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Modal verbs terminology

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

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Contents

Foreword

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

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

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

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

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

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 Application Function Event Exposure Service of the 5G System. It provides stage 3 protocol definitions, message flows and specifies the API for the Naf_EventExposure service.

The 5G System stage 2 architecture and the procedures are specified in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3], and 3GPP TS 23.288 [4].

The Technical Realization of the Service Based Architecture and the Principles and Guidelines for Services Definition are specified in 3GPP TS 29.500 [5] and 3GPP TS 29.501 [6].

The Application Function Event Exposure Service is provided by the Application Function (AF). This service exposes service experience events observed at the AF.

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 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

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

[6]   3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

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

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

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

[10]   IETF RFC 7807: "Problem Details for HTTP APIs".

[11]   3GPP TR 21.900: "Technical Specification Group working methods".

[12]   3GPP TS 29.523: "5G System; Policy Control Event Exposure Service; Stage 3".

[13]   3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces Stage 3".

[14]   3GPP TS 33.501: "Security architecture and procedures for 5G system".

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

[16]   3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".

[17]   3GPP TS 29.122: "T8 reference point for northbound Application Programming Interfaces (APIs)".

[18]   3GPP TS 29.514: "5G System; Policy Authorization Service; Stage 3".

[19]   3GPP TS 29.520: "5G System; Network Data Analytics Services; Stage 3".

[20]   Void.

[21]   IETF RFC 7230: "Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing".

[22]   IETF RFC 7231: "Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content".

[23]   IETF RFC 7232: "Hypertext Transfer Protocol (HTTP/1.1): Conditional Requests".

[24]   IETF RFC 7233: "Hypertext Transfer Protocol (HTTP/1.1): Range Requests".

[25]   IETF RFC 7234: "Hypertext Transfer Protocol (HTTP/1.1): Caching".

[26]   IETF RFC 7235: "Hypertext Transfer Protocol (HTTP/1.1): Authentication".

[27]   3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".

3   Definitions of terms, symbols and abbreviations

3.1   Terms

For the purposes of the present document, the terms 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].

(None)

3.2   Symbols

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

(None)

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].

AF	Application Function
DNAI	DN Access Identifier
GPSI	Generic Public Subscription Identifier
NEF	Network Exposure Function
NF	Network Function
NWDAF	Network Data Analytics Function
SUPI	Subscription Permanent Identifier
URI	Uniform Resource Identifier

4 Naf_EventExposure Service

4.1 Service Description

4.1.1 Overview

The Application Function Exposure Service, as defined in 3GPP TS 23.502 [3] and 3GPP TS 23.288 [4], is provided by the Application Function (AF).

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 AF.

The types of observed events include:

- Service Experience information for an application;

- UE mobility information;

- UE communication information;

- Exceptions information;

- User Data Congestion information;

- Collective Behaviour information;

- Dispersion information; and

- Performance Data information.

When the event to which the NF service consumer has subscribed occurs, the AF reports the requested information to the NF service consumer based on the event reporting information definition requested by the NF service consumer (see 3GPP TS 23.502 [3]).

4.1.2 Service Architecture

The Data Analytics Architecture is defined in 3GPP TS 23.288 [4].

The Application Function Exposure Service (Naf_EventExposure) is part of the Naf service-based interface exhibited by the Application Function (AF).

The known NF service consumers of the Naf_EventExposure service are the Network Exposure Function (NEF) and the Network Data Analytics Function (NWDAF).

The Naf_EventExposure service is provided by the AF and consumed by NF service consumers (e.g. NEF, NWDAF), as shown in figure 4.1.2-1 for the SBI representation model and in figure 4.1.2-2 for reference point representation model.
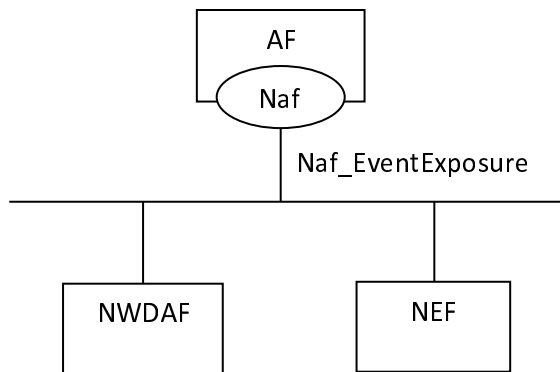
Figure 4.1.2-1: Naf_EventExposure service Architecture, SBI representation
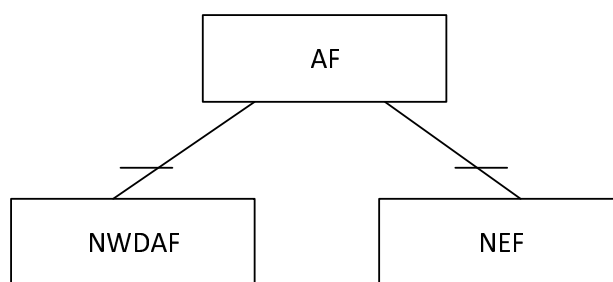
Figure 4.1.2-2: Naf_EventExposure service Architecture, reference point representation

4.1.3   Network Functions

4.1.3.1   Application Function (AF)

The AF is a functional element that provides service or application related information to NF service consumers.

The AF allows NF service consumers to subscribe to and unsubscribe from periodic notifications and/or notifications related to the detection of subscribed event.

4.1.3.2   NF Service Consumers

The Network Data Analytics Function (NWDAF):

-    supports (un)subscribing to notifications of subscribed event(s) from the AF;

-    supports receiving the notifications of subscribed event(s) from the AF.

The Network Exposure Function (NEF):

-    supports (un)subscribing to notifications of service experience information from the AF;

-    supports receiving the notifications of subscribed event(s) from the AF.

4.2   Service Operations

4.2.1   Introduction

Service operations defined for the Naf_EventExposure Service are shown in table 4.2.1-1.

Table 4.2.1-1: Naf_EventExposure Service Operations

Service Operation Name	Description	Initiated by
Naf_EventExposure_Subscribe	This service operation is used by an NF service consumer to subscribe to, or modify a subscription in the AF for event notifications on a specified application related event for one or more UE(s) or any UE.	NF Consumer (NWDAF, NEF)
Naf_EventExposure_Unsubscribe	This service operation is used by an NF service consumer to unsubscribe from event notifications.	NF Consumer (NWDAF, NEF)
Naf_EventExposure_Notify	This service operation is used by the AF to report application related event(s) to the NF service consumer which has subscribed to the event report service.	AF

4.2.2 Naf_EventExposure_Subscribe service operation

4.2.2.1 General

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

The following are the types of events for which a subscription can be made:

- Service Experience information for an application;

- UE mobility information;

- UE communication information;

- Exceptions information;

- User Data Congestion information;

- Collective Behaviour information;

- Dispersion information; and

- Performance Data information.

The following procedures using the Naf_EventExposure_Subscribe service operation are supported:

- creating a new subscription;

- modifying an existing subscription.

4.2.2.2 Creating a new subscription

Figure 4.2.2.2-1 illustrates the creation of a subscription.
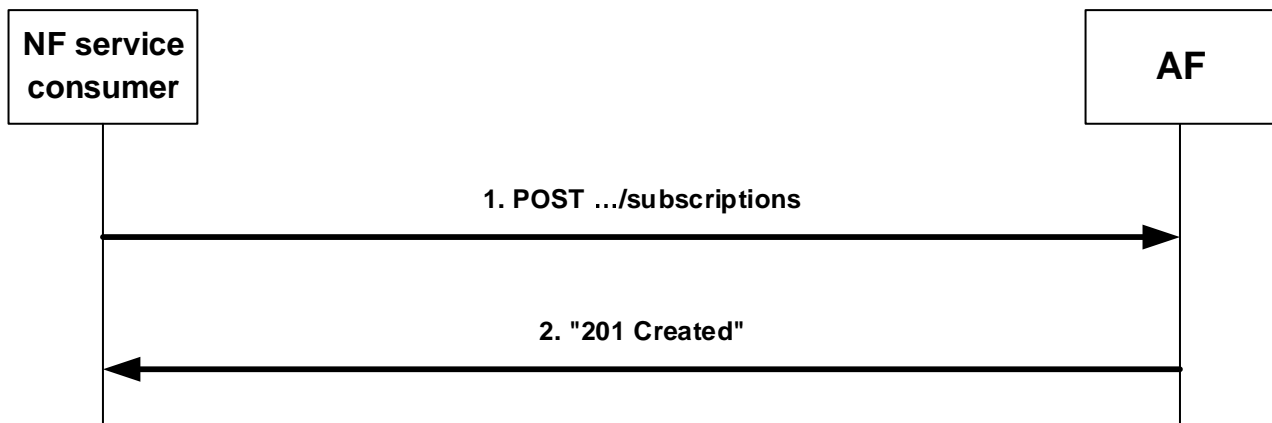
Figure 4.2.2.2-1: Creation of a subscription

To subscribe to event notifications, the NF service consumer shall send an HTTP POST request to the AF with: "{apiRoot}/naf-eventexposure/<apiVersion>/subscriptions" as request URI as shown in step 1 of figure 4.2.2.2-1, and the "AfEventExposureSubsc" data structure as request body.

The "AfEventExposureSubsc" data structure shall include:

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

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

- 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.

The "EventsSubs" data shall include:

- a event to subscribe 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.

The "eventFilter" shall include:

- identification of target UE(s) to which the subscription applies via :

  1) identification of individual UE(s) via "gpsis" attribute or "supis" attribute; or

  2) identification of group(s) of UE(s) via "exterGroupIds" attribute or "interGroupIds" attribute; or

     3) identification of any UE via "anyUeInd" attribute.

    NOTE: It is assumed that the AF is provisioned with the list of UE IDs (GPSIs or SUPIs) belonging to an External or Internal Group ID.

Depending on the event type:

- if the feature "ServiceExperience" is supported and the event is "SVC_EXPERIENCE", the "eventFilter" attribute may provide:

    1) identification of application to which the subscription applies via "appIds" attribute;

    2) an area of interest via "locArea" attribute.

- if the feature "Exceptions" is supported and the event is "EXCEPTIONS", the "eventFilter" attribute may provide:

    1) identification of application to which the subscription applies via "appIds" attribute;

    2) an area of interest via "locArea" attribute;

- if the feature "UeCommunication" is supported and the event is "UE_COMM", the "eventFilter" attribute may provide:

    1) identification of application to which the subscription applies via "appIds" attribute;

    2) an area of interest via "locArea" attribute.

- if the feature "UeMobility" is supported and the event is "UE_MOBILITY", the "eventFilter" attribute may provide:

    1) identification of application to which the subscription applies via "appIds" attribute;

    2) an area of interest via "locArea" attribute.

- if the feature "UserDataCongestion" is supported and the event is "USER_DATA_CONGESTION", the "eventFilter" attribute may provide:

    1) identification of application to which the subscription applies via "appIds" attribute;

    2) an area of interest via "locArea" attribute.

- if the feature "PerformanceData" is supported and the event is "PERF_DATA", the "eventFilter" attribute may provide:

    1) identification of application to which the subscription applies via "appIds" attribute;

    2) an area of interest via "locArea" attribute.

- if the feature "CollectiveBehaviour" is supported and the event is "COLLECTIVE_BEHAVIOUR", the "eventFilter" attribute may provide:

    1) collective attributes information via "collAttrs" attribute;

    2) an area of interest via "locArea" attribute.

- if the feature "Dispersion" is supported and the event is "DISPERSION", the "eventFilter" attribute may provide:

    1) identification of application to which the subscription applies via "appIds" attribute;

    2) an area of interest via "locArea" attribute.

If the AF cannot successfully fulfil the received HTTP POST request due to an internal error or an error in the HTTP POST request, the AF shall send the HTTP error response as specified in clause 5.7.

Upon successful reception of the HTTP POST request with "{apiRoot}/naf-eventexposure/<apiVersion>/subscriptions" as request URI and "AfEventExposureSubsc" data structure as request body, the AF shall create a new "Individual

Application Event Subscription" resource, store the subscription and send an HTTP "201 Created" response as shown in step 2 of figure 4.2.2.2-1, containing:

- a Location header field; and

- an "AfEventExposureSubsc" 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}/naf-eventexposure/<apiVersion>/subscriptions/{subscriptionId}".

The "AfEventExposureSubsc" data type payload body shall contain the representation of the created "Individual Application Event Subscription".

When the "monDur" attribute is included in the response by the AF, it represents AF 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 AF shall include the reports of the events subscribed, if available, in the HTTP POST response.

When the sampling ratio as, "sampRatio" attribute, is included in the subscription without a "partitionCriteria" attribute, the AF 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 AF 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 the "grpRepTime" attribute is included in the subscription, the AF shall accumulate all the event reports for the target UEs until the group reporting guard time expires. Then the AF shall notify the NF service consumer using the Naf_EventExposure_Notify service operation, as described in clause 4.2.4.2.

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

4.2.2.3 Modifying an existing subscription

Figure 4.2.2.3-1 illustrates the modification of an existing subscription.
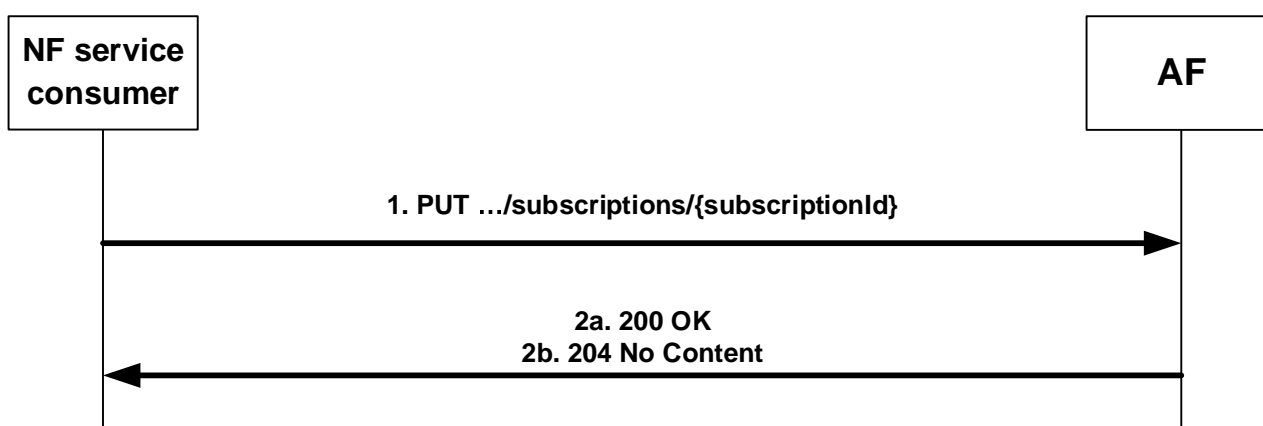
Figure 4.2.2.3-1: Modification of an existing subscription

To modify an existing subscription to event notifications, the NF service consumer shall send an HTTP PUT request with: "{apiRoot}/naf-eventexposure/<apiVersion>/subscriptions/{subscriptionId}" as request URI, as shown in step 1 of figure 4.2.2.3-1, where "{subscriptionId}" is the subscription correlation ID of the existing subscription. The "AfEventExposureSubsc" data structure is included as request body as described in clause 4.2.2.2.

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 AfEventExposureSubsc 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 AfEventExposureSubsc data structure can be modified to extend the expiry time to keep receiving notifications.

If the AF cannot successfully fulfil the received HTTP PUT request due to an internal error or an error in the HTTP PUT request, the AF shall send an HTTP error response as specified in clause 5.7.

If the feature "ES3XX" is supported, and the AF determines the received HTTP PUT request needs to be redirected, the AF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [5].

Upon successful reception of an HTTP PUT request with: "{apiRoot}/naf-eventexposure/<apiVersion>/subscriptions/{subscriptionId}" as request URI and "AfEventExposureSubsc" data structure as request body, the AF shall update the subscription and send either a HTTP "200 OK" response with the "AfEventExposureSubsc" data structure as response body containing the representation of the modified "Individual Application Event Subscription", or an HTTP "204 No Content" response, as shown in step 2 of figure 4.2.2.3-1.

When the "monDur" attribute is included in the response by the AF, it represents AF 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 AF 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 AF 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 AF 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 AF shall accumulate all the event reports for the target UEs until the group reporting guard time expires. Then, the AF shall notify the NF service consumer using the Naf_EventExposure_Notify service operation, as described in clause 4.2.4.2.

When the "notifFlag" attribute is included, and set to "DEACTIVATE" in the request, the AF shall mute the event notification and store the available events; if it is set to "RETRIEVAL" in the request, the AF shall send the stored events to the NF service consumer, and mute the event notification again and store available events.

4.2.3 Naf_EventExposure_Unsubscribe service operation

4.2.3.1 General

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

The following procedure using the Naf_EventExposure_Unsubscribe service operation is supported:

- unsubscription from event notifications.

4.2.3.2 Unsubscription from event notifications

Figure 4.2.3.2-1 illustrates the unsubscription from event notifications.
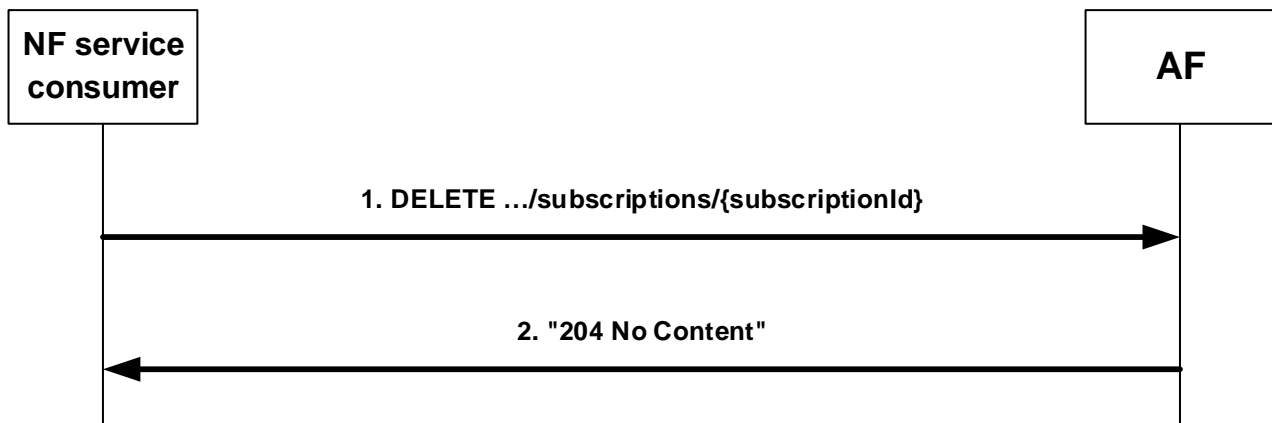
Figure 4.2.3.2-1: Unsubscription from event notifications

To unsubscribe from event notifications, the NF service consumer shall send an HTTP DELETE request with "{apiRoot}/naf-eventexposure/<apiVersion>/subscriptions/{subscriptionId}" as request URI, as shown in step 1 of figure 4.2.3.2-1, where "{subscriptionId}" is the subscription correlation identifier of the existing resource subscription that is to be deleted.

If the AF cannot successfully fulfil the received HTTP DELETE request due to an internal error or an error in the HTTP DELETE request, the AF shall send an HTTP error response as specified in clause 5.7.

If the feature "ES3XX" is supported, and the AF determines the received HTTP DELETE request needs to be redirected, the AF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [5].

Upon successful reception of the HTTP DELETE request with: "{apiRoot}/naf-eventexposure/<apiVersion>/subscriptions/{subscriptionId}" as request URI, the AF shall remove the corresponding subscription and send an HTTP "204 No Content" response as shown in step 2 of figure 4.2.3.2-1.

4.2.4 Naf_EventExposure_Notify service operation

4.2.4.1 General

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

The following procedure using the Naf_EventExposure_Notify service operation is supported:

- notification about subscribed events.

4.2.4.2 Notification about subscribed events

Figure 4.2.4.2-1 illustrates the notification about subscribed events.
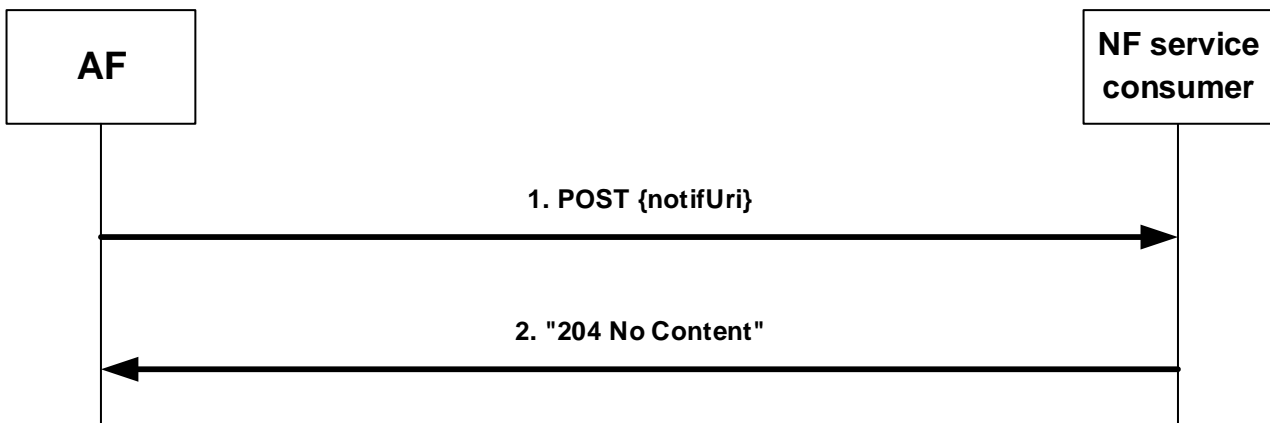
Figure 4.2.4.2-1: Notification about subscribed events

If the AF observes application related event(s) for which an NF service consumer has subscribed, the AF shall send an HTTP POST request as shown in step 1 of figure 4.2.4.2-1, with the "{notifUri}" as request URI containing the value previously provided by the NF service consumer within the corresponding subscription, and the "AfEventExposureNotif" data structure.

The "AfEventExposureNotif" data structure shall include:

a) the notification correlation ID provided by the NF service consumer during the subscription as "notifId" attribute; and

b) information about the observed event(s) within the "eventNotifs" attribute that shall contain for each observed event an "AfEventNotification" data structure that shall include:

1) the application related event as "event" attribute;

2) the time at which the event was observed encoded as "timeStamp" attribute;

3) if the "event" attribute is "SVC_EXPERIENCE":

- service experience information about the application involved in the reported event in the "svcExprcInfos" attribute;

4) if the "event" attribute is "UE_MOBILITY":

- UE mobility information associated with the application as "ueMobilityInfos" attribute;

5) if the "event" attribute is "UE_COMM":

- application communication information associated with the application as "ueCommInfos" attribute;

6) if the "event" attribute is "EXCEPTIONS":

- exceptions information associated with a service flow as "excepInfos" attribute;

7) if the "event" attribute is "COLLECTIVE_BEHAVIOUR":

- collective beahviour information associated with the UEs and its applications as "collBhvrInfs" attribute;

8) if the "event" attribute is "PERF_DATA":

- performance data information associated with the application as "perfDataInfos" attribute;

9) if the "event" attribute is "USER_DATA_CONGESTION":

- user data congestion information collected for an AF application as "congestionInfos" attribute; and

10) if the "event" attribute is "DISPERSION":

- UE dispersion information collected for an AF application as "dispersionInfos" 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 5.7.

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 [5].

Upon successful reception of the HTTP POST request with "{notifUri}" as request URI and "AfEventExposureNotif" data structure as request body, the NF service consumer shall send a "204 No Content" HTTP response, as shown in step 2 of figure 4.2.4.2-1.

5 Naf_EventExposure Service API

5.1 Introduction

The Naf_EventExposure Service shall use the Naf_EventExposure API.

The API URI of the Naf_EventExposure API shall be:

   {apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests from the NF service consumer towards the AF shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [6], i.e.:

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

with the following components:

-   The {apiRoot} shall be set as described in 3GPP TS 29.501 [6].

-   The <apiName> shall be "naf-eventexposure".

-   The <apiVersion> shall be "v1".

-   The <apiSpecificResourceUriPart> shall be set as described in clause 5.3.

5.2 Usage of HTTP

5.2.1 General

If the AF is untrusted, support of HTTP/1.1 (IETF RFC 7230 [21], IETF RFC 7231 [22], IETF RFC 7232 [23], IETF RFC 7233 [24], IETF RFC 7234 [25] and IETF RFC 7235 [26]) over TLS is mandatory and support of HTTP/2 (IETF RFC 7540 [7]) over TLS is recommended. TLS shall be used as specified in clause 12.3 and clause 13.1 of 3GPP TS 33.501 [14].

If the AF is trusted, HTTP/2, IETF RFC 7540 [7], shall be used as specified in clause 5.2 of 3GPP TS 29.500 [5].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [5].

The OpenAPI [8] specification of HTTP messages and content bodies for the Naf_EventExposure is contained in Annex A.

5.2.2 HTTP standard headers

5.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [5] for the usage of HTTP standard headers.

5.2.2.2 Content type

JSON, IETF RFC 8259 [9], 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 [5]. 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 [10].

5.2.3 HTTP custom headers

5.2.3.1 General

The Naf_EventExposure API shall support mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [5] and may support HTTP custom header fields specified in subclause 5.2.3.3 of 3GPP TS 29.500 [4].

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

5.3 Resources

5.3.1 Resource Structure

{apiRoot}/naf-eventexposure/<apiVersion>

/subscriptions

/{subscriptionId}
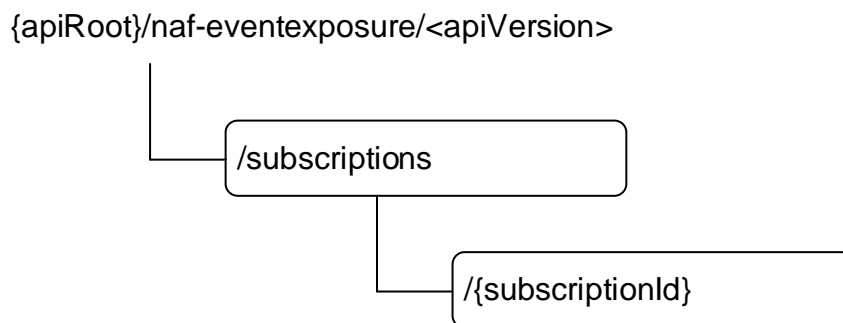
Figure 5.3.1-1: Resource URI structure of the Naf_EventExposure API

Table 5.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 5.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
Application Event Subscriptions	/subscriptions	POST	Subscription to the notification of application events and creation of an Individual Application Event Subscription resource.
Individual Application Event Subscription	/subscriptions/ {subscriptionId}	GET	Reads an Individual Application Event Subscription resource.
		PUT	Modifies an Individual Application Event Subscription.
		DELETE	Cancels an individual subscription to notifications of application event.

5.3.2 Resource: Application Event Subscriptions

5.3.2.1 Description

The Application Event Subscriptions resource represents all subscriptions of the Naf_EventExposure service at a given AF.

5.3.2.2 Resource definition

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

This resource shall support the resource URI variables defined in table 5.3.2.2-1.

Table 5.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.1
apiVersion	string	See clause 5.1

5.3.2.3 Resource Standard Methods

5.3.2.3.1 POST

This method shall support the URI query parameters specified in table 5.3.2.3.1-1.

Table 5.3.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.3.2.3.1-2 and the response data structures and response codes specified in table 5.3.2.3.1-3.

Table 5.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
AfEventExposureSubsc	M	1	Contains the information required for the creation of a new individual application event subscription.

Table 5.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AfEventExposureSubsc	M	1	201 Created	Contains the representation of the Individual Application Event Subscription resource.
NOTE: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [5] also apply.				

Table 5.3.2.3.1-4: 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}/naf-eventexposure/<apiVersion>/subscriptions/{subscriptionId}

5.3.3 Resource: Individual Application Event Subscription

5.3.3.1 Description

The Individual Application Event Subscription resource represents a single subscription of the Naf_EventExposure service at a given AF.

5.3.3.2 Resource definition

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

This resource shall support the resource URI variables defined in table 5.3.3.2-1.

Table 5.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.1
apiVersion	string	See clause 5.1
subscriptionId	string	Identifies a subscription to the AF event exposure service.

5.3.3.3 Resource Standard Methods

5.3.3.3.1 GET

This method shall support the URI query parameters specified in table 5.3.3.3.1-1.

Table 5.3.3.3.1-1: 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 5.3.3.3.1-2 and the response data structures and response codes specified in table 5.3.3.3.1-3.

Table 5.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.3.3.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AfEventExposureSubsc	M	1	200 OK	Contains the representation of the Individual Application 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 AF (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 AF (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 [5] also apply.				

Table 5.3.3.3.1-4: 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 AF (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 5.3.3.3.1-5: 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 AF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

5.3.3.3.2 PUT

This method shall support the URI query parameters specified in table 5.3.3.3.2-1.

Table 5.3.3.3.2-1: 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 5.3.3.3.2-2 and the response data structures and response codes specified in table 5.3.3.3.2-3.

Table 5.3.3.3.2-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
AfEventExposureSubsc	M	1	Modifies the existing Individual Application Event Subscription resource.

Table 5.3.3.3.2-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AfEventExposureSubsc	M	1	200 OK	Successful case. The Individual Application Event Subscription resource was modified and a representation is returned.
n/a			204 No Content	Successful case. The Individual Application 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 AF (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 AF (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 [5] also apply.				

Table 5.3.3.3.2-4: 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 AF (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 5.3.3.3.2-5: 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 AF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

5.3.3.3.3 DELETE

This method shall support the URI query parameters specified in table 5.3.3.3.3-1.

Table 5.3.3.3.3-1: 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 5.3.3.3.3-2 and the response data structures and response codes specified in table 5.3.3.3.3-3.

Table 5.3.3.3.3-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 5.3.3.3.3-3: 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 Application 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 AF (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 AF (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 [5] also apply.				

Table 5.3.3.3.3-4: 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 AF (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 5.3.3.3.3-5: 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 AF (service) instance.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the request is redirected.

5.4   Custom Operations without associated resources

No custom operation is defined in this Release of the specification.

5.5   Notifications

5.5.1   General

Notifications shall comply with clause 6.2 of 3GPP TS 29.500 [5] and clause 4.6.2.3 of 3GPP TS 29.501 [6].

Table 5.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Application Event Notification	{notifUri}	POST	Notification of application related event reporting.

5.5.2   Application Event Notification

5.5.2.1   Description

The Application Event Notification is used by the AF to report one or several observed application related events to the NF service consumer that has subscribed to such notifications.

5.5.2.2   Target URI

The callback URI **"{notifUri}"** shall be used with the callback URI variables defined in table 5.5.2.2-1.

Table 5.5.2.2-1: Callback URI variables

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 AfEventExposureSubsc data type (see table 5.6.2.2-1).

5.5.2.3   Standard Methods

5.5.2.3.1   POST

This method shall support the URI query parameters specified in table 5.5.2.3.1-1.

Table 5.5.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.5.2.3.1-2 and the response data structures and response codes specified in table 5.5.2.3.1-3.

Table 5.5.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
AfEventExposureNotif	M	1	Provides Information about observed application related events

Table 5.5.2.3.1-3: 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: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [5] for the POST method shall also apply.				

Table 5.5.2.3.1-4: 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 5.5.2.3.1-5: 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.

5.6 Data Model

5.6.1 General

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

Table 5.6.1-1 specifies the data types defined for the Naf_EventExposure service based interface protocol.

Table 5.6.1-1: Naf_EventExposure specific Data Types

Data type	Section defined	Description	Applicability
AddrFqdn	5.6.2.18	IP address and/or FQDN.	PerformanceData
AfEvent	5.6.3.3	Represents Application Events.	
AfEventExposureSubsc	5.6.2.2	Represents an Individual Application Event Subscription resource.	
AfEventExposureNotif	5.6.2.3	Describes notifications about application event that occurred in an Individual Application Event Subscription resource.	
AfEventNotification	5.6.2.6	Represents information related to an event to be reported.	
CollectiveBehaviourFilter	5.6.2.19	Contains the parameter type and value pair to express the collective behaviour event filters.	CollectiveBehaviour
CollectiveBehaviourFilterType	5.6.3.4		CollectiveBehaviour
CollectiveBehaviourInfo	5.6.2.20	Contains the collective behaviour analytics information.	CollectiveBehaviour
CommunicationCollection	5.6.2.13	Contains communication information.	UeCommunication
DispersionCollection	5.6.2.21	Contains Dispersion information collected.	Dispersion
EventFilter	5.6.2.5	Represents event filter information	
EventsSubs	5.6.2.4	Represents an event to be subscribed and the related event filter information.	
ExceptionInfo	5.6.2.14	Describes the exceptions information provided by AF.	Exceptions
PerformanceData	5.6.2.17	Indicates the performance data.	PerformanceData
PerformanceDataCollection	5.6.2.16	Represents the performance data information collected for an AF application.	PerformanceData
PerUeAttribute	5.6.2.22	UE application data collected per UE.	CollectiveBehaviour
ServiceExperienceInfoPerApp	5.6.2.7	Contains service experience associated with the application	ServiceExperience
ServiceExperienceInfoPerFlow	5.6.2.8	Contains service experience associated with the service flow	ServiceExperience
SvcExperience	5.6.2.9	Contains a mean opinion score with the customized range.	ServiceExperience
UeCommunicationCollection	5.6.2.11	Contains UE communication information associated with the application.	UeCommunication
UeMobilityCollection	5.6.2.10	Contains UE mobility information associated with the application.	UeMobility
UeTrajectoryCollection	5.6.2.12	Contains UE trajectory information associated with the application.	UeMobility
UserDataCongestionCollection	5.6.2.15	Contains User Data Congestion Analytics related information collected.	UserDataCongestion

Table 5.6.1-2 specifies data types re-used by the Naf_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 Naf_EventExposure service based interface.

Table 5.6.1-2: Naf_EventExposure re-used Data Types

Data type	Reference	Comments	Applicability
ApplicationId	3GPP TS 29.571 [13]	Application Identifier.	
BitRate	3GPP TS 29.571 [13]	String representing a bit rate that shall be formatted as follows: pattern: "^\d+(\.\d+)? (bps|Kbps|Mbps|Gbps|Tbps)$" Examples: "125 Mbps", "0.125 Gbps", "125000 Kbps".	UserDataCongestion CollectiveBehaviour
DateTime	3GPP TS 29.571 [13]	Contains a date and a time.	
Dnai	3GPP TS 29.571 [13]	Identifies a DNAI.	
EthFlowDescription	3GPP TS 29.514 [18]	Defines a packet filter for an Ethernet flow.	
Exception	3GPP TS 29.520 [19]	Describes the Exception information.	
Float	3GPP TS 29.571 [13]	Number with format "float" as defined in OpenAPI Specification [8].	
FlowDescription	3GPP TS 29.514 [18]	Only IP 5-tuple (protocol, source and destination IP address, Source and destination port) is applicable.	Dispersion
FlowInfo	3GPP TS 29.122 [17]	Represents flow information.	
Gpsi	3GPP TS 29.571 [13]	Identifies a GPSI.	
GroupId	3GPP TS 29.571 [13]	Contains a Group identifier.	
IpAddr	3GPP TS 29.571 [13]	Identifies IP address.	Dispersion
LocationArea5G	3GPP TS 29.122 [17]	Represents a user location area when the UE is attached to 5G.	
PacketDelBudget	3GPP TS 29.571 [13]	Indicates average Packet Delay.	PerformanceData
PacketLossRate	3GPP TS 29.571 [13]	Indicates average Loss Rate.	PerformanceData
RedirectResponse	3GPP TS 29.571 [13]	Contains redirection related information.	ES3XX
ReportingInformation	3GPP TS 29.523 [12]	Represents the requirements of reporting the subscription.	
SupportedFeatures	3GPP TS 29.571 [13]	Indicates the features supported.	
TimeWindow	3GPP TS 29.122 [17]	Represents a time window identified by a start time and a stop time.	
Uri	3GPP TS 29.571 [13]	Contains a URI.	
Volume	3GPP TS 29.122 [17]	Unsigned integer identifying a volume in units of bytes.	
UsageThreshold	3GPP TS 29.122 [17]	data volume during the period	Dispersion
Supi	3GPP TS 29.571 [13]	Contains a SUPI.	
ExtGroupId	3GPP TS 29.503 [27]	External Group Identifier for a user group.	

5.6.2   Structured data types

5.6.2.1   Introduction

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

5.6.2.2   Type AfEventExposureSubsc

Table 5.6.2.2-1: Definition of type AfEventExposureSubsc

Attribute name	Data type	P	Cardinality	Description	Applicability
eventsSubs	array(EventsSubs)	M	1..N	Subscribed events and the related event filters.	
eventsRepInfo	ReportingInformation	M	1	Represents the reporting requirements of the subscription.	
notifUri	Uri	M	1	Notification URI for event reporting.	
notifId	string	M	1	Notification Correlation ID assigned by the NF service consumer.	
eventNotifs	array(AfEventNotification)	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.	
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 AF.				

5.6.2.3   Type AfEventExposureNotif

Table 5.6.2.3-1: Definition of type AfEventExposureNotif

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

5.6.2.4   Type EventsSubs

Table 5.6.2.4-1: Definition of type EventsSubs

Attribute name	Data type	P	Cardinality	Description	Applicability
event	AfEvent	M	1	Subscribed event.	
eventFilter	EventFilter	M	1	Represents the event filter information associated with each event.	

5.6.2.5   Type EventFilter

Table 5.6.2.5-1: Definition of type EventFilter

Attribute name	Data type	P	Cardinality	Description	Applicability (NOTE 4)
gpsis	array(Gpsi)	O	1..N	Each element represents external UE identifier. (NOTE 1, NOTE 2)	
supis	array(Supi)	O	1..N	Each element represents a SUPI identifying a UE (NOTE 1, NOTE 2)	
exterGroupIds	array(ExtGroupId)	O	1..N	Each element represents a group of UEs identified by an External Group Identifier. (NOTE 1, NOTE 2)	
interGroupIds	array(GroupId)	O	1..N	Each element represents a group of UEs identified by an Internal Group Identifier (NOTE 1, NOTE 2)	
anyUeInd	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". May only be present and sets to "true" if "AfEvent" sets to "SVC_EXPERIENCE", "EXCEPTIONS" or "USER_DATA_CONGESTION". (NOTE 2)	ServiceExperience Exceptions UserDataCongesti on
appIds	array(ApplicationId)	O	1..N	Each element indicates an application identifier. If absent, the EventFilter data applies to any application (i.e. all applications) (NOTE 3)	
locArea	LocationArea5G	O	0..1	Represents area of interest. (NOTE 5)	
collAttrs	array(CollectiveBe haviourFilter)	O	1..N	Each element indicates a collective attribute parameter type and value.	CollectiveBehaviou r
NOTE 1: For untrusted AF, only gpsis and exterGroupIds are applicable. For trusted AF, only supis and interGroupIds are applicable.					
NOTE 2: For an applicable feature, only one attribute identifying the target UE shall be provided.					
NOTE 3: For event "UE_COMM", "UE_MOBILITY", "EXCEPTIONS" and "PERF_DATA", the "appIds" attribute, if present, shall include only one element.					
NOTE 4: Properties marked with a feature as defined in clause 5.8 are applicable as described in clause 6.6 of 3GPP TS 29.500 [5]. If no features are indicated, the related property applies for all the features.					
NOTE 5: The NetworkAreaInfo data within the LocationArea5G data is only applicable for trusted AF. In addition, for event "SVC_EXPERIENCE", only the "tais" attribute within the NetworkAreaInfo data is applicable for the trusted AF.					

5.6.2.6 Type AfEventNotification

Table 5.6.2.6-1: Definition of type AfEventNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
event	AfEvent	M	1	Represents the reported application related event.	
timeStamp	DateTime	M	1	Time at which the event is observed.	
svcExprcInfos	array(ServiceExperienceInfoPerApp)	C	1..N	Contains the service experience information. Shall be present if the "event" attribute sets to "SVC_EXPERIENCE"	ServiceExperience
ueMobilityInfos	array(UeMobilityCollection)	C	1..N	Contains the UE mobility information. Shall be present if the "event" attribute sets to "UE_MOBILITY"	UeMobility
ueCommInfos	array(UeCommunicationCollection)	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
congestionInfos	array(UserDataCongestionCollection)	C	1..N	Each element represents the user data congestion information collected for an AF application. Shall be present if the "event" attribute sets to "USER_DATA_CONGESTION".	UserDataCongestion
perfDataInfos	array(PerformanceDataCollection)	C	1..N	Each element represents the performance data information collected for an AF application. Shall be present if the "event" attribute sets to "PERF_DATA".	PerformanceData
collBhvrInfs	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
dispersionInfos	array(DispersionCollection)	C	1..N	Each element represents the UE dispersion information collected for an AF application. Shall be present if the "event" attribute sets to "DISPERSION".	Dispersion

5.6.2.7 Type ServiceExperienceInfoPerApp

Table 5.6.2.7-1: Definition of type ServiceExperienceInfoPerApp

Attribute name	Data type	P	Cardinality	Description	Applicability
appId	ApplicationId	C	0..1	Indicates an application identifier. Shall be present if the AF event exposure service request applies to more than one application.	
svcExpPerFlows	array(ServiceExperienceInfoPerFlow)	M	1..N	Each element represents service experience for each service flow.	
gpsis	array(Gpsi)	O	1..N	Each element represents external UE identifier. (NOTE)	
supis	array(Supi)	O	1..N	SUPI identifying a UE. (NOTE)	
NOTE: Either gpsis or supis shall be present. For untrusted AF, only gpsis is applicable. For trusted AF, only supis is applicable.					

5.6.2.8 Type ServiceExperienceInfoPerFlow

Table 5.6.2.8-1: Definition of type ServiceExperienceInfoPerFlow

Attribute name	Data type	P	Cardinality	Description	Applicability
svcExprc	SvcExperience	M	1	Service experience	
timeIntev	TimeWindow	M	1	Represents a start and stop time of the measurement period for the AF service experience.	
dnai	Dnai	O	0..1	Indicates the DN Access Identifiers representing location of the service flow.	
ipTrafficFilter	FlowInfo	O	0..1	Identifies IP packet filter.(NOTE)	
ethTrafficFilter	EthFlowDescription	O	0..1	Identifies Ethernet packet filter.(NOTE)	
NOTE: Either "ipTrafficFilter" or "ethTrafficFilter" shall be provided.					

5.6.2.9 Type SvcExperience

Table 5.6.2.9-1: Definition of type SvcExperience

Attribute name	Data type	P	Cardinality	Description	Applicability
mos	Float	M	1	Mean opinion score.	
upperRange	Float	M	1	The upper value within the rating scale range	
lowerRange	Float	M	1	The lower value within the rating scale range	

5.6.2.10 Type UeMobilityCollection

Table 5.6.2.10-1: Definition of type UeMobilityCollection

Attribute name	Data type	P	Cardinality	Description	Applicability
gpsi	Gpsi	O	0..1	Identifies a UE. (NOTE)	
supi	Supi	O	0..1	SUPI identifying a UE. (NOTE)	
appId	ApplicationId	M	1	Identifies an application identifier.	
ueTrajs	array(UeTrajectoryCollection)	M	1..N	Identifies a list of UE moving trajectories.	
NOTE: Either gpsi or supi shall be present. For untrusted AF, only gpsi is applicable. For trusted AF, only supi is applicable.					

5.6.2.11 Type UeCommunicationCollection

Table 5.6.2.11-1: Definition of type UeCommunicationCollection

Attribute name	Data type	P	Cardinality	Description	Applicability
gpsi	Gpsi	O	0..1	Identifies a UE. (NOTE 1)	
supi	Supi	O	0..1	SUPI identifying a UE. (NOTE 1)	
exterGroupId	ExtGroupId	O	0..1	Identifies an external group of UEs. (NOTE 2)	
interGroupId	GroupId	O	0..1	Identifies an internal group of UEs. (NOTE 2)	
appId	ApplicationId	M	1	Identifies an application identifier.	
comms	array(CommunicationCollection)	M	1..N	This attribute contains a list of communication information.	
NOTE 1: Either gpsi or supi shall be present. For untrusted AF, only gpsi is applicable. For trusted AF, only supi is applicable.					
NOTE 2: "interGroupId" attribute only applies to trusted AF and "exterGroupId" only applies to untrusted AF.					

5.6.2.12 Type UeTrajectoryCollection

Table 5.6.2.12-1: Definition of type UeTrajectoryCollection

Attribute name	Data type	P	Cardinality	Description	Applicability
ts	DateTime	M	1	This attribute identifies the timestamp when the UE enters the location.	
locArea	LocationArea5G	M	1	This attribute includes the location information of the UE.	

5.6.2.13 Type CommunicationCollection

Table 5.6.2.13-1: Definition of type CommunicationCollection

Attribute name	Data type	P	Cardinality	Description	Applicability
startTime	DateTime	M	1	Identifies the timestamp this communication starts.	
endTime	DateTime	M	1	Identifies the timestamp this communication stops.	
ulVol	Volume	O	0..1	Identifies the uplink traffic volume. (NOTE)	
dlVol	Volume	O	0..1	Identifies the downlink traffic volume. (NOTE)	
NOTE: At least one of ulVol or dlVol shall be provided.					

5.6.2.14 Type ExceptionInfo

Table 5.6.2.14-1: Definition of type ExceptionInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
ipTrafficFilter	FlowInfo	O	0..1	Identifies IP flow.(NOTE 1)	
ethTrafficFilter	EthFlowDescription	O	0..1	Identifies Ethernet flow.(NOTE 1)	
exceps	array(Exception)	M	1..N	Contains the description of one or more exception information. (NOTE 2)	
NOTE 1: Either "ipTrafficFilter" or "ethTrafficFilter" shall be provided.					
NOTE 2: Only "excepId", "excepLevel" and "excepTrend" within the Exception data type as defined in 3GPP TS 29.520 [19] apply to the ExceptionInfo data type.					

5.6.2.15   Type UserDataCongestionCollection

Table 5.6.2.15-1: Definition of type UserDataCongestionCollection

Attribute name	Data type	P	Cardinality	Description	Applicability
appId	ApplicationId	C	0..1	Indicates an application identifier. (NOTE)	
ipTrafficFilter	FlowInfo	C	0..1	Identifies IP packet filter. (NOTE)	
timeInterv	TimeWindow	O	0..1	Represents a start and stop time interval of the measurement period for the AF application.	
thrputUl	BitRate	O	0..1	Indicates the average uplink throughput over the measurement period.	
thrputDl	BitRate	O	0..1	Indicates the average downlink throughput over the measurement period.	
thrputPkUl	BitRate	O	0..1	Indicates the peak uplink throughput over the measurement period.	
thrputPkDl	BitRate	O	0..1	Indicates the peak uplink throughput over the measurement period.	
NOTE: Either "appId" or "ipTrafficFilter" shall be provided.					

5.6.2.16   Type PerformanceDataCollection

Table 5.6.2.16-1: Definition of type PerformanceDataCollection

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 an UE.	
ipTrafficFilter	FlowInfo	O	0..1	Identifies IP packet filter.	
ueLoc	LocationArea5G	O	0..1	Represents the UE 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.					

5.6.2.17   Type PerformanceData

Table 5.6.2.17-1: Definition of type PerformanceData

Attribute name	Data type	P	Cardinality	Description	Applicability
pdb	PacketDelBudget	O	0..1	Indicates average Packet Delay.	
plr	PacketLossRate	O	0..1	Indicates average Loss Rate.	
thrputUl	BitRate	O	0..1	Indicates the average uplink throughput.	
thrputDl	BitRate	O	0..1	Indicates the average downlink throughput.	

5.6.2.18 Type AddrFqdn

Table 5.6.2.18-1: Definition of type AddrFqdn

Attribute name	Data type	P	Cardinality	Description	Applicability
ipAddr	IpAddr	O	0..1	Indicates an IP address.	
fqdn	string	O	0..1	Indicates an FQDN.	

5.6.2.19 Type CollectiveBehaviourFilter

Table 5.6.2.19-1: Definition of type CollectiveBehaviourFilter

Attribute name	Data type	P	Cardinality	Description	Applicability
type	CollectiveBehaviourFilterType	M	1	Parameter type for collective behaviour information event filter.	
value	string	M	1	Value of the parameter type as in "type" attribute.	
listOfUeInd	boolean	O	0..1	Indicates whether request list of UE IDs that fulfill a collective behaviour within the area of interest. This attribute shall set to "true" if request the list of UE IDs, otherwise, set to "false". May only be present and sets to "true" if "AfEvent" sets to "COLLECTIVE_BEHAVIOUR".	

5.6.2.20 Type CollectiveBehaviourInfo

Table 5.6.2.20-1: Definition of type CollectiveBehaviourInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
colAttrib	array(PerUeAttribute)	M	1..N	The list of collective attribute values.	
noOfUes	integer	O	0..1	Identifies the total number of UEs that fulfil a collective behaviour within the area of interest.	
appIds	array(ApplicationId)	O	1..N	Indicates the identifiers of the applications providing this information.	
extUeIds	array(Gpsi)	C	1..N	Gpsi information of the UEs that fulfil the collective behaviour with in the area of the interest. May only be present if the "listOfUe" attribute is subscribed and sets to "true". (NOTE)	
ueIds	array(Supi)	C	1..N	Supis of UEs that fulfil the collective behaviour with in the area of the interest. May only be present if the "listOfUe" attribute is subscribed and sets to "true". (NOTE)	
NOTE: Only one of "extUeIds" or "ueIds" shall be provided. "ueIds" attribute may only be provided by trusted AF.					

5.6.2.21 Type DispersionCollection

Table 5.6.2.21-1: Definition of type DispersionCollection

Attribute name	Data type	P	Cardinality	Description	Applicability
gpsi	Gpsi	C	0..1	Indicates external UE identifier. (NOTE 1)	
supi	Supi	C	0..1	Indicates internal UE identifier, represents a SUPI identifying a UE (NOTE 1)	
ueAddr	IpAddr	C	0..1	Indicates UE IP address. (NOTE 1)	
dataUsage	UsageThreshold	M	1	Data volume exchanged for the UE.	
flowDesp	FlowDescription	C	0..1	Represents IP 5-tuple with protocol, IP address and port for UL/DL application traffic. (NOTE 2)	
appId	ApplicationId	C	0..1	Indicates an Application Identifier. (NOTE 2)	
dnais	array(Dnai)	O	1..N	Indicates the DN Access Identifiers representing location of the service flow. May only be provided if the "ueAddr" attribute is provided.	
NOTE 1: One of the "supi", "gpsi" or "ueAddr" attribute shall be provided.					
NOTE 2: If the "ueAddr" attribute is provided, either the "appId" or "flowDesp" attribute shall be provided.					

5.6.2.22 Type PerUeAttribute

Table 5.6.2.22-1: Definition of type PerUeAttribute

Attribute name	Data type	P	Cardinality	Description	Applicability
ueDest	LocationArea5G	M	1	Expected final location of UE based on the route planned.	
route	string	O	0..1	Planned path of movement by a UE application (e.g. a navigation app). The format is based on the SLA.	
avgSpeed	BitRate	O	0..1	Expected speed over the route planned by a UE application.	
timeOfArrival	DateTime	O	0..1	Expected Time of arrival to destination based on the route planned.	

5.6.3 Simple data types and enumerations

5.6.3.1 Introduction

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

5.6.3.2 Simple data types

The simple data types defined in table 5.6.3.2-1 shall be supported.

Table 5.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

5.6.3.3 Enumeration: AfEvent

The enumeration AfEvent represents the application events that can be subscribed. It shall comply with the provisions defined in table 5.6.3.3-1.

Table 5.6.3.3-1: Enumeration AfEvent

Enumeration value	Description	Applicability
SVC_EXPERIENCE	Indicates that the event subscribed is service experience information for an application.	ServiceExperience
UE_MOBILITY	Indicates that the event subscribed is UE mobility information.	UeMobility
UE_COMM	Indicates that the event subscribed is UE communication information.	UeCommunication
EXCEPTIONS	Indicates that the event subscribed 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
COLLECTIVE_BEHAVIOUR	Indicates that the event subscribed is collective behaviour information.	CollectiveBehaviour
DISPERSION	Indicates that the event subscribed is dispersion information.	Dispersion

5.6.3.4 Enumeration: CollectiveBehaviourFilterType

The enumeration CollectiveBehaviourFilterType represents the parameter type for collective behaviour information filter. It shall comply with the provisions defined in table 5.6.3.4-1.

Table 5.6.3.4-1: Enumeration CollectiveBehaviourFilterType

Enumeration value	Description	Applicability
COLLECTIVE_ATTRIBUTE	Parameter type related to collective attributes.	
DATA_PROCESSING	Parameter type related to data processing type.	

5.7 Error handling

5.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [5].

For the Naf_EventExposure API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [6]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [5] 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 [5].

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

5.7.2 Protocol Errors

In this Release of the specification, there are no service specific protocol errors applicable for the Naf_EventExposure API.

5.7.3 Application Errors

The application errors defined for the Naf_EventExposure service are listed in table 5.7.3-1.

Table 5.7.3-1: Application errors

Application Error	HTTP status code	Description

5.8 Feature negotiation

The optional features in table 5.8-1 are defined for the Naf_EventExposure API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [5].

Table 5.8-1: Supported Features

Feature number	Feature Name	Description
1	ServiceExperience	This feature indicates support for the event related to service experience.
2	UeMobility	This feature indicates support for the event related to UE mobility.
3	UeCommunication	This feature indicates support for the event related to UE communication information.
4	Exceptions	This feature indicates support for the event related to exception information.
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 subclauses 6.5.3.2 and 6.5.3.3 of 3GPP TS 29.500 [5] and according to HTTP redirection principles for indirect communication, as specified in subclause 6.10.9 of 3GPP TS 29.500 [5].
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 for the event related to collective behaviour information.

5.9 Security

TLS shall be used to support the security communication between the NF Service Consumer and the AF as defined in clause 12.3 and clause 13.1 of 3GPP TS 33.501 [14].

If the AF is trusted, as indicated in 3GPP TS 33.501 [14] and 3GPP TS 29.500 [5], the access to the Naf_EventExposure API may be authorized by means of the OAuth 2.0 protocol (see IETF RFC 6749 [15]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [16]) plays the role of the authorization server.

If OAuth 2.0 is used, an NF Service Consumer, prior to consuming services offered by the Naf_EventExposure API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [16], 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 Naf_EventExposure service.

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

If the AF is untrusted, the access to Naf_EventExposure API shall be authorized by means of OAuth2 protocol (see IETF RFC 6749 [15]), based on local configuration, using the "Client Credentials" authorization grant. If OAuth2 is used, a NF Service Consumer (e.g. NEF), prior to consuming services offered by the Naf_EventExposure API, shall obtain a "token" from the authorization server.

Annex A (normative): OpenAPI specification

A.1 General

This Annex is based on the OpenAPI Specification [8] and provides corresponding representations of all APIs defined in the present specification.

NOTE 1: An OpenAPIs representation embeds JSON Schema representations of HTTP message bodies.

This Annex shall take 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 2: 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 [11] and clause 5.3.1 of the 3GPP TS 29.501 [6] for further information).

The security scheme defined below for the Naf_EventExposure API shows the case when the AF is in untrusted domain and the "scopes" and "tokenUrl" are undefined. For the trusted AF, the "scopes" definition shall use "naf-eventexposure" and the "tokenUrl" definition shall use "{nrfApiRoot}/oauth2/token".

A.2 Naf_EventExposure API

```
openapi: 3.0.0
info:
  version: 1.1.0-alpha.5
  title: Naf_EventExposure
  description: |
    AF Event Exposure Service.
    © 2022, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 29.517 V17.5.0; 5G System; Application Function Event Exposure Service; Stage 3.
  url: https://www.3gpp.org/ftp/Specs/archive/29_series/29.517/

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

security:
  - {}
  - oAuth2ClientCredentials: []


paths:
  /subscriptions:
    post:
      summary: Creates a new Individual Application Event Exposure Subscription resource
      operationId: PostAfEventExposureSubsc
      tags:
        - Application Event Subscription (Collection)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AfEventExposureSubsc'
```

```
        responses:
          '201':
            description: Success
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/AfEventExposureSubsc'
            headers:
              Location:
                description: >
                  Contains the URI of the created individual application event subscription resource
                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:
            $ref: 'TS29571_CommonData.yaml#/components/responses/default'
      callbacks:
        AfEventExposureNotif:
          '{$request.body#/notifUri}':
            post:
              requestBody:
                required: true
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/AfEventExposureNotif'
              responses:
                '204':
                  description: No Content, Notification was successful
                '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: "Reads an existing Individual Application Event Subscription"
```

```
      operationId: GetAfEventExposureSubsc
      tags:
        - Individual Application Event Subscription (Document)
      parameters:
        - name: subscriptionId
          in: path
          description: Application 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/AfEventExposureSubsc'
        '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: "Modifies an existing Individual Application Event Subscription "
      operationId: PutAfEventExposureSubsc
      tags:
        - Individual Application Event Subscription (Document)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AfEventExposureSubsc'
      parameters:
        - name: subscriptionId
          in: path
          description: Application Event Subscription ID
          required: true
          schema:
            type: string
      responses:
        '200':
          description: OK. Resource was successfully modified and representation is returned
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/AfEventExposureSubsc'
        '204':
          description: No Content. Resource was successfully 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: "Cancels an existing Individual Application Event Subscription "
        operationId: DeleteAfEventExposureSubsc
        tags:
          - Individual Application Event Subscription (Document)
        parameters:
          - name: subscriptionId
            in: path
            description: Application 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: '{tokenUri}'
          scopes: {}
      description: >
        For trusted AF, the 'naf-eventexposure' shall be used as 'scopes' and
        '{nrfApiRoot}/oauth2/token' shall be used as 'tokenUri'.

  schemas:
    AfEventExposureNotif:
      description: >
        Represents notifications on application event(s) that occurred for an Individual Application
        Event Subscription resource.
      type: object
      properties:
        notifId:
          type: string
        eventNotifs:
```

```
          type: array
          items:
            $ref: '#/components/schemas/AfEventNotification'
          minItems: 1
      required:
        - notifId
        - eventNotifs
    AfEventExposureSubsc:
      description: Represents an Individual Application Event Subscription resource.
      type: object
      properties:
        eventsSubs:
          type: array
          items:
            $ref: '#/components/schemas/EventsSubs'
          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/AfEventNotification'
          minItems: 1
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      required:
        - eventsSubs
        - eventsRepInfo
        - notifId
        - notifUri
    AfEventNotification:
      description: Represents information related to an event to be reported.
      type: object
      properties:
        event:
          $ref: '#/components/schemas/AfEvent'
        timeStamp:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        svcExprcInfos:
          type: array
          items:
            $ref: '#/components/schemas/ServiceExperienceInfoPerApp'
          minItems: 1
        ueMobilityInfos:
          type: array
          items:
            $ref: '#/components/schemas/UeMobilityCollection'
          minItems: 1
        ueCommInfos:
          type: array
          items:
            $ref: '#/components/schemas/UeCommunicationCollection'
          minItems: 1
        excepInfos:
          type: array
          items:
            $ref: '#/components/schemas/ExceptionInfo'
          minItems: 1
        congestionInfos:
          type: array
          items:
            $ref: '#/components/schemas/UserDataCongestionCollection'
          minItems: 1
        perfDataInfos:
          type: array
          items:
            $ref: '#/components/schemas/PerformanceDataCollection'
          minItems: 1
        dispersionInfos:
          type: array
          items:
            $ref: '#/components/schemas/DispersionCollection'
          minItems: 1
        collBhvrInfs:
```

```
            type: array
            items:
              $ref: '#/components/schemas/CollectiveBehaviourInfo'
            minItems: 1
      required:
        - event
        - timeStamp
    EventsSubs:
      description: Represents an event to be subscribed and the related event filter information.
      type: object
      properties:
        event:
          $ref: '#/components/schemas/AfEvent'
        eventFilter:
          $ref: '#/components/schemas/EventFilter'
      required:
        - event
        - eventFilter
    EventFilter:
      description: Represents event filter information for an event.
      type: object
      properties:
        gpsis:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
          minItems: 1
        supis:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
          minItems: 1
        exterGroupIds:
          type: array
          items:
            $ref: 'TS29503_Nudm_SDM.yaml#/components/schemas/ExtGroupId'
          minItems: 1
        interGroupIds:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
          minItems: 1
        anyUeInd:
          type: boolean
        appIds:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
          minItems: 1
        locArea:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/LocationArea5G'
        collAttrs:
          type: array
          items:
            $ref: '#/components/schemas/CollectiveBehaviourFilter'
          minItems: 1
    ServiceExperienceInfoPerApp:
      description: Contains service experience information associated with an application.
      type: object
      properties:
        appId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
        svcExpPerFlows:
          type: array
          items:
            $ref: '#/components/schemas/ServiceExperienceInfoPerFlow'
          minItems: 1
        gpsis:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
          minItems: 1
        supis:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
          minItems: 1
      required:
        - svcExpPerFlows
```

```
ServiceExperienceInfoPerFlow:
  description: Contains service experience information associated with a service flow.
  type: object
  properties:
    svcExprc:
      $ref: '#/components/schemas/SvcExperience'
    timeIntev:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
    dnai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
    ipTrafficFilter:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/FlowInfo'
    ethTrafficFilter:
      $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/EthFlowDescription'
SvcExperience:
  description: Contains a mean opinion score with the customized range.
  type: object
  properties:
    mos:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
    upperRange:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
    lowerRange:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
UeMobilityCollection:
  description: Contains UE mobility information associated with an application.
  type: object
  properties:
    gpsi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
    supi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
    appId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
    ueTrajs:
      type: array
      items:
        $ref: '#/components/schemas/UeTrajectoryCollection'
      minItems: 1
  required:
    - appId
    - ueTrajs
UeCommunicationCollection:
  description: Contains UE communication information associated with an application.
  type: object
  properties:
    gpsi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
    supi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
    exterGroupId:
      $ref: 'TS29503_Nudm_SDM.yaml#/components/schemas/ExtGroupId'
    interGroupId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
    appId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
    comms:
      type: array
      items:
        $ref: '#/components/schemas/CommunicationCollection'
      minItems: 1
  required:
    - appId
    - comms
UeTrajectoryCollection:
  description: Contains UE trajectory information associated with an application.
  type: object
  properties:
    ts:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    locArea:
      $ref: 'TS29122_CommonData.yaml#/components/schemas/LocationArea5G'
  required:
    - ts
    - locArea
CommunicationCollection:
  description: Contains communication information.
  type: object
```

```
      properties:
        startTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        endTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        ulVol:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Volume'
        dlVol:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Volume'
      required:
        - startTime
        - endTime
        - ulVol
        - dlVol
    ExceptionInfo:
      description: Represents the exceptions information provided by the AF.
      type: object
      properties:
        ipTrafficFilter:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/FlowInfo'
        ethTrafficFilter:
          $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/EthFlowDescription'
        exceps:
          type: array
          items:
            $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/Exception'
          minItems: 1
    UserDataCongestionCollection:
      description: Contains User Data Congestion Analytics related information collection.
      type: object
      properties:
        appId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
        ipTrafficFilter:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/FlowInfo'
        timeInterv:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
        thrputUl:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
        thrputDl:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
        thrputPkUl:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
        thrputPkDl:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
    PerformanceDataCollection:
      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'
        ueLoc:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/LocationArea5G'
        appLocs:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
          minItems: 1
        asAddr:
          $ref: '#/components/schemas/AddrFqdn'
        perfData:
          $ref: '#/components/schemas/PerformanceData'
        timeStamp:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      required:
        - perfData
        - timeStamp
    PerformanceData:
      description: Contains Performance Data.
      type: object
      properties:
        pdb:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketDelBudget'
        plr:
```

```
                  $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketLossRate'
               thrputUl:
                  $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
               thrputDl:
                  $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
      AddrFqdn:
        description: IP address and/or FQDN.
        type: object
        properties:
          ipAddr:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/IpAddr'
          fqdn:
            type: string
            description: Indicates an FQDN.
      DispersionCollection:
        description: Contains the dispersion information collected for an AF.
        type: object
        properties:
          gpsi:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
          supi:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
          ueAddr:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/IpAddr'
          dataUsage:
            $ref: 'TS29122_CommonData.yaml#/components/schemas/UsageThreshold'
          flowDesp:
            $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/FlowDescription'
          appId:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
          dnais:
            type: array
            items:
              $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
            minItems: 1
        required:
          - dataUsage
      CollectiveBehaviourFilter:
        description: Contains the collective behaviour filter information to be collected from UE.
        type: object
        properties:
          type:
            $ref: '#/components/schemas/CollectiveBehaviourFilterType'
          value:
            type: string
            description: Value of the parameter type as in the type attribute.
          listOfUeInd:
            type: boolean
            description: Indicates whether request list of UE IDs that fulfill a collective behaviour
within the area of interest. This attribute shall set to "true" if request the list of UE IDs,
otherwise, set to "false". May only be present and sets to "true" if "AfEvent" sets to
"COLLECTIVE_BEHAVIOUR".
        required:
          - type
          - value
      CollectiveBehaviourInfo:
        description: Contains the collective behaviour information to be reported to the subscriber.
        type: object
        properties:
          colAttrib:
            type: array
            items:
              $ref: '#/components/schemas/PerUeAttribute'
            minItems: 1
          noOfUes:
            type: integer
            description: Total number of UEs that fulfil a collective within the area of interest.
          appIds:
            type: array
            items:
              $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
            minItems: 1
          extUeIds:
            type: array
            items:
              $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
            minItems: 1
          ueIds:
```

```
            type: array
            items:
              $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
            minItems: 1
        required:
          - colAttrib
        oneOf:
          - required: [extUeIds]
          - required: [ueIds]
    PerUeAttribute:
      description: UE application data collected per UE.
      type: object
      properties:
        ueDest:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/LocationArea5G'
        route:
          type: string
        avgSpeed:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
        timeOfArrival:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'

# Simple data types and Enumerations

    AfEvent:
      description: Represents Application Events.
      anyOf:
      - type: string
        enum:
          - SVC_EXPERIENCE
          - UE_MOBILITY
          - UE_COMM
          - EXCEPTIONS
          - USER_DATA_CONGESTION
          - PERF_DATA
          - DISPERSION
          - COLLECTIVE_BEHAVIOUR
      - type: string
    CollectiveBehaviourFilterType:
      description: Represents collective behaviour parameter type.
      anyOf:
      - type: string
        enum:
          - COLLECTIVE_ATTRIBUTE
          - DATA_PROCESSING
      - type: string
```

Annex B (informative):
Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Cat	Subject/Comment	New
2019-03						TS skeleton of Application Function Event Exposure Service	0.0.0
2019-04	CT3#102					Inclusion of C3-191230, C3-191374 and editorial change from Rapporteur.	0.1.0
2019-05	CT3#103					Inclusion of C3-192194, C3-192393, C3-192260 and C3-192261.	0.2.0
2019-08	CT3#105					Inclusion of C3-193373, C3-193440, C3-193441 and C3-193446.	0.3.0
2019-10	CT3#106					Inclusion of C3-194263, C3-194264, C3-194393 and C3-194439.	0.4.0
2019-11	CT3#107					Inclusion of C3-195068, C3-195226, C3-195238.	0.5.0
2019-12	CT#86	CP-193178				Presented for information	1.0.0
2019-12	CT#86	CP-193295				A title corrected	1.0.1
2020-02	CT3#108e					Inclusion of C3-201297, C3-201369, C3-201385, C3-201399, C3-201440 and C3-201466.	1.1.0
2020-03	CT#87e	CP-200188				TS sent to plenary for approval	2.0.0
2020-03	CT#87e	CP-200188				TS approved by plenary	16.0.0
2020-06	CT#88e	CP-201234	0001		F	Update service operation for Ue Communication	16.1.0
2020-06	CT#88e	CP-201234	0002		F	Corrections in TS 29.517	16.1.0
2020-06	CT#88e	CP-201234	0003		F	Definition of AfEventExposureSubsc in OpenAPI	16.1.0
2020-06	CT#88e	CP-201234	0004	1	D	Unsubscribe service operation	16.1.0
2020-06	CT#88e	CP-201234	0005	1	F	Correction to event description	16.1.0
2020-06	CT#88e	CP-201234	0006	1	F	Correction to target UE description	16.1.0
2020-06	CT#88e	CP-201244	0007	1	F	Storage of YAML files in ETSI Forge	16.1.0
2020-06	CT#88e	CP-201234	0008		F	Service operation description for UE mobility	16.1.0
2020-06	CT#88e	CP-201256	0009	1	F	URI of the Naf_EventExposure service	16.1.0
2020-06	CT#88e	CP-201234	0010		F	Support of immediate reporting	16.1.0
2020-06	CT#88e	CP-201077	0012	1	F	Supported features definition	16.1.0
2020-06	CT#88e	CP-201234	0013	1	F	Target UE information	16.1.0
2020-06	CT#88e	CP-201234	0014	1	F	Supported headers, Resource Data type and yaml mapping	16.1.0
2020-06	CT#88e	CP-201255	0015		F	Update of OpenAPI version and TS version in externalDocs field	16.1.0
2020-09	CT#89e	CP-202066	0017	1	F	Missed data type definition	16.2.0
2020-09	CT#89e	CP-202066	0018		F	Corrections on UE Mobility	16.2.0
2020-09	CT#89e	CP-202066	0019		F	Missed response code	16.2.0
2020-09	CT#89e	CP-202066	0020	1	F	Any UE indication applies to EXCEPTIONS	16.2.0
2020-12	CT#90e	CP-203139	0021	1	F	Essential Corrections and alignments	16.3.0
2020-12	CT#90e	CP-203139	0022		F	Storage of YAML files in 3GPP Forge	16.3.0
2020-12	CT#90e	CP-203129	0023	1	F	Removal of trailing forward slash in resource URI	16.3.0
2020-12	CT#90e	CP-203139	0024	1	F	Callback URI correction	16.3.0
2020-12	CT#90e	CP-203152	0027		F	Update of OpenAPI version and TS version in externalDocs field	16.3.0
2020-12	CT#90e	CP-203130	0025	1	F	Corrections to location area usage	17.0.0
2021-03	CT#91e	CP-210206	0029		A	Correction to anyUeInd attribute	17.1.0
2021-03	CT#91e	CP-210191	0031	1	A	Support Stateless NFs	17.1.0
2021-03	CT#91e	CP-210218	0032		F	OpenAPI reference	17.1.0
2021-03	CT#91e	CP-210219	0033		F	Adding some missing description fields to data type definitions in OpenAPI specification files	17.1.0
2021-03	CT#91e	CP-210220	0034		F	Optional header clarification	17.1.0
2021-03	CT#91e	CP-210206	0036		F	Resource URI correction	17.1.0
2021-03	CT#91e	CP-210240	0038		F	Update of OpenAPI version and TS version in externalDocs field	17.1.0
2021-06	CT#92e	CP-211221	0039	1	B	Partitioning criteria for applying sampling in specific UE partitions in AF exposure	17.2.0
2021-06	CT#92e	CP-211221	0040		B	Support of Mute reporting	17.2.0
2021-06	CT#92e	CP-211200	0041	1	A	Redirection responses	17.2.0
2021-06	CT#92e	CP-211221	0043	1	B	Extensions to User Data Congestion Analytics	17.2.0
2021-06	CT#92e	CP-211265	0045		F	Update of OpenAPI version and TS version in externalDocs field	17.2.0
2021-09	CT#93e	CP-212203	0046	2	B	Support of Performance Data event	17.3.0
2021-09	CT#93e	CP-212220	0047		F	Resource URI correction on Naf_EventExposure API	17.3.0
2021-09	CT#93e	CP-212203	0048	1	B	Collective Behaviour analytics	17.3.0
2021-09	CT#93e	CP-212203	0049	2	B	Support UE data volume dispersion collection	17.3.0
2021-09	CT#93e	CP-212223	0050		F	Update of OpenAPI version and TS version in externalDocs field	17.3.0
2021-12	CT#94e	CP-213227	0052	1	B	Updates to UE data volume dispersion collection	17.4.0
2021-12	CT#94e	CP-213256	0055		B	Collective Behaviour Analytics update	17.4.0
2021-12	CT#94e	CP-213227	0051	1	F	Updates to User Data Congestion	17.4.0
2021-12	CT#94e	CP-213227	0053		F	Adding collective behaviour analytics feature	17.4.0
2021-12	CT#94e	CP-213227	0054	2	F	Update of notification procedure with description of USER_DATA_CONGESTION and DISPERSION events	17.4.0

2021-12	CT#94e	CP-213220	0056		B	Alignment with SA3 supported TLS profiles	17.4.0
2021-12	CT#94e	CP-213246	0057		F	Update of OpenAPI version and TS version in externalDocs field	17.4.0
2022-03	CT#95e	CP-220190	0058	1	B	Update UE Application collective behaviour for NF Load analytics	17.5.0
2022-03	CT#95e	CP-220190	0059	1	F	type attribute in CollectiveBehaviourFilter data type	17.5.0
2022-03	CT#95e	CP-220190	0060	1	F	Miscellaneous corrections	17.5.0
2022-03	CT#95e	CP-220191	0062	1	F	Formatting of description fields	17.5.0
2022-03	CT#95e	CP-220201	0061	1	F	Corrections to Data Model of AF Event Exposure service	17.5.0
2022-03	CT#95e	CP-220194	0063		F	Update of info and externalDocs field	17.5.0

History

Document history		
V17.5.0	May 2022	Publication