ETSI TS 129 564 V18.7.0 (2025-01)

5G;
5G System;
User Plane Function Services;
Stage 3
(3GPP TS 29.564 version 18.7.0 Release 18)

Reference
RTS/TSGC-0429564vi70

Keywords
5G

ETSI

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

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

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Intellectual Property Rights

Essential patents

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

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

Trademarks

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

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™**, **LTE™** and **5G™** logo are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM**® and the GSM logo are trademarks registered and owned by the GSM Association.

Legal Notice

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

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

The cross reference between 3GPP and ETSI identities can be found at 3GPP to ETSI numbering cross-referencing.

Modal verbs terminology

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

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

Contents

Foreword

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

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

Version x.y.z

where:

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

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

should not indicates a recommendation not to do something

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

cannot indicates that something is impossible

The constructions "can" and "cannot" are not 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

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 9113: "HTTP/2".

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

[13] IETF RFC 9457: "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".

[17] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[18] 3GPP TS 24.539: "5G System (5GS); Network to TSN translator (TT) protocol aspects; Stage 3".

[19] 3GPP TS 29.512: "5G System; Session Management Policy Control Service; Stage 3".

[20] 3GPP TS 29.122: "Technical Specification Group Core Network and Terminals; T8 reference point for Northbound APIs".

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].

AF	Application Function
DCCF	Data Collection Coordination Function
L-UPF	Local User Plane Function
L-NEF	Local Network Exposure Function
MFAF	Messaging Framework Adaptor Function
NAT	Network Address Translation
NEF	Network Exposure Function
NWDAF	Network Data Analytics Function
UPF	User Plane Function
SMF	Session Management Function
TSCTSF	Time Sensitive Communication and Time Synchronization Function
TSN	Time Sensitive Networking

4 Overview

4.1 Introduction

Within the 5GC, the UPF offers services to the NEF, AF, SMF, NWDAF, DCCF, MFAF, TSCTSF and TSN AF via the Nupf service based interface (see 3GPP TS 23.501 [2], 3GPP TS 23.502 [3], 3GPP TS 23.288 [17] 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.

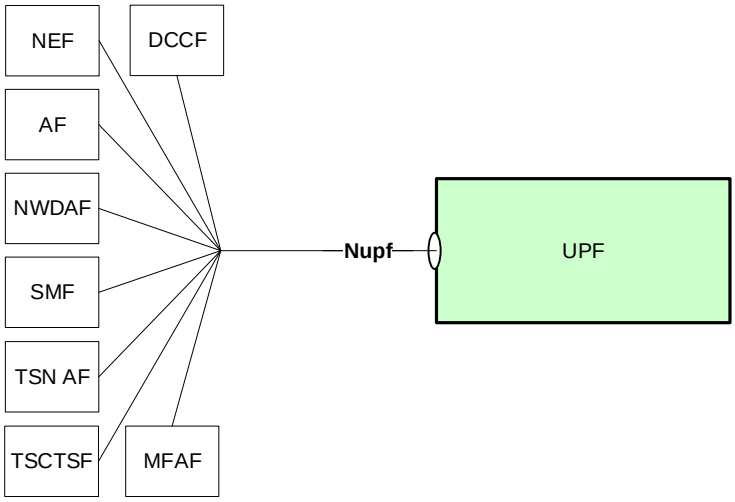

Figure 4.1-1: Reference model – UPF

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

- Subscription to notifications of events exposed by the UPF;
- Notification about UPF events; and
- Translation of (NATed) Public UE IP address and port to (5GC) Private UE IP address.

5 Services offered by the UPF

5.1 Introduction

The UPF offers the following services via the Nupf interface:

- Nupf_EventExposure Service
- Nupf_GetUEPrivateIPaddrAndIdentifiers

Table 5.1-1 summarizes the SBI services produced by the UPF:

Table 5.1-1: NF Services provided by UPF

Service Name	Description	Example Consumers
Nupf_EventExposure	This service exposes UPF related information to other NFs	SMF, NWDAF, NEF, AF, TSCTSF, TSN AF, DCCF, MFAF
Nupf_GetUEPrivateIPaddrAndIdentifiers	This service provides the private UE IP address information of a PDU session from the (NATed) public IP address and port number	NEF

Table 5.1-2 summarizes the corresponding APIs defined for this specification.

Table 5.1-2: API Descriptions

Service Name	Clause	Description	OpenAPI Specification File	apiName	Annex
Nupf_EventExposure	6.1	UPF Event Exposure Service	TS29564_Nupf_EventExposure.yaml	nupf-ee	A.2
Nupf_GetUEPrivateIPaddrAndIdentifiers	6.2	UPF Get UE Private IP address and Identifiers Service	TS29564_Nupf_GetUEPrivateIPaddrAndIdentifiers.yaml	nupf-gueip	A.3

5.2 Nupf_EventExposure Service

5.2.1 Service Description

5.2.1.1 Service operations

The Nupf_EventExposure service enables NF service consumers to subscribe to UPF events and/or the UPF to send notifications about UPF events to NF service consumers.

The Nupf_EventExposure service supports the service operations defined in Table 5.2.1.1-1.

Table 5.2.1.1-1: Service operations supported by the Nupf_EventExposure service

Service Operations	Description	Operation Semantics	Example Consumer(s)
Subscribe	Subscribe to UPF events	Subscribe/Notify	NWDAF, SMF, DCCF
Unsubscribe	Unsubscribe from UPF events	Subscribe/Notify	NWDAF, SMF, DCCF
Notify	Notification about UPF events	Subscribe/Notify	NEF, AF, NWDAF, TSCTSF, TSNAF, DCCF, MFAF

5.2.1.2 Subscription to UPF events

The UPF exposes UPF events via the Nupf_EventExposure service as defined in Table 5.2.1.2-1.

Table 5.2.1.2-1: Subscriptions to UPF events

Subscription	Protocol used for the subscription to UPF	Description
Subscription via SMF	PFCP	The NF service consumer creates the subscription for the event of interest via the SMF. The SMF instructs the UPF to report the events directly to the NF service consumer via the N4 interface as specified in 3GPP TS 29.244 [15]. Upon occurrence of the event of interest, the UPF sends a notification directly to the NF service consumer using the Nupf_EventExposure Notify service operation.
	Nupf_EventExposure Subscribe	The NF service consumer creates the subscription for the event of interest via the SMF. The SMF subscribes to the UPF using the Nupf_EventExposure Subscribe service operation. Upon occurrence of the event of interest, the UPF sends a notification directly to the NF Service Consumer using the Nupf_EventExposure Notify service operation.
Subscription to UPF	Nupf_EventExposure Subscribe	The NF service consumer creates the subscription for the event of interest to the UPF using the Nupf_EventExposure Subscribe service operation. Upon occurrence of the event of interest, the UPF sends a notification directly to the NF Service Consumer using the Nupf_EventExposure Notify service operation

Clause 5.2.1.3 decribes which of the above subscriptions shall be used for each event type supported by the Nupf_EventExposure service.

5.2.1.3 UPF events supported by the Nupf_EventExposure service

5.2.1.3.1 General

The Nupf_EventExposure service supports the events defined in this clause.

See also clauses 4.15.4.5.1 and 5.2.26.2.1 of 3GPP TS 23.502 [3].

5.2.1.3.2 QoS Monitoring

Table 5.2.1.3.2-1: QoS Monitoring event

Description	This event provides QoS flow performance information, i.e. QoS monitoring results for the QoS parameter(s) to be measured. The following QoS parameters may be measured and/or reported: - Packet delay monitoring: DL, UL and/or Round-Trip packet delay between UE and PSA UPF of specific QoS flow(s) of the PDU session. - Data rate monitoring: UL and/or DL data rate measurement for a QoS flow. - Congestion information of a QoS flow on the UL and/or DL directions received from the NG-RAN.
Subscription type	Subscription via SMF using PFCP
Subscription inputs to UPF	- QFI(s) of a specific PDU session - requested QoS measurements - UPF event consumer notification URI - Notification correlation ID - Reporting suggestion information (i.e. Report urgency, Reporting time information) See clauses 5.24.4, 5.24.5 and 5.39 of 3GPP TS 29.244 [15].
Report type	Continuous (event triggered) Report (for Packet Delay, Data Rate and Congestion Information). Periodic Report (for Packet Delay and Data Rate)

5.2.1.3.3 User Data Usage Measures

Table 5.2.1.3.3-1: User Data Usage Measures event

Description	This event provides information of user data usage of a PDU session: - Volume Measurement: measurements of data volume exchanged (UL, DL and/or overall) and/or number of packets exchanged (UL, DL and/or overall) determined for the requested Granularity of Measurements. - Throughput Measurement: measurements of data throughput (UL and DL) determined for the requested Granularity of Measurements. - Application related information: URL(s) and/or Domain information (domain name and protocol) detected for the target traffic. This Type of Measurement requires that Application Id(s) or Traffic Filtering Information is provided (i.e. this measurement is not possible to be applied for all traffic handled by the UPF).
Subscription type	Subscription via SMF using Nupf_EventExposure Subscribe, if the target is: - PDU session(s) of a specific UE or a group of UEs; or - PDU session(s) of any UE and the subscription includes at least one of the following parameters: AoI, BSSID/SSID and DNAI. Subscription to the UPF, if the target is PDU session(s) of any UE and the subscription does not need to include any of the following parameters: AoI, BSSID/SSID and DNAI.
Subscription inputs to UPF	Required: - UE IP address (for an IP PDU session type), SUPI (for a non-IP PDU session type) or "Any UE" - Type of Measurement (i.e. Volume, Throughput, Application related information) - UPF event consumer notification URI - Notification correlation ID Optional: - DNN - S-NSSAI - either Application ID(s) or Traffic filters - Granularity of Measurement (i.e. required granularity for the information reported, i.e. per PDU session, per data flow or per application) - Reporting suggestion information (i.e. Report urgency, Reporting time information)
Report type	One-Time Report Periodic Report

5.2.1.3.4 User Data Usage Trends

Table 5.2.1.3.4-1: User Data Usage Trends event

Description	This event provides statistics related to user data usage of a PDU session: - Throughput Statistic Measurement (average and/or peak throughput) over the measurement period determined for the requested Granularity of Measurements.
Subscription type	Subscription via SMF using Nupf_EventExposure Subscribe, if the target is: - PDU session(s) of a specific UE or a group of UEs; or - PDU session(s) of any UE and the subscription includes at least one of the following parameters: AoI, BSSID/SSID and DNAI. Subscription to the UPF, if the target is PDU session(s) of any UE and the subscription does not need to include any of the following parameters: AoI, BSSID/SSID and DNAI.
Subscription inputs to UPF	Required: - UE IP address (for an IP PDU session type), SUPI (for a non-IP PDU session type) or "Any UE" - UPF event consumer notification URI - Notification correlation ID Optional: - DNN - S-NSSAI - either Application ID(s) or Traffic filters - Granularity of Measurement (i.e. required granularity for the information reported, i.e per PDU session, per data flow or per application) - Reporting suggestion information (i.e. Report urgency, Reporting time information)
Report type	One-Time Report Periodic Report

5.2.1.3.5 TSC Management Information

Table 5.2.1.3.5-1: TSC Management Information event

Description	This event provides TSC Management Information.
Subscription type	Subscription via SMF using PFCP
Subscription inputs to UPF	- UPF event consumer notification URI - Notification correlation ID See clauses 5.26.3.2 of 3GPP TS 29.244 [15] and clauses 6.2.1 and 6.3.1 of 3GPP TS 24.539 [18].
Report type	Continuous (event triggered) Report.

5.2.2 Service Operations

5.2.2.1 Introduction

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

- Subscribe: It enables an NF service consumer to subscribe to UPF event exposure notifications..
- Unsubscribe: It enables an NF service consumer to unsubscribe from UPF event exposure notifications.
- Notify: It allows the UPF to send event notifications directly to NF service consumers.

NOTE: The Subscribe and Unsubscribe service operations only apply to UPF events that can be subscribed using the Nupf service based interface (see clauses 5.2.1.2 and 5.2.1.3).

5.2.2.2 Subscribe

5.2.2.2.1 General

The Subscribe service operation is used by a NF Service Consumer to subscribe to UPF event exposure notifications, e.g. for the purpose of UPF data collection for a specified PDU session or any UE.

NOTE: NF service consumers can only be SMF, NWDAF or DCCF in this release of the specification.

5.2.2.2.2 Creation of a subscription

An NF Service Consumer shall invoke the Subscribe service operation towards the UPF to create a subscription to monitor at least one UPF event. The NF Service Consumer may subscribe to multiple events in a subscription. A subscription may be associated with one UE's PDU session or with any UE.

The NF Service Consumer shall request to create a new subscription by using the HTTP method POST with the URI of the subscriptions collection, see clause 6.1.3.2.

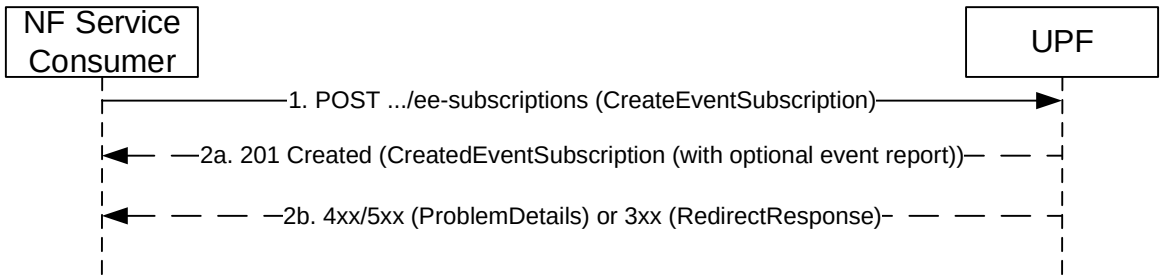

Figure 5.2.2.2.2-1 Subscription creation

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

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

   - NF ID, indicating the identity of the network function instance creating the subscription;
   - Target of Event Reporting, indicating the target(s) to be monitored, i.e.
     - a specific PDU Session of a UE identified with a UE IP address for an IP PDU session type;
     - a specific PDU Session of a UE identified with a SUPI (and S-NSSAI/DNN) for a non-IP PDU session type; or
     - any UE (identified by the "anyUE" flag);
   - List of UPF events requested to be subscribed;
   - Type of measurement, for UPF events supporting multiple types of measurement, e.g. for a subscription to the UserDataUsageMeasures event;
   - Event Reporting Mode, indicating how the events shall be reported (One-time Report or Periodic Report); and
   - UPF event consumer notification URI, indicating the address where to send the event notifications generated by the subscription.

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

   - The S-NSSAI and/or the DNN of PDU sessions to which the subscription applies;

- either one or more Application ID(s) or traffic filters identifying the traffic to be monitored by the subscription;
- Granularity of Measurement, indicating that the granularity of the required measurements is per PDU Session, per data flow or per application;
- Reporting period, defining the period for periodic reporting;
- Maximum number of reports, defining the maximum number of reports after which the event subscription ceases to exist;
- Expiry time, suggested by the NF Service Consumer representing the time up to which the subscription is desired to be kept active and the time after which the subscribed event(s) shall stop generating reports;
- Reporting suggestion information, i.e. Report urgency indicating whether the event report can be delayed (i.e. it is delay-tolerant) and if so, the Reporting time information defining the last valid reporting time for the UPF to report the detected event;
- Deactivate notification flag, indicating that the notification of the available events shall be muted until the event consumer NF (e.g. NWDAF or DCCF) provides the retrieval notification flag to retrieve the stored events;
- Immediate Report Flag per event, indicating an immediate report to be generated with the current event status;
- Notification Correlation ID, indicating the correlation identity to be signaled in the event notifications generated by the subscription;
- Sampling ratio, defining the random subset of PDU sessions among target PDU sessions, in which case the UPF shall only report the event(s) related to the selected subset of PDU sessions;
- partitioningCriteria, defining the criteria for partitioning PDU sessions before applying the sampling ratio; and/or
- Muting Exception Instructions, which specify instructions to apply to the subscription and the stored events when an exception occurs at the UPF while the event is muted (e.g., the buffer of stored event reports is full, or the number of stored event reports exceeds a certain number), if the EEMM feature is supported (see clause 6.1.8).

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

If the NF Service Consumer has included more than one events in the event subscription and some of the events cannot be subscribed, the UPF shall accept the request and provide the successfully subscribed event(s) in the CreatedEventSubscription.

If the NF Service Consumer has included the Immediate Report Flag with the value true in the event subscription, and if the current status of the events subscribed are available, the UPF shall include the current status of the events subscribed in the response. Otherwise, the UPF shall generate reports for the events and notify the NF service consumer using the Nupf_EventExposure_Notify service operation. If the events with the Immediate Report Flag set to true are subscribed via an SMF, the notification shall be sent to the actual NF service consumer directly, i.e. the current status of the events subscribed shall not be included in the subscription creation response.

If the NF Service Consumer has set the event reporting option to ONE_TIME and if the UPF has included the current status of the events subscribed in the response, then the UPF shall not do any subsequent event notification for the corresponding events.

The response, based on operator policy and taking into account the expiry time included in the request, may contain the expiry time, as determined by the UPF, after which the subscription becomes invalid. Once the subscription expires, if the NF Service Consumer wants to keep receiving notifications, it shall create a new subscription in the UPF. The UPF shall not provide the same expiry time for many subscriptions in order to avoid all of them expiring and recreating the subscription at the same time. If the expiry time is not included in the response, the NF Service Consumer shall consider the subscription to be valid without an expiry time.

If the sampling ratio ("sampRatio") attribute is included in the subscription without a partitioningCriteria, the UPF shall select a random subset of PDU sessions among target PDU sessions according to the sampling ratio and only report the event(s) related to the selected subset of PDU sessions. If the partitioningCriteria attribute is also included along with sampling ratio, the UPF shall apply the sampling ratio on the group of PDU sessions determined according to the partitioning criteria.

If the "notifFlag" attribute is included and set to "DEACTIVATE" in the request by e.g. the NWDAF or DCCF, the UPF shall mute the event notification and store the available events. Additionally, if the UPF supports the EEMM feature (see clause 6.1.8) and if the NF service consumer includes event muting instructions in the request, the UPF should evaluate the received event muting instructions against to local actions (if configured) and, if the subscription creation request is accepted, the UPF may indicate the following information to the NF service consumer in the response:

- the maximum number of notifications that the UPF expects to be able to store for the subscription;
- an estimate of the duration for which notifications can be buffered.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.2.3.1-3 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.3.2.3.1-3.

If the UPF supports the EEMM features (see clause 6.1.8), the NF service consumer sets the "notifFlag" attribute to "DEACTIVATE" and event muting instructions in the request, but the UPF cannot accept the received instructions, the UPF may reject the request with a 403 Forbidden response and the application error "MUTING_EXC_INSTR_NOT_ACCEPTED".

For a subscription request targeting a PDU session, if the UPF cannot find a unique PDU session due to no DNN and/or S-NSSAI being received in the request, the UPF shall reject the request with a 403 Forbidden response and the application error "REJECTION_DUE_TO_NO_DNN_SNSSAI" (see clause 4.4.1.2 of 3GPP TS 23.502 [3]).

5.2.2.2.3 Modification of a subscription

The service operation is invoked by a NF Service Consumer, towards the UPF, when it needs to modify an existing subscription previously created at the UPF.

The NF Service Consumer shall modify the subscription by using the HTTP method PATCH with the URI of the individual subscription resource (see clause 6.1.3.3) to be modified.

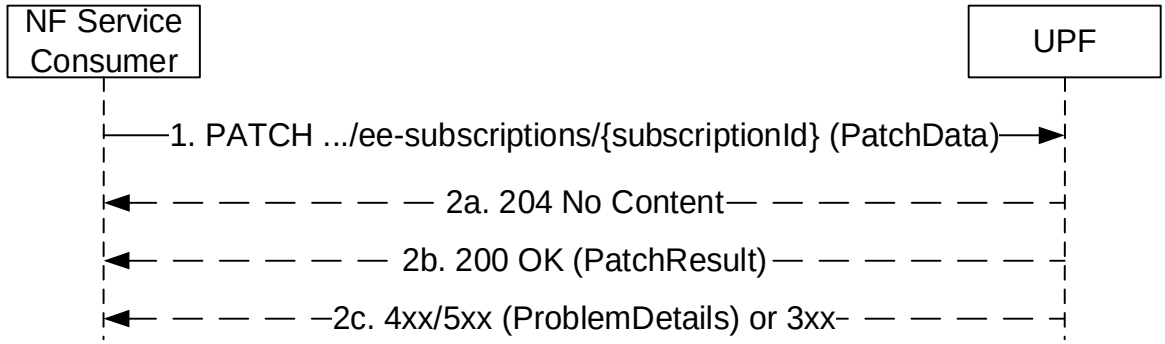

Figure 5.2.2.2.3-1: Modification of a subscription

1. The NF service consumer shall send a PATCH request to the resource representing a subscription. The modification may be for the events subscribed or for updating the event report options, or the NF Id.

2a. On success, the request is accepted, and all the modification instructions in the PATCH request have been implemented, the UPF shall respond with "204 No Content".

2b. On success, the request is accepted, but some of the modification instructions in the PATCH request have been discarded, the UPF shall respond with "200 OK" including PatchResult to indicate the failed modifications.

2c. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.3.3.2-3 shall be returned. For a 4xx/5xx response, the message body may contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.3.3.3.2-3.

5.2.2.2A Unsubscribe

5.2.2.2A.1 General

The Unsubscribe service operation is invoked by a NF Service Consumer towards the UPF to delete an existing subscription previously created at the UPF.

The NF Service Consumer shall unsubscribe from a subscription by using the HTTP method DELETE with the URI of the individual subscription resource (see clause 6.1.3.3) to be deleted.

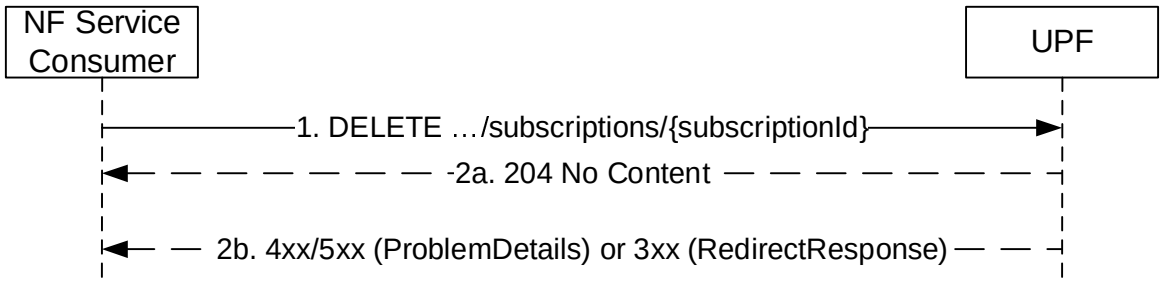

Figure 5.2.2.2A.1-1 Unsubscribing from UPF events

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

2a. On success (i.e. if the request is accepted), the UPF shall reply with the status code 204 in the response message to indicate that the resource identified by the subscription ID has been successfully deleted.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.3.3.1-3 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.3.3.3.1-3.

5.2.2.3 Notify

5.2.2.3.1 General

The Notify service operation is invoked by the UPF, to send a notification, towards the notification URI, when certain event included in the subscription has taken place. See Figure 5.2.2.3.2-1.

For the events "USER_DATA_USAGE_MEASURES" and "USER_DATA_USAGE_TRENDS", the UPF shall use the HTTP method POST, using the notification URI received in the subscription creation as specified in clause 5.2.2.2.2, including e.g. the subscription ID, Event ID(s) for which event has happened, notification correlation ID provided by the NF service consumer at the time of event subscription, to send a notification.

If the subscription is targeting PDU sessions of any UE, i.e. the "anyUe" is set to true in the subscription creation request, the UPF shall perform the requested measurementsfor every PDU session that matches the event filter information (i.e. S-NSSAIs, DNNs, either Application ID(s) or traffic filters) and send notification(s) with multiple NotificationItem IEs within the NotificationData wherein each NotificationItem shall correspond to a report on one subscribed event per PDU session. If the subscription request included a sampling ratio, the notification may include the sampling ratio achieved by the UPF.

For the events "QOS_MONITORING" and "TSC_MNGT_INFO", the UPF shall use the HTTP method POST, using the notification URI received from the SMF via N4 interface, see clause 5.33.5 of 3GPP TS 29.244 [15].

For the event "USER_DATA_USAGE_MEASURES", the event notification may contain following information:

- Volume Measurement: measurements of data volume exchanged (UL, DL and/or overall) and/or number of packets exchanged (UL, DL and/or overall) determined for the requested Granularity of Measurements.

- Throughput Measurement: measurements of data throughput (UL and DL) determined for the requested Granularity of Measurements.

- Application related Information: URLs and/or Domain information (Domain name and protocol) detected in the target traffic identified by the information included in the subscription request, e.g. an application id.

When the granularity of the measurement is per data flow, the notification shall include the packet filter set and the Applications Identifier if available.

For the event "USER_DATA_USAGE_TRENDS", the event notification may contain following information:

- Throughput Statistic Measurement (average and/or peak throughput) over the measurement determined for the requested Granularity of Measurements.

When the granularity of the measurement is per data flow, the notification shall include the packet filter set and the Applications Identifier if available.

For the event "QOS_MONITORING", this service operation is used by the UPF to send the following types of event notifications:

- 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.

- Event triggered notification of congestion information of the QoS flow on the UL and/or DL directions received from the NG-RAN, upon a change of the congestion information.

For the event "TSC_MNGT_INFO", the event notification may contain the following information:

- Port Management Information Container(s) for one or more NW-TT ports and/or

- a User Plane Node Management Information Container.

The event notification shall also contain the following information:

- the related NW-TT port number(s), if Port Management Information Container(s) is present; and

- the notification correlation ID received from the SMF, if any.

5.2.2.3.2 UPF sends notification on subscribed events

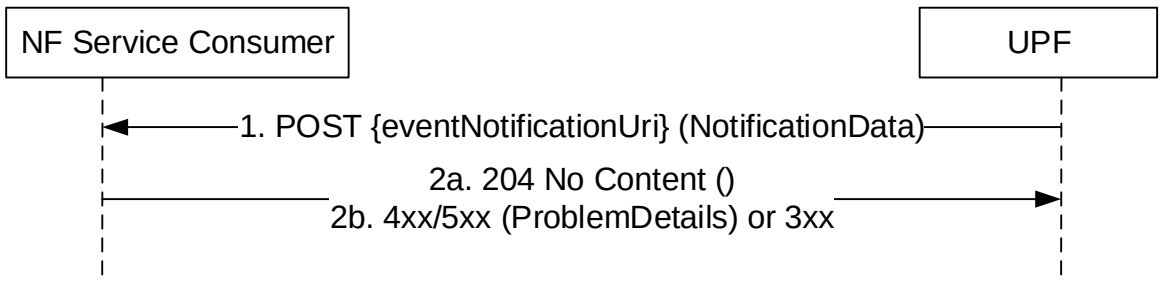

Figure 5.2.2.3.2-1: UPF sends notification on subscribed events

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]) or received in the subscription creation as specified in clause 5.2.2.2.2.

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.

5.3 Nupf_GetUEPrivateIPaddrAndIdentifiers Service

5.3.1 Service Description

The Nupf_GetUEPrivateIPaddrAndIdentifiers Service enables the UPF to provide the UE IP address information of a PDU session and optionally UE identifiers (e.g. SUPI, GPSI), e.g. to provide the (private) UE IP address when being queried with a NATed UE IP Address, to the NF service consumer (e.g. a NEF), when the NAT functionality of the UE IP address is deployed within the UPF.

Table 5.3.1-1 lists the service operations that are supported by the Nupf_GetUEPrivateIPaddrAndIdentifiers service.

Table 5.3.1-1: Service operations supported by the Nupf_GetUEPrivateIPaddrAndIdentifiers service

Service Operations	Description	Operation Semantics	Example Consumers
Get	Retrieve the UE IP address information of a PDU session, to get e.g., UE's private IP address and optionally the associated IP domain.	Request / Response	NEF

5.3.2 Service Operations

5.3.2.1 Introduction

See Table 5.3.1-1 for an overview of the service operations supported by the Nupf_GetUEPrivateIPaddrAndIdentifiers service.

5.3.2.2 Get

5.3.2.2.1 General

The Get service operation is used in the following procedure:

- AF specific UE ID retrieval as specified in clause 4.15.10 of 3GPP TS 23.502 [3] ;
- AF traffic influence request without HPLMN DNN, S-NSSAI information for a single UE, private IP address or public IP address owned by VPLMN as specified in clause 4.3.6.5.3 of 3GPP TS 23.502 [3];
- AF traffic influence request without HPLMN DNN, S-NSSAI information for a single UE, UE IP address owned and assigned by HPLMN as specified in clause 4.3.6.5.4 of 3GPP TS 23.502 [3].

This service operation is consumed by querying the "ue-ip-info" resource. The request is sent to the UPF hosting the IP address in the query.

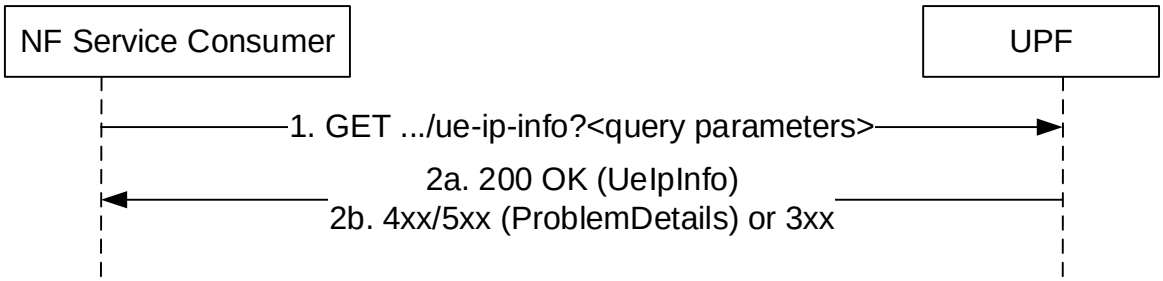

Figure 5.3.2.2.1-1: Retrieval of UE IP Info for a PDU session

1. The NF Service Consumer shall send an HTTP GET request to the resource URI of "ue-ip-info". The input filter criteria for the discovery request shall be included in query parameters, e.g. the UE (public) IP address and Port Number, and optionally DNN and S-NSSAI.

2a. On success, "200 OK" shall be returned. The response body shall include a UeIpInfo object which contains relevant attributes matching the query parameters included in the request message.

2b. On failure, one of the HTTP status code listed in Table 6.2.3.2.3.1-3 shall be returned. For a 4xx/5xx response, the message body may contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.2.3.2.3.1-3, where applicable.
On redirection, "307 Temporary Redirect" or "308 Permanent Redirect" shall be returned. A RedirectResponse IE may be included in the content of POST response.

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 9113 [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 9457 [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

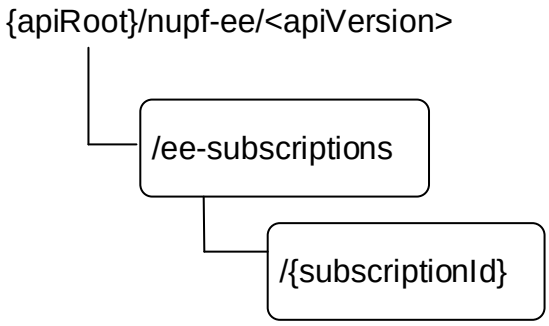

Figure 6.1.3.1-1: Resource URI structure of the nupf-ee API

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 (service operation)
EventExposureSubscriptions (Collection)	/ee-subscriptions	POST	Subscribe service operation, creating a new subscription .
Individual subscription (Document)	/ee-subscriptions/{subscriptionId}	DELETE	Unsubscribe service operation
		PATCH	Subscribe service operation, modification of a subscription

6.1.3.2 Resource: EventExposureSubscriptions

6.1.3.2.1 Description

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

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

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 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
CreateEventSubscription	M	1	Content of the Subscribe request to create a subscription.

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
CreatedEventSubscription	M	1	201 Created	Represents successful creation of an UPF Event Subscription
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	Indicates the creation of subscription has failed due to application error. The "cause" attribute may be used to indicate one of the following application errors: - PDU_SESSION_NOT_SERVED_BY_UPF - MUTING_EXC_INSTR_NOT_ACCEPTED - REJECTION_DUE_TO_NO_DNN_SNSSAI
ProblemDetails	O	0..1	501 Not Implemented	The "cause" attribute may be used to indicate one of the following application errors: - UNSUPPORTED_EVENT_TYPE
NOTE 1: 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, with response body containing an object of ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4].				

Table 6.1.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

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

Table 6.1.3.2.3.1-5: Headers supported by the 307 Response Code on this endpoint

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance. For the case, when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

Table 6.1.3.2.3.1-6: Headers supported by the 308 Response Code on this endpoint

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance. For the case, when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

6.1.3.2.4 Resource Custom Operations

None.

6.1.3.3 Resource: Individual subscription

6.1.3.3.1 Description

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

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

6.1.3.3.2 Resource Definition

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

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

Table 6.1.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.2.1
apiVersion	string	See clause 6.2.1.
subscriptionId	string	String identifies an individual subscription to the UPF event exposure service

6.1.3.3.3 Resource Standard Methods

6.1.3.3.3.1 DELETE

This method shall support the URI query parameters specified in table 6.1.3.3.3.1-1.

Table 6.1.3.3.3.1-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description
n/a				

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

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

Data type	P	Cardinality	Description
n/a			

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

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	404 Not Found	Indicates the modification of subscription has failed due to application error. The "cause" attribute may be used to indicate one of the following application errors: - SUBSCRIPTION_NOT_FOUND
NOTE 1: The mandatory HTTP error status code for the DELETE method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply, with response body containing an object of ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4].				

Table 6.1.3.3.3.1-4: Headers supported by the 307 Response Code on this endpoint

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance. For the case, when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

Table 6.1.3.3.3.1-5: Headers supported by the 308 Response Code on this endpoint

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance. For the case, when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

6.1.3.3.3.2 PATCH

This method shall support the URI query parameters specified in table 6.1.3.3.3.2-1.

Table 6.1.3.3.3.2-1: URI query parameters supported by the PATCH method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.1.3.3.3.2-2 and the response data structures and response codes specified in table 6.1.3.3.3.2-3.

Table 6.1.3.3.3.2-2: Data structures supported by the PATCH Request Body on this resource

Data type	P	Cardinality	Description
array(PatchItem)	M	1..N	Items describe the modifications to the Event Subscription

Table 6.1.3.3.3.2-3: Data structures supported by the PATCH Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Upon success, an empty response body shall be returned. (NOTE 2)
PatchResult	M	1	200 OK	Upon success, the execution report is returned. (NOTE 2)
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 3)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 3)
ProblemDetails	O	0..1	403 Forbidden	One or more attributes are not allowed to be modified. The "cause" attribute may be used to indicate one of the following application errors: - MODIFICATION_NOT_ALLOWED, see 3GPP TS 29.500 [4] table 5.2.7.2-1. - MUTING_EXC_INSTR_NOT_ACCEPTED
ProblemDetails	O	0..1	404 Not Found	The "cause" attribute may be used to indicate one of the following application errors: - SUBSCRIPTION_NOT_FOUND, see 3GPP TS 29.500 [4] table 5.2.7.2-1.

NOTE 1: The mandatory HTTP error status code for the PATCH method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply, with response body containing an object of ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]).
NOTE 2: If all the modification instructions in the PATCH request have been implemented, the UPF shall respond with 204 No Content response; if some of the modification instructions in the PATCH request have been discarded, the UPF shall respond with PatchResult.
NOTE 3: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4].

Table 6.1.3.3.3.2-4: Headers supported by the 307 Response Code on this endpoint

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance. It is implementation specific how the alternative URI is determined. For the case, when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

Table 6.1.3.3.3.2-5: Headers supported by the 308 Response Code on this endpoint

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance. It is implementation specific how the alternative URI is determined. For the case, when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

6.1.3.3.4 Resource Custom Operations

None.

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 either provided by NF service consumer via Nupf interface, or 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], or by NF Service Consumer during creation of the subscription as specified in clause 5.2.2.2.2.

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	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: 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]). NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 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. For the case, when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
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. For the case, when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
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	
UserDataUsageMeasurements	6.1.6.2.5	User Data Usage Measurements	
VolumeMeasurement	6.1.6.2.6	Volume Measurement	
ThroughputMeasurement	6.1.6.2.7	Throughput Measurement	
ApplicationRelatedInformation	6.1.6.2.8	Application Related Information	
ThroughputStatisticsMeasurement	6.1.6.2.9	Throughput Statistics Measurement	
DomainInformation	6.1.6.2.10	Domain Name and Domain Name Protocol	
UpfEventSubscription	6.1.6.2.11	Represents an individual event subscription resource on UPF	
UpfEventMode	6.1.6.2.12	Describes how the reports shall be generated for a subscribed event	
UpfEvent	6.1.6.2.13	Describes an event to be subscribed	
CreateEventSubscription	6.1.6.2.14	Data within a create UPF event subscription request	
CreatedEventSubscription	6.1.6.2.15	Data within a create UPF event subscription response	
ReportingSuggestionInformation	6.1.6.2.16	Reporting Suggestion Information	
TscManagementInfo	6.1.6.2.17	TSC Management Information	
EventType	6.1.6.3.3	Event Type	
UpfEventTrigger	6.1.6.3.4	Describes how the UPF generates the report for the event	
MeasurementType	6.1.6.3.5	Type of Measurement	
GranularityOfMeasurement	6.1.6.3.6	Granularity Of Measurement	
DnProtocol	6.1.6.3.7	Domain Name Protocol	
ReportingUrgency	6.1.6.3.8	Reporting Urgency	

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	
Uint64	3GPP TS 29.571 [16]	Unsigned 64-bit integer	
BitRate	3GPP TS 29.571 [16]	Bit rate	
PacketRate	3GPP TS 29.571 [16]	Packet rate	
TrafficVolume	3GPP TS 29.571 [16]	Traffic Volume	
ApplicationId	3GPP TS 29.571 [16]	The application identifier.	
DurationSec	3GPP TS 29.571 [16]		
NotificationFlag	3GPP TS 29.571 [16]	Notification flag.	
PartitioningCriteria	3GPP TS 29.571 [16]	Used to partition UEs before applying sampling.	
ProblemDetails	3GPP TS 29.571 [16]		
SamplingRatio	3GPP TS 29.571 [16]	Sampling Ratio.	
Uri	3GPP TS 29.571 [16]		
IpAddr	3GPP TS 29.571 [16]		
SupportedFeatures	3GPP TS 29.571 [16]		
Supi	3GPP TS 29.571 [16]		
Pei	3GPP TS 29.571 [16]		
Uinteger	3GPP TS 29.571 [16]	Unsigned Integer	
PortManagementContainer	3GPP TS 29.512 [19]	PMIC	
BridgeManagementContainer	3GPP TS 29.512 [19]	UMIC	
FlowInformation	3GPP TS 29.512 [19]	IP or Ethernet Flow Information	
PatchItem	3GPP TS 29.571 [16]	Patch item of JSON PATCH	
PatchResult	3GPP TS 29.571 [16]	Patch result of JSON PATCH	
MutingExceptionInstructions	3GPP TS 29.571 [16]	Muting exception instructions.	
MutingNotificationsSettings	3GPP TS 29.571 [16]	Muting notifications settings.	

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	List of NotificationItem, whereby each entry shall correspond to a report for one subscribed event per PDU session.	
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]) or if the notifyCorrelationId IE was received in the Nupf_EventExposure Subscribe request. When present, it shall be set to the notification correlation ID received via the N4 or Nupf interface.	
achievedSampRatio	SamplingRatio	O	0..1	This IE may be included for an event subscription for any UE to indicate the ratio of the random subset of target PDU sessions achieved by the UPF.	

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, NOTE 3)	
ueIpv6Prefix	Ipv6Prefix	C	0..1	IPv6 address prefix of the UE (NOTE 1, NOTE 3)	
ueMacAddr	MacAddr48	O	0..1	MAC address of the UE. (NOTE 2, NOTE 3)	
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.	
supi	Supi	O	0..1	Subscription Permanent Identifier	
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 measured for generating this report was started.	
qosMonitoringMeasurement	QosMonitoringMeasurement	C	0..1	This attribute shall be present if eventType is set to "QOS_MONITORING".	
userDataUsageMeasurements	array(UserDataUsageMeasurements)	C	1..N	This IE shall be present if eventType is set to "USER_DATA_USAGE_MEASURES" or "USER_DATA_USAGE_TRENDS".	
tscMngtInfo	TscManagementInfo	C	0..1	This attribute shall be present if eventType is set to "TSC_MNGT_INFO".	

NOTE 1: At least one of ueIpv4Addr and ueIpv6Prefix shall be present if the subscription applies to an IP PDU session.
NOTE 2: An NF service consumer subscribing to receive QoS Monitoring Measurement report for an ethernet PDU session shall accept the NotificationItem having neither ueIpv4Addr nor ueIpv6Prefix.
NOTE 3: At least one of ueIpv4Addr, ueIpv6Prefix and ueMacAddr shall be present.

6.1.6.2.4 Type: QosMonitoringMeasurement

Table 6.1.6.2.4-1: 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].	
dlAveThroughput	BitRate	O	0..1	When present, this IE shall indicate the average data throughput in downlink direction as specified in clause 5.39.3.4 of 3GPP TS 29.244 [15].	
ulAveThroughput	BitRate	O	0..1	When present, this IE shall indicate the average data throughput in uplink direction as specified in clause 5.39.3.4 of 3GPP TS 29.244 [15].	
dlCongestion	integer	O	0..1	When present, this IE shall contain the Downlink congestion information, expressed as an integer value in the range 0 to 10000, representing the percentage of congestion level in the downlink direction, up to two decimal points, for the QoS flow. Minimum = 0. Maximum = 10000. Example: the value 9574 corresponds to a percentage of 95.74%.	

ulCongestion	integer	O	0..1	When present, this IE shall contain the Uplink congestion information, expressed as an integer value in the range 0 to 10000, representing the percentage of congestion level in the uplink direction, up to two decimal points, for the QoS flow. Minimum = 0. Maximum = 10000. Example: the value 9574 corresponds to a percentage of 95.74%.	
defaultQosFlowInd	boolean	C	0..1	The IE shall be present when the SMF has indicated that the QoS Monitoring is for a QoS flow associated with the default QoS rule in the QoS Monitoring per QoS flow Control Information as specified in 3GPP TS 29.244 [15]. When present, this IE shall indicate whether the QoS measurements is for a QoS flow associated with the default QoS rule. - true: Qos Monitoring Measurement is for a QoS flow associated with the default QoS rule; - false(default): Qos Monitoring Measurement is not for a QoS flow associated with the default QoS rule.	
NOTE: Either the flowInfos IE or the appIds IE should be present, not both.					

6.1.6.2.5 Type: UserDataUsageMeasurements

Table 6.1.6.2.5-1: Definition of type UserDataUsageMeasurements

Attribute name	Data type	P	Cardinality	Description
appId	ApplicationId	C	0..1	When present, this IE shall contain the application identifier. This IE shall be included if the requested granularity of measurement was set to "PER_APPLICATION". This IE may be present if the requested granularity of measurement was set to "PER FLOW". (NOTE)
flowInfo	FlowInformation	C	0..1	When present, this IE shall contain the IP or Ethernet data flow information. This IE shall be included if the requested granularity of measurement was set to "PER FLOW". (NOTE)
volumeMeasurement	VolumeMeasurement	C	0..1	This attribute shall be present if eventType is set to "USER_DATA_USAGE_MEASURES" and measurementType is set to "VOLUME_MEASUREMENT".
throughputMeasurement	ThroughputMeasurement	C	0..1	This attribute shall be present if eventType is set to "USER_DATA_USAGE_MEASURES" and measurementType is set to "THROUGHPUT_MEASUREMENT".
applicationRelatedInformation	ApplicationRelatedInformation	C	0..1	This attribute shall be present if eventType is set to "USER_DATA_USAGE_MEASURES" and measurementType is set to "APPLICATION_RELATED_INFORMATION".
throughputStatisticsMeasurement	ThroughputStatisticsMeasurement	C	0..1	This attribute shall be present if eventType is set to "USER_DATA_USAGE_TRENDS".

NOTE: When neither appId nor flowInfo is present, the measurements (i.e., the volumeMeasurement and/or the throughputMeasurement, and/or the applicationRelatedInformation and/or the throughputStatisticsMeasurement) shall correspond to the user plane measurements of the PDU session. When appId is present, the measurements shall correspond to user plane measurements of the application identified by the appId. When flowInfo is present, the measurement shall correspond to user plane measurements for the data flow identified by the flowInfo.

6.1.6.2.6 Type: VolumeMeasurement

Table 6.1.6.2.6-1: Definition of type VolumeMeasurement

Attribute name	Data type	P	Cardinality	Description
totalVolume	TrafficVolume	O	0..1	When present, this IE shall indicate the total volume (bytes) of user plane traffic for both the uplink and downlink directions.
ulVolume	TrafficVolume	O	0..1	When present, this IE shall indicate the volume (bytes) of user plane traffic for the uplink direction.
dlVolume	TrafficVolume	O	0..1	When present, this IE shall indicate the volume (bytes) of user plane traffic for the downlink direction.
totalNbOfPackets	Uint64	O	0..1	When present, this IE shall indicate the total number of user plane packets for both uplink and downlink directions.
ulNbOfPackets	Uint64	O	0..1	When present, this IE shall indicate the number of user plane packets for the uplink direction.
dlNbOfPackets	Uint64	O	0..1	When present, this IE shall indicate the number of user plane packets for the downlink direction.

6.1.6.2.7 Type: ThroughputMeasurement

Table 6.1.6.2.7-1: Definition of type ThroughputMeasurement

Attribute name	Data type	P	Cardinality	Description
ulThroughput	BitRate	O	0..1	When present, this IE shall indicate the measurement of data throughput in uplink direction.
dlThroughput	BitRate	O	0..1	When present, this IE shall indicate the measurement of data throughput in downlink direction.
ulPacketThroughput	PacketRate	O	0..1	When present, this IE shall indicate the measurement of packet throughput in uplink direction.
dlPacketThroughput	PacketRate	O	0..1	When present, this IE shall indicate the measurement of packet throughput in downlink direction.

6.1.6.2.8 Type: ApplicationRelatedInformation

Table 6.1.6.2.8-1: Definition of type ApplicationRelatedInformation

Attribute name	Data type	P	Cardinality	Description
urls	array(Uri)	O	1..N	This IE may be present if available. When present, it shall contain a list of URLs detected in the traffic identified by the information included in the subscription request, e.g. an application id.
domainInfoList	array(DomainInformation)	O	1..N	This IE may be present if available. When present, it shall contain a list of Domain information detected in the traffic identified by the information included in the subscription request, e.g. an application id.

6.1.6.2.9 Type: ThroughputStatisticsMeasurement

Table 6.1.6.2.9-1: Definition of type ThroughputStatisticsMeasurement

Attribute name	Data type	P	Cardinality	Description
ulAverageThroughput	BitRate	O	0..1	When present, this IE shall indicate the average throughput in uplink direction over the measurement period.
dlAverageThroughput	BitRate	O	0..1	When present, this IE shall indicate the average throughput in downlink direction over the measurement period.
ulPeakThroughput	BitRate	O	0..1	When present, this IE shall indicate the peak throughput in uplink direction over the measurement period.
dlPeakThroughPut	BitRate	O	0..1	When present, this IE shall indicate the peak throughput in downlink direction over the measurement period.
ulAveragePacketThroughput	PacketRate	O	0..1	When present, this IE shall indicate the average packet throughput in uplink direction.
dlAveragePacketThroughput	PacketRate	O	0..1	When present, this IE shall indicate the average packet throughput in downlink direction.
ulPeakPacketThroughput	PacketRate	O	0..1	When present, this IE shall indicate the Peak packet throughput in uplink direction.
dlPeakPacketThroughput	PacketRate	O	0..1	When present, this IE shall indicate the Peak packet throughput in downlink direction.

6.1.6.2.10 Type: DomainInformation

Table 6.1.6.2.10-1: Definition of type: DomainInformation

Attribute name	Data type	P	Cardinality	Description
domainName	Fqdn	M	1	This IE shall contain a domain name.
domainNameProtocol	DnProtocol	O	0..1	This IE may be present to contain the Domain Name Protocol.

6.1.6.2.11 Type: UpfEventSubscription

Table 6.1.6.2.11-1: Definition of type UpfEventSubscription

Attribute name	Data type	P	Cardinality	Description	Applicability
eventList	array(UpfEvent)	M	1..N	This IE shall describe the events requested to be subscribed in a subscription request or the events successfully subscribed for this subscription in a subscription response.	
eventNotifyUri	Uri	M	1	This IE shall identify the recipient address of the notifications sent by the UPF for this subscription.	
notifyCorrelationId	string	M	1	This IE shall contain the notification correlation ID. The UPF shall include this notification correlation ID in the notifications. The value of this IE shall be unique per subscription for a given NF service consumer.	
eventReportingMode	UpfEventMode	M	1	This IE shall describe how the reports of the event shall be generated.	
nfId	NfInstanceId	M	1	This IE shall indicate the instance identity of the network function creating the subscription.	
ueIpAddress	IpAddr	C	0..1	The IE shall be present if the event subscription targets one specific UE's PDU session, for an IP PDU session type. When present, the IE shall indicate the IP address of the UE's PDU Session. (NOTE)	
supi	Supi	C	0..1	The IE shall be present if the event subscription targets one specific UE's PDU session, for a non-IP PDU session type, and the UPF is allowed by local SMF configuration to receive the SUPI associated with a N4 session. (NOTE 1, NOTE 2)	
anyUe	boolean	C	0..1	This IE shall be present if the event subscription targets any UE. When present, it shall be set as follows: true: the subscription applies to any UE. false (default): the subscription applies to a specific UE. (NOTE 1)	
dnn	Dnn	O	0..1	Data Network Name.	
snssai	Snssai	O	0..1	A single Network Slice Selection Assistance Information.	
NOTE 1: Either information about a single UE (i.e. ueIpAddress or supi) or anyUe set to true shall be included. NOTE 2: UPF event Exposure targeting a UE is not supported for non-IP PDU session types, when the UPF is not allowed by local SMF configuration to receive the SUPI associated with a N4 session.					

6.1.6.2.12 Type: UpfEventMode

Table 6.1.6.2.12-1: Definition of type UpfEventMode

Attribute name	Data type	P	Cardinality	Description	Applicability
trigger	UpfEventTrigger	M	1	Describes how the reports are triggered.	
maxReports	integer	C	0..1	This IE may be present if the trigger is set to "PERIODIC". When present, this IE shall indicate the maximum number of reports that can be generated by each subscribed event in the subscription. If the UPF event subscription is for a list of events, this parameter shall be applied to each individual event in the list.	
expiry	DateTime	C	0..1	This IE shall be included in an event subscription response, if, based on operator policy and taking into account the expiry time included in the request, the UPF needs to include an expiry time. This IE may be included in an event subscription request. When present, this IE shall represent the time after which the subscribed event(s) shall stop generating report and the subscription becomes invalid. If the trigger value included in an event subscription response is "ONE_TIME" and if an event report is included in the subscription response, then the value of the expiry included in the response shall be an immediate timestamp.	
repPeriod	DurationSec	C	0..1	This IE shall be present if the trigger is set to "PERIODIC". When present, this IE shall indicate the time period for the event reports. When the Event Subscription is for "ANY UE", the NF Consumer should set the "repPeriod" to a value which does not lead to a potential overload in the UPF.	
sampRatio	SamplingRatio	O	0..1	This IE may be included in an event subscription request for any UE to indicate the ratio of the random subset of target PDU sessions. Event reports shall only relate to the subset. If the UPF event subscription is for a list of UPF event, this parameter shall be applied to each individual event.	
partitioningCriteria	array(PartitioningCriteria)	O	1..N	This IE may be included in an event subscription request for any UE if the sampRatio IE is provided. When present, this IE shall define the criteria for determining the PDU sessions for which the sampling ratio shall apply. (NOTE)	
notifFlag	NotificationFlag	O	0..1	Indicates the notification flag, which is used to mute/unmute notifications and to retrieve events stored during a period of muted notifications.	

mutingExcInstructions	MutingExceptionInstructions	O	0..1	This IE may be included by NWDAF or DCCF in the event subscription request, if the notifFlag IE is present and set to "DEACTIVATE". When present, it shall indicate the instructions for the subscription and stored events when an exception (e.g. the buffer of stored event reports is full, or the number of stored event reports exceeds a certain number) occurs at UPF while the events are muted. See 3GPP TS 23.288 [17], clause 6.2.7.2. Write-Only: true	EEMM
mutingNotSettings	MutingNotificationsSettings	O	0..1	This IE may be included in the event subscription response if the event notifications muting is activated. This IE Indicates the UPF muting notification settings. See 3GPP TS 23.288 [17], clause 6.2.7.2. Read-Only: true	EEMM
NOTE: In this release of specification, the partitioningCriteria values defined in 3GPP TS 29.571 [16] that apply to UPF Event Exposure are SNSSAI and DNN.					

6.1.6.2.13 Type: UpfEvent

Table 6.1.6.2.13-1: Definition of type UpfEvent

Attribute name	Data type	P	Cardinality	Description	Applicability
type	EventType	M	1	Describes the UPF event type to be reported	
immediateFlag	boolean	O	0..1	Indicates if an immediate event report containing the currently available value / status of the event is requested. The report contains the value / status of the event currently available at the UPF at the time of the subscription. The default value is false.	
measurementTypes	array(MeasurementType)	C	1..N	This IE shall be present if the type IE is set to "USER_DATA_USAGE_MEASURES". When present, this IE shall indicate the types of requested measurements.	
appIds	array(ApplicationId)	O	1..N	Contains the application identifiers. (NOTE 1, NOTE 2)	
trafficFilters	array(FlowInformation)	O	1..N	Identifies IP or Ethernet packet filters. (NOTE 1, NOTE 2)	
granularityOfMeasurement	GranularityOfMeasurement	O	0..1	Indicates the granularity of measurement. (NOTE 2)	
reportingSuggestionInfo	ReportingSuggestionInformation	C	0..1	The IE should be present if the event notification can be delayed, i.e. it is delay tolerant.	
NOTE 1: Either the appIds IE or the trafficFilters IE may be present, not both. NOTE 2: If the appIds or trafficFilters is provided, the granularityOfMeasurement shall not be set to "PER_SESSION". If neither appIds nor trafficFilters is provided, the granularityOfMeasurement may be set to "PER_SESSION", "PER_APPLICATION" or "PER_FLOW" to request the UPF to provide measurements with the corresponding granularity.					

6.1.6.2.14 Type: CreateEventSubscription

Table 6.1.6.2.14-1: Definition of type CreateEventSubscription

Attribute name	Data type	P	Cardinality	Description
subscription	UpfEventSubscription	M	1	Represents the UPF Event Subscription resource to be created.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in clause 6.1.8 is supported.

6.1.6.2.15 Type: CreatedEventSubscription

Table 6.1.6.2.15-1: Definition of type CreatedEventSubscription

Attribute name	Data type	P	Cardinality	Description
subscription	UpfEventSubscription	M	1	Represents the newly created UPF Event Subscription resource.
subscriptionId	Uri	M	1	Represents the URI of the newly created UPF Event Subscription resource. This shall contain an absolute URI set to the Resource URI specified in clause 6.1.3.3.2. (NOTE)
reportList	array(NotificationItem)	O	1..N	Represents the immediate event reports (i.e. the current value / status of the events subscribed), if available.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in clause 6.1.8 is supported.
NOTE: 3GPP TS 23.502 [3] specifies this attribute as "Subscription Correlation ID".				

6.1.6.2.16 Type: ReportingSuggestionInformation

Table 6.1.6.2.16-1: Definition of type ReportingSuggestionInformation

Attribute name	Data type	P	Cardinality	Description
reportingUrgency	ReportingUrgency	M	1	Indicates whether the event report is delay tolerant.
reportingTimeInfo	DurationSec	C	0..1	This IE shall be present if the Reporting urgency information indicates it is delay tolerant. When present, this IE shall define the latest time for the UPF to report the detected event.

6.1.6.2.17 Type: TscManagementInfo

Table 6.1.6.2.17-1: Definition of type TscManagementInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
pmics	array(PortManagementContainer)	O	1..N	When present, this IE shall contain a Port Management Information Container for one or more NW-TT ports.	
umic	BridgeManagementContainer	O	0..1	When present, this IE shall contain a User Plane Node Management Information Container.	

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 NF service consumer may subscribe to and for which the notification is generated. It shall comply with the provisions defined in table 6.1.6.3.3-1.

Table 6.1.6.3.3-1: Enumeration EventType

Enumeration value	Description	Applicability
"QOS_MONITORING"	QoS Monitoring Measurement (see clause 5.2.1.3.2)	
"USER_DATA_USAGE_MEASURES"	User Data Usage Measures (see clause 5.2.1.3.3)	
"USER_DATA_USAGE_TRENDS"	User Data Usage Trends (see clause 5.2.1.3.4)	
"TSC_MNGT_INFO"	TSC Management Information	

6.1.6.3.4 Enumeration: UpfEventTrigger

Table 6.1.6.3.4-1: Enumeration UpfEventTrigger

Enumeration value	Description
"ONE_TIME"	Defines that UPF should generate report for the event only once. After reporting, the subscription to this event is terminated.
"PERIODIC"	Defines that UPF should periodically generate reports for the event, until the subscription to this event ends, due to end of report duration or up to the maximum number of reports or the event being unsubscribed explicitly.

6.1.6.3.5 Enumeration: MeasurementType

Table 6.1.6.3.5-1: Enumeration MeasurementType

Enumeration value	Description
"VOLUME_MEASUREMENT"	Measures of data volume exchanged (UL, DL and/or overall and/or number of packets exchanged (UL, DL and/or overall). (NOTE)
"THROUGHPUT_MEASUREMENT"	Measures of data throughput (UL and DL). (NOTE)
"APPLICATION_RELATED_INFO"	URL/s and/or Domain name/s detected in the traffic identified by the information included in the subscription request, e.g. an application id. (NOTE)
NOTE: This value may be used for the "USER_DATA_USAGE_MEASURES" event type.	

6.1.6.3.6 Enumeration: GranularityOfMeasurement

Table 6.1.6.3.6-1: Enumeration GranularityOfMeasurement

Enumeration value	Description
"PER_APPLICATION"	Indicates that the granularity of the requested measurements is per application.
"PER_SESSION"	Indicates that the granularity of the requested measurements is per PDU Session.
"PER_FLOW"	Indicates that granularity of the requested measurements is per data flow.

6.1.6.3.7 Enumeration: DnProtocol

Table 6.1.6.3.7-1: Enumeration DnProtocol

Enumeration value	Description
"DNS_QNAME"	Identifies the DNS protocol and the question name in DNS query.
"TLS_SNI"	Identifies the Server Name Indication in TLS ClientHello message.
"TLS_SAN"	Identifies the Subject Alternative Name in TLS ServerCertificate message.
"TLS_SCN"	Identifies the Subject Common Name in TLS ServerCertificate message.

6.1.6.3.8 Enumeration: ReportingUrgency

Table 6.1.6.3.8-1: Enumeration ReportingUrgency

Enumeration value	Description
"DELAY_TOLERANT"	The event report is delay tolerant.
"NON_DELAY_TOLERANT"	The event report is not delay tolerant.

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

The common application errors defined in the Table 5.2.7.2-1 in 3GPP TS 29.500 [4] may also be used for the Nupf_EventExposure service, and the following application errors listed in Table 6.1.7.3-1 are specific for the Nupf_EventExposure service.

Table 6.2.7.3-1: Application errors

Application Error	HTTP status code	Description
PDU_SESSION_NOT_SERVED_BY_UPF	403 Forbidden	Indicates the creation of a subscription towards a PDU session has failed due to an application error when the PDU session is not served by the UPF.
MUTING_EXC_INSTR_NOT_ACCEPTED	403 Forbidden	Indicates the UPF does not accept the received muting exception instructions.
REJECTION_DUE_TO_NO_DNN_SNSSAI	403 Forbidden	Indicates the creation of a subscription towards a PDU session has failed due to an application error when the UPF cannot find a unique PDU session due to no DNN and/or S-NSSAI received.
SUBSCRIPTION_NOT_FOUND	404 Not Found	Indicates the deletion of subscription has failed due to an application error when the subscription is not found in the UPF.
UNSUPPORTED_EVENT_TYPE	501 Not Implemented	The request for creation of a subscription is rejected because none of the events is supported by the UPF.

6.1.8 Feature negotiation

The optional features listed in table 6.2.8-1 are defined for the Nupf_EventExposure API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.1.8-1: Supported Features

Feature number	Feature Name	M/O	Description
1	EEMM	O	Event Exposure Muting Mechanism An UPF supporting this feature shall support the handling of event muting exception instructions as specified in clause 6.2.7.2 of 3GPP TS 23.288 [17].

6.1.9 Security

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

If Oauth2 authorization is used, an NF Service Consumer, prior to consuming services offered by the Nupf_EventExposure API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [10], clause 5.4.2.2.

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

The Nupf_EventExposure API defines scopes for OAuth2 authorization as specified in 3GPP TS 33.501 [8]; it defines a single scope consisting on the name of the service (i.e., "nupf-ee"), and it does not define any additional scopes at resource or operation level.

6.1.10 HTTP redirection

An HTTP request may be redirected to a different UPF service instance when using direct or indirect communications (see 3GPP TS 29.500 [4]).

An SCP that reselects a different UPF producer instance will return the NF Instance ID of the new UPF producer instance in the 3gpp-Sbi-Producer-Id header, as specified in clause 6.10.3.4 of 3GPP TS 29.500 [4].

If an UPF redirects a service request to a different UPF using an 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new UPF towards which the service request is redirected shall be indicated in the 3gpp-

Sbi-Target-Nf-Id header of the 307 Temporary Redirect or 308 Permanent Redirect response as specified in clause 6.10.9.1 of 3GPP TS 29.500 [4].

6.2 Nupf_GetUEPrivateIPaddrAndIdentifiers Service API

6.2.1 Introduction

The Nupf_GetUEPrivateIPaddrAndIdentifiers service shall use the Nupf_GetUEPrivateIPaddrAndIdentifiers API.

The API URI of the Nupf_GetUEPrivateIPaddrAndIdentifiers Service API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URI 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-gueip".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 6.2.3.

6.2.2 Usage of HTTP

6.2.2.1 General

HTTP/2, IETF RFC 9113 [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_GetUEPrivateIPaddrAndIdentifiers API is contained in Annex A.

6.2.2.2 HTTP standard headers

6.2.2.2.1 General

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

6.2.2.2.2 Content type

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

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 9457 [13].

6.2.2.3 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.

6.2.3 Resources

6.2.3.1 Overview

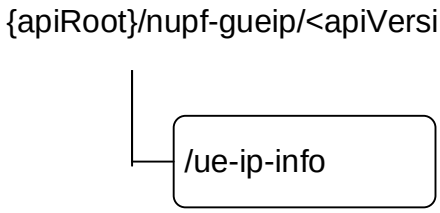

Figure 6.2.3.1-1: Resource URI structure of the Nupf_GetUEPrivateIPaddrAndIdentifiers API

Table 6.2.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.2.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
UE IP Address Info (Document)	/ue-ip-info	GET	Nupf_GetUEPrivateIPaddrAndIdentifiers_Get

6.2.3.2 Resource: UE IP Address Info

6.2.3.2.1 Description

This resource represents the UE IP Address Info of all the PDU sessions served by the UPF.

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

6.2.3.2.2 Resource Definition

Resource URI: **{apiRoot}/nupf-gueip/<apiVersion>/ue-ip-info**

This resource shall support the resource URI variables defined in table 6.2.3.2.2-1.

Table 6.2.3.2.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 6.2.1
apiVersion	See clause 6.2.1

6.2.3.2.3 Resource Standard Methods

6.2.3.2.3.1 GET

This operation retrieves the UE IP Info of a PDU session, which contains the UE's PDU Session (private) IP address and optionally UE identifiers (e.g. SUPI, GPSI), by querying the UPF with the NATed UE's public IP address and an optional Port number, and optionally the DNN and S-NSSAI.

This method shall support the URI query parameters specified in table 6.2.3.2.3.1-1.

Table 6.2.3.2.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
ue-ipv4-address	Ipv4Addr	C	0..1	UE's IPv4 address (NOTE)	
ue-ipv6-prefix	Ipv6Prefix	C	0..1	UE's IPv6 Prefix (NOTE)	
port-number	integer	O	0..1	UDP or TCP Port	
dnn	Dnn	O	0..1	DNN of the PDU session	
snssai	Snssai	O	0..1	S-NSSAI of the PDU session	
NOTE: Either the ue-ipv4-address or the ue-ipv6-prefix shall be present.					

This method shall support the request data structures specified in table 6.2.3.2.3.1-2 and the response data structures and response codes specified in table 6.2.3.2.3.1-3.

Table 6.2.3.2.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

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

Data type	P	Cardinality	Response codes	Description
UeIpInfo	M	1	200 OK	The response body contains a UeIpInfo for a PDU session which contains attributes that are matching the queryparameter.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	404 Not Found	The "cause" attribute may be used to indicate the following application error: - NO_MATCHING_UE_IP_ADDRESS See table 6.2.7.3-1 for the description of this error.
NOTE 1: The mandatory HTTP error status code for the GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply, with response body containing an object of ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4].				

Table 6.2.3.2.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance. For the case, when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected, see clause 6.10.9.1 in 3GPP TS 29.500 [4].

Table 6.2.3.2.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance. For the case, when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected.

6.2.3.2.4 Resource Custom Operations

None.

6.2.4 Custom Operations without associated resources

None

6.2.5 Notifications

6.2.5.1 General

None.

6.2.6 Data Model

6.2.6.1 General

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

Table 6.2.6.1-1 specifies the data types defined for the Nupf_GetUEPrivateIPaddrAndIdentifiers service based interface protocol.

Table 6.2.6.1-1: Nupf_GetUEPrivateIPaddrAndIdentifiers specific Data Types

Data type	Clause defined	Description	Applicability
UeIpInfo	6.2.6.2.2	A UeIpInfo for a PDU session	

Table 6.2.6.1-2 specifies data types re-used by the Nupf_GetUEPrivateIPaddrAndIdentifiers 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 Nupf_GetUEPrivateIPaddrAndIdentifiers service based interface.

Table 6.2.6.1-2: Nupf_GetUEPrivateIPaddrAndIdentifiers re-used Data Types

Data type	Reference	Comments	Applicability
Dnn	3GPP TS 29.571 [16]	DNN	
Snssai	3GPP TS 29.571 [16]	S-NSSAI	
Ipv4Addr	3GPP TS 29.571 [16]	IPv4 address	
Ipv6Prefix	3GPP TS 29.571 [16]	IPv6 address prefix	
Supi	3GPP TS 29.571 [16]	SUPI	
Gpsi	3GPP TS 29.571 [16]	GPSI	

6.2.6.2 Structured data types

6.2.6.2.1 Introduction

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

6.2.6.2.2 Type: UeIpInfo

Table 6.2.6.2.2-1: Definition of type UeIpInfo

Attribute name	Data type	P	Cardinality	Description
privateIpv4Address	Ipv4Address	C	0..1	When present, this IE shall contain the Private IPv4 IP address. (NOTE)
ipDomain	string	O	0..1	When present, this IE contains the IP domain of the private IPv4 address.
privateIpv6Prefix	Ipv6Prefix	C	0..1	When present, this IE shall contain the Private IPv6 Prefix. (NOTE)
publicIpv4Address	Ipv4Address	O	0..1	When present, this IE shall contain the public (NATed) IPv4 IP address.
publicIpv6Prefix	Ipv6Prefix	O	0..1	When present, this IE shall contain the public (NATed) IPv6 Prefix.
portNumber	Uint16	O	0..1	When present, this IE shall contain the port number for the source UDP or TCP port when Port Address Translation is used.
dnn	Dnn	O	0..1	When present, this IE shall contain the DNN of the PDU Session.
snssai	Snssai	O	0..1	When present, this IE shall contain the S-NSSAI of the PDU Session.
hplmnSnssai	Snssai	O	0..1	This IE may be included by a V-UPF acting as (local) PSA for a HR-SBO PDU session. When present, it shall contain the HPLMN S-NSSAI of the PDU session.
supi	Supi	O	0..1	When present, this IE shall contain the SUPI of the UE.
gpsi	Gpsi	O	0..1	When present, this IE shall contain the GPSI of the UE.
hrsboInd	boolean	C	0..1	This IE shall be included by a V-UPF and set to true if the PDU session is working in HR-SBO mode. The presence of this IE with the value false shall be prohibited.
NOTE: Either the privateIpv4Address or the privateIpv6Prefix shall be present when the request is to retrieve the UE private IP address.				

6.2.6.3 Simple data types and enumerations

6.2.6.3.1 Introduction

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

6.2.7 Error Handling

6.2.7.1 General

For the Nupf_GetUEPrivateIPaddrAndIdentifiers 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_GetUEPrivateIPaddrAndIdentifiers API.

6.2.7.2 Protocol Errors

No specific procedures for the Nupf_GetUEPrivateIPaddrAndIdentifiers service are specified.

6.2.7.3 Application Errors

The application errors defined for the Nupf_GetUEPrivateIPaddrAndIdentifiers service are listed in Table 6.2.7.3-1.

Table 6.2.7.3-1: Application errors

Application Error	HTTP status code	Description
NO_MATCHING_UE_IP_ADDRESS	404 Not Found	There is no UE IP address matching the query parameters.

6.2.8 Feature negotiation

The optional features in table 6.2.8-1 are defined for the Nupf_GetUEPrivateIPaddrAndIdentifiers API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.2.8-1: Supported Features

Feature number	Feature Name	Description

6.2.9 Security

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

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

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

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

6.2.10 HTTP redirection

An HTTP request may be redirected to a different UPF service instance when using direct or indirect communications (see 3GPP TS 29.500 [4]).

An SCP that reselects a different UPF producer instance will return the NF Instance ID of the new UPF producer instance in the 3gpp-Sbi-Producer-Id header, as specified in clause 6.10.3.4 of 3GPP TS 29.500 [4].

If an UPF redirects a service request to a different UPF using an 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new UPF towards which the service request is redirected shall be indicated in the 3gpp-Sbi-Target-Nf-Id header of the 307 Temporary Redirect or 308 Permanent Redirect response as specified in clause 6.10.9.1 of 3GPP TS 29.500 [4].

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: 1.1.1
  description: |
    UPF Event Exposure Service.
    © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: 3GPP TS 29.564 V18.6.0; 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

security:
  - {}
  - oAuth2ClientCredentials:
      - nupf-ee

paths:
  /ee-subscriptions:
    post:
      summary: Nupf_EventExposure Subscribe service Operation
      operationId: CreateSubscription
      tags:
        - Subscriptions (Collection)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/CreateEventSubscription'
      responses:
        '201':
          description: Successful creation of an UPF Event Subscription
          headers:
            Location:
              description: 'Contains the URI of the newly created resource, according to the
structure: {apiRoot}/nupf-ee/<apiVersion>/ee-subscriptions/{subscriptionId}'
```

```
            required: true
            schema:
              type: string
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/CreatedEventSubscription'
        '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'
        '501':
          $ref: 'TS29571_CommonData.yaml#/components/responses/501'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        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 or in the Nupf_EventExposure Subscribe request.
            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
```

```
              '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'
              '502':
                $ref: 'TS29571_CommonData.yaml#/components/responses/502'
              '503':
                $ref: 'TS29571_CommonData.yaml#/components/responses/503'
              default:
                $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  /ee-subscriptions/{subscriptionId}:
    patch:
      summary: Nupf_EventExposure Subscribe Modify service Operation
      operationId: ModifySubscription
      parameters:
        - name: subscriptionId
          in: path
          required: true
          description: Unique ID of the subscription to be modified
          schema:
            type: string
      requestBody:
        content:
          application/json-patch+json:
            schema:
              type: array
              items:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/PatchItem'
              minItems: 1
        required: true
      responses:
        '200':
          description: Expected response to a valid request
          content:
            application/json:
              schema:
                $ref: 'TS29571_CommonData.yaml#/components/schemas/PatchResult'
        '204':
          description: Successful response
        '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'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
```

```
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

    delete:
      summary: Nupf_EventExposure UnSubscribe service Operation
      operationId: DeleteSubscription
      parameters:
        - name: subscriptionId
          in: path
          required: true
          description: Unique ID of the subscription to be deleted
          schema:
            type: string
      responses:
        '204':
          description: Subsription deleted successfully
        '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'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nupf-ee: Access to the Nupf_EventExposure API

  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
        achievedSampRatio:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
```

```
    NotificationItem:
      description: represents a report on one subscribed event
      type: object
      required:
        - eventType
        - timeStamp
      anyOf:
        - required: [ ueIpv4Addr ]
        - required: [ ueIpv6Prefix ]
        - required: [ ueMacAddr ]
      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'
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        timeStamp:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        startTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        qosMonitoringMeasurement:
          $ref: '#/components/schemas/QosMonitoringMeasurement'
        tscMngtInfo:
          $ref: '#/components/schemas/TscManagementInfo'
        userDataUsageMeasurements:
          type: array
          items:
            $ref: '#/components/schemas/UserDataUsageMeasurements'
          minItems: 1


    UpfEventSubscription:
      description: UPF Event Subscription
      type: object
      properties:
        eventList:
          type: array
          items:
            $ref: '#/components/schemas/UpfEvent'
          minItems: 1
        eventNotifyUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        notifyCorrelationId:
          type: string
        eventReportingMode:
          $ref: '#/components/schemas/UpfEventMode'
        nfId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        ueIpAddress:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/IpAddr'
        anyUe:
          type: boolean
          default: false
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        dnn:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
        snssai:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
      required:
        - eventList
        - eventNotifyUri
        - notifyCorrelationId
        - eventReportingMode
        - nfId

    UpfEventMode:
```

```
    description: UPF Event Mode
    type: object
    properties:
      trigger:
        $ref: '#/components/schemas/UpfEventTrigger'
      maxReports:
        type: integer
      expiry:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      repPeriod:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
      sampRatio:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
      partitioningCriteria:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/PartitioningCriteria'
        minItems: 1
      notifFlag:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NotificationFlag'
      mutingExcInstructions:
        writeOnly: true
        allOf:
          - $ref: 'TS29571_CommonData.yaml#/components/schemas/MutingExceptionInstructions'
      mutingNotSettings:
        readOnly: true
        allOf:
          - $ref: 'TS29571_CommonData.yaml#/components/schemas/MutingNotificationsSettings'
    required:
      - trigger

  UpfEvent:
    description: UPF Event
    type: object
    properties:
      type:
        $ref: '#/components/schemas/EventType'
      immediateFlag:
        type: boolean
        default: false
      measurementTypes:
        type: array
        items:
          $ref: '#/components/schemas/MeasurementType'
        minItems: 1
      appIds:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
        minItems: 1
      trafficFilters:
        type: array
        items:
          $ref: 'TS29512_Npcf_SMPolicyControl.yaml#/components/schemas/FlowInformation'
        minItems: 1
      granularityOfMeasurement:
        $ref: '#/components/schemas/GranularityOfMeasurement'
      reportingSuggestionInfo:
        $ref: '#/components/schemas/ReportingSuggestionInformation'
    required:
      - type

  CreateEventSubscription:
    description: Data within UPF Create Event Subscription Request
    type: object
    properties:
      subscription:
        $ref: '#/components/schemas/UpfEventSubscription'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - subscription

  CreatedEventSubscription:
    description: Data within UPF Create Event Subscription Response
    type: object
    properties:
      subscription:
```

```
        $ref: '#/components/schemas/UpfEventSubscription'
      subscriptionId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      reportList:
        type: array
        items:
          $ref: '#/components/schemas/NotificationItem'
        minItems: 1
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - subscription
      - subscriptionId

  ReportingSuggestionInformation:
    description: Reporting Suggestion Information
    type: object
    properties:
      reportingUrgency:
        $ref: '#/components/schemas/ReportingUrgency'
      reportingTimeInfo:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
    required:
      - reportingUrgency

  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
      dlAveThroughput:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
      ulAveThroughput:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
      dlCongestion:
        type: integer
        minimum: 0
        maximum: 10000
      ulCongestion:
        type: integer
        minimum: 0
        maximum: 10000
      defaultQosFlowInd:
        type: boolean
        default: false


  TscManagementInfo:
    description: TSC Management Information
    type: object
    properties:
      pmics:
        type: array
        items:
          $ref: 'TS29512_Npcf_SMPolicyControl.yaml#/components/schemas/PortManagementContainer'
        minItems: 1
      umic:
        $ref: 'TS29512_Npcf_SMPolicyControl.yaml#/components/schemas/BridgeManagementContainer'

  UserDataUsageMeasurements:
    description: >
      User Data Usage Measurements either for the PDU session, or the app-id, or the data flow
    type: object
    properties:
      appId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
      flowInfo:
        $ref: 'TS29512_Npcf_SMPolicyControl.yaml#/components/schemas/FlowInformation'
      volumeMeasurement:
```

```
        $ref: '#/components/schemas/VolumeMeasurement'
      throughputMeasurement:
        $ref: '#/components/schemas/ThroughputMeasurement'
      applicationRelatedInformation:
        $ref: '#/components/schemas/ApplicationRelatedInformation'
      throughputStatisticsMeasurement:
        $ref: '#/components/schemas/ThroughputStatisticsMeasurement'

  VolumeMeasurement:
    description: Volume Measurement information
    type: object
    properties:
      totalVolume:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/TrafficVolume'
      ulVolume:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/TrafficVolume'
      dlVolume:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/TrafficVolume'
      totalNbOfPackets:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint64'
      ulNbOfPackets:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint64'
      dlNbOfPackets:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint64'

  ThroughputMeasurement:
    description: Throughput Measurement information
    type: object
    properties:
      ulThroughput:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
      dlThroughput:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
      ulPacketThroughput:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketRate'
      dlPacketThroughput:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketRate'

  ApplicationRelatedInformation:
    description: Application Related Information
    type: object
    properties:
      urls:
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        minItems: 1
      domainInfoList:
        type: array
        items:
          $ref: '#/components/schemas/DomainInformation'
        minItems: 1


  ThroughputStatisticsMeasurement:
    description: Throughput Statistics Measurement
    type: object
    properties:
      ulAverageThroughput:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
      dlAverageThroughput:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
      ulPeakThroughput:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
      dlPeakThroughPut:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
      ulAveragePacketThroughput:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketRate'
      dlAveragePacketThroughput:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketRate'
      ulPeakPacketThroughput:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketRate'
      dlPeakPacketThroughput:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/PacketRate'

  DomainInformation:
    description: Domain Information
    type: object
```

```
      properties:
        domainName:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Fqdn'
        domainNameProtocol:
          $ref: '#/components/schemas/DnProtocol'
      required:
        - domainName


# ENUMS

    EventType:
      description: Event Type
      anyOf:
        - type: string
          enum:
          - QOS_MONITORING
          - USER_DATA_USAGE_MEASURES
          - USER_DATA_USAGE_TRENDS
          - TSC_MNGT_INFO
        - type: string

    UpfEventTrigger:
      description: Upf Event Trigger
      anyOf:
        - type: string
          enum:
          - ONE_TIME
          - PERIODIC
        - type: string


    MeasurementType:
      description: Measurement Type
      anyOf:
        - type: string
          enum:
          - VOLUME_MEASUREMENT
          - THROUGHPUT_MEASUREMENT
          - APPLICATION_RELATED_INFO
        - type: string

    GranularityOfMeasurement:
      description: Granularity Of Measurement
      anyOf:
        - type: string
          enum:
          - PER_APPLICATION
          - PER_SESSION
          - PER_FLOW
        - type: string

    DnProtocol:
      description: Domain Name Protocol
      anyOf:
        - type: string
          enum:
          - DNS_QNAME
          - TLS_SNI
          - TLS_SAN
          - TLS_SCN
        - type: string

    ReportingUrgency:
      description: Reporting Urgency
      anyOf:
        - type: string
          enum:
          - DELAY_TOLERANT
          - NON_DELAY_TOLERANT
        - type: string


# SIMPLE TYPES
```

A.3 Nupf_GetUEPrivateIPaddrAndIdentifiers API

```
openapi: 3.0.0

info:
  version: '1.0.0'
  title: 'UPF GET UE Private IP address and Identifiers Service'
  description: |
    Nupf_GetUEPrivateIPaddrAndIdentifiers Service.
    © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: 3GPP TS 29.564 V18.5.0; 5G System; 5G System; User Plane Function Services; Stage 3
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.564/'

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

security:
  - {}
  - oAuth2ClientCredentials:
      - nupf-gueip

paths:
  /ue-ip-info:
    get:
      summary: Search UeIpInfo for a PDU session from the UeIpInfo
      operationId: SearchUeIpInfo
      tags:
        - UE IP Info_Get
      parameters:
        - name: snssai
          in: query
          description: Slice of the PDU session
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
        - name: dnn
          in: query
          description: Dnn of the PDU session
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
        - name: ue-ipv4-address
          in: query
          description: IPv4 address of the UE
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
        - name: ue-ipv6-prefix
          in: query
          description: IPv6 prefix of the UE
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Prefix'
        - name: port-number
          in: query
          description: UDP or TCP port associated with the public address
          schema:
            type: integer
            minimum: 0
            maximum: 65535
      responses:
        '200':
          description: Successful response
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/UeIpInfo'
        '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 UPF
              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 UPF
              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'
        '406':
          $ref: 'TS29571_CommonData.yaml#/components/responses/406'
        '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'
        '501':
          $ref: 'TS29571_CommonData.yaml#/components/responses/501'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nupf-gueip: Access to the Nupf_GetUEPrivateIPaddrAndIdentifiers API

  schemas:
    UeIpInfo:
      description: a UE IP Address Info for a PDU session
      type: object
      properties:
        privateIpv4Address:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
        ipDomain:
          type: string
        privateIpv6Prefix:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Prefix'
        publicIpv4Address:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
        publicIpv6Prefix:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Prefix'
        portNumber:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint16'
        dnn:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
        snssai:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
        hplmnSnssai:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        gpsi:
```

```
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
    hrsboInd:
      type: boolean
      enum:
       - true
```

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
2023-03	CT#99	CP-230034	0010	1	B	Service operations of the UPF event exposure service	18.0.0
2023-03	CT#99	CP-230034	0011	1	B	Subscriptions to UPF events	18.0.0
2023-03	CT#99	CP-230034	0012	1	B	UPF events supported by the UPF event exposure service	18.0.0
2023-03	CT#99	CP-230034	0014	1	B	Unsubscribe service operation	18.0.0
2023-03	CT#99	CP-230034	0015	1	B	Resource URI structure of the UPF event exposure API	18.0.0
2023-03	CT#99	CP-230034	0017	1	B	Security of UPF Event Exposure service	18.0.0
2023-03	CT#99	CP-230034	0022	1	B	Service operations of Nupf_EventExposure service	18.0.0
2023-03	CT#99	CP-230034	0019	1	B	Nupf_GetPrivateUEIPaddr service operation and API	18.0.0
2023-03	CT#99	CP-230034	0021	1	B	Resource and data type of Nupf_GetPrivateUEIPaddr service	18.0.0
2023-03	CT#99	CP-230034	0009	3	B	Updates to the Introduction of TS 29.564	18.0.0
2023-03	CT#99	CP-230034	0013	2	B	Subscribe service operation	18.0.0
2023-03	CT#99	CP-230034	0023	2	B	Resource for Nupf_EventExposure service	18.0.0
2023-03	CT#99	CP-230071	0029		F	29.564 Rel-18 API version and External doc update	18.0.0
2023-06	CT#100	CP-231027	0027	4	F	Location header and missing Redirection clause	18.1.0
2023-06	CT#100	CP-231035	0030		F	Correction on DNN and S-NSSAI in Nupf_GetPrivateUEIPaddr_Get Operation	18.1.0
2023-06	CT#100	CP-231035	0035		B	Support for Data rate monitoring	18.1.0
2023-06	CT#100	CP-231035	0032	1	F	Creation of a Subscription for Nupf_eventexposure	18.1.0
2023-06	CT#100	CP-231259	0033	3	B	Data types for Nupf_eventexposure service notify operation and openAPI	18.1.0
2023-06	CT#100	CP-231260	0024	3	B	Data types for Nupf_eventexposure service subscribe operation and openAPI	18.1.0
2023-06	CT#100	CP-231035	0036	1	B	Including SUPI in the response	18.1.0
2023-06	CT#100	CP-231035	0038	1	B	UPF exposure of TSC Management Information	18.1.0
2023-06	CT#100	CP-231035	0039	1	B	NF ID in Nupf_EventExposure_Subscribe Request and Fixing Incorrect References	18.1.0
2023-06	CT#100	CP-231035	0040	1	B	Modification of a subscription for UPF events	18.1.0
2023-06	CT#100	CP-231035	0041	1	B	Resource and data type of modification of a subscription for UPF events	18.1.0
2023-06	CT#100	CP-231057	0037	1	B	UPF exposure of congestion information	18.1.0
2023-06	CT#100	CP-231070	0045		F	29.564 Rel-18 API version and External doc update	18.1.0
2023-09	CT#101	CP-232038	0046		F	Consumers of the UPF Event Exposure service	18.2.0
2023-09	CT#101	CP-232038	0053		B	Applicability of the value "CONTINUOUS" for UpfEventTrigger	18.2.0
2023-09	CT#101	CP-232038	0055		F	RedirectResponse Description	18.2.0
2023-09	CT#101	CP-232038	0056		B	The Immediate Report Flag	18.2.0
2023-09	CT#101	CP-232038	0047	1	F	Subscription type for User Data Usage Measures / Trends	18.2.0
2023-09	CT#101	CP-232038	0054	1	B	Domain Name Protocol	18.2.0
2023-09	CT#101	CP-232038	0058	2	B	The partitioning criteria for the UPF Event Exposure	18.2.0
2023-09	CT#101	CP-232038	0057	2	B	Multiple PDU Sessions in a NotificationItem	18.2.0
2023-09	CT#101	CP-232054	0050	1	B	QoS flow description in QoS monitoring report	18.2.0

2023-09	CT#101	CP-232054	0048	2	B	Data rate monitoring	18.2.0
2023-09	CT#101	CP-232054	0049	3	B	Exposure of congestion information	18.2.0
2023-09	CT#101	CP-232060	0059		F	29.564 Rel-18 API version and External doc update	18.2.0
2023-09	CT#101	CP-232067	0052	1	A	Support of an Ethernet PDU Session	18.2.0
2023-12	CT#102	CP-233028	0069	1	F	HTTP RFCs obsoleted by IETF RFC 9113	18.3.0
2023-12	CT#102	CP-233030	0075		F	ProblemDetails RFC 7807 obsoleted by 9457	18.3.0
2023-12	CT#102	CP-233032	0064		F	Miscellaneous corrections	18.3.0
2023-12	CT#102	CP-233032	0066		F	List and description of events supported by the Nupf_EventExposure service	18.3.0
2023-12	CT#102	CP-233032	0068		B	Reporting Suggestion Information	18.3.0
2023-12	CT#102	CP-233032	0063	1	F	Correction on dnn and reportingUrgency attributes	18.3.0
2023-12	CT#102	CP-233032	0073		B	Achieved sampling ratio in Nupf_EventExposure_Notify	18.3.0
2023-12	CT#102	CP-233032	0074	1	B	Indication of QoS Flow associated with the default QoS Rule	18.3.0
2023-12	CT#102	CP-233032	0072	1	B	Nupf_GetPrivateUEIPaddr_Get response with GPSI	18.3.0
2023-12	CT#102	CP-233038	0065		B	UPF GetPrivateUEIPaddr service extensions for HR-SBO PDU sessions	18.3.0
2023-12	CT#102	CP-233045	0061	2	B	Muting enhancements	18.3.0
2023-12	CT#102	CP-233053	0071	1	F	Per QoS flow data rate monitoring	18.3.0
2023-12	CT#102	CP-233060	0077		F	29.564 Rel-18 API version and External doc update	18.3.0
2024-03	CT#103	CP-240033	0080	1	B	Change the Nupf_GetPrivateUEIPaddr service as Nupf_GetUEPrivateIPaddrAndIdentifiers service	18.4.0
2024-03	CT#103	CP-240033	0082	1	B	DNN and S-NSSAI for UPF exposure service	18.4.0
2024-03	CT#103	CP-240033	0086	1	B	Editor Note cleanup for Nupf_EventExposure Service	18.4.0
2024-03	CT#103	CP-240034	0085	1	F	Update the description of QoS Monitoring event	18.4.0
2024-03	CT#103	CP-240034	0078	1	B	Encoding of UL/DL Congestion Information	18.4.0
2024-03	CT#103	CP-240034	0081	1	F	AppId and flow information in the QoS Monitoring Measurement	18.4.0
2024-03	CT#103	CP-240056	0087		F	29.564 Rel-18 API version and External doc update	18.4.0
2024-06	CT#104	CP-241028	0091	2	B	Returning UNSUPPORTED_EVENT_TYPE	18.5.0
2024-06	CT#104	CP-241028	0096	1	F	Correct the api name of Nupf_GetUEPrivateIPaddrAndIdentifiers service	18.5.0
2024-06	CT#104	CP-241031	0092	1	B	Application Function influence on traffic routing in HR-SBO	18.5.0
2024-06	CT#104	CP-241032	0089	1	F	Input parameters of Nupf_GetPrivateUEIPaddr_Get Request	18.5.0
2024-06	CT#104	CP-241032	0093	1	F	Correction of Nupf_GetUEPrivateIPaddrAndIdentifiers API	18.5.0
2024-06	CT#104	CP-241032	0095		F	UE ID corrections	18.5.0
2024-06	CT#104	CP-241032	0094	1	F	Corrections to the Nupf_EventExposure service	18.5.0
2024-06	CT#104	CP-241052	0097		F	29.564 Rel-18 API version and External doc update	18.5.0
2024-09	CT#105	CP-242040	0101		F	Correct application error for the GetUEPrivateIpAddrAndIdentifiers service	18.6.0
2024-09	CT#105	CP-242040	0103		F	Correct Upf event subscription for per S-NSSAI and/or DNN	18.6.0
2024-09	CT#105	CP-242040	0102	1	F	Correct data type UeIpInfo for the GetUEPrivateIpAddrAndIdentifiers serviceS	18.6.0
2024-09	CT#105	CP-242040	0104	1	F	Correction on presence condition of appId	18.6.0
2024-09	CT#105	CP-242040	0099	4	F	UPF event exposure for Ethernet PDU sessions	18.6.0
2024-09	CT#105	CP-242054	0106		F	29.564 Rel-18 API version and External doc update	18.6.0
2024-12	CT#106	CP-243030	0117	1	F	Corrections on dlPeakThroughput and throughputStatisticMeasurements attributes R18	18.7.0

History

Document history		
V18.4.0	May 2024	Publication
V18.5.0	July 2024	Publication
V18.6.0	September 2024	Publication
V18.7.0	January 2025	Publication