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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:

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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.

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In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

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

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

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may indicates permission to do something

need not indicates permission not to do something

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

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

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

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 Nupf Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the UPF.

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.548[14].

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

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1]		3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2]		3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[3]		3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[4]		3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

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

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

[7]		3GPP TR 21.900: "Technical Specification Group working methods".

[8]		3GPP TS 33.501: "Security architecture and procedures for 5G system".

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

[10]		3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".

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

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

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

[14]		3GPP TS 23.548: "5G System Enhancements for Edge Computing; Stage 2".

[15]		3GPP TS 29.244: "Interface between the Control Plane and the User Plane Nodes; Stage 3".

[16]		3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

3   Definitions, symbols and abbreviations

3.1   Definitions

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

3.2   Symbols

None in this release.

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].

L-UPF	Local User Plane Function
L-NEF	Local Network Exposure Function
NEF	Network Exposure Function
UPF	User Plane Function

4   Overview

4.1   Introduction

Within the 5GC, the UPF offers services to the NEF and AF via the Nupf service based interface (see 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.548 [14]).

Figure 4.1-1 provides the reference model (in service based interface representation and in reference point representation), with focus on the UPF.
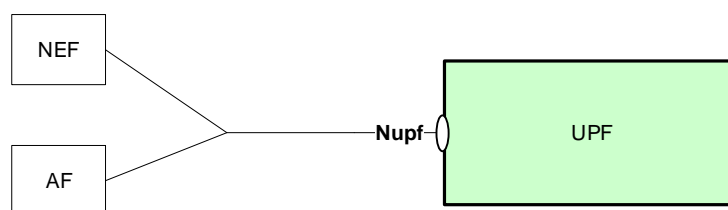

Figure 4.1-1: Reference model – UPF

The UPF supports the following functionalities which are provided via Service Based Interface:

-    Notification about the QoS monitoring information.

5   Services offered by the UPF

5.1   Introduction

The UPF offers the following services via the Nupf interface:

-    Nupf_EventExposure Service

Table 5.1-1 summarizes the corresponding APIs defined for this specification.

Table 5.1-1: API Descriptions

Service Name	Clause	Description	OpenAPI Specification File	apiName	Annex
Nupf_EventExposure	6.1	UPF Event Exposure Service	TS29564_Nupf_EE.yaml	nupf-ee	A.2

5.2   Nupf_EventExposure Service

5.2.1   Service Description

The Nupf_EventExposure service enables the UPF to expose UPF related information to the service consumers, e.g. local NEF, AF. Via Nupf_EventExposure service the UPF exposes the UPF related information in the following manners:

- Subscribe/Notify:

  The NF service consumers create the subscription on the event of interest via SMF. When required, the SMF instructs the UPF to report QoS Monitoring events directly to a local NEF or AF via N4 interface as specified in 3GPP TS 29.244 [15]. Upon the event of interest the UPF sends notification directly to the local NEF or AF via Nupf interface.

  The event notification may contain following information:

  - QoS Monitoring report, e.g. end to end delay for a specific QoS flow of a PDU session.

  NOTE: In the current release direct subscription from NF service consumer to UPF is not supported.

5.2.2   Service Operations

5.2.2.1   Introduction

The service operations defined for the Nupf_EventExposure service are as follows:

- Subscribe: This is a pseudo operation, the actual subscription to the event is created via N4 interface.

  NOTE 1: In the current release OpenAPI 3.0.0 is adopted, with OpenAPI 3.0.0 it is not possible to document a stand-alone callback operation, thus the Notify operation has to be defined in combination with a Subscribe operation.

- Notify: It allows the UPF to send event notifications directly to NF service consumers, e.g. local NEF, AF.

  NOTE 2: Subscribe service operation is not defined in this release.

5.2.2.2   Subscribe

This is a pseudo operation, the UPF does not actually provide Subscribe service operation through Nupf_EventExposure service. The subscription on the UPF is created via N4 interface.

5.2.2.3   Notify

5.2.2.3.1   General

This service operation is used by the UPF to send the following kinds of event notification:

- Periodic notification on the downlink packet delay, uplink packet delay, and/or the round trip packet delay between the UPF (PSA) and UE;

- Event triggered notification on the downlink packet delay, uplink packet delay, and/or the round trip packet delay between the UPF (PSA) and UE, i.e. when the packet delay exceeds a defined threshold;

- Notification on the downlink packet delay, uplink packet delay, and/or the round trip packet delay between the UPF (PSA) and UE when the PDU session is released.

The subscription corresponding to the notification is created by the SMF via N4 interface, see clause 5.33.5 of 3GPP TS 29.244 [15].

5.2.2.3.2   UPF sends notification on QoS monitoring
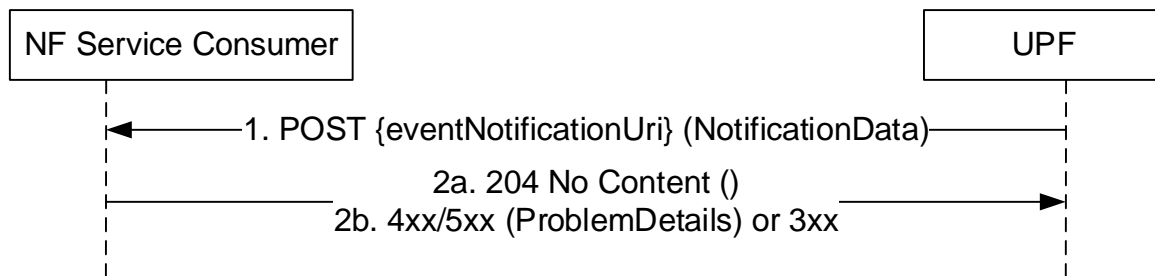
Figure 5.2.2.3.2-1: UPF sends notification on QoS monitoring

1. The UPF shall send a POST request to the eventNotificationUri as provided by the SMF during the provisioning of Session Reporting Rule (see clause 7.5.2.9 of 3GPP TS 29.244 [15]).

2a. Upon success, the NF Service Consumer responds with "204 No Content".

2b. On failure or redirection:

   - If the NF Service Consumer does not consider the "eventNotificationUri" as a valid notification URI, the NF Service Consumer shall return "404 Not Found" status code with the ProblemDetails IE providing details of the error.

   - In the case of redirection, the NF service consumer shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint of another NF service consumer endpoint.

6   API Definitions

6.1   Nupf_EventExposure Service API

6.1.1   API URI

The Nupf_EventExposure shall use the Nupf_EventExposure API.

The API URI of the Nupf_EventExposure API shall be:

{apiRoot}/<apiName>/<apiVersion>

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

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

with the following components:

   - The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].

   - The <apiName> shall be "nupf-ee".

- The <apiVersion> shall be "v1".

- The <apiSpecificResourceUriPart> shall be set as described in clause 6.1.3.

6.1.2 Usage of HTTP

6.1.2.1 General

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

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

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

6.1.2.2 HTTP standard headers

6.1.2.2.1 General

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

6.1.2.2.2 Content type

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

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

6.1.2.3 HTTP custom headers

The mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be supported, and the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4] may be supported.

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

6.1.3 Resources

6.1.3.1 Overview

{apiRoot}/nupf-ee/v1

/ee-subscriptions
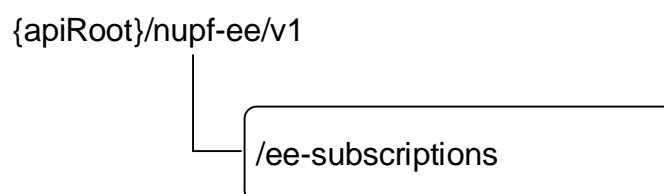
Figure 6.1.3.1-1: Resource URI structure of the nupf-ee API

Table 6.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.1.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
EventExposureSubscriptions (Collection)	/ee-subscriptions	POST	This is a pseudo operation.

6.1.3.2 Resource: EventExposureSubscriptions

6.1.3.2.1 Description

6.1.3.2.2 Resource Definition

Resource URI: **{apiRoot}/nupf-ee/<apiVersion>/ee-subscriptions**

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

Table 6.1.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.1.1
apiVersion	string	See clause 6.1.1

6.1.3.2.3 Resource Standard Methods

6.1.3.2.3.1 POST

This method will not be actually invoked.

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

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

Name	Data type	P	Cardinality	Description	Applicability
n/a					

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

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

Data type	P	Cardinality	Description
Any			

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

Data type	P	Cardinality	Response codes	Description
n/a				
NOTE: The mandatory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

6.1.4   void

6.1.5   Notifications

6.1.5.1   General

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

Table 6.1.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Event Notification	{eventNotificationUri} (This URI is not provided by NF service consumer via Nupf interface, it is provided via N4 interface during the provisioning of Session Reporting Rule)	POST	Notify about the events that UPF exposes and to which the NF service consumer may subscribe to.

6.1.5.2   Event Notification

6.1.5.2.1   Description

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

6.1.5.2.2   Target URI

The POST method shall be used for Event Notification and the URI shall be the Event Notification URI provided by the SMF during the provisioning of Session Reporting Rule, see clause 5.33.5 of 3GPP TS 29.244 [15].

Resource URI: **{eventNotificationUri}**

Support of URI query parameters is specified in table 6.1.5.2.2-1.

Table 6.1.5.2.2-1: Callback URI variables

Name	Data type	P	Cardinality	Description
n/a				

Support of request data structures is specified in table 6.1.5.2.2-2, and support of response data structures and response codes is specified in table 6.1.5.2.2-3.

Table 6.1.5.2.2-2: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
NotificationData	M	1	Representation of the event notification.

Table 6.1.5.2.2-3: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents a successful notification of the event.
ProblemDetails	O	0..1	404 Not Found	If the NF Service Consumer considers the "eventNotificationUri" and/or "Notification Correlation ID" is not recognized, the NF Service Consumer shall return "404 Not Found" status code
RedirectResponse	O	0..1	307 Temporary Redirect	The NF service consumer shall generate a Location header field containing a URI pointing to the endpoint of another NF Service Consumer instance to which the notification should be sent. If an SCP redirects the message to another SCP then the location header field shall contain the same URI or a different URI pointing to the endpoint of the NF service consumer to which the notification should be sent.
RedirectResponse	O	0..1	308 Permanent Redirect	The NF service consumer shall generate a Location header field containing a URI pointing to the endpoint of another NF Service Consumer instance to which the notification should be sent. If an SCP redirects the message to another SCP then the location header field shall contain the same URI or a different URI pointing to the endpoint of the NF service consumer to which the notification should be sent.
NOTE:	The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]).			

Table 6.1.5.2.2-4: Headers supported by the 307 Response Code on this endpoint

Name	Data type	P	Cardinality	Description
Location	string	M	1	A URI pointing to the endpoint of the NF service consumer instance to which the request should be sent
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF instance ID towards which the notification is redirected

Table 6.1.5.2.2-5: Headers supported by the 308 Response Code on this endpoint

Name	Data type	P	Cardinality	Description
Location	string	M	1	A URI pointing to the endpoint of the NF service consumer instance to which the request should be sent
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF instance ID towards which the notification is redirected

6.1.6   Data Model

6.1.6.1   General

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

Table 6.1.6.1-1 specifies the data types defined for the Nupf_EventExposure service.

Table 6.1.6.1-1: Nupf_EventExposure specific Data Types

Data type	Clause defined	Description	Applicability
NotificationData	6.1.6.2.2	The list of NotificationItems	
NotificationItem	6.1.6.2.3	Represents a report on one subscribed event	
QosMonitoringMeasurement	6.1.6.2.4	QoS Monitoring Measurement information	
EventType	6.1.6.3.3	Event Type	

Table 6.1.6.1-2 specifies data types re-used by the Nupf_EventExposure service from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nupf_EventExposure service.

Table 6.1.6.1-2: Nupf_EventExposure re-used Data Types

Data type	Reference	Comments	Applicability
DateTime	3GPP TS 29.571 [16]	Date time	
Dnn	3GPP TS 29.571 [16]	DNN	
Gpsi	3GPP TS 29.571 [16]	GPSI	
Snssai	3GPP TS 29.571 [16]	S-NSSAI	
Uint32	3GPP TS 29.571 [16]	Uint32	
MacAddr48	3GPP TS 29.571 [16]	MAC Address	
Ipv4Addr	3GPP TS 29.571 [16]	IPv4 address	
Ipv6Prefix	3GPP TS 29.571 [16]	IPv6 address prefix	

6.1.6.2 Structured data types

6.1.6.2.1 Introduction

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

6.1.6.2.2 Type: NotificationData

Table 6.1.6.2.2-1: Definition of type NotificationData

Attribute name	Data type	P	Cardinality	Description	Applicability
notificationItems	array(NotificationItem)	M	1..N	The list of NotificationItem, each entry corresponds to a report on one subscribed event.	
correlationId	string	C	0..1	The UPF shall include this attribute in the notification if the "Notification Correlation ID" IE was received via N4 interface (see clause 7.5.2.9 of 3GPP TS 29.244 [15])	

6.1.6.2.3   Type: NotificationItem

Table 6.1.6.2.3-1: Definition of type NotificationItem

Attribute name	Data type	P	Cardinality	Description	Applicability
eventType	EventType	M	1	The event type of the event for which the notification is generated.	
ueIpv4Addr	Ipv4Addr	C	0..1	IPv4 address of the UE (NOTE 1)	
ueIpv6Prefix	Ipv6Prefix	C	0..1	IPv6 address prefix of the UE (NOTE 1)	
ueMacAddr	MacAddr48	O	0..1	MAC address of the UE.	
dnn	Dnn	O	0..1	When present, this attribute indicates the DNN of the PDU session for which the notification is generated.	
snssai	Snssai	O	0..1	When present, this attribute indicates the S-NSSAI of the PDU session for which the notification is generated.	
gpsi	Gpsi	O	0..1	When present, this attribute indicates the GPSI of the UE for which the notification is generated.	
timeStamp	DateTime	M	1	The value represents the UTC time when the information in this report was generated.	
startTime	DateTime	O	0..1	When present, this attribute shall provide the timestamp when the information in this report was started	
qosMonitoringMeasurement	QosMonitoringMeasurement	C	0..1	This attribute shall be present if eventType is set to "QOS_MONITORING"	
NOTE 1: At least one of ueIpv4Addr and ueIpv6Prefix shall be present if IP PDU session is monitored..					

6.1.6.2.4 Type: QosMonitoringMeasurement

Table 6.1.6.2.3-1: Definition of type QosMonitoringMeasurement

Attribute name	Data type	P	Cardinality	Description	Applicability
dlPacketDelay	Uint32	O	0..1	When present, the value of this attribute is set to the measured downlink packet delay in millisecond (ms).	
ulPacketDelay	Uint32	O	0..1	When present, the value of this attribute is set to the measured uplink packet delay in millisecond (ms).	
rtrPacketDelay	Uint32	O	0..1	When present, the value of this attribute is set to the measured round trip packet delay in millisecond (ms).	
measureFailure	boolean	C	0..1	This IE shall be present to report packet delay measurement failure. When present, it shall be set to true to indicate the report is sent due to packet delay measurement failure. This IE is named as the "PLMF" flag over PFCP interface. See also clauses 5.24.4.3 and 8.2.171 in 3GPP TS 29.244 [15].	

6.1.6.3 Simple data types and enumerations

6.1.6.3.1 Introduction

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

6.1.6.3.2 Simple data types

No specific simple data types are defined in this release.

6.1.6.3.3 Enumeration: EventType

The enumeration EventType represents the type of event to which the service consumer may subscribe to and for which the notification is generated. It shall comply with the provisions defined in table 6.1.5.3.3-1.

Table 6.1.6.3.3-1: Enumeration EventType

Enumeration value	Description	Applicability
"QOS_MONITORING"	QoS Monitoring Measurement	

6.1.7 Error Handling

6.1.7.1 General

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

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

6.1.7.2 Protocol Errors

No specific procedures for the Nupf_EventExposure service are specified in this release.

6.1.7.3 Application Errors

No application errors for the Nupf_EventExposure service are specified in this release.

6.1.8 Feature negotiation

No specific features for Nupf_EventExposure service are defined in this release.

6.1.9 Security

In this release there is only notification procedure which will be actually invoked, the authorization mechanism does not apply.

Annex A (normative):
OpenAPI specification

A.1   General

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

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

> NOTE 1: The semantics and procedures, as well as conditions, e.g. for the applicability and allowed combinations of attributes or values, not expressed in the OpenAPI definitions but defined in other parts of the specification also apply.

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

A.2   Nupf_EventExposure API

```
openapi: 3.0.0
info:
  title: 'UPF Event Exposure Service'
  version: 1.0.1
  description: |
    UPF Event Exposure Service.
    © 2022, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 29.564 V17.2.0; 5G System; User Plane Function Services; Stage 3.
  url: https://www.3gpp.org/ftp/Specs/archive/29_series/29.564/
servers:
  - url: '{apiRoot}/nupf-ee/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501
paths:
  /ee-subscriptions:
    post:
    # This is a pseudo operation, clients shall NOT invoke this method!
      summary: subscribe to notifications
      operationId: CreateIndividualSubcription
      tags:
        - Subscriptions (Collection)
      requestBody:
        required: true
        content:
          application/json:
            schema: {}
      responses:
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
      callbacks:
        eeNotification:
          '{eventNotificationUri}':
          # The URI in {eventNotificationUri} is provided via N4 interface during provisioning of
Session Reporting Rule.
            post:
              requestBody:
                required: true
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/NotificationData'
              responses:
```

```
                '204':
                  description: No Content, Notification was succesfull
                '307':
                  description: Temporary Redirect
                  content:
                    application/json:
                      schema:
                        $ref: 'TS29571_CommonData.yaml#/components/schemas/RedirectResponse'
                  headers:
                    Location:
                      description: 'The URI pointing to the resource located on the redirect target
NF service consumer'
                      required: true
                      schema:
                        type: string
                '308':
                  description: Permanent Redirect
                  content:
                    application/json:
                      schema:
                        $ref: 'TS29571_CommonData.yaml#/components/schemas/RedirectResponse'
                  headers:
                    Location:
                      description: 'The URI pointing to the resource located on the redirect target
NF service consumer'
                      required: true
                      schema:
                        type: string
                '404':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/404'
                default:
                  $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:
  schemas:
    # API specific definitions
# STRUCTURED DATA TYPES

    NotificationData:
      description: the list of NotificationItems
      type: object
      required:
        - notificationItems
      properties:
        notificationItems:
          type: array
          items:
            $ref: '#/components/schemas/NotificationItem'
          minItems: 1
        correlationId:
          type: string

    NotificationItem:
      description: represents a report on one subscribed event
      type: object
      required:
        - eventType
        - timeStamp
      anyOf:
        - required: [ ueIpv4Addr ]
        - required: [ ueIpv6Prefix ]
      properties:
        eventType:
          $ref: '#/components/schemas/EventType'
        ueIpv4Addr:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
        ueIpv6Prefix:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Prefix'
        ueMacAddr:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/MacAddr48'
        dnn:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
        snssai:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        timeStamp:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
```

```
        startTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        qosMonitoringMeasurement:
          $ref: '#/components/schemas/QosMonitoringMeasurement'

    QosMonitoringMeasurement:
      description: QoS Monitoring Measurement information
      type: object
      properties:
        dlPacketDelay:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint32'
        ulPacketDelay:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint32'
        rtrPacketDelay:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint32'
        measureFailure:
          type: boolean
          enum:
            - true

# ENUMS

    EventType:
      description: Event Type
      anyOf:
        - type: string
          enum:
            - QOS_MONITORING
        - type: string

# SIMPLE TYPES
```

Annex B (informative):
Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2021-09	CT4#105e	C4-214754				Version after CT4#105-e including agreed pCRs: C4-214464 C4-214465 C4-214559	0.1.0
2021-10	CT4#106e	C4-215518				Version after CT4#106-e including agreed pCRs: C4-215441 C4-215443 C4-215532 C4-215536	0.2.0
2021-11	CT4#107e	C4-216471				Version after CT4#107-e including agreed pCRs: C4-216524 C4-216525	0.3.0
2021-12	CT#94e	CP-213167				V1.0.0 presented for information	1.0.0
2022-01	CT4#107bis-e	C4-220453				Version after CT4#107bis-e including agreed pCRs: C4-220146 C4-220147 C4-220148 C4-220149	1.1.0
2022-02	CT4#108-e	C4-221591				Editorial corrections of the rapporteur	1.2.0
2022-03	CT#95-e	CP-220106				TS presented for approval	2.0.0
2022-03	CT#95-e					TS approved	17.0.0
2022-06	CT#96-e	CP-221034	0001	2	B	Resolving Editor's Note on Notification Information	17.1.0
2022-06	CT#96-e	CP-221051	0003		F	29.564 Rel-17 API version and External doc update	17.1.0
2022-09	CT#97-e	CP-222029	0005		F	Description fields	17.2.0
2022-09	CT#97-e	CP-222029	0004	1	F	Reporting Packet Delay Measurement Failure to AF/NEF when direct reporting applies	17.2.0
2022-09	CT#97-e	CP-222029	0006	1	F	Add MAC address information in NotificationItem	17.2.0
2022-09	CT#97-e	CP-222058	0008		F	29.564 Rel-17 API version and External doc update	17.2.0

History

Document history		
V17.0.0	May 2022	Publication
V17.1.0	July 2022	Publication
V17.2.0	October 2022	Publication