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TECHNICAL SPECIFICATION

5G;
5G System;
Network Exposure Function Southbound Services;
Stage 3
(3GPP TS 29.591 version 16.3.0 Release 16)

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Contents

Foreword

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

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x the first digit:

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

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

In the present document, 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 3.0.0 Specification", https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md.

[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".

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].

API	Application Programming Interface
NEF	Network Exposure Function
NF	Network Function
NWDAF	Network Data Analytics 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

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.

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].

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).

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:

- Service experience;

- UE mobility;

- UE communication; and

- Exceptions.

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 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)
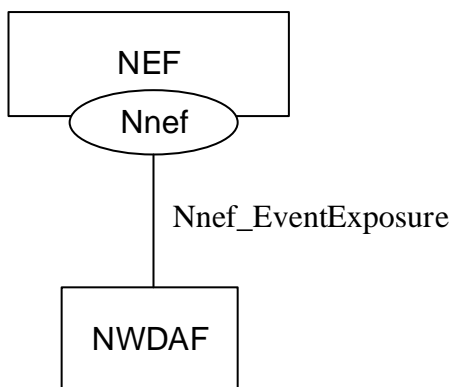
Figure 4.2.1.2-1: Reference Architecture for the Nnef_EventExposure Service; SBI representation
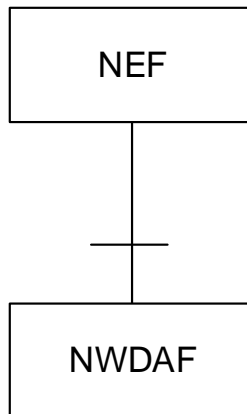
Figure 4.2.1.2-2: Reference Architecture for the Nnef_EventExposure Service: reference point representation

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.

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:

- Service experience;

- UE mobility;

- UE communication; and

- Exceptions;

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.
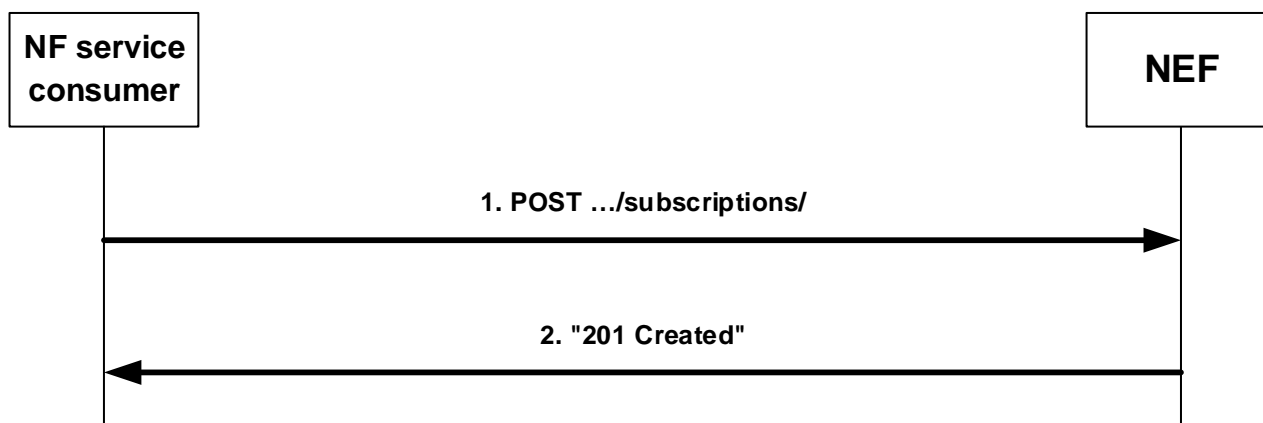
Figure 4.2.2.2.2-1: Creation of a subscription

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; and

- a Notification Correlation Identifier assigned by the NF service consumer for the requested notifications as "notifId" attribute.

- description of subscribed event information as "eventsSubs" attribute by using one or more "NefEventSubs" data;

- conditionally, 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; and/or

- group reporting guard time as "grpRepTime" attribute.

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 Event Exposure 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 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 POST response.

When the sampling ratio attribute, as "sampRatio", is included in the subscription, 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.

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.

4.2.2.2.3 Modifying an existing subscription

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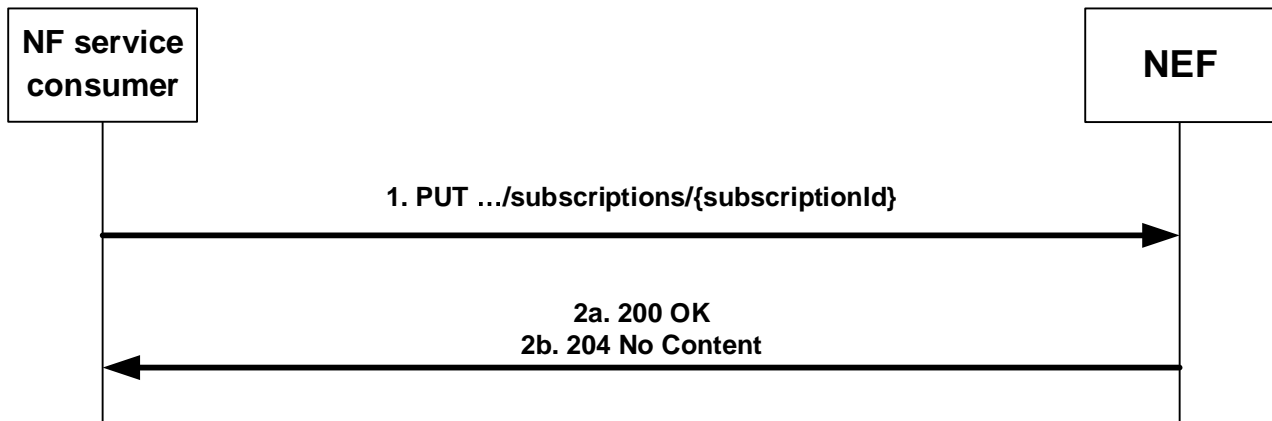
Figure 4.2.2.2.3-1: Modification of an existing subscription

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.

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, 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.

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.

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.
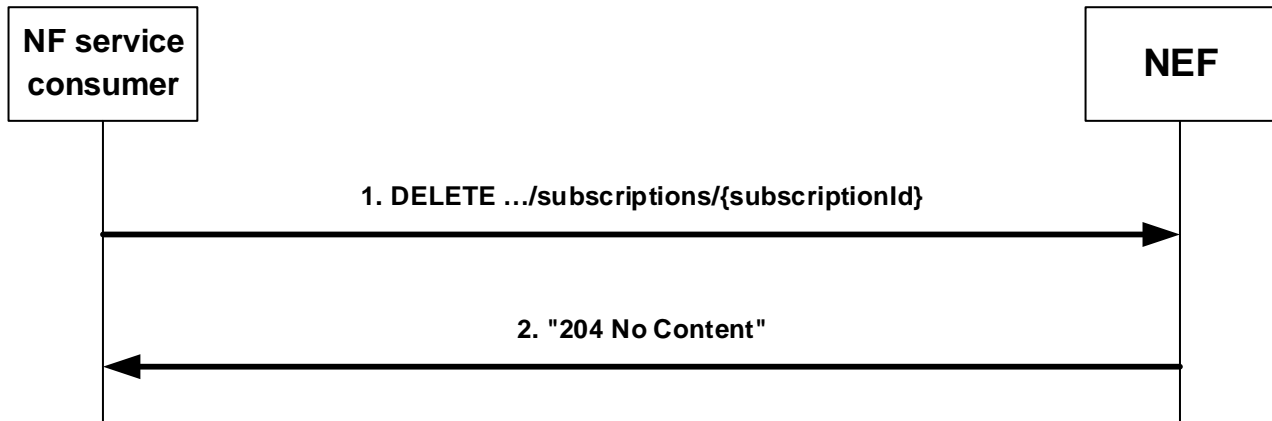
Figure 4.2.2.3.2-1: Unsubscription from event notifications

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 6.1.7.

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.
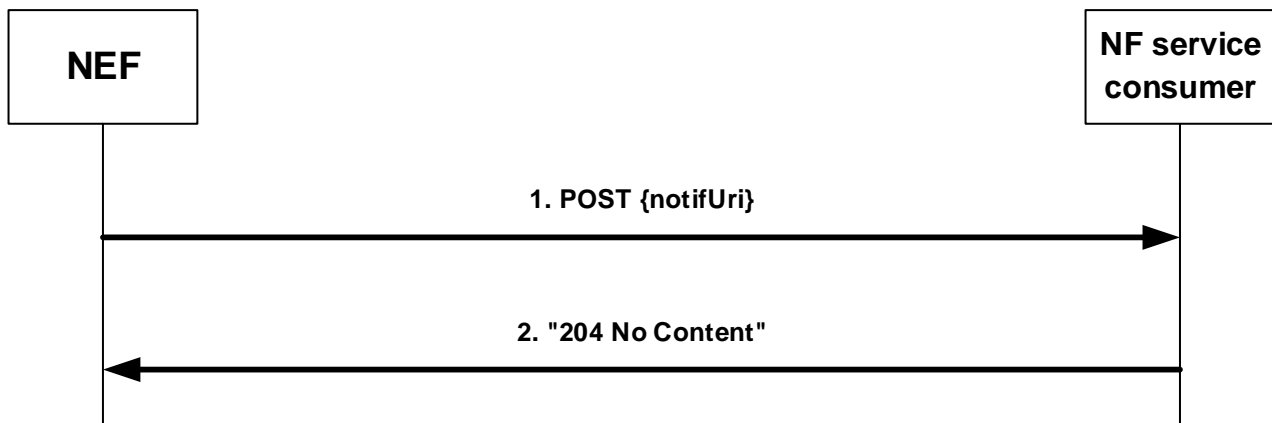
Figure 4.2.2.4.2-1: Notification about subscribed events

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 "svcExprcInfos" attribute;

    - if the "event" attribute is "UE_MOBILITY", UE mobility information assoicated with the application as "ueMobilityInfos" attribute;

    - if the "event" attribute is "UE_COMM", UE communication information assoicated with the application as "ueCommInfos" attribute; and

    - if the "event" attribute is "EXCEPTIONS", exceptions information associated with a service flow as "excepInfos" 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.

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.

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 mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be applicable.

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

{apiRoot}/nnef-eventexposure/<apiVersion>

```
|
+-- /subscriptions
         |
         +-- /{subscriptionId}
```
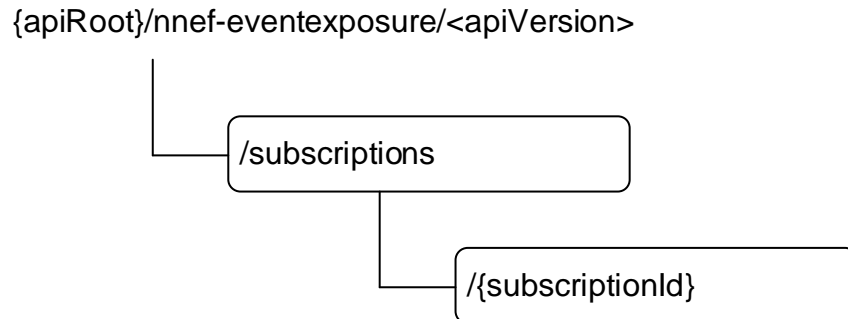
Figure 5.1.3.1-1: Resource URI structure of the Nnef_EventExposure API

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
apiVersion	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
NefEventExposur eSubsc	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
NefEventExposur eSubsc	M	1	201 Created	Contains the representation of the Individual Network Exposure Event Subscription resource.
NOTE: The manadatory 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
apiVersion	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.
NOTE: The mandatory HTTP error status codes for the GET method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [5] also apply.				

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.
NOTE: The mandatory HTTP error status codes for the PUT method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [5] also apply.				

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.
NOTE: The mandatory HTTP error status code for the DELETE method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [5] also apply.				

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.
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.			

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		
NefEventExposureNotif	5.1.6.2.3		
NefEventExposureSubsc	5.1.6.2.2		
NefEventFilter	5.1.6.2.7		
NefEventNotification	5.1.6.2.4		
NefEventSubs	5.1.6.2.5		
ServiceExperienceInfo	5.1.6.2.9		
TargetUeIdentification	5.1.6.2.8		
UeCommunicationInfo	5.1.6.2.6		
UeMobilityInfo	5.1.6.2.10		
UeTrajectoryInfo	5.1.6.2.11		

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
ApplicationId	3GPP TS 29.571 [16]		
ReportingInformation	3GPP TS 29.523 [22]		
CommunicationCollection	3GPP TS 29.517 [18]		
DateTime	3GPP TS 29.571 [16]		
ExceptionInfo	3GPP TS 29.517 [18]		
GroupId	3GPP TS 29.571 [16]		
NetworkAreaInfo	3GPP TS 29.554 [21]		
Supi	3GPP TS 29.571 [16]		
SupportedFeatures	3GPP TS 29.571 [16]		
ServiceExperienceInfoPerFlow	3GPP TS 29.517 [18]		
UserLocation	3GPP TS 29.571 [16]		
Uri	3GPP TS 29.571 [16]		

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	C	0..1	Represents the reporting requirements of the subscription. If omitted, the default values within the ReportingInformationdata type apply.	
notifUri	Uri	M	1	Notification URI for event reporting.	
eventNotifs	array(NefEventNotification)	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	Reported application related event.	
timeStamp	DateTime	M	1	Time at which the event is observed.	
svcExprcInfos	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
excepInfos	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

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" or "EXCEPTIONS".	ServiceExperience UeCommunication UeMobility Exceptions

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.	
appId	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)
appIds	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
locArea	NetworkAreaInfo	O	0..1	Represents an area of interest.	ServiceExperience Exceptions UeCommunication UeMobility
NOTE 1: Applicability is further described in the corresponding data type. NOTE 2: For the events "EXCEPTIONS", "UE_MOBILITY" and "UE_COMM", if present, the "appIds" attribute shall include only one element.					

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
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
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
appId	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.	
appId	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.	

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.	ServiceExperience
UE_COMM	Indicates that the observed event is UE communication.	UeCommunication
UE_MOBILITY	Indicates that the observed event is UE mobility.	UeMobility
EXCEPTIONS	Indicates that the observed event is exceptions information.	Exceptions

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.

5.1.9 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.

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: 1.0.2
  description: |
    NEF Event Exposure Service.
    © 2020, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 29.591 V16.3.0; 5G System; Network Exposure Function Southbound Services;
Stage 3.
  url: http://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: CreateIndividualSubcription
      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
                 '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: GetIndividualSubcription
      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'
            '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: ReplaceIndividualSubcription
        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
          '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: DeleteIndividualSubcription
      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
        '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:
      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:
      type: object
      properties:
        notifId:
          type: string
        eventNotifs:
          type: array
          items:
            $ref: '#/components/schemas/NefEventNotification'
          minItems: 1
      required:
        - notifId
        - eventNotifs
```

```
      NefEventNotification:
        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
        required:
          - event
          - timeStamp
      NefEventSubs:
        type: object
        properties:
          event:
            $ref: '#/components/schemas/NefEvent'
          eventFilter:
            $ref: '#/components/schemas/NefEventFilter'
        required:
          - event
      NefEventFilter:
        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'
        required:
          - tgtUe
      TargetUeIdentification:
        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:
        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:
      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:
      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:
      type: object
      properties:
        ts:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        location:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/UserLocation'
      required:
        - ts
        - location

# Simple data types and Enumerations

    NefEvent:
      anyOf:
      - type: string
        enum:
          - SVC_EXPERIENCE
          - UE_MOBILITY
          - UE_COMM
          - EXCEPTIONS
      - type: string
```

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
2020-06	CT#88e	CP-201210	0009	1	F	Removal of Ninef_EventExposure service	16.1.0
2020-06	CT#88e	CP-201256	0011	1	F	URI of the Nnef_EventExposure service	16.1.0
2020-06	CT#88e	CP-201234	0012	-	F	Event Reporting Information data usage	16.1.0
2020-06	CT#88e	CP-201234	0013	-	F	Support of immediate reporting	16.1.0
2020-06	CT#88e	CP-201234	0014	-	F	Supported features definition	16.1.0
2020-06	CT#88e	CP-201234	0015	-	F	Correction on the ueCommInfos	16.1.0
2020-06	CT#88e	CP-201234	0016	-	F	Applicabilities for UE communication	16.1.0
2020-06	CT#88e	CP-201234	0017	1	F	Supported headers, Resource Data type and yaml mapping	16.1.0
2020-06	CT#88e	CP-201255	0018	-	F	Update of OpenAPI version and TS version in externalDocs field	16.1.0
2020-09	CT#89e	CP-202066	0019	1	F	Defalt value for eventsRepInfo attribute	16.2.0
2020-09	CT#89e	CP-202066	0022	-	F	Missed response code	16.2.0
2020-09	CT#89e	CP-202066	0023	-	F	Applicabilities of appIds 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
2020-12	CT#90e	CP-203139	0025	1	F	Essential Corrections and alignments	16.3.0
2020-12	CT#90e	CP-203139	0026	-	F	Storage of YAML files in 3GPP Forge	16.3.0
2020-12	CT#90e	CP-203139	0028	1	F	Callback URI correction	16.3.0
2020-12	CT#90e	CP-203152	0030	-	F	Update of OpenAPI version and TS version in externalDocs field	16.3.0

History

Document history		
V16.1.0	August 2020	Publication
V16.2.0	November 2020	Publication
V16.3.0	January 2021	Publication