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Keywords

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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 - APE 7112B
Association à but non lucratif enregistrée à la
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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
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In the present document, certain modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

NOTE 1: The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

NOTE 2: The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

NOTE 3: The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

NOTE 4: The constructions "can" and "cannot" shall not to be used as substitutes for "may" and "need not".

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

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

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

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

In addition:

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

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

NOTE 5: The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies the stage 3 protocol and data model for the Nnef southbound Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the Network Exposure Function (NEF).

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.288 [14].

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

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".
- [3] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".
- [4] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".
- [5] 3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".
- [6] OpenAPI: "OpenAPI Specification Version 3.0.0", <https://spec.openapis.org/oas/v3.0.0>.
- [7] 3GPP TR 21.900: "Technical Specification Group working methods".
- [8] 3GPP TS 33.501: "Security architecture and procedures for 5G system".
- [9] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".
- [10] 3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".
- [11] IETF RFC 7540: "Hypertext Transfer Protocol Version 2 (HTTP/2)".
- [12] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".
- [13] IETF RFC 7807: "Problem Details for HTTP APIs".
- [14] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".
- [15] 3GPP TS 29.522: "5G System; Network Exposure Function Northbound APIs; Stage 3".
- [16] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".
- [17] 3GPP TS 29.520: "5G System; Network Data Analytics Services; Stage 3".
- [18] 3GPP TS 29.517: "5G System; Application Function Event Exposure Service; Stage 3".
- [19] 3GPP TS 29.551: "5G System; Packet Flow Description Management Service; Stage 3".

- [20] 3GPP TS 29.541: "5G System; Network Exposure (NE) function services for Non-IP Data Delivery (NIDD); Stage 3".
- [21] 3GPP TS 29.554: "5G System; Background Data Transfer Policy Control Service; Stage 3".
- [22] 3GPP TS 29.523: "5G System; Policy Control Event Exposure Service; Stage 3".
- [23] 3GPP TS 29.256: "Uncrewed Aerial Systems Network Function (UAS-NF); Aerial Management Services; Stage 3".
- [24] 3GPP TS 26.531: "Data Collection and Reporting; General Description and Architecture".
- [25] 3GPP TS 26.501: "5G Media Streaming (5GMS); General description and architecture".
- [26] 3GPP TS 26.512: "5G Media Streaming (5GMS); Protocols".

3 Definitions, symbols 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].

3.2 Symbols

For the purposes of the present document, the following symbols apply:

3.3 Abbreviations

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

5GMS	5G Media Streaming
AF	Application Function
API	Application Programming Interface
ASP	Application Service Provider
EAS	Edge Application Server
NEF	Network Exposure Function
NF	Network Function
NWDAF	Network Data Analytics Function
SMF	Session Management Function
SUPI	Subscription Permanent Identifier
URI	Uniform Resource Identifier

4 Services offered by the NEF

4.1 Introduction

The NEF offers to other NFs the following southbound services:

- Nnef_EventExposure
- Nnef_PFDManagement

- Nnef_SMContext
- Nnef_Authentication
- Nnef_EASDeployment

NOTE 1: The northbound services offered by the NEF are defined in 3GPP TS 29.522 [15], e.g. the northbound requirement of Nnef_EventExposure service or Nnef_EASDeployment.

NOTE 2: The services offered by the NEF (e.g. Nnef_EventExposure service) as specified in the present specification are only applicable for Nnef southbound services.

NOTE 3: The Nnef_PFDManagement service offered by the NEF southbound is defined in 3GPP TS 29.551 [19].

NOTE 4: The Nnef_SMContext service offered by the NEF southbound is defined in 3GPP TS 29.541 [20].

NOTE 5: The Nnef_Authentication service offered by the NEF southbound is defined in 3GPP TS 29.256 [23].

4.2 Nnef_EventExposure Service

4.2.1 Service Description

4.2.1.1 Overview

The Nnef_EventExposure service, as defined in 3GPP TS 23.502 [3], is provided by the Network Exposure Function (NEF). When the UE Application data is collected via the Data Collection AF, the NEF collect the Application Function Exposure Service as defined in 3GPP TS 26.531 [24], 3GPP TS 26.501 [25], and 3GPP TS 26.512 [26], is provided by the Data Collection AF instantiated in 5GMS AF for the Event Consumer AF instantiated in 5GMS ASP.

This service:

- allows NF service consumers to subscribe, modify and unsubscribe for application events; and
- notifies NF service consumers with a corresponding subscription about observed events on the NEF.

The types of observed events applicable for NEF include:

AF application events exposed by AF:

- Service experience;
- UE mobility;
- UE communication;
- Exceptions;
- User Data Congestion;
- Dispersion;
- Performance Data information; and
- Collective Behaviour information

UE application events exposed via Data Collection AF:

- QoE metrics;
- Consumption reports;
- Network Assistance invocations;
- Charging and Policy invocations; and

- Media streaming access activity.

The target of the event reporting may include one or more UE(s), a group of UEs or any UE (i.e. all UEs). When an event to which the NF service consumer has subscribed occurs, the NEF reports the requested information to the NF service consumer based on the event reporting information definition requested by the NF service consumer.

4.2.1.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The Network Data Analytics Exposure architecture is defined in 3GPP TS 23.288 [14]. The Media Streaming UE application data collection via the Data Collection AF is defined in 3GPP TS 26.531 [24].

The Nnef_EventExposure service is part of the Nnef service-based interface exhibited by the Network Exposure Function (NEF).

Known consumers of the Nnef_EventExposure service are:

- Network Data Analytics Function (NWDAF)
- Event Consumer AF in the 5GMS ASP

The Nnef_EventExposure service is provided by the NEF and consumed by NF service consumers (e.g. NWDAF, Event Consumer AF), as shown in figure 4.2.1.2-1 for the SBI representation model and in figure 4.2.1.2-2 for reference point representation model.

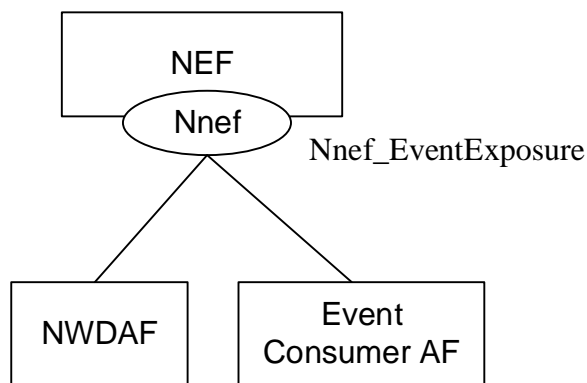


Figure 4.2.1.2-1: Reference Architecture for the Nnef_EventExposure Service; SBI representation

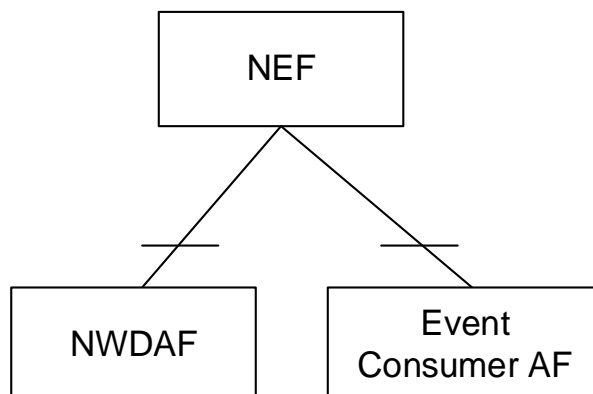


Figure 4.2.1.2-2: Reference Architecture for the Nnef_EventExposure Service: reference point representation

4.2.1.3 Network Functions

4.2.1.3.1 Network Exposure Function (NEF)

The Network Exposure Function (NEF) is a functional element that provides application or user related information to the NF service consumers as defined in this specification.

The NEF allows the NF consumer(s) to (un)subscribe to notifications of monitoring observed event, and sends the notification to the NF consumer(s) when a subscribed event is detected.

4.2.1.3.2 NF Service Consumers

The known NF service consumers are as follows:

The Network Data Analytics Function (NWDAF):

- supports (un)subscribing to notifications of subscribed event(s) from the NEF;
- supports receiving the notifications of subscribed event(s) from the NEF.

The Event Consumer Application Function (Event Consumer AF):

- supports (un)subscribing to notifications of service experience information from the NEF;
- supports receiving the notifications of subscribed event(s) from the NEF.

4.2.2 Service Operations

4.2.2.1 Introduction

Service operations defined for the Nnef_EventExposure Service are shown in table 4.2.2.1-1.

Table 4.2.2.1-1: Nnef_EventExposure Service Operations

Service Operation Name	Description	Initiated by
Nnef_EventExposure_Subscribe	This service operation is used by an NF service consumer to subscribe to, or modify a subscription in the NEF for event notifications on a specified application or user related event.	NF service consumer
Nnef_EventExposure_Unsubscribe	This service operation is used by an NF service consumer to unsubscribe from event notifications.	NF service consumer
Nnef_EventExposure_Notify	This service operation is used by the NEF to report application or user related event(s) to the NF service consumer which has subscribed to the event report service.	NEF

4.2.2.2 Nnef_EventExposure_Subscribe service operation

4.2.2.2.1 General

This service operation is used by an NF service consumer to subscribe to notifications on specified event(s) or modify an existing subscription.

The following are the types of events for which a subscription to notifications can be created by the NWDAF as the NF service consumer:

- Service experience;
- UE mobility;
- UE communication;

- Exceptions;
- User Data Congestion;
- Dispersion;
- Performance Data information; and
- Collective Behaviour information.

The following are the types of events for which a subscription can be made by the NWDAF or Event Consumer AF as the NF service consumer:

- QoE metrics;

The following are the types of events for which a subscription can be made by the Event Consumer AF as the NF service consumer:

- Consumption reports;
- Network Assistance invocations;
- Charging and Policy invocations; and
- Media streaming access activity.

The following procedures using the Nnef_EventExposure_Subscribe service operation are supported:

- creating a new subscription;
- modifying an existing subscription.

4.2.2.2.2 Creating a new subscription

Figure 4.2.2.2.2-1 illustrates the creation of a Network Exposure Event Subscription.

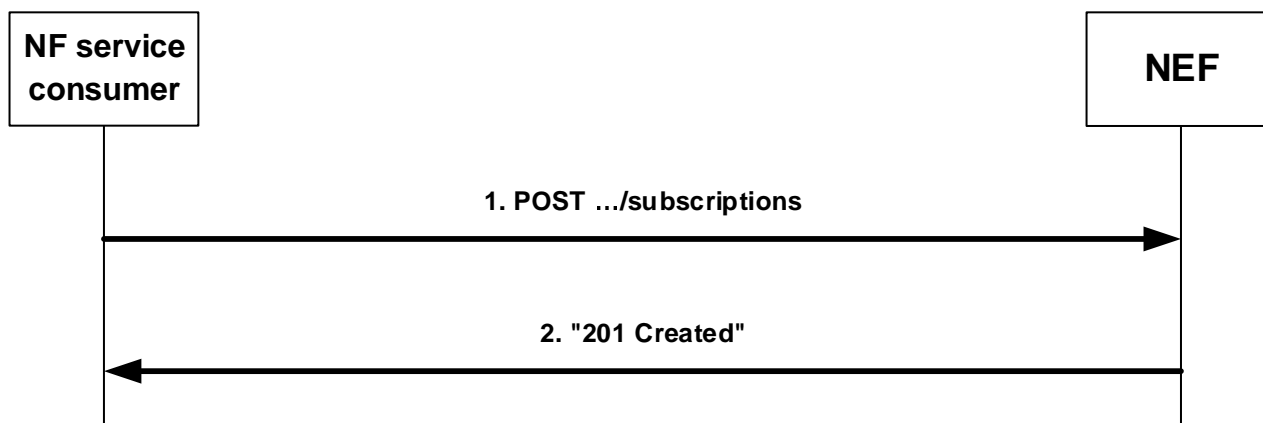


Figure 4.2.2.2.2-1: Creation of a subscription

To subscribe to event notifications, the NF service consumer shall send an HTTP POST request to the NEF with: "{apiRoot}/nnef-eventexposure/<apiVersion>/subscriptions" as request URI as shown in step 1 of figure 4.2.2.2.2-1, and the "NefEventExposureSubsc" data structure as request body.

The "NefEventExposureSubsc" data structure shall include:

- a URI where to receive the requested notifications as "notifUri" attribute;
- a Notification Correlation Identifier assigned by the NF service consumer for the requested notifications as "notifId" attribute; and
- description of subscribed event information as "eventsSubs" attribute by using one or more "NefEventSubs" data.

The "NefEventExposureSubsc" data structure may also include:

- the description of the event reporting information as "eventsRepInfo" attribute.

The "NefEventSubs" data structure shall include:

- an event to subscribe to as a "event" attribute; and
- event filter information as "eventFilter" attribute associated with the event.

The "eventsRepInfo" attribute may include:

- event notification method (periodic, one time, on event detection) as "notifMethod" attribute;
- Maximum Number of Reports as "maxReportNbr" attribute;
- Monitoring Duration as "monDur" attribute;
- repetition period for periodic reporting as "repPeriod" attribute;
- immediate reporting indication as "immRep" attribute;
- sampling ratio as "sampRatio" attribute;
- partitioning criteria for partitioning the UEs before performing sampling as "partitionCriteria" attribute if the EneNA feature is supported;
- group reporting guard time as "grpRepTime" attribute; and/or
- a notification flag as "notifFlag" attribute if the EneNA feature is supported.

If the NEF cannot successfully fulfil the received HTTP POST request due to an internal error or an error in the HTTP POST request, the NEF shall send an HTTP error response as specified in clause 5.1.7.

Upon successful reception of an HTTP POST request with "{apiRoot}/nnef-eventexposure/<apiVersion>/subscriptions" as request URI and "NefEventExposureSubsc" data structure as request body, the NEF shall create a new "Individual Network Exposure Event Subscription" resource, store the subscription and send an HTTP "201 Created" response, as shown in step 2 of figure 4.2.2.2.2-1. The NEF shall include in the "201 Created" response:

- a Location header field; and
- an "NefEventExposureSubsc" data type in the payload body.

The Location header field shall contain the URI of the created individual application session context resource i.e. "{apiRoot}/nnef-eventexposure/<apiVersion>/subscriptions/{subscriptionId}".

The "NefEventExposureSubsc" data type payload body shall contain the representation of the created "Individual Network Exposure Event Subscription".

When the "monDur" attribute is included in the response by the NEF, it represents NEF selected expiry time that is equal or less than the expiry time received in the request.

When the "immRep" attribute is included and set to "true" in the subscription and the subscribed events are available, the NEF shall include the reports of the events subscribed, if available, in the HTTP POST response.

When the sampling ratio attribute, as "sampRatio", is included in the subscription without a "partitionCriteria" attribute, the NEF shall select a random subset of UEs among the target UEs according to the sampling ratio and only report the event(s) related to the selected subset of UEs. If the "partitionCriteria" attribute is additionally included, then the NEF shall first partition the UEs according to the value of the "partitionCriteria" attribute and then select a random subset of UEs from each partition according to the sampling ratio and only report the event(s) related to the selected subsets of UEs.

When the group reporting guard time, as "grpRepTime" attribute, is included in the subscription, the NEF shall accumulate all the event reports for the target UEs until the group reporting guard time expires. Then, the NEF shall notify the NF service consumer using the Nnef_EventExposure_Notify service operation, as described in clause 4.2.2.4.

When the "notifFlag" attribute is included and set to "DEACTIVATE" in the request, the NEF shall mute the event notification and store the available events.

4.2.2.2.3 Modifying an existing subscription

Figure 4.2.2.2.3-1 illustrates the modification of an existing subscription.

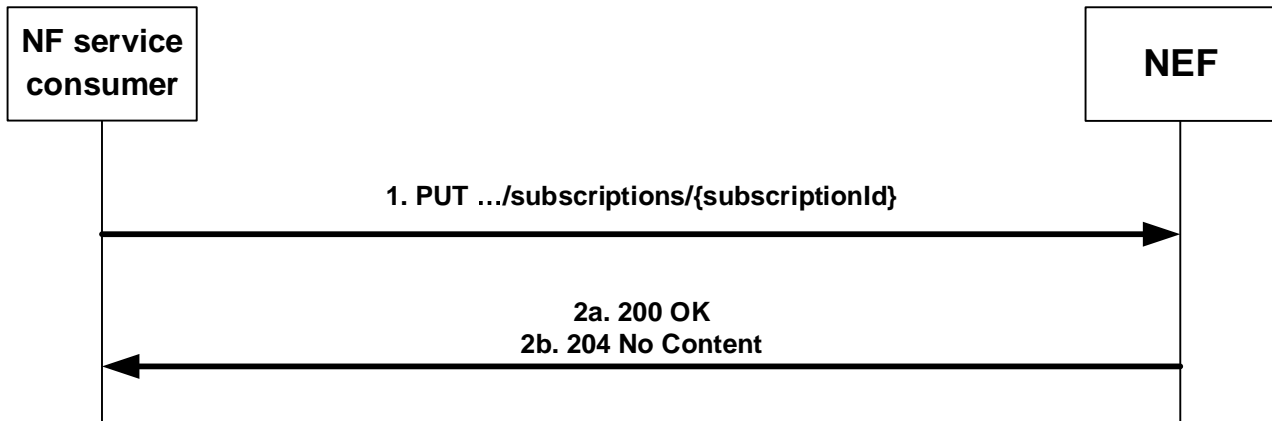


Figure 4.2.2.2.3-1: Modification of an existing subscription

To modify an existing subscription to event notifications, the NF service consumer shall send an HTTP PUT request with: "{apiRoot}/nnef-eventexposure/<apiVersion>/subscriptions/{subscriptionId}" as request URI, as shown in step 1 of figure 4.2.2.2.3-1, where "{subscriptionId}" is the subscription correlation ID of the existing subscription. The "NefEventExposureSubsc" data structure is included as request body as described in clause 4.2.2.2.2.

NOTE 1: An alternate NF service consumer than the one that requested the generation of the subscription resource can send the PUT request.

NOTE 2: The "notifUri" attribute within the NefEventExposureSubsc data structure can be modified to request that subsequent notifications are sent to a new NF service consumer.

NOTE 3: The "monDur" attribute within the NefEventExposureSubsc data structure can be modified to extend the expiry time to keep receiving notifications.

If the NEF cannot successfully fulfil the received HTTP PUT request due to an internal error or an error in the HTTP PUT request, the NEF shall send an HTTP error response as specified in clause 5.1.7.

If the feature "ES3XX" is supported, and the NEF determines the received HTTP PUT request needs to be redirected, the NEF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

Upon successful reception of an HTTP PUT request with: "{apiRoot}/nnef-eventexposure/<apiVersion>/subscriptions/{subscriptionId}" as request URI and "NefEventExposureSubsc" data structure as request body, the NEF shall update the subscription and send an HTTP "200 OK" response with the "NefEventExposureSubsc" data structure as response body containing the representation of the modified "Individual Network Exposure Event Subscription", or an HTTP "204 No Content" response, as shown in step 2 of figure 4.2.2.2.3-1.

When the "monDur" attribute is included in the response by the NEF, it represents NEF selected expiry time that is equal or less than the expiry time received in the request.

When the "immRep" attribute is included and sets to "true" in the subscription and the subscribed events are available, the NEF shall include the reports of the events subscribed, if available, in the HTTP PUT response.

When the sampling ratio, as "sampRatio" attribute, is included in the subscription without a "partitionCriteria" attribute, the NEF shall select a random subset of UEs among the target UEs according to the sampling ratio and only report the event(s) related to the selected subset of UEs. If the "partitionCriteria" attribute is additionally included, then the NEF shall first partition the UEs according to the value of the "partitionCriteria" attribute and then select a random subset of UEs from each partition according to the sampling ratio and only report the event(s) related to the selected subsets of UEs.

When the group reporting guard time, as "grpRepTime" attribute, is included in the subscription, the NEF shall accumulate all the event reports for the target UEs until the group reporting guard time expires. Then, the NEF shall notify the NF service consumer using the Nnef_EventExposure_Notify service operation, as described in clause 4.2.2.4.

When the "notifFlag" attribute is included, and set to "DEACTIVATE" in the request, the NEF shall mute the event notification and store the available events; if it is set to "RETRIEVAL" in the request, the NEF shall send the stored events to the NF service consumer, and mute the event notification again and store available events; if it is set to "ACTIVATE" and the event notifications are muted (due to a previously received "DECATIVATE" value), the NEF shall unmute the event notification, i.e. start sending again notifications for available events.

4.2.2.3 Nnef_EventExposure_Unsubscribe service operation

4.2.2.3.1 General

This service operation is used by an NF service consumer to unsubscribe from event notifications.

The following procedure using the Nnef_EventExposure_Unsubscribe service operation is supported:

- unsubscription from event notifications.

4.2.2.3.2 Unsubscription from event notifications

Figure 4.2.2.3.2-1 illustrates the unsubscription from event notifications.

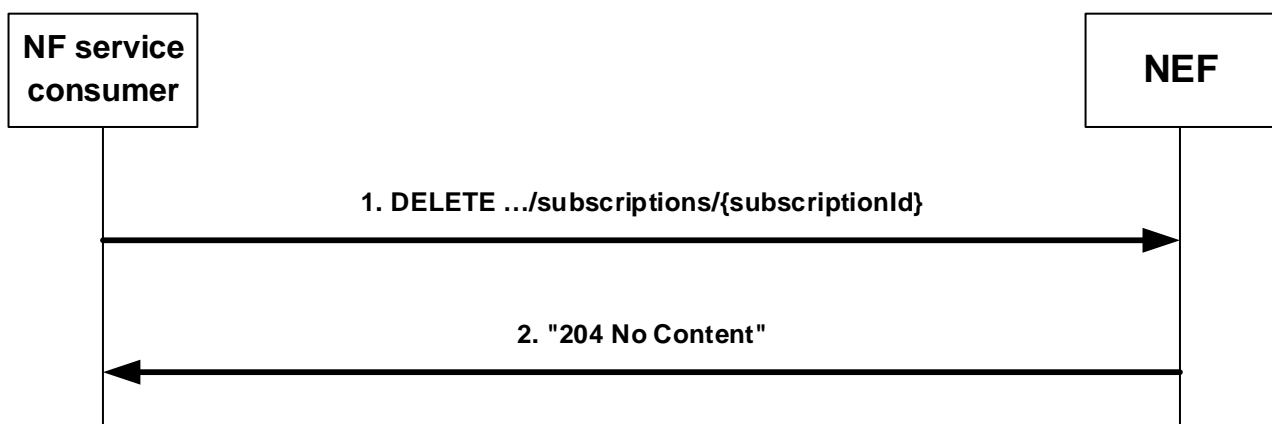


Figure 4.2.2.3.2-1: Unsubscription from event notifications

To unsubscribe from event notifications, the NF service consumer shall send an HTTP DELETE request with "{apiRoot}/nnef-eventexposure/<apiVersion>/subscriptions/{subscriptionId}" as request URI, as shown in step 1 of figure 4.2.2.3.2-1, where "{subscriptionId}" is the subscription correlation identifier of the existing subscription resource that is to be deleted.

If the NEF cannot successfully fulfil the received HTTP DELETE request due to an internal error or an error in the HTTP DELETE request, the NEF shall send an HTTP error response as specified in clause 5.1.7.

If the feature "ES3XX" is supported, and the NEF determines the received HTTP DELETE request needs to be redirected, the NEF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

Upon successful reception of an HTTP DELETE request with: "{apiRoot}/nnef-eventexposure/<apiVersion>/subscriptions/{subscriptionId}" as request URI, the NEF shall remove the corresponding subscription and send an HTTP "204 No Content" response, as shown in step 2 of figure 4.2.2.3.2-1.

4.2.2.4 Nnef_EventExposure_Notify service operation

4.2.2.4.1 General

The Nnef_EventExposure_Notify service operation enables the NEF to notify the NF service consumer(s) that the previously subscribed application related event occurred.

The following procedure using the Nnef_EventExposure_Notify service operation is supported:

- notification about subscribed events.

4.2.2.4.2 Notification about subscribed events

Figure 4.2.2.4.2-1 illustrates the notification about subscribed events.

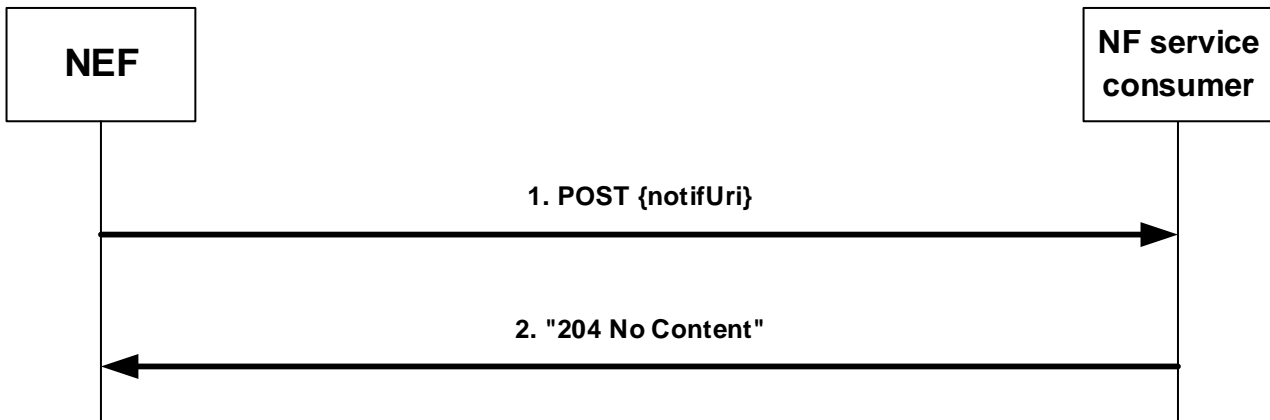


Figure 4.2.2.4.2-1: Notification about subscribed events

If the NEF observes application related event(s) for which an NF service consumer has subscribed, the NEF shall send an HTTP POST request as shown in step 1 of figure 4.2.2.4.2-1, with the "{notifUri}" as request URI containing the value previously provided by the NF service consumer within the corresponding subscription, and the "NefEventExposureNotif" data structure.

The "NefEventExposureNotif" data structure shall include:

- notification correlation ID provided by the NF service consumer during the subscription as "notifId" attribute; and
- information about the observed event(s) within the "eventNotifs" attribute that shall contain for each observed event an "NefEventNotification" data structure that shall include:
 - the application related event as "event" attribute;
 - the time at which the event was observed encoded as "timeStamp" attribute;
 - if the "event" attribute is "SVC_EXPERIENCE", service experience information about the application involved in the reported event in the "svcExprInfos" attribute;
 - if the "event" attribute is "UE_MOBILITY", UE mobility information associated with the application as "ueMobilityInfos" attribute;
 - if the "event" attribute is "UE_COMM", UE communication information associated with the application as "ueCommInfos" attribute;
 - if the "event" attribute is "EXCEPTIONS", exceptions information associated with a service flow as "excepInfos" attribute;
 - if the "event" attribute is "PERF_DATA", Performance Data Analytics related information as "perfDataInfos" attribute;
 - if the "event" attribute is "COLLECTIVE_BEHAVIOUR", collective behaviour information associated with the UEs and its applications as "collBhvrInfos" attribute;
 - if the "event" attribute is "USER_DATA_CONGESTION", user data congestion information collected for an AF application as "congestionInfos" attribute; and
 - if the "event" attribute is "DISPERSION", UE dispersion information collected for an AF as "dispersionInfos" attribute.

- if the "event" attribute is "QOE_METRICS", QoE metrics information collected for an UE application via the Data Collection AF as "qoeMetrInfos" attribute.
- if the "event" attribute is "CONSUMPTION", Consumption reports information collected for an UE application via the Data Collection AF as "consumpInfos" attribute.
- if the "event" attribute is "NET_ASSIST_INVOCATION", Network Assistance invocations information collected for an UE application via the Data Collection AF as "netAssInvInfos" attribute.
- if the "event" attribute is "CHARGING_POLICY_INVOCATION", Charging and Policy invocations information collected for an UE application via the Data Collection AF as "chgPlyInvInfos" attribute.
- if the "event" attribute is "MS_ACCESS_ACTIVITY", Media Streaming access activity information collected for an UE application via the Data Collection AF as "msAccActInfos" attribute.

If the NF service consumer cannot successfully fulfil the received HTTP POST request due to an internal error or an error in the HTTP POST request, the NF service consumer shall send an HTTP error response as specified in clause 5.1.7.

If the feature "ES3XX" is supported, and the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

Upon successful reception of an HTTP POST request with "{notifUri}" as request URI and "NefEventExposureNotif" data structure as request body, the NF service consumer shall send an HTTP "204 No Content" response, as shown in step 2 of figure 4.2.2.4.2-1, in case of a successful processing.

4.3 Nnef_EASDeployment Service

4.3.1 Service Description

4.3.1.1 Overview

The Nnef_EASDeployment service, as defined in 3GPP TS 23.502 [3], is provided by the Network Exposure Function (NEF). This service allows the SMF to subscribe/unsubscribe the notification of AF provisioned EAS Deployment information, and for the NEF to notify the AF provisioned EAS Deployment information to the subscribed SMF.

4.3.1.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2].

The Nnef_EASDeployment service is part of the Nnef service-based interface exhibited by the Network Exposure Function (NEF).

Known consumer of the Nnef_EASDeployment service is:

- Session Management Function (SMF)

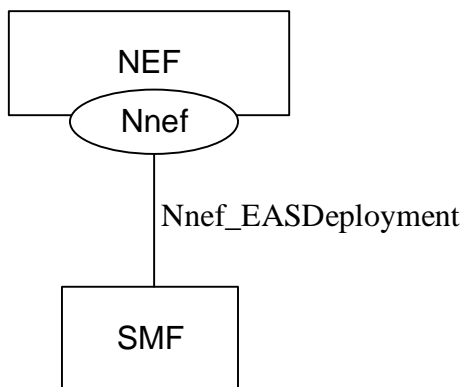


Figure 4.3.1.2-1: Reference Architecture for the Nnef_EASDeployment Service; SBI representation

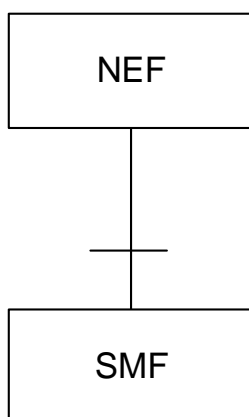


Figure 4.3.1.2-2: Reference Architecture for the Nnef_EASDeployment Service: reference point representation

4.3.1.3 Network Functions

4.3.1.3.1 Network Exposure Function (NEF)

The Network Exposure Function (NEF) is a functional element that support for the NF service consumer (i.e SMF) subscribing to the notification of the AF provisioned EAS Deployment Information and provide EAS Deployment Information change notification to the NF service consumer as defined in this specification.

4.3.1.3.2 NF Service Consumers

The known NF service consumers are as follows:

The Session Management Function (SMF):

- supports (un)subscribing to notifications of subscribed event(s) from the NEF.
- supports receiving the notifications of subscribed event(s) from the NEF.

4.3.2 Service Operations

4.3.2.1 Introduction

Service operations defined for the Nnef_EASDeployment Service are shown in table 4.3.2.1-1.

Table 4.3.2.1-1: Nnef_EventExposure Service Operations

Service Operation Name	Description	Initiated by
Nnef_EASDeployment_Subscribe	This service operation is used by an NF service consumer to explicitly subscribe the notification of changes of EAS Deployment Information.	NF service consumer
Nnef_EASDeployment_Unsubscribe	This service operation is used by an NF service consumer to explicitly unsubscribe the notification of changes of EAS Deployment Information.	NF service consumer
Nnef_EASDeployment_Notify	This service operation is used by the NEF to provide subscribed event information, e.g. updated EAS Deployment Information to the NF service consumer.	NEF

4.3.2.2 Nnef_EASDeployment_Subscribe service operation

4.3.2.2.1 General

This service operation is provided by the NEF for NF consumers to explicitly subscribe the notification of changes of EAS Deployment Information.

4.3.2.2.2 Creating a new subscription

In order to subscribe to EAS Deployment Information change event, the SMF shall send an HTTP POST request message to the NEF for the "EAS Deployment Event Subscriptions" resource. The HTTP POST message shall include EasDeploySubData data structure as request body. The EasDeploySubData data structure shall include:

- Event Id in the "eventId" attribute;
- An notification correlation ID provided by the NF service consumer during the subscription as "notifId" attribute; and
- An URI to receive the subscribed EAS Deployment information change notifications as "notifUri" attribute.

and may include:

- an indicator to immediately report the current status of EAS Deployment Information if available, as "immRep" attribute;
- (list of) DNN and/or S-NSSAI combination as "dnnSnsaiInfos" attribute;
- identification of an application as "appId" attribute; and/or
- an internal Group Identifier as "interGroupId" attribute.

Upon receipt of the HTTP request from the SMF, if the SMF is validated, the NEF shall interact with the UDR by invoking the Nudr_DataRepository service as described in 3GPP TS 29.504 [20] to fetch the EAS Deployment Information in the application data in the UDR.

After receiving a successful response from the UDR, the NEF shall create a new subscription and assign a subscription identifier for the "Individual EAS Deployment Event Subscription" resource. Then the NEF shall send a HTTP "201 Created" response with EASDeploySubData data structure as response body and a Location header field containing the URI of the created individual subscription resource to the NF service consumer. If the immediate report indicator is included in the subscription request, the NEF shall include the current available status of EAS Deployment Information in the response body.

If the NEF receives an error code from the UDR, the NEF shall take proper error handling actions and shall respond to the SMF with a proper error status code.

4.3.2.3 Nnef_EASDeployment_Unsubscribe service operation

4.3.2.3.1 General

This service operation is used by an NF service consumer (i.e. SMF) to explicitly unsubscribe the notification of changes of EAS Deployment Information.

The following procedure using the Nnef_EASDeployment_Unsubscribe service operation is supported:

- unsubscription from the notification of changes of EAS Deployment Information.

4.3.2.3.2 Unsubscription of notification of changes of EAS Deployment Information

In order to delete an existing subscription to EAS Deployment Information change event, the NF service consumer shall send an HTTP DELETE request message to the individual resource URI "{apiRoot}/nnef-eas-deployment/v1/subscriptions/{subscriptionId}" in which the "{subscriptionId}" is the subscription correlation identifier of the existing subscription resource that is to be deleted.

The NEF shall delete the individual resource and shall respond to the NF service consumer with an HTTP "204 No Content" response message.

If the NEF cannot delete the individual resource, shall take proper error handling actions and shall respond to the NF service consumer with a proper error status code.

4.3.2.4 Nnef_EASDeployment_Notify service operation

4.3.2.4.1 General

The Nnef_EASDeployment_Notify service operation enables the NEF to notify the subscribed event information, e.g. updated EAS Deployment Information to the NF Consumer.

The following procedure using the Nnef_EASDeployment_Notify service operation is supported:

- notification about subscribed EAS Deployment Information change.

4.3.2.4.2 Notification of changes of EAS Deployment Information

If there is current status of EAS Deployment Information available and immediate report is required, the NEF may immediately provide a notification to the subscribed NF service consumer by sending an HTTP POST message that include the EasDeployInfoNotif data structure in the request body to notify the current status of EAS Deployment information to the NF service consumer.

If the immediate report is not required or the current status of EAS Deployment Information is not available, when the EAS Deployment information was changed, the NEF shall provide a notification to the subscribed NF service consumer by sending an HTTP POST message that include the EasDeployInfoNotif data structure in the request body to notify the EAS Deployment information changes to the NF service consumer.

The EasDeployInfoNotif data structure shall include the subscribed Event ID and the EAS Deployment Information.

Upon receipt of the EAS Deployment event notification, the NF service consumer shall respond with a "204 No Content" status code to confirm the received notification.

5 API Definitions

5.1 Nnef_EventExposure Service API

5.1.1 Introduction

The Nnef_EventExposure service shall use the Nnef_EventExposure API.

The API URI of the Nnef_EventExposure API shall be:

{apiRoot}/<apiName>/<apiVersion>

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

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

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "nnef-eventexposure".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 5.1.3.

5.1.2 Usage of HTTP

5.1.2.1 General

HTTP/2, IETF RFC 7540 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

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

The OpenAPI [6] specification of HTTP messages and content bodies for the Nnef_EventExposure API is contained in Annex A.

5.1.2.2 HTTP standard headers

5.1.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [4] for the usage of HTTP standard headers.

5.1.2.2.2 Content type

JSON, IETF RFC 8259 [12], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [4]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 7807 [13].

5.1.2.3 HTTP custom headers

The Nnef_EventExposure API shall support mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] and may support HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4].

In this Release of the specification, no specific custom headers are defined for the Nnef_EventExposure API.

5.1.3 Resources

5.1.3.1 Overview

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 5.1.3.1-1 depicts the resource URIs structure for the Nnef_EventExposure API.

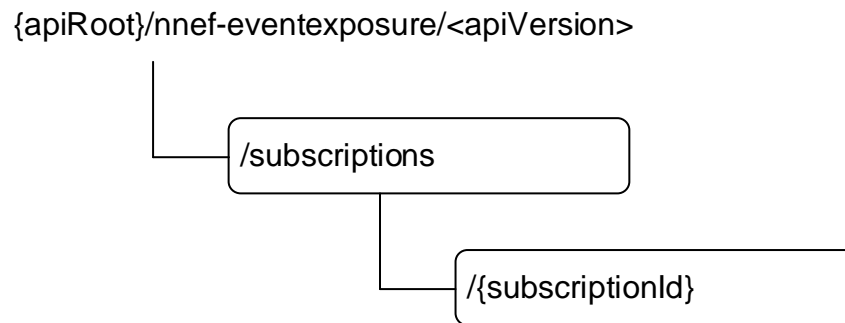


Figure 5.1.3.1-1: Resource URI structure of the Nnef_EventExposure API

Table 5.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 5.1.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
Network Exposure Event Subscriptions	/subscriptions	POST	Creates a subscription to notifications on application or user related event(s), i.e. creation of an Individual Network Exposure Event Subscription resource.
Individual Network Exposure Event Subscription	/subscriptions/{subscriptionId}	GET	Reads an Individual Network Exposure Event Subscription resource.
		PUT	Modifies an Individual Network Exposure Event Subscription.
		DELETE	Cancels an individual subscription to notifications of subscribed event.

5.1.3.2 Resource: Network Exposure Event Subscriptions

5.1.3.2.1 Description

The resource represents the collection of Network Exposure Event subscriptions of the Nnef_EventExposure service. It allows NF service consumers to create a new subscription to notifications on application or user related event(s).

5.1.3.2.2 Resource Definition

Resource URI: **{apiRoot}/nnef-eventexposure/<apiVersion>/subscriptions**

This resource shall support the resource URI variables defined in table 5.1.3.2.2-1.

Table 5.1.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.1.1

5.1.3.2.3 Resource Standard Methods

5.1.3.2.3.1 POST

This method shall support the URI query parameters specified in table 5.1.3.2.3.1-1.

Table 5.1.3.2.3.1-1: URI query parameters supported by the <method 1> method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 5.1.3.2.3.1-2 and the response data structures and response codes specified in table 5.1.3.2.3.1-3.

Table 5.1.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
NefEventExposureSubsc	M	1	Contains the information required for the creation of a new Individual Network Exposure Event Subscription resource.

Table 5.1.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NefEventExposureSubsc	M	1	201 Created	Contains the representation of the Individual Network Exposure Event Subscription resource.
NOTE: The mandatory HTTP error status code for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

Table 5.1.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/nnef-eventexposure/<apiVersion>/subscriptions/{subscriptionId}

5.1.3.3 Resource: Individual Network Exposure Event Subscription

5.1.3.3.1 Description

The resource represents an individual Network Exposure Event subscription of the Nnef_EventExposure service. It allows NF service consumers to read/modify/cancel a subscription to notifications on application or user related event(s).

5.1.3.3.2 Resource Definition

Resource URI: {apiRoot}/nnef-eventexposure/<apiVersion>/subscriptions/{subscriptionId}

This resource shall support the resource URI variables defined in table 5.1.3.3.2-1.

Table 5.1.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.1.1
subscriptionId	string	Identifies a subscription to the NEF event exposure service.

5.1.3.3.3 Resource Standard Methods

5.1.3.3.3.1 GET

This method shall support the URI query parameters specified in table 5.1.3.3.3.1-1.

Table 5.1.3.3.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description
supp-feat	SupportedFeatures	O	0..1	The features supported by the NF service consumer.

This method shall support the request data structures specified in table 5.1.3.3.3.1-2 and the response data structures and response codes specified in table 5.1.3.3.3.1-3.

Table 5.1.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.1.3.3.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NefEventExposureSubsc	M	1	200 OK	Contains the representation of the Individual Network Exposure Event Subscription resource.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during subscription retrieval. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NEF (service) instance. Applicable if the feature "ES3XX" is supported.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during subscription retrieval. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NEF (service) instance. Applicable if the feature "ES3XX" is supported.
NOTE: The mandatory HTTP error status codes for the GET method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

Table 5.1.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NEF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

Table 5.1.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NEF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

5.1.3.3.3.2 PUT

This method shall support the URI query parameters specified in table 5.1.3.3.3.2-1.

Table 5.1.3.3.3.2-1: 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 5.1.3.3.3.2-2 and the response data structures and response codes specified in table 5.1.3.3.3.2-3.

Table 5.1.3.3.3.2-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
NefEventExposureSubsc	M	1	Modifies the existing Individual Network Exposure Event Subscription resource.

Table 5.1.3.3.3.2-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
NefEventExposureSubsc	M	1	200 OK	Successful case. The Individual Network Exposure Event Subscription resource was modified and a representation is returned.
n/a			204 No Content	Successful case. The Individual Network Exposure Event Subscription resource was modified.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during subscription modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NEF (service) instance. Applicable if the feature "ES3XX" is supported.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during subscription modification. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NEF (service) instance. Applicable if the feature "ES3XX" is supported.
NOTE: The mandatory HTTP error status codes for the PUT method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

Table 5.1.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NEF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

Table 5.1.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NEF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

5.1.3.3.3.3 DELETE

This method shall support the URI query parameters specified in table 5.1.3.3.3.3-1.

Table 5.1.3.3.3.3-1: 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 5.1.3.3.3.3-2 and the response data structures and response codes specified in table 5.1.3.3.3.3-3.

Table 5.1.3.3.3.3-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.1.3.3.3.3-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. The Individual Network Exposure Event Subscription resource matching the subscriptionId was deleted.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during subscription termination. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NEF (service) instance. Applicable if the feature "ES3XX" is supported.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during subscription termination. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NEF (service) instance. Applicable if the feature "ES3XX" is supported.
NOTE: The mandatory HTTP error status code for the DELETE method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

Table 5.1.3.3.3.3-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NEF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

Table 5.1.3.3.3.3-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NEF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

5.1.4 Custom Operations without associated resources

None.

5.1.5 Notifications

5.1.5.1 General

Notifications shall comply to clause 6.2 of 3GPP TS 29.500 [4] and clause 4.6.2.3 of 3GPP TS 29.501 [5].

Table 5.1.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Network Exposure Event Notification	{notifUri}	POST	Provides Information about observed events.

5.1.5.2 Network Exposure Event Notification

5.1.5.2.1 Description

The Network Exposure Event Notification is used by the NEF to report one or several observed Events to a NF service consumer that has subscribed to such Notifications.

5.1.5.2.2 Target URI

The Notification URI "{notifUri}" shall be used with the callback URI variables defined in table 5.1.5.2.2-1.

Table 5.1.5.2.2-1: Callback URI variables for this resource

Name	Data type	Definition
notifUri	Uri	The Notification Uri as assigned by the NF service consumer during the subscription service operation and described within the NefEventExposureSubsc data type (see table 5.1.6.2.2-1).

5.1.5.2.3 Standard Methods

5.1.5.2.3.1 POST

This method shall support the request data structures specified in table 5.1.5.2.3.1-1 and the response data structures and response codes specified in table 5.1.5.2.3.1-1.

Table 5.1.5.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
NefEventExposureNotif	M	1	Provides Information about observed events

Table 5.1.5.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The receipt of the Notification is acknowledged.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during event notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent. Applicable if the feature "ES3XX" is supported.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during event notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent. Applicable if the feature "ES3XX" is supported.
NOTE: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

Table 5.1.5.2.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected.

Table 5.1.5.2.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected.

5.1.6 Data Model

5.1.6.1 General

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

Table 5.1.6.1-1 specifies the data types defined for the Nnef_EventExposure service based interface protocol.

Table 5.1.6.1-1: Nnef_EventExposure specific Data Types

Data type	Section defined	Description	Applicability
NefEvent	5.1.6.3.3	Represents Network Exposure Events.	
NefEventExposureNotif	5.1.6.2.3	Represents notifications on network exposure event(s) that occurred for an Individual Network Exposure Event Subscription resource.	
NefEventExposureSubsc	5.1.6.2.2	Represents an Individual Network Exposure Event Subscription resource.	
NefEventFilter	5.1.6.2.7	Represents event filter information for an event.	
NefEventNotification	5.1.6.2.4	Represents information related to an event to be reported.	
NefEventSubs	5.1.6.2.5	Represents an event to be subscribed and the related event filter information	
PerformanceDataInfo	5.1.6.2.12	Contains Performance Data Analytics related information collection	PerformanceData
ServiceExperienceInfo	5.1.6.2.9	Contains service experience information associated with an application.	ServiceExperience
TargetUeIdentification	5.1.6.2.8	Identifies the UE to which the request applies.	
UeCommunicationInfo	5.1.6.2.6	Contains UE communication information associated with an application.	UeCommunication
UeMobilityInfo	5.1.6.2.10	Contains UE mobility information associated with an application.	UeMobility
UeTrajectoryInfo	5.1.6.2.11	Contains UE trajectory information.	UeMobility

Table 5.1.6.1-2 specifies data types re-used by the Nnef_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 Nnef_EventExposure service based interface.

Table 5.1.6.1-2: Nnef_EventExposure re-used Data Types

Data type	Reference	Comments	Applicability
AddrFqdn	3GPP TS 29.517 [18]	IP address and/or FQDN.	
ApplicationId	3GPP TS 29.571 [16]	Application identifier	
ChargPolicyInvocationCollection	3GPP TS 29.517 [18]	Represents the Charging and Policy invocations of UE Application collected via Data Collection AF.	ChargingPolicyInvocation
CollectiveBehaviourFilter	3GPP TS 29.517 [18]	Contains the parameter type and value pair to express the collective behaviour event filters.	CollectiveBehaviour
CollectiveBehaviourInfo	3GPP TS 29.517 [18]	Contains the collective behaviour analytics information.	CollectiveBehaviour
CommunicationCollection	3GPP TS 29.517 [18]	Contains communication information.	UeCommunication
ConsumptionCollection	3GPP TS 29.517 [18]	Represents the Consumption reports of UE Application collected via Data Collection AF.	Consumption
DateTime	3GPP TS 29.571 [16]	Contains a date and a time.	
Dnai	3GPP TS 29.571 [16]		
DispersionCollection	3GPP TS 29.517 [18]	Contains dispersion collection information.	Dispersion
ExceptionInfo	3GPP TS 29.517 [18]	Represents exception information for a service flow.	Exceptions
GroupId	3GPP TS 29.571 [16]	Contains a Group identifier.	
IpAddr	3GPP TS 29.571 [16]	Identifies the IP address of a UE.	PerformanceData
MSAccessActivityCollection	3GPP TS 29.517 [18]	Represents the Media Streaming access activity of UE Application collected via Data Collection AF.	MSAccessActivity
NetAssInvocationCollection	3GPP TS 29.517 [18]	Represents the Network Assistance invocations of UE Application collected via Data Collection AF.	NetAssInvocation
NetworkAreaInfo	3GPP TS 29.554 [21]	Represents a network area information.	
PacketDelBudget	3GPP TS 29.571 [16]	Indicates average Packet Delay.	PerformanceData
PacketLossRate	3GPP TS 29.571 [16]	Indicates average Loss Rate.	PerformanceData
PerformanceData	3GPP TS 29.517 [18]	Contains Performance Data	PerformanceData
QoeMetricsCollection	3GPP TS 29.517 [18]	Represents the QoE Metrics of UE Application collected via Data Collection AF.	QoeMetrics
RedirectResponse	3GPP TS 29.571 [16]	Contains redirection related information.	ES3XX
ReportingInformation	3GPP TS 29.523 [22]	Represents the type of reporting the subscription requires.	
Supi	3GPP TS 29.571 [16]	Contains a SUPI.	
SupportedFeatures	3GPP TS 29.571 [16]	Indicates the features supported.	
ServiceExperienceInfoPerFlow	3GPP TS 29.517 [18]	Contains service experience information associated with a service flow.	ServiceExperience
UserDataCongestionCollection	3GPP TS 29.517 [18]	Contains User Data Congestion Analytics related information collection.	UserDataCongestion

UserLocation	3GPP TS 29.571 [16]	Contains user location information.	UeMobility
Uri	3GPP TS 29.571 [16]	Contains a URI.	

5.1.6.2 Structured data types

5.1.6.2.1 Introduction

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

5.1.6.2.2 Type: NefEventExposureSubsc

Table 5.1.6.2.2-1: Definition of type NefEventExposureSubsc

Attribute name	Data type	P	Cardinality	Description	Applicability
eventsSubs	array(NefEventSubs)	M	1..N	Subscribed events and the related event filters.	
eventsRepInfo	ReportingInformation	O	0..1	Represents the reporting requirements of the subscription. If omitted, the default values within the ReportingInformation data type apply.	
notifUri	Uri	M	1	Notification URI for event reporting.	
eventNotifs	array(NefEventNotificationData)	C	1..N	Represents the Events to be reported. Shall only be present if the immediate reporting indication in the "immRep" attribute within the "eventsRepInfo" attribute sets to true in the event subscription, and the reports are available.	
notifId	string	M	1	Notification Correlation ID assigned by the NF service consumer.	
suppFeat	SupportedFeatures	C	0..1	This IE represents a list of Supported features used as described in clause 5.8. Shall be present in the HTTP POST request/response; or in the HTTP GET response if the "supp-feat" attribute query parameter is included in the HTTP GET request. (NOTE)	
NOTE: In the HTTP POST request it represents the set of NF service consumer supported features. In the HTTP POST and GET responses it represents the set of features supported by both the NF service consumer and the NEF.					

5.1.6.2.3 Type: NefEventExposureNotif

Table 5.1.6.2.3-1: Definition of type NefEventExposureNotif

Attribute name	Data type	P	Cardinality	Description	Applicability
notifId	string	M	1	Notification Correlation ID assigned by the NF service consumer.	
eventNotifs	array(NefEventNotification)	M	1..N	Represents the Events to be reported according to the subscription corresponding to the Notification Correlation ID.	

5.1.6.2.4 Type: NefEventNotification

Table 5.1.6.2.4-1: Definition of type NefEventNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
event	NefEvent	M	1	Represents the reported application related event.	
timeStamp	DateTime	M	1	Time at which the event is observed.	
svcExprclnfos	array(ServiceExperienceInfo)	C	1..N	Contains the service experience information. Shall be present if the "event" attribute sets to "SVC_EXPERIENCE"	ServiceExperience
ueMobilityInfos	array(UeMobilityInfo)	C	1..N	Contains the UE mobility information. Shall be present if the "event" attribute sets to "UE_MOBILITY"	UeMobility
ueCommInfos	array(UeCommunicationInfo)	C	1..N	Contains the application communication information. Shall be present if the "event" attribute sets to "UE_COMM"	UeCommunication
exceptInfos	array(ExceptionInfo)	C	1..N	Each element represents the exception information for a service flow. Shall be present if the "event" attribute sets to "EXCEPTIONS".	Exceptions
congestionInfos	array(UserDataCongestionCollection)	C	1..N	Each element represents the user data congestion information for an AF application. Shall be present if the "event" attribute sets to "USER_DATA_CONGESTION".	UserDataCongestion
perfDataInfos	array(PerformanceDataInfo)	C	1..N	Each element represents the performance data information collected for an AF application.	PerformanceData
dispersionInfos	array(DispersionCollection)	C	1..N	Each element represents the UE dispersion information collected for an AF. Shall be present if the "event" attribute sets to "DISPERSION".	Dispersion
collBhvrInfos	array(CollectiveBehaviourInfo)	C	1..N	Each element represents the collective behaviour information related to a set of UEs, applications. Shall be present if the "event" attribute sets to "COLLECTIVE_BEHAVIOUR".	CollectiveBehaviour
qoeMetrInfos	array(QoeMetricsCollection)	C	1..N	Each element represents the QoE metrics information collected for an UE application via the Data Collection AF. Shall be present if the "event" attribute sets to "QOE_METRICS".	QoeMetrics
consumpInfos	array(ConsumptionCollection)	C	1..N	Each element represents the Consumption reports information collected for an UE application via the Data Collection AF. Shall be present if the "event" attribute sets to "CONSUMPTION".	Consumption

netAssInvInfos	array(NetAssInvocationCollection)	C	1..N	Each element represents the Network Assistance invocations information collected for an UE application via the Data Collection AF. Shall be present if the "event" attribute sets to "NET_ASSIST_INVOCATION".	NetAssInvocation
chgPlyInvInfos	array(ChargPolicyInvocationCollection)	C	1..N	Each element represents the Charging and Policy invocation information collected for an UE application via the Data Collection AF. Shall be present if the "event" attribute sets to "CHARGING_POLICY_INVOCATION".	ChargingPolicyInvocation
msAccActInfos	array(MSAccessActivityCollection)	C	1..N	Each element represents the Media Streaming access activity collected for an UE application via the Data Collection AF. Shall be present if the "event" attribute sets to "MS_ACCESS_ACTIVITY".	MSAccessActivity

5.1.6.2.5 Type NefEventSubs

Table 5.1.6.2.5-1: Definition of type NefEventSubs

Attribute name	Data type	P	Cardinality	Description	Applicability
event	NefEvent	M	1	Subscribed event.	
eventFilter	NefEventFilter	C	0..1	Represents the event filter information associated with each event. Shall be present if "event" sets to "SVC_EXPERIENCE", "UE_MOBILITY", "UE_COMM", "EXCEPTIONS", "USER_DATA_CONGESTION", "PERF_DATA", "COLLECTIVE_BEHAVIOUR", "DISPERSION", "QOE_METRICS", "CONSUMPTION", "NET_ASSIST_INVOCATION", "CHARGING_POLICY_INVOCATION" or "MS_ACCESS_ACTIVITY".	ServiceExperience UeCommunication UeMobility Exceptions UserDataCongestion PerformanceData Dispersion CollectiveBehaviour QoeMetrics Consumption NetAssInvocation ChargingPolicyInvocation MSAccessActivity

5.1.6.2.6 Type UeCommunicationInfo

Table 5.1.6.2.6-1: Definition of type UeCommunicationInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	C	0..1	Identifies an UE. Shall be present if the event exposure request applies to more than one UE.	
interGroupId	GroupId	O	0..1	Identifies an UE group.	
appld	ApplicationId	O	0..1	Identifies an application identifier.	
comms	array(CommunicationCollection)	M	1..N	This attribute contains a list of communication information.	

5.1.6.2.7 Type NefEventFilter

Table 5.1.6.2.7-1: Definition of type NefEventFilter

Attribute name	Data type	P	Cardinality	Description	Applicability
tgtUe	TargetUeIdentification	M	1	Represents the UE information to which the request applies.	(NOTE 1)
applds	array(ApplicationId)	C	1..N	Each element indicates an application identifier. If absent, the NefEventFilter data applies to any application (i.e. all applications). (NOTE 2)	ServiceExperience Exceptions UeCommunication UeMobility UserDataCongestion PerformanceData Dispersion
locArea	NetworkAreaInfo	O	0..1	Represents an area of interest. (NOTE 3)	ServiceExperience Exceptions UeCommunication UeMobility UserDataCongestion Dispersion CollectiveBehaviour
collAttrs	array(CollectiveBehaviourFilter)	O	1..N	Each element indicates a collective attribute parameter type and value.	CollectiveBehaviour
NOTE 1: Applicability is further described in the corresponding data type.					
NOTE 2: For the events "EXCEPTIONS", "UE_MOBILITY", "UE_COMM", and "PERF_DATA", if present, the "applds" attribute shall include only one element.					
NOTE 3: For event "SVC_EXPERIENCE", only the "tais" attribute within the NetworkAreaInfo data is applicable.					

Editor's note: It's for FFS on the needed attributes for the feature "QoeMetrics".

Editor's note: It's for FFS on the needed attributes for the feature "Consumption".

Editor's note: It's for FFS on the needed attributes for the feature "NetAssInvocation".

Editor's note: It's for FFS on the needed attributes for the feature "ChargingPolicyInvocation".

Editor's note: It's for FFS on the needed attributes for the feature "MSAccessActivity".

5.1.6.2.8 Type TargetUeIdentification

Table 5.1.6.2.8-1: Definition of type TargetUeIdentification

Attribute name	Data type	P	Cardinality	Description	Applicability
supis	array(Supi)	O	1..N	Each element identifies a SUPI for an UE.	ServiceExperience Exceptions UeMobility UeCommunication UserDataCongestion Dispersion QoeMetrics Consumption NetAssInvocation ChargingPolicyInvocation MSAccessActivity
interGroupIds	array(GroupId)	O	1..N	Each element represents an internal group identifier which identifies a group of UEs.	ServiceExperience Exceptions UeMobility UeCommunication
anyUeId	boolean	O	0..1	Identifies whether the request applies to any UE. This attribute shall set to "true" if applicable for any UE, otherwise, set to "false".	ServiceExperience Exceptions UserDataCongestion
NOTE: For an applicable feature, only one attribute identifying the target UE shall be provided.					

5.1.6.2.9 Type: ServiceExperienceInfo

Table 5.1.6.2.9-1: Definition of type ServiceExperienceInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
appld	ApplicationId	C	0..1	Identifies an application identifier. Shall be present if the event exposure service request applies to more than one application.	ServiceExperience
supis	array(Supi)	C	1..N	Each element represents the internal UE identifier.	ServiceExperience
svcExpPerFlows	array(ServiceExperienceInfoPerFlow)	M	1..N	Each element indicates service experience for each service flow.	ServiceExperience

5.1.6.2.10 Type: UeMobilityInfo

Table 5.1.6.2.10-1: Definition of type UeMobilityInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	M	1	Identifies an UE. Shall be present if the event exposure request applies to more than one UE.	
appld	ApplicationId	O	0..1	Identifies an application identifier.	
ueTrajs	array(UeTrajectoryInfo)	M	1..N	Identifies an UE moving trajectory.	

5.1.6.2.11 Type: UeTrajectoryInfo

Table 5.1.6.2.11-1: Definition of type UeTrajectoryInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
ts	DateTime	M	1	Identifies the timestamp when the UE enters this area.	
location	UserLocation	M	1	Includes the location of the UE. (NOTE)	
NOTE: Only EutraLocation data and/or NrLocation data in UserLocation data are applicable to the property.					

5.1.6.2.12 Type PerformanceDataInfo

Table 5.1.6.2.12-1: Definition of type PerformanceDataInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
appId	ApplicationId	O	0..1	Indicates an application identifier.	
ueIpAddr	IpAddr	O	0..1	Identifies the IP address of a UE.	
ipTrafficFilter	FlowInfo	O	0..1	Identifies IP packet filter.	
userLoc	UserLocation	O	0..1	Represents the user location.	
appLocs	array(Dnai)	O	1..N	Represents the application locations.	
asAddr	AddrFqdn	O	0..1	Represents the IP address or FQDN of the Application Server. (NOTE)	
perfData	PerformanceData	M	1	Indicates the performance data.	
timeStamp	DateTime	M	1	It defines the timestamp of analytics generation.	
NOTE: If the "asAddr" attribute is included, either the "ipAddr" attribute or the "fqdn" attribute in the AddrFqdn data type shall be provided.					

5.1.6.3 Simple data types and enumerations

5.1.6.3.1 Introduction

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

5.1.6.3.2 Simple data types

The simple data types defined in table 5.1.6.3.2-1 shall be supported.

Table 5.1.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

5.1.6.3.3 Enumeration: NefEvent

The enumeration NefEvent represents the observed event requested by the NF service consumer to be monitored. It shall comply with the provisions defined in table 5.1.6.3.3-1.

Table 5.1.6.3.3-1: Enumeration NefEvent

Enumeration value	Description	Applicability
SVC_EXPERIENCE	Indicates that the observed event is service experience information.	ServiceExperience
UE_COMM	Indicates that the observed event is UE communication information.	UeCommunication
UE_MOBILITY	Indicates that the observed event is UE mobility information.	UeMobility
EXCEPTIONS	Indicates that the observed event is exceptions information.	Exceptions
USER_DATA_CONGESTION	Indicates that the event subscribed is user data congestion analytics related information.	UserDataCongestion
PERF_DATA	Indicates that the event subscribed is performance data information.	PerformanceData
DISPERSION	Indicates that the event subscribed is dispersion information.	Dispersion
COLLECTIVE_BEHAVIOUR	Indicates that the event subscribed is collective behaviour information.	CollectiveBehaviour
QOE_METRICS	Indicates that the event subscribed is QoE metrics.	QoeMetrics
CONSUMPTION	Indicates that the event subscribed is Consumption reports.	Consumption
NET_ASSIST_INVOCATION	Indicates that the event subscribed is Network Assistance invocations.	NetAssInvocation
CHARGING_POLICY_INVOCATION	Indicates that the event subscribed is Charging and Policy invocations.	ChargingPolicyInvocation
MS_ACCESS_ACTIVITY	Indicates that the event subscribed is Media Streaming access activity.	MSAccessActivity

5.1.7 Error Handling

5.1.7.1 General

For the Nnef_EventExposure API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [4] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of 3GPP TS 29.500 [4].

In addition, the requirements in the following clauses are applicable for the Nnef_EventExposure API.

5.1.7.2 Protocol Errors

No specific procedures for the Nnef_EventExposure service are specified.

5.1.7.3 Application Errors

The application errors defined for the Nnef_EventExposure service are listed in Table 5.1.7.3-1.

Table 5.1.7.3-1: Application errors

Application Error	HTTP status code	Description

5.1.8 Feature negotiation

The optional features in table 5.1.8-1 are defined for the Nnef_EventExposure API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 5.1.8-1: Supported Features

Feature number	Feature Name	Description
1	ServiceExperience	This feature indicates support for the "SVC_EXPERIENCE" event.
2	UeMobility	This feature indicates support for the "UE_MOBILITY" event.
3	UeCommunication	This feature indicates support for the "UE_COMM" event.
4	Exceptions	This feature indicates support for the "EXCEPTIONS" event.
5	ES3XX	Extended Support for 3xx redirections. This feature indicates the support of redirection for any service operation, according to Stateless NF procedures as specified in clauses 6.5.3.2 and 6.5.3.3 of 3GPP TS 29.500 [4] and according to HTTP redirection principles for indirect communication, as specified in clause 6.10.9 of 3GPP TS 29.500 [4].
6	EneNA	This feature indicates support for the enhancements of network data analytics requirements.
7	UserDataCongestion	This feature indicates support for the event related to User Data Congestion Analytics related information.
8	PerformanceData	This feature indicates support for the event related to performance data information.
9	Dispersion	This feature indicates support for the event related to Dispersion Analytics related information.
10	CollectiveBehaviour	This feature indicates support of collective behaviour information associated with the UEs and its applications.
11	QoeMetrics	This feature indicates support for the event related to QoE metrics for UE Application collected via the Data Collection AF.
12	Consumption	This feature indicates support for the event related to Consumption reports for UE Application collected via the Data Collection AF.
13	NetAssInvocation	This feature indicates support for the event related to Network Assistance invocations for UE Application collected via the Data Collection AF.
14	ChargingPolicyInvocation	This feature indicates support for the event related to Charging and Policy invocations for UE Application collected via the Data Collection AF.
15	MSAccessActivity	This feature indicates support for the event related to Media Streaming access activity for UE Application collected via the Data Collection AF.

5.1.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Nnef_EventExposure API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Nnef_EventExposure API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [10], clause 5.4.2.2.

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

The Nnef_EventExposure API defines a single scope "nnef-eventexposure" for the entire service, and it does not define any additional scopes at resource or operation level.

5.2 Nnef_EASDeployment Service API

5.2.1 Introduction

The Nnef_EASDeployment service shall use the Nnef_EASDeployment API.

The API URI of the Nnef_EASDeployment API shall be:

{apiRoot}/<apiName>/<apiVersion>

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

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

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "nnef-eas-deployment".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 5.2.3.

5.2.2 Usage of HTTP

5.2.2.1 General

HTTP/2, IETF RFC 7540 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

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

The OpenAPI [6] specification of HTTP messages and content bodies for the Nnef_EASDeployment API is contained in Annex 3.

5.2.2.2 HTTP standard headers

5.2.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [4] for the usage of HTTP standard headers.

5.2.2.2.2 Content type

JSON, IETF RFC 8259 [12], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [4]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 7807 [13].

5.2.2.3 HTTP custom headers

The Nnef_EASDeployment API shall support mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] and may support HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4].

In this Release of the specification, no specific custom headers are defined for the Nnef_EASDeployment API.

5.2.3 Resources

5.2.3.1 Overview

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 5.2.3.1-1 depicts the resource URIs structure for the Nnef_EASDeployment API.

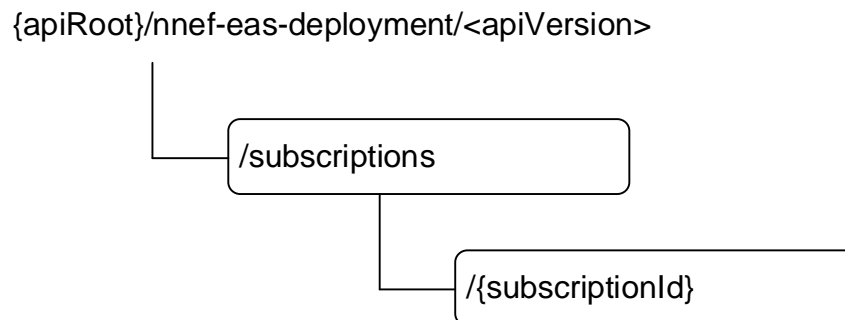


Figure 5.2.3.1-1: Resource URI structure of the Nnef_EASDeployment API

Table 5.2.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 5.2.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
EAS Deployment Event Subscriptions	/subscriptions	POST	Creates a subscription to notifications of changes of EAS Deployment Information, i.e. creation of an Individual EAS Deployment Event Subscription resource.
Individual EAS Deployment Event Subscription	/subscriptions/{subscriptionId}	GET	Reads an Individual EAS Deployment Event Subscription resource.
		DELETE	Cancels an individual subscription to notifications of subscribed EAS Deployment changes event.

5.2.3.2 Resource: EAS Deployment Event Subscriptions

5.2.3.2.1 Description

The resource represents the collection of EAS Deployment changes Event subscriptions of the Nnef_EASDeployment service. It allows NF service consumers to create a new subscription to notifications on EAS Deployment changes event(s).

5.2.3.2.2 Resource Definition

Resource URI: **{apiRoot}/nnef-eas-deployment/<apiVersion>/subscriptions**

This resource shall support the resource URI variables defined in table 5.2.3.2.2-1.

Table 5.2.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.2.1

5.2.3.2.3 Resource Standard Methods

5.2.3.2.3.1 POST

This method shall support the URI query parameters specified in table 5.2.3.2.3.1-1.

Table 5.2.3.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 5.2.3.2.3.1-2 and the response data structures and response codes specified in table 5.2.3.2.3.1-3.

Table 5.2.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
EasDeploySubData	M	1	Contains the information required for the creation of a new Individual EAS Deployment Event Subscription resource.

Table 5.2.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response Codes	Description
EasDeploySubData	M	1	201 Created	Contains the representation of the Individual EAS Deployment Event Subscription resource.
NOTE: The mandatory HTTP error status code for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

Table 5.2.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/nnef-eas-deployment/<apiVersion>/subscriptions/{subscriptionId}

5.2.3.3 Resource: Individual EAS Deployment Event Subscription

5.2.3.3.1 Description

The resource represents an individual EAS Deployment Event subscription of the Nnef_EASDeployment service. It allows NF service consumers to subscribe/unsubscribe an EAS Deployment information change event, and allows the NEF to notify EAS Deployment change event to the subscribed NF service consumer.

5.2.3.3.2 Resource Definition

Resource URI: {apiRoot}/nnef-eas-deployment/<apiVersion>/subscriptions/{subscriptionId}

This resource shall support the resource URI variables defined in table 5.2.3.3.2-1.

Table 5.2.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.2.1
subscriptionId	string	Identifies a subscription to the NEF event exposure service.

5.2.3.3.3 Resource Standard Methods

5.2.3.3.3.1 GET

This method shall support the URI query parameters specified in table 5.2.3.3.3.1-1.

Table 5.2.3.3.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description

This method shall support the request data structures specified in table 5.2.3.3.3.1-2 and the response data structures and response codes specified in table 5.2.3.3.3.1-3.

Table 5.2.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.2.3.3.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
EasDeploySubData	M	1	200 OK	Contains the representation of the Individual EAS Deployment information changes Event Subscription resource.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during subscription retrieval. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NEF (service) instance.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during subscription retrieval. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NEF (service) instance.
NOTE: The mandatory HTTP error status codes for the GET method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

Table 5.2.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NEF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

Table 5.2.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NEF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

5.2.3.3.3.2 PUT

This HTTP method is not supported for the resource.

5.2.3.3.3.3 DELETE

This method shall support the URI query parameters specified in table 5.2.3.3.3.3-1.

Table 5.2.3.3.3.3-1: 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 5.2.3.3.3.3-2 and the response data structures and response codes specified in table 5.2.3.3.3.3-3.

Table 5.2.3.3.3.3-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.2.3.3.3.3-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. The Individual EAS Deployment information changes Event Subscription resource matching the subscriptionId was deleted.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during subscription termination. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NEF (service) instance.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during subscription termination. The response shall include a Location header field containing an alternative URI of the resource located in an alternative NEF (service) instance.
NOTE: The mandatory HTTP error status code for the DELETE method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

Table 5.2.3.3.3.3-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NEF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

Table 5.2.3.3.3.3-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located in an alternative NEF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

5.2.4 Custom Operations without associated resources

None.

5.2.5 Notifications

5.2.5.1 General

Notifications shall comply to clause 6.2 of 3GPP TS 29.500 [4] and clause 4.6.2.3 of 3GPP TS 29.501 [5].

Table 5.2.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Event Notification	{notifUri}	POST	Provides Information about EAS Deployment Information changes event(s).

5.2.5.2 EAS Deployment Event Notification

5.2.5.2.1 Description

The EAS Deployment Event Notification is used by the NEF to report the observed EAS Deployment information changes event to a NF service consumer that has subscribed to such Notifications.

5.2.5.2.2 Target URI

The Notification URI "{**notifUri**}" shall be used with the callback URI variables defined in table 5.2.5.2.2-1.

Table 5.2.5.2.2-1: Callback URI variables for this resource

Name	Data type	Definition
notifUri	Uri	The Notification Uri as assigned by the NF service consumer during the subscription service operation and described within the EasDeploySubData data type (see table 5.2.6.2.2-1).

5.2.5.2.3 Standard Methods

5.2.5.2.3.1 POST

This method shall support the request data structures specified in table 5.2.5.2.3.1-1 and the response data structures and response codes specified in table 5.2.5.2.3.1-1.

Table 5.2.5.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
EasDeployInfoNotif	M	1	Provides Information about the EAS Deployment Information changes event.

Table 5.2.5.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The receipt of the Notification is acknowledged.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during event notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during event notification. The response shall include a Location header field containing an alternative URI representing the end point of an alternative NF consumer (service) instance where the notification should be sent.
NOTE: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

Table 5.2.5.2.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected.

Table 5.2.5.2.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected.

5.2.6 Data Model

5.2.6.1 General

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

Table 5.2.6.1-1 specifies the data types defined for the Nnef_EASDeployment service based interface protocol.

Table 5.2.6.1-1: Nnef_EASDeployment specific Data Types

Data type	Section defined	Description	Applicability
EasDeployInfoNotif	5.2.6.2.3	Represents notifications on EAS Deployment Information changes event(s) that occurred for an Individual EAS Deployment Event Subscription resource.	
EasDeploySubData	5.2.6.2.2	Represents EAS Deployment Information changes event(s) subscription data.	
EasDeployInfoData	5.2.6.2.5	Represents the EAS Deployment Information to be reported.	
EasDepNotification	5.2.6.2.4	Represents the EAS Deployment Notification.	
EasEvent	5.2.6.3.3	represents the EAS event.	

Table 5.2.6.1-2 specifies data types re-used by the Nnef_EASDeployment 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 Nnef_EASDeployment service based interface.

Table 5.2.6.1-2: Nnef_EASDeployment re-used Data Types

Data type	Reference	Comments	Applicability
DnailInformation	3GPP TS 29.522 [15]	Represents the DNAI information including the DNS server identifier (consisting of IP address and port) and/or IP address(s) of the EAS in the local DN for the DNAI.	
DnnSnssailInformation	3GPP TS 29.522 [15]	Identifies a combination of (DNN, S-NSSAI).	
FqdnPatternMatchingRule	3GPP TS 29.571 [16]	Represents the FQDN pattern matching rule.	
Groupld	3GPP TS 29.571 [16]	Contains a Group identifier.	
Uri	3GPP TS 29.571 [16]	Contains a URI.	

5.2.6.2 Structured data types

5.2.6.2.1 Introduction

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

5.2.6.2.2 Type: EasDeploySubData

Table 5.2.6.2.2-1: Definition of type EasDeploySubData

Attribute name	Data type	P	Cardinality	Description	Applicability
appld	string	O	0..1	Identifies the application for which the EAS Deployment Information corresponds to.	
dnnSnssailInfos	array(DnnSnssailInformation)	O	1..N	Each of the element identifies a combination of (DNN, S-NSSAI).	
eventId	EasEvent	M	1	Event ID assigned by the NF service consumer.	
eventsNotifs	array(EasDeployInfo)	C	1..N	Represents the EAS Deployment Information changes event(s) to be reported. Shall only be present if the "immRep" attribute is included and sets to true, and the current status of EAS Deployment Information is available.	
immRep	boolean	O	0..1	Indication of immediate reporting: - true: requires the immediate reporting of the current status of EAS Deployment Information, if available. - false (default): EAS Deployment Information event report occurs when the event is met.	
interGroupld	Groupld	O	0..1	Identifies an internal UE group.	
notifld	string	M	1	Notification Correlation ID assigned by the NF service consumer.	
notifUri	Uri	M	1	Notification URI for the EAS Deployment Information event reporting.	

5.2.6.2.3 Type: EasDeployInfoNotif

Table 5.2.6.2.3-1: Definition of type EasDeployInfoNotif

Attribute name	Data type	P	Cardinality	Description	Applicability
easDepNotifs	array(EasDepNotifcation)	M	1..N	Represents the EAS Deployment Notification(s).	
notifId	string	M	1	Notification Correlation ID assigned by the NF service consumer.	

5.2.6.2.4 Type: EasDepNotification

Table 5.2.6.2.4-1: Definition of type EasDepNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
easDepInfo	EasDeployInfoData	M	1	Represents the EAS Deployment Information to be reported.	
eventId	EasEvent	M	1	Event ID assigned by the NF service consumer.	

5.2.6.2.5 Type: EasDeployInfoData

Table 5.2.6.2.5-1: Definition of type EasDeployInfoData

Attribute name	Data type	P	Cardinality	Description	Applicability
applId	string	O	0..1	Identifies the application for which the EAS Deployment Information corresponds to.	
dnailfos	map(DnailInformation)	O	1..N	list of DNS server identifier (consisting of IP address and port) and/or IP address(s) of the EAS in the local DN for each DNAI. The key of map is the DNAI.	
dnn	Dnn	O	0..1	DNN for the EAS Deployment Information.	
fqdnPatternList	array(FqdnPatternMatchingRule)	M	1..N	Supported FQDN pattern(s) for application(s) deployed in the Local part of the DN where each FQDN pattern is described by a FQDN Pattern Matching Rule.	
interGroupId	GroupId	O	0..1	Internal Group ID for the EAS Deployment Information.	
snssai	Snssai	O	0..1	S-NSSAI for the EAS Deployment Information.	

5.2.6.3 Simple data types and enumerations

5.2.6.3.1 Introduction

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

5.2.6.3.2 Simple data types

The simple data types defined in table 5.2.6.3.2-1 shall be supported.

Table 5.2.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

5.2.6.3.3 Enumeration: EasEvent

The enumeration EasEvent represents the EAS event requested by the NF service consumer. It shall comply with the provisions defined in table 5.2.6.3.3-1.

Table 5.1.6.3.3-1: Enumeration EasEvent

Enumeration value	Description	Applicability
EAS_INFO_CHG	Indicates that the EAS Deployment Information is changed.	

5.2.7 Error Handling

5.2.7.1 General

For the Nnef_EASDeployment API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [4] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of 3GPP TS 29.500 [4].

In addition, the requirements in the following clauses are applicable for the Nnef_EASDeployment API.

5.2.7.2 Protocol Errors

No specific procedures for the Nnef_EASDeployment service are specified.

5.2.7.3 Application Errors

The application errors defined for the Nnef_EASDeployment service are listed in Table 5.2.7.3-1.

Table 5.2.7.3-1: Application errors

Application Error	HTTP status code	Description

5.2.8 Feature negotiation

The optional features in table 5.2.8-1 are defined for the Nnef_EASDeployment API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 5.2.8-1: Supported Features

Feature number	Feature Name	Description

5.2.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Nnef_EASDeployment API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Nnef_EASDeployment API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [10], clause 5.4.2.2.

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

The Nnef_EASDeployment API defines a single scope "nnef-eas-deployment" for the entire service, and it does not define any additional scopes at resource or operation level.

Annex A (normative): OpenAPI specification

A.1 General

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

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

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

Informative copies of the OpenAPI specification files contained in this 3GPP Technical Specification are available on a Git-based repository that uses the GitLab software version control system (see clause 5B of the 3GPP TR 21.900 [7] and clause 5.3.1 of the 3GPP TS 29.501 [5] for further information).

A.2 Nnef_EventExposure API

```

openapi: 3.0.0
info:
  title: Nnef_EventExposure
  version: 1.1.0
  description: |
    NEF Event Exposure Service.
    © 2022 , 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: >
    3GPP TS 29.591 V17.6.0; 5G System; Network Exposure Function Southbound Services; Stage 3.
  url: https://www.3gpp.org/ftp/Specs/archive/29_series/29.591/
servers:
- url: '{apiRoot}/nnef-eventexposure/v1'
  variables:
    apiRoot:
      default: https://example.com
      description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501
security:
- {}
- oAuth2ClientCredentials:
  - nnef-eventexposure
paths:
  /subscriptions:
    post:
      summary: subscribe to notifications
      operationId: CreateIndividualSubscription
      tags:
        - Subscriptions (Collection)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NefEventExposureSubsc'
      responses:
        '201':
          description: Success
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/NefEventExposureSubsc'
      headers:
        Location:
          description: >

```

```

    Contains the URI of the newly created resource, according to the structure
    {apiRoot}/nnef-eventexposure/<apiVersion>/subscriptions/{subscriptionId}
    required: true
    schema:
      type: string
'400':
  $ref: 'TS29571_CommonData.yaml#/components/responses/400'
'401':
  $ref: 'TS29571_CommonData.yaml#/components/responses/401'
'403':
  $ref: 'TS29571_CommonData.yaml#/components/responses/403'
'404':
  $ref: 'TS29571_CommonData.yaml#/components/responses/404'
'411':
  $ref: 'TS29571_CommonData.yaml#/components/responses/411'
'413':
  $ref: 'TS29571_CommonData.yaml#/components/responses/413'
'415':
  $ref: 'TS29571_CommonData.yaml#/components/responses/415'
'429':
  $ref: 'TS29571_CommonData.yaml#/components/responses/429'
'500':
  $ref: 'TS29571_CommonData.yaml#/components/responses/500'
'503':
  $ref: 'TS29571_CommonData.yaml#/components/responses/503'
default:
  $ref: 'TS29571_CommonData.yaml#/components/responses/default'
callbacks:
  myNotification:
    '{$request.body#/notifUri}':
      post:
        requestBody:
          required: true
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/NefEventExposureNotif'
  responses:
    '204':
      description: No Content, Notification was succesfull
    '307':
      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
    '308':
      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
/subscriptions/{subscriptionId}:
  get:
    summary: retrieve subscription
    operationId: GetIndividualSubscription
    tags:
      - IndividualSubscription (Document)
    parameters:
      - name: subscriptionId
        in: path
        description: Event Subscription ID
        required: true
        schema:

```

```

    type: string
  - name: supp-feat
    in: query
    description: Features supported by the NF service consumer
    required: false
    schema:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
responses:
  '200':
    description: OK. Resource representation is returned
    content:
      application/json:
        schema:
          $ref: '#/components/schemas/NefEventExposureSubsc'
  '307':
    $ref: 'TS29571_CommonData.yaml#/components/responses/307'
  '308':
    $ref: 'TS29571_CommonData.yaml#/components/responses/308'
  '400':
    $ref: 'TS29571_CommonData.yaml#/components/responses/400'
  '401':
    $ref: 'TS29571_CommonData.yaml#/components/responses/401'
  '403':
    $ref: 'TS29571_CommonData.yaml#/components/responses/403'
  '404':
    $ref: 'TS29571_CommonData.yaml#/components/responses/404'
  '406':
    $ref: 'TS29571_CommonData.yaml#/components/responses/406'
  '429':
    $ref: 'TS29571_CommonData.yaml#/components/responses/429'
  '500':
    $ref: 'TS29571_CommonData.yaml#/components/responses/500'
  '503':
    $ref: 'TS29571_CommonData.yaml#/components/responses/503'
  default:
    $ref: 'TS29571_CommonData.yaml#/components/responses/default'
put:
  summary: update subscription
  operationId: ReplaceIndividualSubscription
  tags:
    - IndividualSubscription (Document)
  requestBody:
    required: true
    content:
      application/json:
        schema:
          $ref: '#/components/schemas/NefEventExposureSubsc'
  parameters:
    - name: subscriptionId
      in: path
      description: Event Subscription ID
      required: true
      schema:
        type: string
  responses:
    '200':
      description: OK. Resource was succesfully modified and representation is returned
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/NefEventExposureSubsc'
    '204':
      description: No Content. Resource was succesfully modified
    '307':
      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
    '308':
      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':

```

```

    $ref: 'TS29571_CommonData.yaml#/components/responses/413'
  '415':
    $ref: 'TS29571_CommonData.yaml#/components/responses/415'
  '429':
    $ref: 'TS29571_CommonData.yaml#/components/responses/429'
  '500':
    $ref: 'TS29571_CommonData.yaml#/components/responses/500'
  '503':
    $ref: 'TS29571_CommonData.yaml#/components/responses/503'
  default:
    $ref: 'TS29571_CommonData.yaml#/components/responses/default'
delete:
  summary: unsubscribe from notifications
  operationId: DeleteIndividualSubscription
  tags:
    - IndividualSubscription (Document)
  parameters:
    - name: subscriptionId
      in: path
      description: Event Subscription ID
      required: true
      schema:
        type: string
  responses:
    '204':
      description: No Content. Resource was successfully deleted
    '307':
      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
    '308':
      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nnef-eventexposure: Access to the Nnef_EventExposure API
schemas:
  NefEventExposureSubsc:
    description: Represents an Individual Network Exposure Event Subscription resource.
    type: object
    properties:
      eventsSubs:
        type: array
        items:
          $ref: '#/components/schemas/NefEventSubs'
        minItems: 1
      eventsRepInfo:
        $ref: 'TS29523_Npcf_EventExposure.yaml#/components/schemas/ReportingInformation'
      notifUri:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      notifId:
        type: string
      eventNotifs:
        type: array
        items:
          $ref: '#/components/schemas/NefEventNotification'
        minItems: 1
      suppFeat:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'

```



```

    required:
      - eventsSubs
      - notifId
      - notifUri
  NefEventExposureNotif:
    description: >
      Represents notifications on network exposure event(s) that occurred for an Individual
Network
  Exposure Event Subscription resource.
  type: object
  properties:
    notifId:
      type: string
    eventNotifs:
      type: array
      items:
        $ref: '#/components/schemas/NefEventNotification'
      minItems: 1
    required:
      - notifId
      - eventNotifs
  NefEventNotification:
    description: Represents information related to an event to be reported.
    type: object
    properties:
      event:
        $ref: '#/components/schemas/NefEvent'
      timeStamp:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      svcExprcInfos:
        type: array
        items:
          $ref: '#/components/schemas/ServiceExperienceInfo'
        minItems: 1
      ueMobilityInfos:
        type: array
        items:
          $ref: '#/components/schemas/UeMobilityInfo'
        minItems: 1
      ueCommInfos:
        type: array
        items:
          $ref: '#/components/schemas/UeCommunicationInfo'
        minItems: 1
      excepInfos:
        type: array
        items:
          $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/ExceptionInfo'
        minItems: 1
      congestionInfos:
        type: array
        items:
          $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/UserDataCongestionCollection'
        minItems: 1
      perfDataInfos:
        type: array
        items:
          $ref: '#/components/schemas/PerformanceDataInfo'
        minItems: 1
      dispersionInfos:
        type: array
        items:
          $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/DispersionCollection'
        minItems: 1
      collBhvrInfs:
        type: array
        items:
          $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/CollectiveBehaviourInfo'
        minItems: 1
      qoeMetrInfos:
        type: array
        items:
          $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/QoeMetricsCollection'
        minItems: 1
      consumpInfos:
        type: array
        items:
          $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/ConsumptionCollection'

```

```

    minItems: 1
  netAssInvInfos:
    type: array
    items:
      $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/NetAssInvocationCollection'
  minItems: 1
  chgPlyInvInfos:
    type: array
    items:
      $ref:
'TS29517_Naf_EventExposure.yaml#/components/schemas/ChargPolicyInvocationCollection'
  minItems: 1
  msAccActInfos:
    type: array
    items:
      $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/MSAccessActivityCollection'
  minItems: 1
  required:
  - event
  - timeStamp
NefEventSubs:
  description: Represents an event to be subscribed and the related event filter information.
  type: object
  properties:
    event:
      $ref: '#/components/schemas/NefEvent'
    eventFilter:
      $ref: '#/components/schemas/NefEventFilter'
  required:
  - event
NefEventFilter:
  description: Represents event filter information for an event.
  type: object
  properties:
    tgtUe:
      $ref: '#/components/schemas/TargetUeIdentification'
    appIds:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
      minItems: 1
    locArea:
      $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
    collAttrs:
      type: array
      items:
        $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/CollectiveBehaviourFilter'
      minItems: 1
  required:
  - tgtUe
TargetUeIdentification:
  description: Identifies the UE to which the request applies.
  type: object
  properties:
    supis:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      minItems: 1
    interGroupIds:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
      minItems: 1
    anyUeId:
      type: boolean
ServiceExperienceInfo:
  description: Contains service experience information associated with an application.
  type: object
  properties:
    appId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
    supis:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      minItems: 1
    svcExpPerFlows:

```

```

        type: array
        items:
          $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/ServiceExperienceInfoPerFlow'
        minItems: 1
      required:
        - svcExpPerFlows
    UeMobilityInfo:
      description: Contains UE mobility information associated with an application.
      type: object
      properties:
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        appId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
        ueTrajs:
          type: array
          items:
            $ref: '#/components/schemas/UeTrajectoryInfo'
          minItems: 1
      required:
        - supi
        - ueTrajs
    UeCommunicationInfo:
      description: Contains UE communication information associated with an application.
      type: object
      properties:
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        interGroupId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
        appId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
        comms:
          type: array
          items:
            $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/CommunicationCollection'
          minItems: 1
      required:
        - comms
    UeTrajectoryInfo:
      description: Contains UE trajectory information.
      type: object
      properties:
        ts:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        location:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/UserLocation'
      required:
        - ts
        - location
    PerformanceDataInfo:
      description: Contains Performance Data Analytics related information collection.
      type: object
      properties:
        appId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
        ueIpAddr:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/IpAddr'
        ipTrafficFilter:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/FlowInfo'
        userLoc:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/UserLocation'
        appLocs:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
          minItems: 1
        asAddr:
          $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/AddrFqdn'
        perfData:
          $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/PerformanceData'
        timeStamp:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      required:
        - perfData
        - timeStamp
# Simple data types and Enumerations

```

```

NefEvent:
  description: Represents Network Exposure Events.
  anyOf:
  - type: string
    enum:
      - SVC_EXPERIENCE
      - UE_MOBILITY
      - UE_COMM
      - EXCEPTIONS
      - USER_DATA_CONGESTION
      - PERF_DATA
      - DISPERSION
      - COLLECTIVE_BEHAVIOUR
      - QOE_METRICS
      - CONSUMPTION
      - NET_ASSIST_INVOCATION
      - CHARGING_POLICY_INVOCATION
      - MS_ACCESS_ACTIVITY
  - type: string

```

A.3 Nnef_EASDeployment API

```

openapi: 3.0.0
info:
  title: Nnef_EASDeployment
  version: 1.0.0
  description: |
    NEF EAS Deployment service.
    © 2022, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: >
    3GPP TS 29.591 V17.6.0; 5G System; Network Exposure Function Southbound Services; Stage 3.
  url: https://www.3gpp.org/ftp/Specs/archive/29_series/29.591/
servers:
  - url: '{apiRoot}/nnef-eas-deployment/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501
security:
  - {}
  - oAuth2ClientCredentials:
    - nnef-eas-deployment
paths:
  /subscriptions:
    post:
      summary: subscribe to notifications
      operationId: CreateIndividualSubscription
      tags:
        - Subscriptions (Collection)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/EasDeploySubData'
      responses:
        '201':
          description: Success
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/EasDeploySubData'
          headers:
            Location:
              description: >
                Contains the URI of the newly created resource, according to the structure:
                {apiRoot}/nnef-eas-deployment/<apiVersion>/subscriptions/{subscriptionId}.
              required: true
              schema:
                type: string
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':

```

```

    $ref: 'TS29571_CommonData.yaml#/components/responses/401'
  '403':
    $ref: 'TS29571_CommonData.yaml#/components/responses/403'
  '404':
    $ref: 'TS29571_CommonData.yaml#/components/responses/404'
  '411':
    $ref: 'TS29571_CommonData.yaml#/components/responses/411'
  '413':
    $ref: 'TS29571_CommonData.yaml#/components/responses/413'
  '415':
    $ref: 'TS29571_CommonData.yaml#/components/responses/415'
  '429':
    $ref: 'TS29571_CommonData.yaml#/components/responses/429'
  '500':
    $ref: 'TS29571_CommonData.yaml#/components/responses/500'
  '503':
    $ref: 'TS29571_CommonData.yaml#/components/responses/503'
  default:
    $ref: 'TS29571_CommonData.yaml#/components/responses/default'
callbacks:
  notifUri:
    '{$request.body#/notifUri}':
      post:
        requestBody:
          required: true
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/EasDeployInfoNotif'
  responses:
    '204':
      description: No Content, Notification was succesfull
    '307':
      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
    '308':
      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
/subscriptions/{subscriptionId}:
  get:
    summary: retrieve subscription
    operationId: GetIndividualSubscription
    tags:
      - IndividualSubscription (Document)
    parameters:
      - name: subscriptionId
        in: path
        description: Event Subscription ID
        required: true
        schema:
          type: string
    responses:
      '200':
        description: OK. Resource representation is returned
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/EasDeploySubData'

```

```

'307':
  $ref: 'TS29571_CommonData.yaml#/components/responses/307'
'308':
  $ref: 'TS29571_CommonData.yaml#/components/responses/308'
'400':
  $ref: 'TS29571_CommonData.yaml#/components/responses/400'
'401':
  $ref: 'TS29571_CommonData.yaml#/components/responses/401'
'403':
  $ref: 'TS29571_CommonData.yaml#/components/responses/403'
'404':
  $ref: 'TS29571_CommonData.yaml#/components/responses/404'
'406':
  $ref: 'TS29571_CommonData.yaml#/components/responses/406'
'429':
  $ref: 'TS29571_CommonData.yaml#/components/responses/429'
'500':
  $ref: 'TS29571_CommonData.yaml#/components/responses/500'
'503':
  $ref: 'TS29571_CommonData.yaml#/components/responses/503'
default:
  $ref: 'TS29571_CommonData.yaml#/components/responses/default'
delete:
  summary: unsubscribe from notifications
  operationId: DeleteIndividualSubscription
  tags:
    - IndividualSubscription (Document)
  parameters:
    - name: subscriptionId
      in: path
      description: Event Subscription ID
      required: true
      schema:
        type: string
  responses:
    '204':
      description: No Content. Resource was succesfully deleted
    '307':
      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
    '308':
      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nnef-eas-deployment: Access to the Nnef_EASDeployment API
schemas:
  EasDeploySubData:
    description: Represents an Individual EAS Deployment Event Subscription resource.
    type: object
    properties:
      appId:
        type: string
      dnnSnssaiInfos:
        type: array
        items:
          $ref: 'TS29522_AMInfluence.yaml#/components/schemas/DnnSnssaiInformation'
        minItems: 1

```

```

    description: Each of the element identifies a (DNN, S-NSSAI) combination.
  eventId:
    $ref: '#/components/schemas/EasEvent'
  eventsNotifs:
    type: array
    items:
      $ref: '#/components/schemas/EasDeployInfoData'
    minItems: 1
    description: >
      Represents the EAS Deployment Information changes event(s) to be reported.
      Shall only be present if the "immRep" attribute is included and sets to true,
      and the current status of EAS Deployment Information is available.
  immRep:
    type: boolean
    description: >
      Indication of immediate reporting. Set to true: requires the immediate reporting of the
      current status of EAS Deployment Information, if available. Set to false (default): EAS
      Deployment Information event report occurs when the event is met.
  interGroupId:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
  notifId:
    type: string
  notifUri:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
  required:
    - eventId
    - notifId
    - notifUri
EasDeployInfoNotif:
  description: >
    Represents notifications on EAS Deployment Information changes event(s) that occurred for an
    Individual EAS Deployment Event Subscription resource.
  type: object
  properties:
    easDepNotifs:
      type: array
      items:
        $ref: '#/components/schemas/EasDepNotification'
      minItems: 1
    notifId:
      type: string
  required:
    - easDepNotifs
    - notifId
EasDepNotification:
  description: Represents the EAS Deployment Notification.
  type: object
  properties:
    easDepInfo:
      $ref: '#/components/schemas/EasDeployInfoData'
    eventId:
      $ref: '#/components/schemas/EasEvent'
  required:
    - easDepInfo
    - eventId
EasDeployInfoData:
  description: Represents the EAS Deployment Information to be reported.
  type: object
  properties:
    appId:
      type: string
    dnaiInfos:
      type: object
      additionalProperties:
        $ref: 'TS29522_EASDeployment.yaml#/components/schemas/DnaiInformation'
      minProperties: 1
      description: >
        list of DNS server identifier (consisting of IP address and port) and/or IP address(s)
        of the EAS in the local DN for each DNAI. The key of map is the DNAI.
    dnn:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
    fqdnPatternList:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/FqdnPatternMatchingRule'
      minItems: 1
    internalGroupId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'

```

```
    snssai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
    required:
      - fqdnPatternList
# Simple data types and Enumerations

EasEvent:
  anyOf:
    - type: string
    enum:
      - EAS_INFO_CHG
    - type: string
  description: >
    Possible values are
    - EAS_INFO_CHG: Indicates that the EAS Deployment Information is changed.
```


Annex B (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2019-10	CT3#106					TS Skeleton	0.0.0
2019-10	CT3#106	C3-194392				Removed some subclauses and editorial changes	0.1.0
2019-10	CT3#106					Inclusion of C3-194271, C3-194396, C3-194397 and C3-194399.	0.2.0
2019-11	CT3#107					Inclusion of C3-195234, C3-195235, C3-195236 and C3-195274.	0.3.0
2020-02	CT3#108e					Inclusion of C3-201284, C3-201288, C3-201367, C3-201368, C3-201370, C3-201407, C3-201409, C3-201413 and C3-201516.	0.4.0
2020-03	CT#87e	CP-200187				TS sent to plenary for approval	1.0.0
2020-03	CT#87e	CP-200187				TS approved by plenary	16.0.0
2020-06	CT#88e	CP-201234	0001	1	F	Correction on resource usage	16.1.0
2020-06	CT#88e	CP-201234	0002		F	Data type used during event subscription	16.1.0
2020-06	CT#88e	CP-201234	0007	1	F	Correction to service operation description	16.1.0
2020-06	CT#88e	CP-201244	0008	1	F	Storage of YAML files in ETSI Forge	16.1.0
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2020-06	CT#88e	CP-201256	0011	1	F	URI of the Nnef_EventExposure service	16.1.0
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2020-06	CT#88e	CP-201234	0017	1	F	Supported headers, Resource Data type and yaml mapping	16.1.0
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2020-09	CT#89e	CP-202066	0023		F	Applicabilities of appls and locArea	16.2.0
2020-09	CT#89e	CP-202084	0024		F	Update of OpenAPI version and TS version in externalDocs field	16.2.0
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2021-03	CT#91e	CP-210221	0035	1	F	Adding some missing description fields to data type definitions in OpenAPI	17.1.0
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2022-06	CT#96	CP-221152	0088	-	F	Update of info and externalDocs fields	17.6.0

History

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