE: When the AmfEventArea is provided during event subscription, then for UE specific presence reporting area subscription, the areaId along with what constitutes that UE specific presence reporting area (i.e. set of Tai and/or set of ecgi and/or set of ncgi and/or set of globalRanNodeId) shall be provided.				

6.2.6.3 Simple data types and enumerations

6.2.6.3.1 Introduction

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

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
5gGuti	string	5G Global Unique Temporary Identifier, defined in subclause 5.9.4 of 3GPP TS 23.501 [2]
Sari	Bytes	Service Area Restriction information
RfspIndex	integer	RFSP Index

6.2.6.3.3 Enumeration: AmfEventType

Table 6.2.6.3.3-1: Enumeration AmfEventType

Enumeration value	Description
"LOCATION_REPORT"	A NF subscribes to this event to receive the Last Known Location of a UE or a group of UEs, and Updated Location of the UE or any UE in the group when AMF becomes aware of a location change of the UE.
"PRESENCE_IN_AOI_REPORT"	A NF subscribes to this event to receive the current present state of a UE in a specific Area of Interest (AOI), and notification when a specified UE enters or leaves the specified area. The area could be identified by a TA list, an area ID or specific interest area name like "LADN".
"TIMEZONE_REPORT"	A NF subscribes to this event to receive the current time zone of a UE or a group of UEs, and updated time zone of the UE or any UE in the group when AMF becomes aware of a time zone change of the UE.
"ACCESS_TYPE_REPORT"	A NF subscribes to this event to receive the current access type(s) of a UE or a group of UEs, and updated access type(s) of the UE or any UE in the group when AMF becomes aware of the access type change of the UE.
"REGISTRATION_STATE_REPORT"	A NF subscribes to this event to receive the current registration state of a UE or a group of UEs, and report for updated registration state of a UE or any UE in the group when AMF becomes aware of a registration state change of the UE.
"CONNECTIVITY_STATE_REPORT"	A NF subscribes to this event to receive the current connectivity state of a UE or a group of UEs, and report for updated connectivity state of a UE or any UE in the group when AMF becomes aware of a connectivity state change of the UE.
"REACHABILITY_REPORT"	A NF subscribes to this event to receive the current reachability of a UE or a group of UEs, and report for updated reachability of a UE or any UE in the group when AMF becomes aware of a reachability change of the UE.
"SUBSCRIBED_DATA_REPORT"	A NF subscribes to this event to receive the current Subscribed Data for the UE(s) received from UDM, and notification when AMF received updated subscribed data for the UE(s) from UDM.
"COMMIUNICATION_FAILURE_REPORT"	A NF subscribes to this event to receive the Communication failure report of a UE or group of UEs or any UE.
"UES_IN_AREA_REPORT"	A NF subscribes to this event to receive the number of UEs in a specific area.

6.2.6.3.4 Enumeration: AmfEventTrigger

Table 6.2.6.3.4-1: Enumeration AmfEventTrigger

Enumeration value	Description
"ONE_TIME"	Defines that AMF should generate report for the event only once. After reporting, the subscription to this event will be terminated.
"CONTINUOUS"	Defines that AMF should continuously generate reports for the event, until the subscription to this event ends, due to end of report duration or the event being unsubscribed explicitly

6.2.6.3.5 Enumeration: LocationFilter

Table 6.2.6.3.5-1: Enumeration LocationFilter

Enumeration value	Description
"TAI"	Indicates any change of the TA used by the UE should be reported
"CELL_ID"	Indicates any change of the Cell used by the UE should be reported
"N3IWF"	Indicates any change of the N3IWF node used by the UE should be reported
"UE_IP"	Indicates any change of the UE local IP address should be reported
"UDP_PORT"	Indicates any change of local UDP port used by the UE reported

6.2.6.3.6 Enumeration: SubscribedDataFilter

Table 6.2.6.3.6-1: Enumeration SubscribedDataFilter

Enumeration value	Description
"SARI"	Indicates any change of the Service Area Restriction Information for the UE received from UDM should be reported
"RFSP_INDEX"	Indicates any change of the RFSP Index for the UE received from UDM should be reported

6.2.6.3.7 Enumeration: UeReachability

Table 6.2.6.3.7-1: Enumeration UeReachability

Enumeration value	Description
"UNREACHABLE"	Indicates the UE is not reachable
"REACHABLE"	Indicates the UE is reachable for services
"REGULATORY_ONLY"	Indicates the UE is reachable only for Regulatory Prioritized Service

6.2.6.3.8 Enumeration: PresenceState

Table 6.2.6.3.8-1: Enumeration PresenceState

Enumeration value	Description
"IN"	Indicates the UE is in the specified Area of interest
"OUT"	Indicates the UE is out of the specified Area of interest
"UNKNOWN"	Indicates it is unknown whether the UE is in the specified Area of interest or not

6.2.6.3.9 Enumeration: RmState

Table 6.2.6.3.9-1: Enumeration RmState

Enumeration value	Description
"REGISTERED"	Indicates the UE in RM-REGISTERED state
"DEREGISTERED"	Indicates the UE in RM-DEREGISTERED state

6.2.6.3.10 Enumeration: CmState

Table 6.2.6.3.10-1: Enumeration CmState

Enumeration value	Description
"IDLE"	Indicates the UE is in CM-IDLE state
"CONNECTED"	Indicates the UE is in CM-CONNECTED state

6.2.6.4 Binary data

None.

6.2.7 Error Handling

6.2.7.1 General

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

6.2.7.2 Protocol Errors

Protocol Error Handling shall be supported as specified in subclause 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 Namf_EventExposure service, and the following application errors listed in Table 6.2.7.3-1 are specific for the Namf_EventExposure service.

Table 6.2.7.3-1: Application errors

Application Error	HTTP status code	Description
UE_NOT_SERVED_BY_AMF	403 Forbidden	Indicates the creation or the modification of a subscription has failed due to an application error when the UE is not served by the AMF.
SUBSCRIPTION_NOT_FOUND	404 Not Found	Indicates the modification of subscription has failed due to an application error when the subscription is not found in the AMF.

6.2.8 Feature Negotiation

The feature negotiation mechanism specified in subclause 6.6 of 3GPP TS 29.500 [4] shall be used to negotiate the optional features applicable between the AMF and the NF Service Consumer, for the Namf_EventExposure service, if any.

The NF Service Consumer shall indicate the optional features it supports for the Namf_EventExposure service, if any, by including the supportedFeatures attribute in payload of the HTTP Request Message for subscription resource creation.

The AMF shall determine the supported features for the service operations as specified in subclause 6.6 of 3GPP TS 29.500 [4] and shall indicate the supported features by including the supportedFeatures attribute in payload of the HTTP response for subscription resource creation.

The syntax of the supportedFeatures attribute is defined in subclause 5.2.2 of 3GPP TS 29.571 [13].

The following features are defined for the Namf_EventExposure service:

Table 6.2.8-1: Features of supportedFeatures attribute used by Namf_EventExposure service

Feature Number	Feature	M/O	Description
Feature number: The order number of the feature within the supportedFeatures attribute (starting with 1). Feature: A short name that can be used to refer to the bit and to the feature. M/O: Defines if the implementation of the feature is mandatory ("M") or optional ("O"). Description: A clear textual description of the feature.			

6.2.9 Security

As indicated in 3GPP TS 33.501 [27], the access to the Namf_EventExposure API shall be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [28]), using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [29]) plays the role of the authorization server.

An NF Service Consumer, prior to consuming services offered by the Namf_EventExposure API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [29], subclause 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 Namf_EventExposure service.

The Namf_EventExposure API does not define any scopes for OAuth2 authorization.

6.3 Namf_MT Service API

6.3.1 API URI

URIs of this API shall have the following root:

{apiRoot}/{apiName}/{apiVersion}/

where the "apiName" shall be set to "namf-mt" and the "apiVersion" shall be set to "v1" for the current version of this specification.

6.3.2 Usage of HTTP

6.3.2.1 General

HTTP/2, as defined in IETF RFC 7540 [19], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

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

HTTP messages and bodies for the Namf_MT service shall comply with the OpenAPI [23] 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 subclause 5.2.2 of 3GPP TS 29.500 [4].

6.3.2.2.2 Content type

The JSON format shall be supported. The use of the JSON format (IETF RFC 8259 [8]) shall be signalled by the content type "application/json". See also subclause 5.4 of 3GPP TS 29.500 [4].

6.3.2.3 HTTP custom headers

6.3.2.3.1 General

In this release of this specification, no custom headers specific to the Namf_MT service are defined. 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

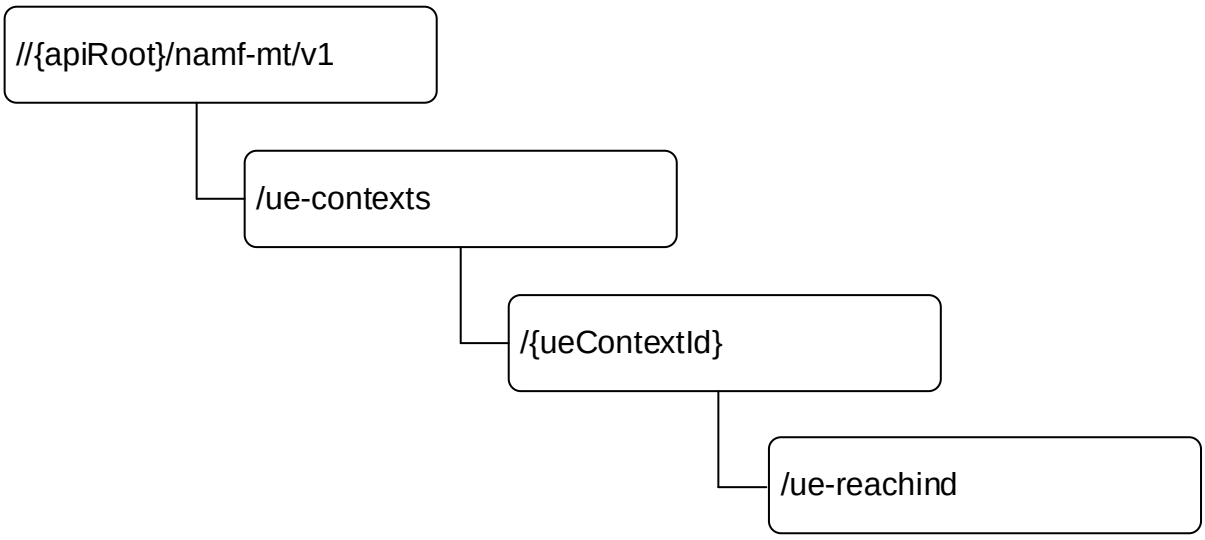

Figure 6.3.3.1-1: Resource URI structure of the Namf_MT Service API

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
ueReachInd	{apiRoot}/namf-mt/v1/ue-contexts/{ueContextId}/ue-reachind	PUT	Update the ueReachInd to UE Reachable
ueContext	{apiRoot}/namf-mt/v1/ue-contexts/{ueContextId}	GET	Map to following service operation: - ProvideDomainSelectionInfo

6.3.3.2 Resource: ueReachInd

6.3.3.2.1 Description

This resource represents the ueReachInd for a SUPI.

This resource is modelled as the Document resource archetype (see subclause C.1 of 3GPP TS 29.501 [5]).

6.3.3.2.2 Resource Definition

Resource URI: {apiRoot}/namf-mt/v1/ue-contexts/{ueContextId}ue-reachind

This resource shall support the resource URI variables defined in table 6.3.3.2.2-1.

Table 6.3.3.2.2-1: Resource URI variables for this resource

Name	Definition
ueContextId	Represents the Subscription Permanent Identifier (see 3GPP TS 23.501 [2] clause 5.9.2) pattern: "(imsi-[0-9]{5,15}|nai-.+)"

6.3.3.2.3 Resource Standard Methods

6.3.3.2.3.1 PUT

This method shall support the URI query parameters specified in table 6.3.3.2.3.1-1.

Table 6.3.3.2.3.1-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.3.3.2.3.1-2 and the response data structures and response codes specified in table 6.3.3.2.3.1-3.

Table 6.3.3.2.3.1-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
EnableUeReachabilityReqData	M	1	Contain the State of the UE, the value shall be set to UE Reachable.

Table 6.3.3.2.3.1-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
EnableUeReachabilityRspData	M	1	200 OK	Indicate the ueReachInd is updated to UE Reachable.
ProblemDetails	M	1	307 Temporary Redirect	This represents the case when the related UE context is not fully available at the target NF Service Consumer (e.g. AMF) during a planned maintenance case (e.g. AMF planned maintenance without UDSF case). The "cause" attribute shall be set to one of the following application error: - NF_CONSUMER_REDIRECT_ONE_TXN See table 6.3.7.3-1 for the description of these errors The Location header of the response shall be set to the target NF Service Consumer (e.g. AMF) to which the request is redirected.
ProblemDetails	M	1	400 Bad Request	The "cause" attribute shall be set to one of the following application errors: - INVALID_MSG_FORMAT - MANDAT_IE_INCORRECT - MANDAT_IE_MISSING See table 6.3.7.3-1 for the description of these errors.
ProblemDetails	M	1	403 Forbidden	The "cause" attribute shall be set to one of the following application errors: - UNABLE_TO_PAGE_UE - UNSPECIFIED See table 6.3.7.3-1 for the description of this error.
ProblemDetails	M	1	404 Not Found	This represents the case when the related UE is not found in the NF Service Consumer (e.g. AMF). The "cause" attribute shall be set to one of the following application error: - CONTEXT_NOT_FOUND See table 6.3.7.3-1 for the description of these errors
ProblemDetails	M	1	500 Internal Server Error	The "cause" attribute shall be set to the following application error: - SYSTEM_FAILURE See table 6.3.7.3-1 for the description of this error.
ProblemDetails	M	1	503 Service Unavailable	The "cause" attribute shall be set to the following application error: - NF_CONGESTION See table 6.3.7.3-1 for the description of these errors. The HTTP header field "Retry-After" shall not be included in this scenario.
ProblemDetails	M	1	504 Gateway Timeout	The "cause" attribute shall be set to the following application error: - UE_NOT_RESPONDING See table 6.3.7.3-1 for the description of this error.

6.3.3.2.4 Resource Custom Operations

There is no custom operation supported on this resource.

6.3.3.3 Resource: UeContext

6.3.3.3.1 Description

This resource represents the UeContext for a UE.

This resource is modelled as the Document resource archetype (see subclause C.1 of 3GPP TS 29.501 [5]).

6.3.3.3.2 Resource Definition

Resource URI: {apiRoot}/namf-mt/v1/ue-contexts/{ueContextId}

This resource shall support the resource URI variables defined in table 6.3.3.3.2-1.

Table 6.3.3.3.2-1: Resource URI variables for this resource

Name	Definition
ueContextId	Represents the Subscription Permanent Identifier (see 3GPP TS 23.501 [2] clause 5.9.2) pattern: "(imsi-[0-9]{5,15}|nai-.+)"

6.3.3.3.3 Resource Standard Methods

6.3.3.3.3.1 GET

This method shall support the URI query parameters specified in table 6.3.3.3.3.1-1.

Table 6.3.3.2.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description
Info-class	UeContextInfoClass	M	1	Indicates the class of the UE Context information elements to be fetched.
Supported-features	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.3.8 is supported.

This method shall support the request data structures specified in table 6.3.3.3.3.1-2 and the response data structures and response codes specified in table 6.3.3.3.3.1-3.

Table 6.3.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.3.3.3.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
UeContextInfo	M	1	200 OK	This represents the operation is successful and request UE Context information is returned.
ProblemDetails	M	1	307 Temporary Redirect	This represents the case when the related UE context is not fully available at the target NF Service Consumer (e.g. AMF) during a planned maintenance case (e.g. AMF planned maintenance without UDSF case). The "detail" attribute shall be set to one of the following application error: - NF_CONSUMER_REDIRECT_ONE_TXN See table 6.3.7.3-1 for the description of these errors The Location header of the response shall be set to the target NF Service Consumer (e.g. AMF) to which the request is redirected.
ProblemDetails	M	1	404 Not Found	This represents the case when the related UE is not found in the NF Service Consumer (e.g. AMF). The "detail" attribute shall be set to one of the following application error: - CONTEXT_NOT_FOUND See table 6.3.7.3-1 for the description of these errors
ProblemDetails	M	1	403 Forbidden	Indicate the operation is failed as the UE is not reachable, e.g. after paging.

6.3.3.3.4 Resource Custom Operations

There is no custom operation supported on this resource.

6.3.4 Custom Operations without associated resources

There are no custom operations without associated resources supported on Namf_MT service.

6.3.5 Notifications

There are no notifications supported on Namf_MT service.

6.3.6 Data Model

6.3.6.1 General

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

Table 6.3.6.3-1 specifies the data types defined for the Namf_MT service based interface protocol.

Table 6.3.6.3-1: Namf_MT specific Data Types

Data type	Section defined	Description
EnableUeReachabilityReqData	6.3.6.2.2	Contain the UeReachability, indicates the desired reachability status of the UE
EnableUeReachabilityRspData	6.3.6.2.3	Indicates the reachability of UE has been changed as requested.
UeContextInfo	6.3.6.2.4	Contains the UE Context Information
UeContextInfoClass	6.3.6.3.5	Indicates the UE Context information class

Table 6.3.6.3-2 specifies data types re-used by the Namf_MT 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 Namf_MT service based interface.

Table 6.3.6.3-2: Namf_MT re-used Data Types

Data type	Reference	Comments
ProblemDetails	3GPP TS 29.571 [6]	Common data type used in response bodies
supportedFeatures	3GPP TS 29.571 [6]	Supported Features
UeReachability	6.2.6.3.7	Describes the reachability of the UE

6.3.6.2 Structured data types

6.3.6.2.1 Introduction

Structured data types used in Namf_MT service are specified in this clause.

6.3.6.2.2 Type: EnableUeReachabilityReqData

Table 6.3.6.3.2-1: Definition of type EnableUeReachabilityReqData

Attribute name	Data type	P	Cardinality	Description
reachability	UeReachability	M	1	Indicates the desired reachability of the UE
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.3.8 is supported.

6.3.6.2.3 Type: EnableUeReachabilityRspData

Table 6.3.6.2.3-1: Definition of type EnableUeReachabilityRspData

Attribute name	Data type	P	Cardinality	Description
reachability	UeReachability	M	1	Indicates the current reachability of the UE
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.3.8 is supported.

6.3.6.2.4 Type: UeContextInfo

Table 6.3.6.2.3-1: Definition of type UeContextInfo

Attribute name	Data type	P	Cardinality	Description
supportVoPS	boolean	C	0..1	This IE shall be present when following UE Context Information class are required: - "TADS" When present, this IE shall indicate the UE is supporting IMS Voice over PS or not.
lastActTime	DateTime	C	0..1	This IE shall be present when following UE Context Information class are required: - "TADS" When present, this IE shall indicate the time stamp of the last radio contact with the UE.
ratType	RatType	C	0..1	This IE shall be present when following UE Context Information class are required: - "TADS" When present, this IE shall indicate the current RAT type of the UE.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.3.8 is supported.

6.3.6.3.5 Enumeration: UeContextInfoClass

Table 6.3.6.3.x-1: Enumeration UeContextInfoClass

Enumeration value	Description
"TADS"	Defines the UE Context Information for Terminating Domain Selection for IMS Voice over PS.

6.3.6.3 Simple data types and enumerations

6.3.6.3.1 Introduction

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

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

6.3.6.4 Binary data

None.

6.3.7 Error Handling

6.3.7.1 General

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

6.3.7.2 Protocol Errors

Protocol Error Handling shall be supported as specified in subclause 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 Namf_MT service, and the following application errors listed in Table 6.3.7.3-1 are specific for the Namf_MT service.

Table 6.3.7.3-1: Application errors

Application Error	HTTP status code	Description
NF_CONSUMER_REDIRECT_ONE_TXN	307 Temporary Redirect	The request has been asked to be redirected to a specified target.
UNABLE_TO_PAGE_UE	403 Forbidden	AMF is unable page the UE, temporarily.
CONTEXT_NOT_FOUND	404 Not Found	The related UE is not found in the NF Service Consumer.
UE_NOT_RESPONDING	504 Gateway Timeout	UE is not responding to the request initiated by the network, e.g. Paging.

6.3.8 Feature Negotiation

The feature negotiation mechanism specified in subclause 6.6 of 3GPP TS 29.500 [4] shall be used to negotiate the optional features applicable between the AMF and the NF Service Consumer, for the Namf_MT service, if any.

The NF Service Consumer shall indicate the optional features it supports for the Namf_MT service, if any, by including the supportedFeatures attribute in payload of the HTTP Request Message for following service operations:

- EnableUEReachability, as specified in subclause 5.4.2.2;

- ProvideDomainSelectionInfo, as specified in subclause 5.4.2.3;The AMF shall determine the supported features for the service operations as specified in subclause 6.6 of 3GPP TS 29.500 [4] and shall indicate the supported features by including the supportedFeatures attribute in payload of the HTTP response for the service operation.

The syntax of the supportedFeatures attribute is defined in subclause 5.2.2 of 3GPP TS 29.571 [13].

The following features are defined for the Namf_MT service.

Table 6.3.8-1: Features of supportedFeatures attribute used by Namf_MT service

Feature Number	Feature	M/O	Description
Feature number: The order number of the feature within the supportedFeatures attribute (starting with 1). Feature: A short name that can be used to refer to the bit and to the feature. M/O: Defines if the implementation of the feature is mandatory ("M") or optional ("O"). Description: A clear textual description of the feature.			

6.3.9 Security

As indicated in 3GPP TS 33.501 [27], the access to the Namf_MT API shall be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [28]), using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [29]) plays the role of the authorization server.

An NF Service Consumer, prior to consuming services offered by the Namf_MT API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [29], subclause 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 Namf_MT service.

The Namf_MT API does not define any scopes for OAuth2 authorization.

6.4 Namf_Location Service API

6.4.1 API URI

URIs of this API shall have the following root:

{apiRoot}/{apiName}/{apiVersion}/

where the "apiName" shall be set to "namf-location" 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 [19], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

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

HTTP messages and bodies for the Namf_Location service shall comply with the OpenAPI [23] specification contained in Annex A.

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 subclause 5.2.2 of 3GPP TS 29.500 [4].

6.4.2.2.2 Content type

The JSON format shall be supported. The use of the JSON format (IETF RFC 8259 [8]) shall be signalled by the content type "application/json". See also subclause 5.4 of 3GPP TS 29.500 [4].

6.4.2.3 HTTP custom headers

6.4.2.3.1 General

In this release of this specification, no custom headers specific to the Namf_Location service are defined. For 3GPP specific HTTP custom headers used across all service based interfaces, see clause 5.2.3 of 3GPP TS 29.500 [4].

6.4.3 Resources

6.4.3.1 Overview

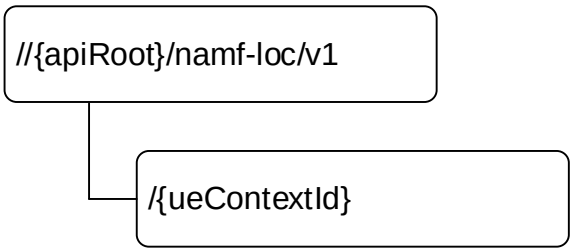

Figure 6.4.3.1-1: Resource URI structure of the Namf_Location Service API

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	Resource URI	HTTP method or custom operation	Description
Location Information for individual UE context	…/ueContextId}/provide	(POST) provide	ProvideLocation

6.4.3.2 Resource: Individual UE Context

6.4.3.2.1 Description

This resource represents an individual ueContextId.

This resource is modelled with the Document resource archetype (see subclause C.1 of 3GPP TS 29.501 [5]).

6.4.3.2.2 Resource Definition

Resource URI:{apiRoot}/namf-loc/v1/{ueContextId}

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
ueContextId	Represents the Subscription Permanent Identifier (see 3GPP TS 23.501 [2] clause 5.9.2) pattern: "(supi-[0-9]{5,15}|nai-.+)" Or represents the Permanent Equipment Identifier (see 3GPP TS 23.501 [2] clause 5.9.3) pattern: "(pei-[0-9]{15})"

6.4.3.2.3 Resource Standard Methods

There are no standard methods supported on this resource.

6.4.3.2.4 Resource Custom Operations

6.4.3.2.4.1 Overview

Table 6.4.3.2.4.1-1: Custom operations

Custom operaration URI	Mapped HTTP method	Description
{apiRoot}/namf-loc/v1/{ueContextId}/provide	POST	Request the locationInformation resource of the UE. It is used for the Provide Location service operation.

6.4.3.2.4.2 Operation: (POST) provide

6.4.3.2.4.2.1 Description

This ueContextId identifies the individual ueContext is composed by supi.{supi} or the pei.{pei}.

6.4.3.2.4.2.2 Operation Definition

This operation shall support the request data structures specified in table 6.4.3.2.4.2.2-1 and the response data structure and response codes specified in table 6.4.3.2.4.2.2-2.

Table 6.4.3.2.4.2.2-1: Data structures supported by the (POST) retrieve Request Body on this resource

Data type	P	Cardinality	Description
RequestUELocation	M	1	The information to request the location of the UE.

Table 6.4.3.2.4.2.2-2: Data structures supported by the (POST) retrieve Response Body on this resource

Data type	P	Cardinality	Response codes	Description
ProvideUELocation	M	1	200 OK	This case represents a successful query of the UE location, the AMF returns the related information in the response.
ProblemDetails	M	1	403 Forbidden	The "cause" attribute shall be set to one of the following application errors: - UNAUTHORIZED_REQUESTING_NETWORK - USER_UNKNOWN - DETACHED_USER - POSITIONING_DENIED - POSITIONING_FAILED - UNSPECIFIED See table 6.4.7.3-1 for the description of these errors.
ProblemDetails	M	1	500 Internal Server Error	The "cause" attribute shall be set to the following application error: - SYSTEM_FAILURE See table 6.4.7.3-1 for the description of this error.
ProblemDetails	M	1	503 Service Unavailable	The "cause" attribute shall be set to the following application error: - NF_CONGESTION See table 6.4.7.3-1 for the description of these errors. The HTTP header field "Retry-After" shall not be included in this scenario.
ProblemDetails	M	1	504 Gateway Timeout	The "cause" attribute shall be set to one of the following application errors: - UNREACHABLE_USER - PEER_NOT_RESPONDING See table 6.4.7.3-1 for the description of this error.

6.4.4 Custom Operations without associated resources

There are no custom operations without associated resources supported on Namf_Location service.

6.4.5 Notifications

6.4.5.1 General

This clause provides the definition of the EventNotify notification of the Namf_Location service.

6.4.5.2 Event Notify

6.4.5.2.1 Description

This resource represents the callback reference provided by the NF Service Consumer (e.g. GMLC) to receive LCS event notify.

6.4.5.2.2 Notification Definition

Callback URI: {locationNotificationUri}

Callback URI is provided by the NF Service Consumer (e.g. GMLC) during the ProvideLocation service operation.

6.4.5.2.3 Notification Standard Methods

6.4.5.2.3.1 POST

This method sends an LCS event notify to the NF Service Consumer.

This method shall support the request data structures specified in table 6.4.5.2.3.1-1 and the response data structures and response codes specified in table 6.4.5.2.3.1-2.

Table 6.4.5.2.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
NotifiedUELocation	M	1	Representation of the LCS event notify.

Table 6.4.5.2.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents a successful notification of the LCS event.
ProblemDetails	M	1	403 Forbidden	The "cause" attribute shall be set to one of the following application errors: - INVALID_MSG_FORMAT - MANDAT_IE_INCORRECT - MANDAT_IE_MISSING See table 6.4.7.3-1 for the description of these errors.

6.4.6 Data Model

6.4.6.1 General

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

Table 6.4.6.1-1 specifies the data types defined for the Namf_Location service based interface protocol.

Table 6.4.6.1-1: Namf_Location specific Data Types

Data type	Section defined	Description
RequestUELocation	6.4.6.2.2	Information within Provide Location Request
ProvideUELocation	6.4.6.2.3	Information within Provide Location Response
NotifiedUELocation	6.4.6.2.4	Information within EventNotify notification
BarometricPressure	6.4.6.3.2	Information within Provide Location Response and EventNotify notification
LocationType	6.4.6.3.3	Information within Provide Location Response and EventNotify notification
LocationEvent	6.4.6.3.4	Information within EventNotify notification

Table 6.4.6.1-2 specifies data types re-used by the Namf_Location 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 Namf_Location service based interface.

Table 6.4.6.1-2: Namf_Location re-used Data Types

Data type	Reference	Comments
Supi	3GPP TS 29.571 [6]	Subscription Permanent Identifier
Gpsi	3GPP TS 29.571 [6]	General Public Subscription Identifier
Pei	3GPP TS 29.571 [6]	Permanent Equipment Identifier
ExternalClientType	3GPP TS 29.572 [25]	LCS Client Type (Emergency, Lawful Interception …)
LocationQoS	3GPP TS 29.572 [25]	LCS QoS (accuracy, response time)
SupportedGADShapes	3GPP TS 29.572 [25]	LCS supported GAD shapes
GeographicArea	3GPP TS 29.572 [25]	Estimate of the location of the UE
AccuracyFulfilmentIndicator	3GPP TS 29.572 [25]	Requested accuracy was fulfilled or not
AgeOfLocationEstimate	3GPP TS 29.572 [25]	Age Of Location Estimate
PositioningMethodAndUsage	3GPP TS 29.572 [25]	Usage of each non-GANSS positioning method
VelocityEstimate	3GPP TS 29.572 [25]	Estimate of the velocity of the target UE
VelocityRequested	3GPP TS 29.572 [25]	Indication of the Velocity requirement
LcsPriority	3GPP TS 29.572 [25]	Priority of the LCS client
GnssPositioningMethodAndUsage	3GPP TS 29.572 [25]	Usage of each GANSS positioning method
CivicAddress	3GPP TS 29.572 [25]	Civic address
Ecgi	3GPP TS 29.571 [6]	UE EUTRAN cell information
Ncgi	3GPP TS 29.571 [6]	UE NR cell information
SupportedFeatures	3GPP TS 29.571 [6]	Supported Features

6.4.6.2 Structured data types

6.4.6.2.1 Introduction

Structured data types used in Namf_Location service are specified in this clause.

6.4.6.2.2 Type: RequestUELocation

Table 6.4.6.2.2-1: Definition of type RequestUELocation

Attribute name	Data type	P	Cardinality	Description
lcsClientType	ExternalClientType	M	1	This IE shall contain the type of LCS client (Emergency, Lawful Interception etc.,) issuing the location request
lcsLocation	LocationType	M	1	This IE shall contain the type of location measurement requested, such as current location, initial location, last known location, etc.
supi	Supi	C	0..1	If the SUPI is available, this IE shall be present.
gpsi	Gpsi	C	0..1	If the GPSI is available, this IE shall be present.
priority	LcsPriority	O	0..1	If present, this IE shall contain the priority of the LCS client issuing the positioning request.
lcsQoS	LocationQoS	O	0..1	If present, this IE shall contain the quality of service requested, such as the accuracy of the positioning measurement and the response time of the positioning operation
velocityRequested	VelocityRequested	O	0..1	If present, this IE shall contain an indication of whether or not the Velocity of the target UE is requested.
lcsSupportedGADShapes	SupportedGADShapes	O	0..1	If present, this IE shall contain the list of supported GAD shapes by the LCS client.
locationNotificationUri	Uri	O	0..1	The callback URI on which location change event notification is reported.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.4.8 is supported.

6.4.6.2.3 Type: ProvideUELocation

Table 6.4.6.2.3-1: Definition of type ProvideUELocation

Attribute name	Data type	P	Cardinality	Description
locationEstimate	GeographicArea	O	0..1	If present, this IE shall contain an estimate of the location of the UE in universal coordinates and the accuracy of the estimate.
accuracyFulfilmentIndicator	AccuracyFulfilmentIndicator	O	0..1	If present, this IE shall contain an indication of whether the requested accuracy (as indicated in the LcsQoS in the request message) was fulfilled or not.
ageOfLocationEstimate	AgeOfLocationEstimate	O	0..1	If present, this IE shall contain an indication of how long ago the location estimate was obtained.
velocityEstimate	VelocityEstimate	O	0..1	If present, this IE shall contain an estimate of the velocity of the target UE, composed by horizontal speed, vertical speed, and their respective uncertainty.
positioningData	array(PositioningMethodAndUsage)	O	0..9	If present, this IE shall indicate the usage of each non- GANSS positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully.
gnssPositioningData	GnssPositioningMethodAndUsage	O	0..9	If present, this IE shall indicate the usage of each GANSS positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully.
ecgi	Ecgi	O	0..1	If present, this IE shall contain the current EUTRAN cell location of the target UE as delivered by the 5G-AN.
ncgi	Ncgi	O	0..1	If present, this IE shall contain the current NR cell location of the target UE as delivered by the 5G-AN.
targetServingNode	NfInstanceId	O	0..1	If present, this IE shall contain the address of the target side serving node for handover of an IMS Emergency Call.
civicAddress	CivicAddress	O	0..1	If present, this IE contains a location estimate for the target UE expressed as a Civic address.
barometricPressure	BarometricPressure	O	0..1	If present, this IE contains the barometric pressure measurement as reported by the target UE.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in subclause 6.4.8 is supported.

6.4.6.2.4 Type: NotifiedUELocation

Table 6.4.6.2.4-1: Definition of type NotifiedUELocation

Attribute name	Data type	P	Cardinality	Description
locationEvent	LocationEvent	M	1	This IE shall contain the type of event that caused the location procedure to be initiated.
supi	Supi	C	0..1	This IE shall contain the SUPI if available (see NOTE 1).
gpsi	Gpsi	C	0..1	This IE shall contain the GPSI if available (see NOTE 1).
pei	Pei	C	0..1	This IE shall contain the PEI if available (see NOTE 1).
locationEstimate	GeographicArea	O	0..1	If present, this IE shall contain an estimate of the location of the UE in universal coordinates and the accuracy of the estimate.
ageOfLocationEstimate	AgeOfLocationEstimate	O	0..1	If present, this IE shall contain an indication of how long ago the location estimate was obtained.
velocityEstimate	VelocityEstimate	O	0..1	If present, this IE shall contain an estimate of the velocity of the target UE, composed by horizontal speed, vertical speed, and their respective uncertainty.
positioningData	PositioningMethodAndUsage	O	0..9	If present, this IE shall indicate the usage of each non-GANSS positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully.
gnssPositioningData	GnssPositioningMethodAndUsage	O	0..9	If present, this IE shall indicate the usage of each GANSS positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully.
ecgi	Ecgi	O	0..1	If present, this IE shall contain the current EUTRAN cell location of the target UE as delivered by the 5G-AN.
ncgi	Ncgi	O	0..1	If present, this IE shall contain the current NR cell location of the target UE as delivered by the 5G-AN.
servingNode	NfInstanceId	O	0..1	If present, this IE shall contain the address of the serving node. For handover of an IMS Emergency Call, this IE shall contain the address of the target side serving node.
civicAddress	CivicAddress	O	0..1	If present, this IE contains a location estimate for the target UE expressed as a Civic address.
barometricPressure	BarometricPressure	O	0..1	If present, this IE contains the barometric pressure measurement as reported by the target UE.
NOTE 1: At least one of these IEs shall be present in the message.				

6.4.6.3 Simple data types and enumerations

6.4.6.3.1 Introduction

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

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
BarometricPressure	integer	This IE specifies the measured uncompensated atmospheric pressure in units of Pascal (Pa). Minimum = 30000. Maximum = 115000.

6.4.6.3.3 Enumeration: LocationType

The enumeration LocationType represents the type of location measurement requested.

Table 6.4.6.3.3-1: Enumeration LocationType

Enumeration value	Description
"CURRENT_LOCATION"	
"CURRENT_OR_LAST_KNOWN_LOCATION"	
"INITIAL_LOCATION"	

6.4.6.3.4 Enumeration: LocationEvent

The enumeration LocationEvent represents the type of location measurement requested.

Table 6.4.6.3.4-1: Enumeration LocationEvent

Enumeration value	Description
"EMERGENCY_CALL_ORIGINATION"	Emergency session initiation
"EMERGENCY_CALL_RELEASE"	Emergency session termination
"EMERGENCY_CALL_HANDOVER"	Handover of an Emergency session

6.4.7 Error Handling

6.4.7.1 General

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

6.4.7.2 Protocol Errors

Protocol Error Handling shall be supported as specified in subclause 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 29.501 [5] may also be used for the Namf_Location service, and the following application errors listed in Table 6.4.7.3-1 are specific for the Namf_Location service.

Table 6.4.7.3-1: Application errors

Application Error	HTTP status code	Description
UNAUTHORIZED_REQUESTING_NETWORK	403 Forbidden	The requesting GMLC's network is not authorized to request UE location information.
USER_UNKNOWN	403 Forbidden	The user is unknown.
DETACHED_USER	403 Forbidden	The user is detached in the AMF.
POSITIONING_DENIED	403 Forbidden	The positioning procedure was denied.
POSITIONING_FAILED	403 Forbidden	The positioning procedure failed.
UNREACHABLE_USER	504 Gateway Timeout	The user could not be reached in order to perform positioning procedure.
PEER_NOT_RESPONDING	504 Gateway Timeout	No response is received from a remote peer, e.g. from the LMF.

6.4.8 Feature Negotiation

The feature negotiation mechanism specified in subclause 6.6 of 3GPP TS 29.500 [4] shall be used to negotiate the optional features applicable between the AMF and the NF Service Consumer, for the Namf_Location service, if any.

The NF Service Consumer shall indicate the optional features it supports for the Namf_Location service, if any, by including the supportedFeatures attribute in payload of the HTTP Request Message for following service operations:

- ProvideLocation, as specified in subclause 5.5.2.2;

The AMF shall determine the supported features for the service operations as specified in subclause 6.6 of 3GPP TS 29.500 [4] and shall indicate the supported features by including the supportedFeatures attribute in payload of the HTTP response for the service operation.

The syntax of the supportedFeatures attribute is defined in subclause 5.2.2 of 3GPP TS 29.571 [13].

The following features are defined for the Namf_Location service.

Table 6.1.8-1: Features of supportedFeatures attribute used by Namf_Location service

Feature Number	Feature	M/O	Description
Feature number: The order number of the feature within the supportedFeatures attribute (starting with 1). Feature: A short name that can be used to refer to the bit and to the feature. M/O: Defines if the implementation of the feature is mandatory ("M") or optional ("O"). Description: A clear textual description of the feature.			

6.4.9 Security

As indicated in 3GPP TS 33.501 [27], the access to the Namf_Location API shall be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [28]), using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [29]) plays the role of the authorization server.

An NF Service Consumer, prior to consuming services offered by the Namf_Location API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [29], subclause 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 Namf_Location service.

The Namf_Location API does not define any scopes for OAuth2 authorization.

Annex A (normative): OpenAPI specification

A.1 General

This Annex specifies the API definition of the service provided by AMF in this document. The APIs are defined by OpenAPI 3.0.0 specifications in YAML format, following guidelines in 3GPP TS 29.501 [5].

The APIs for specified for following services:

- Namf_Communication Service
- Namf_EventExposure Service
- Namf_MT Service
- Namf_Location Service

A.2 Namf_Communication API

```
openapi: 3.0.0
info:
  version: 1.R15.0.0
  title: AMF Communication Service
  description: AMF Communication Service
security:
  - oAuth2Clientcredentials: []
externalDocs:
  description: Documentation
  url: 'http://www.3gpp.org/ftp/Specs/archive/29_series/29.518/29518-120.zip'
servers:
  - url: https://{apiRoot}/namf-comm/v1
    variables:
      apiRoot:
        default: locahhost:8080
paths:
  /ue-contexts/{ueContextId}:
    put:
      summary: Namf_Communication CreateUEContext service Operation
      tags:
        - Create UE Contxt
      operationId: CreateUEContext
      parameters:
        - name: ueContextId
          in: path
          description: UE Context Identifier
          required: true
          schema:
            type: string
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/UeContextCreateData'
          multipart/related:  # message with binary body part(s)
            schema:
              type: object
              properties: # Request parts
                jsonData:
                  $ref: '#/components/schemas/UeContextCreateData'
                binaryDataN1Message:
                  type: string
                  format: binary
                binaryDataN2Information:
                  type: string
                  format: binary
            encoding:
              jsonData:
                contentType:  application/json
              binaryDataN1Message:
                contentType:  application/vnd.3gpp.5gnas
```

```
              headers:
                Content-Id:
                  schema:
                    type: string
            binaryDataN2Information:
              contentType:  application/vnd.3gpp.ngap
              headers:
                Content-Id:
                  schema:
                    type: string
      required: true
    responses:
      '201':
        description: UE context successfully created.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/UeContextCreatedData'
          multipart/related:  # message with binary body part(s)
            schema:
              type: object
              properties: # Request parts
                jsonData:
                  $ref: '#/components/schemas/UeContextCreatedData'
                binaryDataN1Message:
                  type: string
                  format: binary
                binaryDataN2Information:
                  type: string
                  format: binary
            encoding:
              jsonData:
                contentType:  application/json
              binaryDataN1Message:
                contentType:  application/vnd.3gpp.5gnas
                headers:
                  Content-Id:
                    schema:
                      type: string
              binaryDataN2Information:
                contentType:  application/vnd.3gpp.ngap
                headers:
                  Content-Id:
                    schema:
                      type: string
      '403':
        description: Forbidden
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/UeContextCreateError'
      default:
        description: Unexpected error
  /ue-contexts/{ueContextId}/release:
    post:
      summary: Namf_Communication ReleaseUEContext service Operation
      tags:
        - Release UE Contxt
      operationId: ReleaseUEContext
      parameters:
        - name: ueContextId
          in: path
          description: UE Context Identifier
          required: true
          schema:
            type: string
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/UEContextRelease'
        required: true
      responses:
        '204':
          description: UE Context successfully released
        '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
/ue-contexts/{ueContextId}/assignEbi:
  post:
    summary: Namf_Communication EBI Assignment service Operation
    tags:
      - EBI Assignment
    operationId: EBIAssignment
    parameters:
      - name: ueContextId
        in: path
        description: UE Context Identifier
        required: true
        schema:
          type: string
    requestBody:
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/AssignEbi'
      required: true
    responses:
      '200':
        description: EBI Assignment successfully performed.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AssignedEbi'
      '403':
        description: Forbidden
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AssignEbiError'
      default:
        description: Unexpected error
/ue-contexts/{ueContextId}/transfer:
  post:
    summary: Namf_Communication UEContextTransfer service Operation
    tags:
      - UE Context Transfer
    operationId: UEContextTransfer
    parameters:
      - name: ueContextId
        in: path
        description: UE Context Identifier
        required: true
        schema:
          type: string
    requestBody:
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/UeContextTransferReqData'
        multipart/related:  # message with binary body part(s)
          schema:
            type: object
            properties: # Request parts
              jsonData:
                $ref: '#/components/schemas/UeContextTransferReqData'
              binaryDataN1Message:
                type: string
                format: binary
          encoding:
            jsonData:
              contentType:  application/json
            binaryDataN1Message:
              contentType:  application/vnd.3gpp.5gnas
              headers:
                Content-Id:
                  schema:
```

```
                    type: string
        required: true
      responses:
        '200':
          description: UE context transfer successfully initiated.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/UeContextTransferRspData'
        '403':
          description: Forbidden
          content:
            application/problem+json:
              schema:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
        default:
          description: Unexpected error
      callbacks:
        onRegistrationCompleteNotify:
          {$response.body#/regCompleteNotifyUri}:
            post:
              summary: Namf_Communication RegistratioComplateNotify service Operation
              tags:
                - Registration Complete Notify
              operationId: RegistrationCompleteNotify
              requestBody:
                description: Registration Complete Notification
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/UERegCompleteNotifData'
              responses:
                '204':
                  description: Expected response to a successful callback processing
  /ue-contexts/{ueContextId}/n1-n2-messages:
    post:
      summary: Namf_Communication N1N2 Message Transfer (UE Specific) service Operation
      tags:
        - N1N2 Message Transfer
      operationId: N1N2MessageTransfer
      parameters:
        - name: ueContextId
          in: path
          description: UE Context Identifier
          required: true
          schema:
            type: string
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/N1N2MessageData'
          multipart/related:  # message with binary body part(s)
            schema:
              type: object
              properties: # Request parts
                jsonData:
                  $ref: '#/components/schemas/N1N2MessageData'
                binaryDataN1Message:
                  type: string
                  format: binary
                binaryDataN2Information:
                  type: string
                  format: binary
            encoding:
              jsonData:
                contentType:  application/json
              binaryDataN1Message:
                contentType:  application/vnd.3gpp.5gnas
                headers:
                  Content-Id:
                    schema:
                      type: string
              binaryDataN2Information:
                contentType:  application/vnd.3gpp.ngap
                headers:
                  Content-Id:
                    schema:
```

```
                    type: string
        required: true
      responses:
        '202':
          description: N1N2 Message Transfer accepted.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/N1N2MessageTransferRspData'
        '200':
          description: N1N2 Message Transfer successfully initiated.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/N1N2MessageTransferRspData'
        '307':
          description: Temporary Redirect
          content:
            application/problem+json:
              schema:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
        '404':
          description: Not Found
          content:
            application/problem+json:
              schema:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
        '409':
          description: Conflicts
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/N1N2MessageTransferError'
        '504':
          description: Gateway Timeout
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/N1N2MessageTransferError'
        default:
          description: Unexpected error
      callbacks:
        onN1N2TransferFailure:
          {$request.body#/n1n2FailureTxfNotifURI}:
            post:
              summary: Namf_Communication N1N2MessageTransfer Failure Notification service Operation
              tags:
                - N1N2MessageTransfer Failure Notification
              operationId: N1N2MessageTransferFailureNotification
              requestBody:
                description: N1N2MessageTransfer Failure Notification
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/N1N2MsgTxfrFailureNotification'
              responses:
                '204':
                  description: Expected response to a successful callback processing
  /ue-contexts/{ueContextId}/n1-n2-messages/subscriptions:
    post:
      summary: Namf_Communication N1N2 Message Subscribe (UE Specific) service Operation
      tags:
        - N1N2 Message Subscribe
      operationId: N1N2MessageSubscribe
      parameters:
        - name: ueContextId
          in: path
          description: UE Context Identifier
          required: true
          schema:
            type: string
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/UeN1N2InfoSubscriptionCreateData'
        required: true
      responses:
```

```
        '201':
          description: N1N2 Message Subscription successfully created.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/UeN1N2InfoSubscriptionCreatedData'
        default:
          description: Unexpected error
      callbacks:
        onN1N2MessageNotify:
          '{$request.body#/n1NotifyCallbackUri}':
            post:
              summary: Namf_Communication N1 Message Notify service Operation
              tags:
                - N1 Message Notify
              operationId: N1MessageNotify
              requestBody:
                description: N1 Message Notification
                content:
                  multipart/related:  # message with binary body part(s)
                    schema:
                      type: object
                      properties: # Request parts
                        jsonData:
                          $ref: '#/components/schemas/N1MessageNotification'
                        binaryDataN1Message:
                          type: string
                          format: binary
                    encoding:
                      jsonData:
                        contentType:  application/json
                      binaryDataN1Message:
                        contentType:  application/vnd.3gpp.5gnas
                        headers:
                          Content-Id:
                            schema:
                              type: string
              responses:
                '204':
                  description: Expected response to a successful callback processing
                '403':
                  description: Forbidden
                  content:
                    application/problem+json:
                      schema:
                        $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
          '{$request.body#/n2NotifyCallbackUri}':
            post:
              summary: Namf_Communication N2 Info Notify (UE Specific) service Operation
              tags:
                - N2 Info Notify
              operationId: N2InfoNotify
              requestBody:
                description: UE Specific N2 Informaiton Notification
                content:
                  multipart/related:  # message with binary body part(s)
                    schema:
                      type: object
                      properties: # Request parts
                        jsonData:
                          $ref: '#/components/schemas/N2InformationNotification'
                        binaryDataN1Message:
                          type: string
                          format: binary
                        binaryDataN2Information:
                          type: string
                          format: binary
                    encoding:
                      jsonData:
                        contentType:  application/json
                      binaryDataN1Message:
                        contentType:  application/vnd.3gpp.5gnas
                        headers:
                          Content-Id:
                            schema:
                              type: string
                      binaryDataN2Information:
                        contentType:  application/vnd.3gpp.ngap
```

```
                      headers:
                        Content-Id:
                          schema:
                            type: string
            responses:
              '204':
                description: Expected response to a successful callback processing
  /ue-contexts/{ueContextId}/n1-n2-messages/subscriptions/{subscriptionId}:
    delete:
      summary: Namf_Communication N1N2 Message UnSubscribe (UE Specific) service Operation
      tags:
        - N1N2 Message UnSubscribe
      operationId: N1N2MessageUnSubscribe
      parameters:
        - name: ueContextId
          in: path
          description: UE Context Identifier
          required: true
          schema:
            type: string
        - name: subscriptionId
          in: path
          description: Subscription Identifier
          required: true
          schema:
            type: string
      responses:
        '204':
          description: N1N2 Message Subscription successfully removed.
  /non-ue-n2-messages/transfer:
    post:
      summary: Namf_Communication Non UE N2 Message Transfer service Operation
      tags:
        - Non UE N2 Message Transfer
      operationId: NonUeN2MessageTransfer
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/N2InformationTransferReqData'
          multipart/related:  # message with binary body part(s)
            schema:
              type: object
              properties: # Request parts
                jsonData:
                  $ref: '#/components/schemas/N2InformationTransferReqData'
                binaryDataN2Information:
                  type: string
                  format: binary
            encoding:
              jsonData:
                contentType:  application/json
              binaryDataN2Information:
                contentType:  application/vnd.3gpp.ngap
                headers:
                  Content-Id:
                    schema:
                      type: string
        required: true
      responses:
        '200':
          description: Non UE N2 Message Transfer successfully initiated.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/N2InformationTransferRspData'
        '400':
          description: Bad Request
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/N2InformationTransferError'
        '403':
          description: Forbidden
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/N2InformationTransferError'
```

```
      '404':
        description: Not Found
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/N2InformationTransferError'
      '500':
        description: Internal Server Error
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/N2InformationTransferError'
      '503':
        description: Service Unavailable
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/N2InformationTransferError'
      default:
        description: Unexpected error
  /non-ue-n2-messages/subscriptions:
    post:
      summary: Namf_Communication Non UE N2 Info Subscribe service Operation
      tags:
        - Non UE N2 Info Subscribe
      operationId: NonUeN2InfoSubscribe
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NonUeN2InfoSubscriptionCreateData'
        required: true
      responses:
        '201':
          description: Non UE N2 Info Subscription successfully created.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/NonUeN2InfoSubscriptionCreatedData'
        '403':
          description: Forbidden
          content:
            application/problem+json:
              schema:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
        default:
          description: Unexpected error
      callbacks:
        onN2InfoNotify:
          {$request.body#/n2NotifyCallbackUri}:
            post:
              summary: Namf_Communication Non UE N2 Info Notify service Operation
              tags:
                - Non UE N2 Info Notify
              operationId: NonUeN2InfoNotify
              requestBody:
                description: Non UE N2 Informaiton Notification
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/N2InformationNotification'
                  multipart/related:  # message with binary body part(s)
                    schema:
                      type: object
                      properties: # Request parts
                        jsonData:
                          $ref: '#/components/schemas/N2InformationNotification'
                        binaryDataN2Information:
                          type: string
                          format: binary
                    encoding:
                      jsonData:
                        contentType:  application/json
                      binaryDataN2Information:
                        contentType:  application/vnd.3gpp.ngap
                        headers:
                          Content-Id:
                            schema:
```

```
                            type: string
            responses:
              '204':
                description: Expected response to a successful callback processing
  /non-ue-n2-messages/subscriptions/{n2NotifySubscriptionId}:
    delete:
      summary: Namf_Communication Non UE N2 Info UnSubscribe service Operation
      tags:
        - Non UE N2 Info UnSubscribe
      operationId: NonUeN2InfoUnSubscribe
      parameters:
        - name: n2NotifySubscriptionId
          in: path
          description: N2 info Subscription Identifier
          required: true
          schema:
            type: string
      responses:
        '204':
          description: Non UE N2 INfo Subscription successfully removed.
  /subscriptions:
    post:
      summary: Namf_Communication AMF Status Change Subscribe service Operation
      tags:
        - AMF Status Change Subscribe
      operationId: AMFStatusChangeSubscribe
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/SubscriptionData'
        required: true
      responses:
        '201':
          description: N1N2 Message Subscription successfully created.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/SubscriptionData'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          description: Unexpected error
      callbacks:
        onAmfStatusChange:
          {$request.body#/amfStatusUri}:
            post:
              summary: Amf Status Change Notify service Operation
              tags:
                - Amf Status Change Notify
              operationId: AmfStatusChangeNotify
              requestBody:
                description: Amf Status Change Notification
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/AmfStatusChangeNotification'
              responses:
                '204':
                  description: Expected response to a successful callback processing
                '404':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/404'
  /subscriptions/{subscriptionId}:
    delete:
      summary: Namf_Communication AMF Status Change UnSubscribe service Operation
      tags:
        - AMF Status Change UnSubscribe
      operationId: AMFStatusChangeUnSubscribe
      parameters:
        - name: subscriptionId
          in: path
          description: AMF Status Change Subscription Identifier
```

```
          required: true
          schema:
            type: string
      responses:
        '204':
          description: N1N2 Message Subscription successfully removed.
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    put:
      summary: Namf_Communication AMF Status Change Subscribe Modify service Operation
      tags:
        - AMF Status Change Subscribe Modify
      operationId: AMFStatusChangeSubscribeModfy
      parameters:
        - name: subscriptionId
          in: path
          description: AMF Status Change Subscription Identifier
          required: true
          schema:
            type: string
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/SubscriptionData'
        required: true
      responses:
        '202':
          description: N1N2 Message Subscription successfully updated.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/SubscriptionData'
        '403':
          description: Forbidden
          content:
            application/problem+json:
              schema:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
        default:
          description: Unexpected error
      callbacks:
        OnAmfStatusChange:
          {$request.body#/amfStatusUri}:
            post:
              summary: Amf Status Change Notify service Operation
              tags:
                - Amf Status Change Notify
              operationId: AmfStatusChangeNOtify
              requestBody:
                description: Amf Status Change Notification
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/AmfStatusChangeNotification'
              responses:
                '204':
                  description: Expected response to a successful callback processing
                '403':
                  description: Forbidden
                  content:
                    application/problem+json:
                      schema:
                        $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes: {}
  schemas:
    SubscriptionData:
      type: object
      properties:
        amfStatusUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
```

```
        guamis:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Guami'
      required:
        - amfStatusUri
    AmfStatusChangeNotification:
      type: object
      properties:
        amfStatusInfo:
          $ref: '#/components/schemas/AmfStatusInfo'
      required:
        - amfStatusInfo
    AmfStatusInfo:
      type: object
      properties:
        guamis:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Guami'
        statusChange:
          $ref: '#/components/schemas/StatusChange'
# TODO: To be fixed. Suggest NfInstanceId
#        targetamfName:
#          $ref: '#/components/schemas/AmfName'
      required:
        - guamis
        - statusChange
    AssignEbi:
      type: object
      properties:
        pduSessionId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/PduSessionId'
        arps:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Arp'
          minItems: 1
        releasedEbiList:
          type: array
          items:
            $ref: '#/components/schemas/EpsBearerId'
          minItems: 0
      required:
        - pduSessionId
    AssignedEbi:
      type: object
      properties:
        pduSessionId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/PduSessionId'
        assignedEbis:
          type: array
          items:
            $ref: 'TS29502_Nsmf_PDUSession.yaml#/components/schemas/EbiArpMapping'
          minItems: 0
        failedArpList:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Arp'
          minItems: 0
        releasedEbiList:
          type: array
          items:
            $ref: '#/components/schemas/EpsBearerId'
          minItems: 0
      required:
        - pduSessionId
        - assignedEbis
    AssignEbiFailed:
      type: object
      properties:
        pduSessionId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/PduSessionId'
        failedArpList:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Arp'
          minItems: 0
      required:
        - pduSessionId
    UEContextRelease:
      type: object
```

```
    properties:
      supi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      unauthenticatedSupi:
        type: boolean
        default: false
      ngapCause:
        $ref: '#/components/schemas/NgApCause'
    required:
      - ngapCause
  N2InformationTransferReqData:
    type: object
    properties:
      tai:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Tai'
      ecgi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ecgi'
      ncgi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ncgi'
      globalRanNodeId:
        type: array
        items:
          $ref: '#/components/schemas/GlobalRanNodeId'
      n2Information:
        $ref: '#/components/schemas/N2InfoContainer'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - n2Information
  NonUeN2InfoSubscriptionCreateData:
    type: object
    properties:
      globalRanNodeId:
        type: array
        items:
          $ref: '#/components/schemas/GlobalRanNodeId'
      anType:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/AccessType'
      n2InformationClass:
        $ref: '#/components/schemas/N2InformationClass'
      n2NotifyCallbackUri:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      lmfId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - n2InformationClass
      - n2NotifyCallbackUri
  NonUeN2InfoSubscriptionCreatedData:
    type: object
    properties:
      n2NotifySubscriptionId:
        type: string
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - n2NotifySubscriptionId
  UeN1N2InfoSubscriptionCreateData:
    type: object
    properties:
      n2InformationClass:
        $ref: '#/components/schemas/N2InformationClass'
      n2NotifyCallbackUri:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      n1MessageClass:
        $ref: '#/components/schemas/N1MessageClass'
      n1NotifyCallbackUri:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      lmfId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
  UeN1N2InfoSubscriptionCreatedData:
    type: object
    properties:
```

```
      n1n2NotifySubscriptionId:
        type: string
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - n1n2NotifySubscriptionId
  N2InformationNotification:
    type: object
    properties:
      n2NotifySubscriptionId:
        type: string
      n2InfoContainer:
        $ref: '#/components/schemas/N2InfoContainer'
      lcsCorrelationId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/CorrelationID'
    required:
      - n2NotifySubscriptionId
      - n2InfoContainer
  N2InfoContainer:
    type: object
    properties:
      n2InformationClass:
        $ref: '#/components/schemas/N2InformationClass'
      smInfo:
        type: array
        items:
          $ref: '#/components/schemas/N2SmInformation'
        minItems: 0
      nrppaInfo:
        $ref: '#/components/schemas/NrppaInformation'
      pwsInfo:
        $ref: '#/components/schemas/PwsInformation'
      areaOfValidity:
        $ref: '#/components/schemas/AreaOfValidity'
    required:
      - n2InformationClass
  N1MessageNotification:
    type: object
    properties:
      n1NotifySubscriptionId:
        type: string
      n1MessageContainer:
        $ref: '#/components/schemas/N1MessageContainer'
      lcsCorrelationId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/CorrelationID'
      registrationCtxtContainer:
        $ref: '#/components/schemas/RegistrationContextContainer'
    required:
      - n1NotifySubscriptionId
      - n1MessageContainer
  N1MessageContainer:
    type: object
    properties:
      n1MessageClass:
        $ref: '#/components/schemas/N1MessageClass'
      n1MessageContent:
        $ref: '#/components/schemas/RefToBinaryData'
      lmfId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
    required:
      - n1MessageClass
      - n1MessageContent
  N1N2MessageData:
    type: object
    properties:
      n1MessageContainer:
        $ref: '#/components/schemas/N1MessageContainer'
      n2InfoContainer:
        $ref: '#/components/schemas/N2InfoContainer'
      lastMsgIndication:
        type: boolean
      sessionId:
        type: string
      anType:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/AccessType'
      ppi:
        $ref: '#/components/schemas/Ppi'
      arp:
```

```
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Arp'
      5qi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/5qi'
      n1n2FailureTxfNotifURI:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
  N1N2MessageTransferRspData:
    type: object
    properties:
      cause:
        $ref: '#/components/schemas/N1N2MessageTransferCause'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - cause
  RegistrationContextContainer:
    type: object
    properties:
      ueContext:
        $ref: '#/components/schemas/UeContext'
      localTimeZone:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/TimeZone'
      anType:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/AccessType'
      anN2IPv4Address:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
      anN2IPv6Addr:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Addr'
      allowedNssai:
        $ref: 'TS29531_Nnssf_NSSelection.yaml#/components/schemas/AllowedNssai'
    required:
      - ueContext
      - anType
  AreaOfValidity:
    type: object
    properties:
      taList:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Tai'
    required:
      - taList
  RefToBinaryData:
    type: object
    properties:
      contentId:
        type: string
    required:
      - contentId
  UeContextTransferReqData:
    type: object
    properties:
      reason:
        $ref: '#/components/schemas/TransferReason'
      regRequest:
        $ref: '#/components/schemas/N1MessageContainer'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - reason
  UeContextTransferRspData:
    type: object
    properties:
      ueContext:
        $ref: '#/components/schemas/UeContext'
      regCompleteNotifyUri:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - ueContext
      - regCompleteNotifyUri
  UeContext:
    type: object
    properties:
      supi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      supiUnauthInd:
        type: boolean
```

```
      gpsi:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        minItems: 0
      pei:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Pei'
      groups:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
        minItems: 0
      drxParameter:
        $ref: '#/components/schemas/DrxParameter'
      subRfsp:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/RfspIndex'
      usedRfsp:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/RfspIndex'
      smsSupport:
        $ref: '#/components/schemas/SmsSupport'
      smsfId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      seafData:
        $ref: '#/components/schemas/SeafData'
      pcfId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      hpcfId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      eventSubscriptions:
        type: array
        items:
          $ref: 'TS29518_Namf_EventExposure.yaml#/components/schemas/AmfEventSubscription'
        minItems: 0
      mmContexts:
        type: array
        items:
          $ref: '#/components/schemas/MmContext'
        minItems: 0
        maxItems: 2
      sessionContexts:
        type: array
        items:
          $ref: '#/components/schemas/PduSessionContext'
        minItems: 0
    required:
      - smsSupport
  N2SmInformation:
    type: object
    properties:
      pduSessionId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PduSessionId'
      n2InfoContent:
        $ref: '#/components/schemas/N2InfoContent'
      nasPdu:
        $ref: '#/components/schemas/N1MessageContainer'
      sNssai:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
      subjectToHo:
        type: boolean
    required:
      - pduSessionId
  N2InfoContent:
    type: object
    properties:
      ngapMessageType:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      ngapIeType:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      ngapData:
        $ref: '#/components/schemas/RefToBinaryData'
    required:
      - ngapIeType
      - ngapData
  NrppaInformation:
    type: object
    properties:
      lmfId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
```

```
      nrppaPdu:
        $ref: '#/components/schemas/N2InfoContent'
    required:
      - routingId
      - nrppaPdu
  PwsInformation:
    type: object
    properties:
      messageIdentifier:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint16'
      serialNumber:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint16'
      pwsContainer:
        $ref: '#/components/schemas/N2InfoContent'
      sendN2Container:
        type: boolean
      omcId:
        $ref: '#/components/schemas/OmcIdentifier'
    required:
      - messageIdentifier
      - serialNumber
      - pwsContainer
  N1N2MsgTxfrFailureNotification:
    type: object
    properties:
      cause:
        $ref: '#/components/schemas/N1N2MessageTransferCause'
      n1n2MsgDataUri:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
    required:
      - cause
      - n1n2MsgDataUri
  N1N2MessageTransferError:
    type: object
    properties:
      error:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
      errInfo:
        $ref: '#/components/schemas/N1N2MsgTxfrErrDetail'
    required:
      - error
  N1N2MsgTxfrErrDetail:
    type: object
    properties:
      retryAfter:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      highestPrioArp:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Arp'
  N2InformationTransferRspData:
    type: object
    properties:
      result:
        $ref: '#/components/schemas/N2InformationTransferResult'
      pwsRspData:
        $ref: '#/components/schemas/PWSResponseData'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - result
  MmContext:
    type: object
    properties:
      accessType:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/AccessType'
      nasSecurityMode:
        $ref: '#/components/schemas/NasSecurityMode'
      nasDownlinkCount:
        $ref: '#/components/schemas/NasCount'
      nasUplinkCount:
        $ref: '#/components/schemas/NasCount'
      5gmmCapability:
        $ref: '#/components/schemas/5gmmCapability'
      mobilityRestrictions:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/MobilityRestrictions'
      ueSecurityCapability:
        $ref: '#/components/schemas/UeSecurityCapability'
      s1UeNetworkCapability:
        $ref: '#/components/schemas/S1UeNetworkCapability'
```

```
        allowedNssai:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
          minItems: 0
        nssaiMapping:
          type: array
          items:
            $ref: '#/components/schemas/NssaiMapping'
          minItems: 0
        nsInstances:
          type: array
          items:
            $ref: 'TS29531_Nnssf_NSSelection.yaml#/components/schemas/NsiId'
          minItems: 0
      required:
        - accessType
    SeafData:
      type: object
      properties:
        ngKsi:
          $ref: '#/components/schemas/NgKsi'
        nh:
          type: string
        ncc:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        keyAmf:
          $ref: '#/components/schemas/KeyAmf'
        keyAmfChangeInd:
          type: boolean
# TODO: To be defined
#        Input:
#          $ref: '#/components/schemas/Input'
      required:
        - ngKsi
        - nh
        - ncc
        - keyAmf
    NasSecurityMode:
      type: object
      properties:
        integrityAlgorithm:
          $ref: '#/components/schemas/IntegrityAlgorithm'
        cipheringAlgorithm:
          $ref: '#/components/schemas/CipheringAlgorithm'
      required:
        - integrityAlgorithm
        - cipheringAlgorithm
    PduSessionContext:
      type: object
      properties:
        pduSessionId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/PduSessionId'
        smContextRef:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        sNssai:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
        dnn:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
        accessType:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/AccessType'
        allocatedEbiList:
          type: array
          items:
            $ref: 'TS29502_Nsmf_PDUSession.yaml#/components/schemas/EbiArpMapping'
          minItems: 1
        hsmfId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        vsmfId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        nsInstance:
          $ref: 'TS29531_Nnssf_NSSelection.yaml#/components/schemas/NsiId'
      required:
        - pduSessionId
        - smContextRef
        - sNssai
        - dnn
        - accessType
```

```
    - allocatedEbiList
NssaiMapping:
  type: object
  properties:
    mappedSnssai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
    hSnssai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
  required:
    - mappedSnssai
    - hSnssai
UERegCompleteNotifData:
  type: object
  properties:
    transferStatus:
      $ref: '#/components/schemas/UeContextTransferStatus'
  required:
    - transferStatus
AssignEbiError:
  type: object
  properties:
    error:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
    failureDetails:
      $ref: '#/components/schemas/AssignEbiFailed'
  required:
    - error
    - failureDetails
UeContextCreateData:
  type: object
  properties:
    ueContext:
      $ref: '#/components/schemas/UeContext'
    targetId:
      $ref: '#/components/schemas/NgRanTargetId'
    sourceToTargetData:
      $ref: '#/components/schemas/N2InfoContainer'
    pduSessions:
      $ref: '#/components/schemas/N2SmInformation'
    ngapCause:
      $ref: '#/components/schemas/NgApCause'
    supportedFeatures:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
  required:
    - ueContext
    - targetId
    - sourceToTargetData
    - pduSessions
UeContextCreatedData:
  type: object
  properties:
    ueContext:
      $ref: '#/components/schemas/UeContext'
    targetToSourceData:
      $ref: '#/components/schemas/N2InfoContainer'
    pduSessions:
      type: array
      items:
        $ref: '#/components/schemas/N2SmInformation'
      minItems: 1
    ngapCause:
      $ref: '#/components/schemas/NgApCause'
    failedSessions:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PduSessionId'
      minItems: 0
    supportedFeatures:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
  required:
    - ueContext
    - targetToSourceData
    - pduSessions
UeContextCreateError:
  type: object
  properties:
    error:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
```

```
      ngapCause:
        $ref: '#/components/schemas/NgApCause'
    required:
      - error
  NgRanTargetId:
    type: object
    properties:
      ranNodeId:
        $ref: '#/components/schemas/NgRanIdentifier'
      tai:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Tai'
    required:
      - plmnId
      - ranNodeId
      - tai
  PWSResponseData:
    type: object
    properties:
      ngapMessageType:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      serialNumber:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint16'
      messageIdentifier:
        type: integer
      unknownTaiList:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Tai'
    required:
      - ngapMessageType
      - serialNumber
      - messageIdentifier
  PWSErrorData:
    type: object
    properties:
      namfCause:
        type: integer
    required:
      - namfCause
  N2InformationTransferError:
    type: object
    properties:
      error:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
      pwdErrorInfo:
        $ref: '#/components/schemas/PWSErrorData'
    required:
      - error
  GlobalRanNodeId:
    type: object
    properties:
      plmnId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PlmnId'
      n3IwfId:
        type: string
      ngRanNodeId:
        $ref: '#/components/schemas/NgRanIdentifier'
    required:
      - plmnId
  NgKsi:
    type: object
    properties:
      tsc:
        $ref: '#/components/schemas/ScType'
      ksi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    required:
      - tsc
      - ksi
  KeyAmf:
    type: object
    properties:
      keyType:
        $ref: '#/components/schemas/KeyAmfType'
      keyVal:
        type: string
    required:
      - keyType
```

```
        - keyVal
    EpsBearerId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    NgApCause:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    NgRanIdentifier:
      type: string
      pattern: 'gNB-[A-Fa-f0-9]{6,8}|Macro-[A-Fa-f0-9]{5}|LMacro-[A-Fa-f0-9]{6}|SMacro-[A-Fa-f0-
9]{5}'
    Ppi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    NasCount:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
    5gmmCapability:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Bytes'
    UeSecurityCapability:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Bytes'
    S1UeNetworkCapability:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Bytes'
    DrxParameter:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Bytes'
    OmcIdentifier:
      type: string
    StatusChange:
      anyOf:
      - type: string
        enum:
          - "AMF_UNAVAILABLE"
          - "AMF_AVAILABLE"
      - type: string
    N2InformationClass:
      anyOf:
      - type: string
        enum:
          - "SM"
          - "NRPPa"
          - "PWS"
          - "PWS-BCAL"
          - "PWS-RF"
      - type: string
    N1MessageClass:
      anyOf:
      - type: string
        enum:
          - "5GMM"
          - "SM"
          - "LPP"
          - "SMS"
      - type: string
    N1N2MessageTransferCause:
      anyOf:
      - type: string
        enum:
          - "ATTEMPTING_TO_REACH_UE"
          - "N1_N2_TRANSFER_INITIATED"
          - "WAITING_FOR_ASYNCHRONOUS_TRANSFER"
      - type: string
    UeContextTransferStatus:
      anyOf:
      - type: string
        enum:
          - "TRANSFERRED"
          - "NOT_TRANSFERRED"
      - type: string
    N2InformationTransferResult:
      anyOf:
      - type: string
        enum:
          - "N2_INFO_TRANSFER_INITIATED"
      - type: string
    CipheringAlgorithm:
      anyOf:
      - type: string
        enum:
          - "NEA0"
          - "NEA1"
          - "NEA2"
          - "NEA3"
```

```
      - type: string
    IntegrityAlgorithm:
      anyOf:
      - type: string
        enum:
          - "NIA0"
          - "NIA1"
          - "NIA2"
          - "NIA3"
      - type: string
    SmsSupport:
      anyOf:
      - type: string
        enum:
          - "3GPP"
          - "NON_3GPP"
          - "BOTH"
          - "NONE"
      - type: string
    ScType:
      anyOf:
      - type: string
        enum:
          - "NATIVE"
          - "MAPPED"
      - type: string
    KeyAmfType:
      anyOf:
      - type: string
        enum:
          - "KAMF"
          - "KPRIMEAMF"
      - type: string
    TransferReason:
      anyOf:
      - type: string
        enum:
          - "INIT_REG"
          - "MOBI_REG"
          - "MOBI_REG_UE_VALIDATED"
      - type: string
```

A.3 Namf_EventExposure API

```
openapi: 3.0.0
info:
  version: 1.R15.0.0
  title: Namf_EventExposure Service
  description: AMF Event Exposure Service
security:
  - oAuth2Clientcredentials: []
externalDocs:
  description: Documentation
  url: 'http://www.3gpp.org/ftp/Specs/archive/29_series/29.518/29518-120.zip'
servers:
  - url: https://{apiRoot}/namf-evts/v1
    variables:
      apiRoot:
        default: locahhost:8080
paths:
  /subscriptions:
    post:
      summary: Namf_EventExposure Subscribe service Operation
      tags:
        - Create Subscription
      operationId: CreateSubscription
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AmfCreateEventSubscription'
        required: true
      responses:
        '201':
          description: Subsription Created
          content:
            application/json:
```

```
            schema:
              $ref: '#/components/schemas/AmfCreatedEventSubscription'
      '403':
        description: Forbidden
        content:
          application/problem+json:
            schema:
              $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
      default:
        description: Unexpected error
    callbacks:
      onEventReport:
        {$request.body#/subscription/notifyUri}:
          post:
            summary: Event Notificaiton Delivery
            requestBody:
              content:
                application/json:
                  schema:
                    $ref: '#/components/schemas/AmfEventNotification'
              required: true
            responses:
              '204':
                description: Successful acknowledgement
              default:
                description: Unexpected error
/subscriptions/{subscriptionId}:
  patch:
    summary: Namf_EventExposure Subscribe Modify service Operation
    tags:
      - Modify Subscription
    operationId: ModifySubscription
    parameters:
      - name: subscriptionId
        in: path
        required: true
        description: Unique ID of the subscription to be modified
        schema:
          type: string
    requestBody:
      content:
        application/json-patch+json:
          schema:
            $ref: '#/components/schemas/AmfUpdateEventSubscriptionItem'
      required: true
    responses:
      '200':
        description: Subsription modified successfully
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AmfUpdatedEventSubscription'
      '403':
        description: Forbidden
        content:
          application/problem+json:
            schema:
              $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
      '404':
        description: Not Found
        content:
          application/problem+json:
            schema:
              $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
      default:
        description: Unexpected error
  delete:
    summary: Namf_EventExposure Unsubscribe service Operation
    tags:
      - Delete Subscription
    operationId: DeleteSubscription
    parameters:
      - name: subscriptionId
        in: path
        required: true
        description: Unique ID of the subscription to be deleted
        schema:
          type: string
```

```
      responses:
        '200':
          description: Subsription deleted successfully
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        default:
          description: Unexpected error
components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes: {}
  schemas:
    AmfEventSubscription:
      type: object
      properties:
        events:
          type: array
          items:
            $ref: '#/components/schemas/AmfEvent'
        eventNotifyUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        notifyCorrelationId:
          type: string
        nfId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        subsChangeNotifyUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        groupId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        pei:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Pei'
        anyUE:
          type: boolean
      required:
        - events
        - eventNotifyUri
        - notifyCorrelationId
        - nfId
    AmfEvent:
      type: object
      properties:
        type:
          $ref: '#/components/schemas/AmfEventType'
        options:
          $ref: '#/components/schemas/AmfEventMode'
        immediateFlag:
          type: boolean
        area:
          type: array
          items:
            $ref: '#/components/schemas/AmfEventArea'
          minItems: 0
        locationFilters:
          $ref: '#/components/schemas/LocationFilter'
        subscribedDataFilters:
          $ref: '#/components/schemas/SubscribedDataFilter'
      required:
        - type
        - options
    AmfEventNotification:
      type: object
      properties:
        subscriptionId:
          type: string
        notifCorelationId:
          type: string
        reports:
          type: array
          items:
            $ref: '#/components/schemas/AmfEventReport'
```

```
      minItems: 1
  required:
    - subscriptionId
    - notifCorelationId
AmfEventReport:
  type: object
  properties:
    type:
      $ref: '#/components/schemas/AmfEventType'
    state:
      $ref: '#/components/schemas/AmfEventState'
    anyUe:
      type: boolean
    supi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
    area:
      type: array
      items:
        $ref: '#/components/schemas/AmfEventArea'
    gpsi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
    pei:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Pei'
    location:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/UserLocation'
    timezone:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/TimeZone'
    accessTypes:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/AccessType'
    rmInfos:
      $ref: '#/components/schemas/RmInfo'
    cmInfos:
      $ref: '#/components/schemas/CmInfo'
    reachability:
      $ref: '#/components/schemas/UeReachability'
    subscribedData:
      $ref: '#/components/schemas/SubscribedData'
    commFailure:
      $ref: '#/components/schemas/CommunicationFailure'
    numberOfUes:
      type: integer
  required:
    - type
    - state
AmfEventMode:
  type: object
  properties:
    trigger:
      $ref: '#/components/schemas/AmfEventTrigger'
    maxReports:
      type: integer
    duration:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
  required:
    - trigger
AmfEventState:
  type: object
  properties:
    active:
      type: boolean
    remainReports:
      type: integer
    remainDuration:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
  required:
    - active
RmInfo:
  type: object
  properties:
    rmState:
      $ref: '#/components/schemas/RmState'
    accessType:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/AccessType'
  required:
    - rmState
    - accessType
CmInfo:
  type: object
```

```
    properties:
      cmState:
        $ref: '#/components/schemas/CmState'
      accessType:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/AccessType'
    required:
      - cmState
      - accessType
  SubscribedData:
    type: object
    properties:
      sari:
        $ref: '#/components/schemas/Sari'
      rfspIndex:
        $ref: '#/components/schemas/RfspIndex'
  CommunicationFailure:
    type: object
    properties:
      nasReleaseCode:
        type: string
      ranReleaseCode:
        $ref: 'TS29518_Namf_Communication.yaml#/components/schemas/NgApCause'
  AmfCreateEventSubscription:
    type: object
    properties:
      subscription:
        $ref: '#/components/schemas/AmfEventSubscription'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - subscription
  AmfCreatedEventSubscription:
    type: object
    properties:
      subscription:
        $ref: '#/components/schemas/AmfEventSubscription'
      reports:
        $ref: '#/components/schemas/AmfEventReport'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - subscription
  AmfUpdateEventSubscriptionItem:
    type: array
    items:
      type: object
      properties:
        op:
          type: string
          enum:
            - add
            - remove
            - replace
        path:
          type: string
          pattern: '\/events\/[0-]$|\/events\/[1-9][0-9]*$'
        value:
          $ref: '#/components/schemas/AmfEvent'
      required:
        - op
        - path
    minItems: 1
  AmfUpdatedEventSubscription:
    type: object
    properties:
      subscription:
        $ref: '#/components/schemas/AmfEventSubscription'
    required:
      - subscription
  AmfEventArea:
    type: object
    properties:
      presence:
        $ref: '#/components/schemas/PresenceState'
      trackingAreas:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Tai'
      areaId:
        type: string
```

```
      ladn:
        type: string
      ecgi:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ecgi'
        minItems: 0
      ncgi:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ncgi'
        minItems: 0
      globalRanNodeId:
        type: array
        items:
          $ref: 'TS29518_Namf_Communication.yaml#/components/schemas/GlobalRanNodeId'
  5gGuti:
    type: string
  Sari:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Bytes'
  RfspIndex:
    type: integer
  AmfEventType:
    anyOf:
    - type: string
      enum:
        - "LOCATION_REPORT"
        - "PRESENCE_IN_AOI_REPORT"
        - "TIMEZONE_REPORT"
        - "ACCESS_TYPE_REPORT"
        - "REGISTRATION_STATE_REPORT"
        - "CONNECTIVITY_STATE_REPORT"
        - "REACHABILITY_REPORT"
        - "SUBSCRIBED_DATA_REPORT"
        - "COMMIUNICATION_FAILURE_REPORT"
        - "UES_IN_AREA_REPORT"
    - type: string
  AmfEventTrigger:
    anyOf:
    - type: string
      enum:
        - "ONE_TIME"
        - "CONTINUOUS"
    - type: string
  LocationFilter :
    anyOf:
    - type: string
      enum:
        - "TAI"
        - "CELL_ID"
        - "N3IWF"
        - "UE_IP"
        - "UDP_PORT"
    - type: string
  SubscribedDataFilter:
    anyOf:
    - type: string
      enum:
        - "SARI"
        - "RFSP_INDEX"
    - type: string
  UeReachability:
    anyOf:
    - type: string
      enum:
        - "UNREACHABLE"
        - "REACHABLE"
        - "REGULATORY_ONLY"
    - type: string
  PresenceState:
    anyOf:
    - type: string
      enum:
        - "IN"
        - "OUT"
        - "UNKNOWN"
    - type: string
  RmState:
```

```
      anyOf:
      - type: string
        enum:
          - "REGISTERED"
          - "DEREGISTERED"
      - type: string
    CmState:
      anyOf:
      - type: string
        enum:
          - "IDLE"
          - "CONNECTED"
      - type: string
```

A.4 Namf_MT

```
openapi: 3.0.0
info:
  version: 1.R15.0.0
  title: AMF MT Service
  description: AMF Mobile Termination Service
security:
  - oAuth2Clientcredentials: []
externalDocs:
  description: Documentation
  url: 'http://www.3gpp.org/ftp/Specs/archive/29_series/29.518/29518-120.zip'
servers:
  - url: https://{apiRoot}/namf-mt/v1
    variables:
      apiRoot:
        default: locahhost:8080
paths:
  '/ue-contexts/{ueContextId}':
    get:
      summary: Namf_MT Provide Domain Selection Info service Operation
      tags:
        - Provide Domain Selection Info
      operationId: Provide Domain Selection Info
      parameters:
        - name: ueContextId
          in: path
          description: UE Context Identifier
          required: true
          schema:
            type: string
        - name: info-class
          in: query
          description: UE Context Information Class
          schema:
            $ref: '#/components/schemas/UeContextInfoClass'
        - name: supported-features
          in: query
          description: Supported Features
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      responses:
        '200':
          description: Requested UE Context Information returned
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/UeContextInfo'
        '307':
          description: Temporary Redirect
          content:
            application/problem+json:
              schema:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        default:
          description: Unexpected error
  /ue-contexts/{ueContextId}/ue-reachind:
    post:
      summary: Namf_MT EnableUEReachability service Operation
```

```
      tags:
        - Enable UE Reachability
      operationId: EnableUeReachability
      parameters:
        - name: ueContextId
          in: path
          description: UE Context Identifier
          required: true
          schema:
            type: string
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/EnableUeReachabilityReqData'
        required: true
      responses:
        '200':
          description: UE has become reachable as desired
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/EnableUeReachabilityRspData'
        '307':
          description: Temporary Redirect
          content:
            application/problem+json:
              schema:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
        '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'
        '504':
          $ref: 'TS29571_CommonData.yaml#/components/responses/504'
        default:
          description: Unexpected error
components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes: {}
  schemas:
    EnableUeReachabilityReqData:
      type: object
      properties:
        reachability:
          $ref: 'TS29518_Namf_EventExposure.yaml#/components/schemas/UeReachability'
        supportedFeatures:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      required:
        - reachability
    EnableUeReachabilityRspData:
      type: object
      properties:
        reachability:
          $ref: 'TS29518_Namf_EventExposure.yaml#/components/schemas/UeReachability'
        supportedFeatures:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      required:
        - reachability
    UeContextInfo:
      type: object
      properties:
        supportVoPS:
          type: boolean
        lastActTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        ratType:
```

```
          $ref: 'TS29571_CommonData.yaml#/components/schemas/RatType'
        supportedFeatures:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    UeContextInfoClass:
      anyOf:
      - type: string
        enum:
          - "TADS"
      - type: string
```

A.5 Namf_Location

```
openapi: 3.0.0
info:
  version: 1.R15.0.0
  title: AMF Location Service
  description: AMF Location Service
security:
  - oAuth2Clientcredentials: []
externalDocs:
  description: Documentation
  url: 'http://www.3gpp.org/ftp/Specs/archive/29_series/29.518/29518-120.zip'
servers:
  - url: https://{apiRoot}/namf-loc/v1
    variables:
      apiRoot:
        default: locahhost:8080
paths:
  /{ueContextId}/provide:
    post:
      summary: Namf_Location ProvideLocation service Operation
      tags:
        - Provide Location
      operationId: ProvideLocation
      parameters:
        - name: ueContextId
          in: path
          description: UE Context Identifier
          required: true
          schema:
            type: string
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/RequestUELocation'
        required: true
      responses:
        '200':
          description: Expected response to a valid request
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/ProvideUELocation'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        '504':
          $ref: 'TS29571_CommonData.yaml#/components/responses/504'
        default:
          description: Unexpected error
      callbacks:
        onUELocationNotification:
          {$request.body#/locationNotificationUri}:
            post:
              requestBody:
                description: UE Location Event Notification
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/NotifiedUELocation'
              responses:
                '204':
                  description: Expected response to a successful callback processing
```

```
               '403':
                 $ref: 'TS29571_CommonData.yaml#/components/responses/504'
components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes: {}
  schemas:
    RequestUELocation:
      type: object
      properties:
        lcsClientType:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/ExternalClientType'
        lcsLocation:
          $ref: '#/components/schemas/LocationType'
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        priority:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LcsPriority'
        lcsQoS:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LocationQoS'
        velocityRequested:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/VelocityRequested'
        lcsSupportedGADShapes:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/SupportedGADShapes'
        locationNotificationUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        supportedFeatures:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      required:
        - lcsClientType
        - lcsLocation
    ProvideUELocation:
      type: object
      properties:
        locationEstimate:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/GeographicArea'
        accuracyFulfilmentIndicator:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/AccuracyFulfilmentIndicator'
        ageOfLocationEstimate:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/AgeOfLocationEstimate'
        velocityEstimate:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/VelocityEstimate'
        positioningData:
          type: array
          items:
            $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/PositioningMethodAndUsage'
          minItems: 0
          maxItems: 9
        gnssPositioningData:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/GnssPositioningMethodAndUsage'
        ecgi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ecgi'
        ncgi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ncgi'
        targetServingNode:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        civicAddress:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/CivicAddress'
        barometricPressure:
          $ref: '#/components/schemas/BarometricPressure'
        supportedFeatures:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    NotifiedUELocation:
      type: object
      properties:
        locationEvent:
          $ref: '#/components/schemas/LocationEvent'
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        pei:
```

```
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Pei'
      locationEstimate:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/GeographicArea'
      ageOfLocationEstimate:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/AgeOfLocationEstimate'
      velocityEstimate:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/VelocityEstimate'
      positioningData:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/PositioningMethodAndUsage'
      gnssPositioningData:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/GnssPositioningMethodAndUsage'
      ecgi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ecgi'
      ncgi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ncgi'
      servingNode:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      civicAddress:
        $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/CivicAddress'
      barometricPressure:
        $ref: '#/components/schemas/BarometricPressure'
    required:
      - locationEvent
  BarometricPressure:
    type: integer
  LocationType:
    anyOf:
    - type: string
      enum:
        - CURRENT_LOCATION
        - CURRENT_OR_LAST_KNOWN_LOCATION
        - INITIAL_LOCATION
    - type: string
  LocationEvent:
    anyOf:
    - type: string
      enum:
        - EMERGENCY_CALL_ORIGINATION
        - EMERGENCY_CALL_RELEASE
        - EMERGENCY_CALL_HANDOVER
    - type: string
```

Annex B (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2017-10	CT4#80	C4-175297				TS Skeleton	0.1.0
2017-10	CT4#80	C4-175397				Implementation of pCRs agreed at CT4#80.	0.2.0
2017-12	CT4#81	C4-176441				Implementation of pCRs agreed at CT4#81, including C4-176285, C4-176290, C4-176291, C4-176292, C4-176293, C4-176375, C4-176376, C4-176378, C4-176379, C4-176380 and C4-176404.	0.3.0
2018-01	CT4#82	C4-181393				Implementation of pCRs agreed at CT4#82, including C4-181090, C4-181091, C4-181258, C4-181259, C4-181260, C4-181269, C4-181270, C4-181311, C4-181312, C4-181313, C4-181314, C4-181352, C4-181353 and C4-181354	0.4.0
2018-03	CT4#83	C4-182437				Implementation of pCRs agreed at CT4#83, including C4-182287, C4-182288, C4-182290, C4-182292, C4-182293, C4-182350, C4-182353, C4-182355, C4-182358, C4-182367, C4-182385, C4-182403, C4-182414, C4-182415	0.5.0
2018-03	CT#79	CP-180033				Presented for information	1.0.0
2018-04	CT4#84	C4-183518				Implementation of pCRs agreed at CT4#84, including C4-183048, C4-183054, C4-183055, C4-183064, C4-183073, C4-183074, C4-183161, C4-183166, C4-183171, C4-183345, C4-183347, C4-183351, C4-183354, C4-183356, C4-183357, C4-183359, C4-183360, C4-183361, C4-183362, C4-183406, C4-183407, C4-183408, C4-183409, C4-183410, C4-183411, C4-183412, C4-183413, C4-183414, C4-183415, C4-183417, C4-183434, C4-183435, C4-183436, C4-183437, C4-183439, C4-183445, C4-183460, C4-183461, C4-183462, C4-183463, C4-183464, C4-183493, C4-183494, C4-183495, C4-183502	1.1.0
2018-05	CT4#85	C4-184629				Implementation of pCRs agreed at CT4#85, including: C4-184390, C4-184391, C4-184562, C4-184393, C4-184561, C4-184395, C4-194052, C4-184396, C4-184399, C4-184404, C4-184405, C4-184407, C4-184102, C4-184408, C4-184104, C4-184410, C4-184412, C4-184413, C4-184569, C4-184563, C4-184124, C4-184418, C4-184565, C4-184127, C4-184566, C4-184129, C4-184421, C4-184131, C4-184426, C4-184427, C4-184428, C4-184429, C4-184430, C4-184431, C4-184432, C4-184433, C4-184434, C4-184435, C4-184436, C4-184437, C4-184151, C4-184481, C4-184154, C4-184515, C4-184516, C4-184568, C4-184485, C4-184486, C4-184487, C4-184488	1.2.0
2018-06	CT#80	CP-181107				Presented for approval	2.0.0
2018-06	CT#80					Approved in CT#80	15.0.0

History

Document history		
V15.0.0	September 2018	Publication