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Foreword

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1 Scope

The present specification provides the stage 3 definition of the Session Management Event Exposure Service (Nsmf_EventExposure) of the 5G System.

The stage 2 definition and procedures of the Session Management Event Exposure Service are contained in 3GPP TS 23.502 [3] and 3GPP TS 23.503 [6]. The 5G System Architecture is defined in 3GPP TS 23.501 [2].

Stage 3 call flows for policy and charging control use cases are provided in 3GPP TS 29.513 [7].

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

The Session Management Event Exposure Service is provided by the Session Management Function (SMF). This service exposes events related to PDU Sessions observed at the SMF.

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] 3GPP TS 23.503: "Policy and Charging Control Framework for the 5G System; Stage 2".
- [7] 3GPP TS 29.513: "5G System; Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3".
- [8] IETF RFC 9113: "HTTP/2".
- [9] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".
- [10] OpenAPI: "OpenAPI Specification Version 3.0.0", <https://spec.openapis.org/oas/v3.0.0>.
- [11] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces Stage 3".
- [12] 3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".
- [13] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3".
- [14] 3GPP TS 29.512: "5G System; Session Management Policy Control Service; Stage 3".
- [15] 3GPP TS 33.501: "Security architecture and procedures for 5G system".
- [16] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".
- [17] Void.

- [18] IETF RFC 9457: "Problem Details for HTTP APIs".
- [19] 3GPP TR 21.900: "Technical Specification Group working methods".
- [20] 3GPP TS 29.522: "5G System; Network Exposure Function Northbound APIs; Stage 3".
- [21] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".
- [22] 3GPP TS 29.514: "5G System; Policy Authorization Service; Stage 3".
- [23] 3GPP TS 29.244: "Interface between the Control Plane and the User Plane of EPC Nodes".
- [24] 3GPP TS 29.122: "T8 reference point for Northbound APIs".
- [25] 3GPP TS 29.591: "5G System; Network Exposure Function Southbound Services; Stage 3".
- [26] 3GPP TS 29.564: "5G System; User Plane Function Services; Stage 3".
- [27] 3GPP TS 29.554: "5G System; Background Data Transfer Policy Control Service; Stage 3".
- [28] Void.
- [29] 3GPP TS 29.520: "5G System; Network Data Analytics Services; Stage 3".
- [30] 3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".

3 Definitions 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 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
AMBR	Aggregate Maximum Bit Rate
AMF	Access and Mobility Management Function
API	Application Programming Interface
DCCF	Data Collection Coordination Function
DDD	Downlink Data Delivery
DNAI	DN Access Identifier
DNN	Data Network Name
EAS	Edge Application Server
EIF	Energy Information Function
FQDN	Fully Qualified Domain Name
GPSI	Generic Public Subscription Identifier
GUAMI	Globally Unique AMF Identifier
HTTP	Hypertext Transfer Protocol
H-SMF	Home SMF
I-SMF	Intermediate SMF
JSON	JavaScript Object Notation
NEF	Network Exposure Function
NF	Network Function
NID	Network Identifier

NRF	Network Repository Function
NSSAI	Network Slice Selection Assistance Information
NWDAF	Network Data Analytics Function
PCF	Policy Control Function
PRA	Presence Reporting Area
QFI	QoS Flow Identifier
SMCC	Session Management Congestion Control
SMCCE	Session Management Congestion Control Experience
SMF	Session Management Function
SNPN	Stand-alone Non-Public Network
SUPI	Subscription Permanent Identifier
S-NSSAI	Single Network Slice Selection Assistance Information
SSC	Session and Service Continuity
UDM	Unified Data Management
UPF	User Plane Function
V-SMF	Visited SMF

4 Session Management Event Exposure Service

4.1 Service Description

4.1.1 Overview

The Session Management Event Exposure Service, as defined in 3GPP TS 23.502 [3] and 3GPP TS 23.503 [6], is provided by the Session Management Function (SMF).

This service:

- allows NF service consumers to subscribe and unsubscribe for events on a PDU session; and
- notifies recipient of notification(s) subscribed by NF service consumers with a corresponding subscription about observed events on the PDU session.

The types of observed events applicable for (H-)SMF (i.e. in non-roaming and LBO scenarios) include:

- UP path change (e.g. addition and/or removal of PDU session anchor);
- access type change;
- RAT type change;
- PLMN change;
- PDU session release;
- PDU session establishment;
- Downlink data delivery status;
- UE IP address/prefix change;
- QFI allocation, QFI deallocation, and QoS flow change;
- QoS monitoring;
- SM congestion control experience for PDU Session;
- Dispersion;
- Satellite backhaul category change;
- WLAN information for PDU Session;

- Redundant transmission experience for PDU Session;
- UPF events;
- Traffic Correlation; and/or
- Energy Consumption Information.

The types of observed events applicable for V-SMF include:

- Downlink data delivery status;
- UP Path Change (for the HR-SBO scenario).

The types of observed events applicable for I-SMF include:

- Downlink data delivery status;
- QoS monitoring;
- UPF events.

4.1.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The Policy and Charging related 5G architecture is also described in 3GPP TS 29.513 [7].

The Session Management Event Exposure Service (Nsmf_EventExposure) is part of the Nsmf service-based interface exhibited by the Session Management Function (SMF).

NOTE 1: The SMF exhibiting this interface can also be an I-SMF or a V-SMF.

The known NF service consumers of the Nsmf_EventExposure service are:

- Network Exposure Function (NEF),
- Access and Mobility Management Function (AMF),
- Application Function (AF),
- Unified Data Management (UDM),
- Network Data Analytics Function (NWDAF),
- Data Collection Coordination Function (DCCF),
- Session Management Function (SMF),
- Policy Control Function (PCF), and
- Energy Information Function (EIF).

NOTE: The PCF can implicitly subscribe on behalf of the AF or NEF to the UP_PATH_CH event, TRAFF_ROUTE_REQ_OUTCOME event, TRAFFIC_CORRELATION event, SIM_CONN_FAIL event, and/or the QOS_MON event by including the information on AF or NEF subscription within the PCC rule.

The AMF accesses the Session Management Event Exposure Service at the SMF via the N11 Reference point.

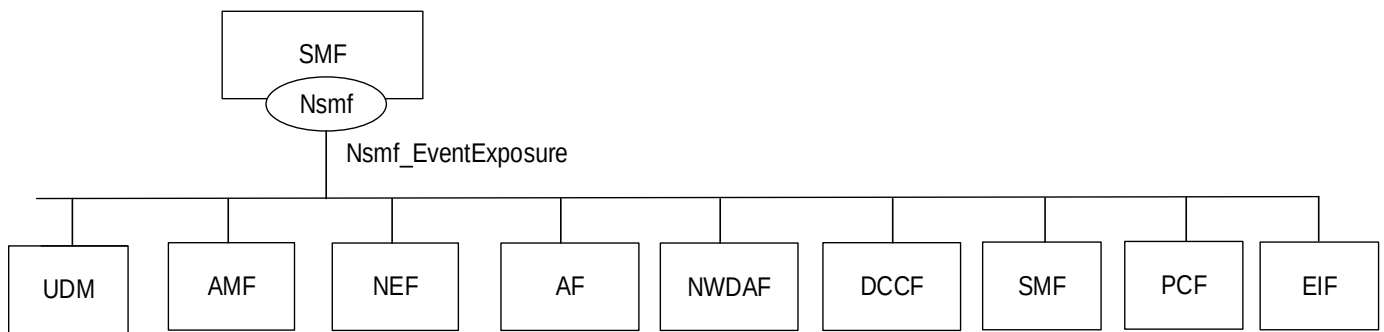


Figure 4.1.2-1: Reference Architecture for the Nsmf_EventExposure Service; SBI representation

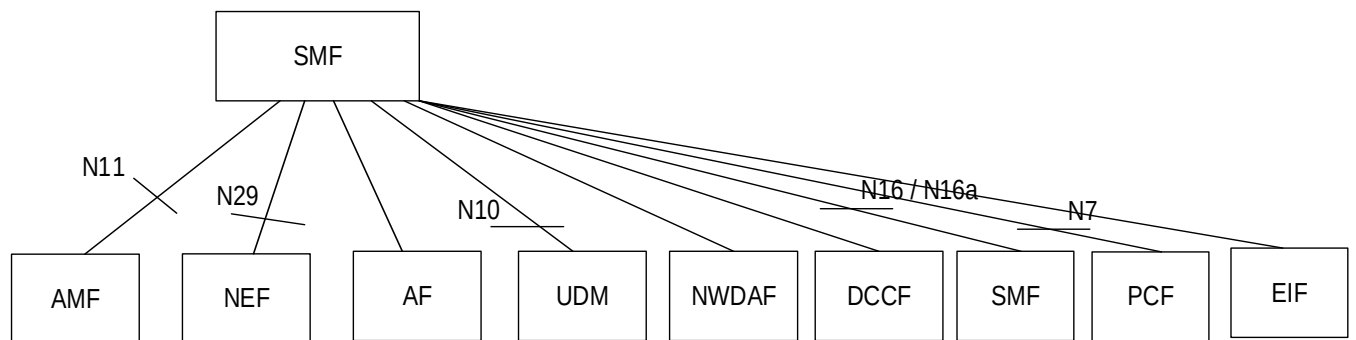


Figure 4.1.2-2: Reference Architecture for the Nsmf_EventExposure Service: reference point representation

4.1.3 Network Functions

4.1.3.1 Session Management Function (SMF)

The Session Management function (SMF) provides:

- Session Management e.g. Session establishment, modification and release;
- UE IP address allocation & management;
- Selection and control of UP function;
- Termination of interfaces towards Policy control functions; and
- Control part of policy enforcement and QoS.

4.1.3.2 NF Service Consumers

The Network Exposure Function (NEF);

- provides means to securely expose the services and capabilities provided by 3GPP network functions to e.g. 3rd parties or internal exposure consumer NF.

The Access and Mobility Management function (AMF) provides:

- Registration management;
- Connection management;
- Reachability management; and

- Mobility Management.

The Application Function (AF)

- interacts with the 3GPP Core Network to provide services.

The Unified Data Management (UDM).

- has access to subscriber information, can determine the SMF serving a user based on that data, and can then subscribe to event notifications for a user (e.g. when triggered by the NEF).

The Network Data Analytics Function (NWDAF)

- collects data that can be used for analytics from multiple data sources;
- retrieves information about NFs;
- performs on demand provision of analytics to NF service consumers, as indicated in clause 6, 3GPP TS 23.288 [21].

The Data Collection Coordination Function (DCCF)

- coordinates the collection and distribution of data and analytics.

The Session Management function (SMF) provides:

- Session Management e.g. Session establishment, modification and release;
- UE IP address allocation & management;
- Selection and control of UP function;
- Termination of interfaces towards Policy control functions; and
- Control part of policy enforcement and QoS.

The Policy Control Function (PCF):

- provides flow description information to support UE-Satellite-UE communication.

The Energy Information Function (EIF) provides:

- Energy Consumption Information collection, calculation and exposure.

4.2 Service Operations

4.2.1 Introduction

Table 4.2.1-1: Operations of the Nsmf_EventExposure Service

Service operation name	Description	Initiated by
Notify	Report UE PDU session related event(s) to recipient of notification(s) which the NF service consumer has subscribed to the event report service.	(H-)SMF, V-SMF, I-SMF
Subscribe	This service operation is used by an NF service consumer to subscribe for event notifications on a specified PDU session, or for all PDU Sessions of one UE, a group of UE(s) or any UE, or to modify a subscription.	NF service consumers (e.g. AMF, NEF, AF, UDM, NWDAF, DCCF, SMF, EIF)
UnSubscribe	This service operation is used by an NF service consumer to unsubscribe from event notifications.	NF service consumers (e.g. AMF, NEF, AF, UDM, NWDAF, DCCF, SMF, EIF)
AppRelocationInfo	This service operation is used by an NF service consumer to acknowledge the notification from the SMF regarding UE PDU Session related event(s)	NF service consumers (e.g. NEF, AF, PCF)

NOTE: The Nsmf_TrafficCorrelation_Notify Service Operation defined in clause 5.2.8.5.2 of 3GPP TS 23.502 [3] is implemented as the "TRAFFIC_CORRELATION" event in the Nsmf_EventExposure_Notify Service Operation with "CommonEASDNAI" feature support.

4.2.2 Nsmf_EventExposure_Notify Service Operation

4.2.2.1 General

The Nsmf_EventExposure_Notify service operation enables the SMF (i.e. (H-)SMF, V-SMF and/or I-SMF) to send notifications to recipient of notification(s) subscribed by NF service consumers upon the occurrence of a previously subscribed event on the related PDU session.

The following procedure using the Nsmf_EventExposure_Notify service operation is supported:

- notification about subscribed events.

4.2.2.2 Notification about subscribed events

The present "notification about subscribed events" procedure is performed by the SMF when any of the subscribed events occur.

The following applies with respect to the detection of subscribed events:

- If:
 - the SMF supports the "DownlinkDataDeliveryStatus" feature,
 - the event "DDDS" is subscribed,
 - the traffic descriptors of the downlink data source have been provided for that subscription, and
 - the SMF is informed that the UE corresponding to that subscription is unreachable,
- if the data is buffered at the UPF, then the SMF shall interact with the UPF to notify that the UPF buffers the downlink packets. The SMF shall include the traffic descriptor of the subscriptions in the PDR with a higher priority if the PCC is not applied to the PDU session or derive the PDR from the PCC rule received from the PCF as defined in clause 4.2.4.27 of 3GPP TS 29.512 [14] if the PCC is applied to the PDU session and request the UPF to report when there are corresponding buffered downlink packets or

discarded packets in the UPF as defined in clause 5.28.1 of 3GPP TS 29.244 [23]. When receiving the report from the UPF, the SMF shall determine whether that subscribed event with delivery status "DISCARDED" or "BUFFERED" occurred. The SMF shall determine that subscribed event with delivery status "TRANSMITTED" occurred by the fact that the related PDU session becomes ACTIVE.

- if the data is buffered at the SMF, the SMF shall determine whether that subscribed event occurred by comparing the downlink packets with the traffic descriptors received in the corresponding event subscription. If the SMF decides to buffer the packets, the subscribed event with delivery status "BUFFERED" occurred. If the SMF decides to discard the packets, the subscribed event with delivery status "DISCARDED" occurred. The SMF shall determine that subscribed event with delivery status "TRANSMITTED" occurred by the fact that the related PDU session becomes ACTIVE.

Figure 4.2.2.2-1 illustrates the notification about subscribed events.

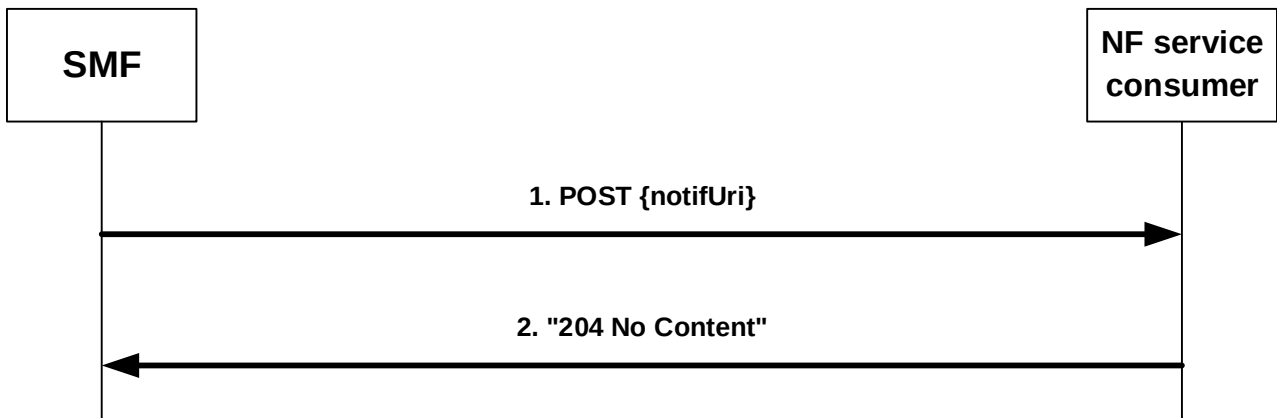


Figure 4.2.2.2-1: Notification about subscribed events

If the SMF observes PDU Session related event(s) for which an NF service consumer has subscribed, the SMF shall send an HTTP POST request with "{notifUri}", as previously provided by the NF service consumer within the corresponding subscription, as URI and NsmfEventExposureNotification data structure as request body that shall include:

- Notification correlation ID provided by the NF service consumer during the subscription, or as provided by the PCF for implicit subscription of UP path change traffic correlation, and/or traffic routing requirement installation outcome, and/or simultaneous connectivity failure as defined in clause 4.2.6.2.6.2 of 3GPP TS 29.512 [14], or as provided by the PCF for implicit subscription of QoS Monitoring as defined in clause 4.2.3.25 of 3GPP TS 29.512 [14], or as provided by the V-NEF for implicit subscription of UP path change as defined in clause 4.4.2.4.2 of 3GPP TS 29.591 [25], as "notifId" attribute; and
- information about the observed event(s) within the "eventNotifs" attribute that shall contain for each observed event an "EventNotification" data structure that shall include:
 1. the Event Trigger as "event" attribute, and if the "EnhEventMgmt" feature is supported and optionally, a reference identifier within the "referenceId" attribute;
 2. for a UP path change notification:
 - a) type of notification ("EARLY" or "LATE") as "dnaiChgType" attribute;
 - b) source DNAI and/or target DNAI as "sourceDnai" attribute and "targetDnai" attribute if DNAI is changed, respectively; and
 - c) if the PDU Session type is IP, for the source DNAI IP address/prefix of the UE as "sourceUeIpv4Addr" attribute or "sourceUeIpv6Prefix" attribute; and
 - d) if the PDU Session type is IP, for the target DNAI IP address/prefix of the UE as "targetUeIpv4Addr" attribute or "targetUeIpv6Prefix" attribute;
 - e) if available, for the source DNAI, N6 traffic routing information related to the UE as "sourceTraRouting" attribute;

- f) if available, for the target DNAI, N6 traffic routing information related to the UE as "targetTraRouting" attribute;
- g) if the PDU Session type is Ethernet, the MAC address of the UE in the "ueMac" attribute;
- h) if the "CommonEASDNAI" feature is supported,
 - the candidate DNAI(s) for the PDU Session in "candidateDnais" attribute, optionally together with the indication of their prioritization within the "candDnaisPrioInd" attribute, if the "candDnaiInd" attribute was set to "true" in the PCC rule(s); or
 - the indication of EAS re-discovery in "easRediscoverInd" attribute if EAS re-discovery took place.

NOTE 1: In this release, when SMF acting as the I-SMF based on the Local Offloading Management does not cover common DNAI/EAS selection.

- i) if both the SMF and the NF service consumer support "ULBuffering" and/or "EASIPreplacement" features, these supported features within the "supportedFeatures" attribute.

NOTE 2: The SMF gets the knowledge of the feature supported by the NF service consumer as described in clause 5.8.

- j) if the "EasRelocationEnh" feature is supported and the SMF determines that the target DNAI is supported by an AF different to the one that shall receive this notification, the identifier of the target AF that supports this DNAI in the "targetAfid" attribute.

NOTE 3: The SMF can determine that the target DNAI is supported by an AF different to the one that shall receive this notification by comparing the AF ID of the EAS Deployment Information entry that contains the old DNAI with the AF ID of the EAS Deployment Information entry that contains the target DNAI. These EAS Deployment Information entries are received via the Nnef_EASDeployment API defined in 3GPP TS 29.591 [25].

- k) if the "HR-SBO" feature is supported and the SMF determines that the UE has moved to a serving PLMN in which local traffic offload is allowed, the identifier of this new serving PLMN within the "plmnId" attribute, as well as the DNN and S-SNSSAI of the HPLMN within the "dnn" and "snssai" attributes, respectively.

NOTE 4: UP path change notification, i.e. DNAI change notification and/or N6 traffic routing information change notification, can be the result of an implicit subscription of the PCF on behalf of the NEF/AF as part of setting PCC rule(s) via the Npcf_SMPolicyControl service (see clause 4.2.6.2.6.2 of 3GPP TS 29.512 [14]).

NOTE 5: If the DNAI is not changed while the N6 traffic routing information change, the source DNAI and target DNAI are not provided.

NOTE 6: The change from the UP path status where no DNAI applies to a status where a DNAI applies indicates the activation of the related AF request and therefore only the target DNAI and N6 traffic routing information is provided in the event notification; the change from the UP path status where a DNAI applies to a status where no DNAI applies indicates the de-activation of the related AF request and therefore only the source DNAI and N6 traffic routing information is provided in the event notification.

NOTE 7: UP path change notification, i.e. DNAI change notification can be the result of an implicit subscription of the PCF on behalf of the AF as part of setting PCC rule(s) in case of UE-Satellite-UE communication in IMS via the Npcf_SMPolicyControl service (see clause 4.2.6.2.6.2 of 3GPP TS 29.512 [14]). The event that satellite identifier serving the UE has changed is represented by the event a DNAI has changed and the DNAI value can be derived from the satellite identifier as per operator policy and implementation.

3. for a UE IP address change:

- a) added new UE IP address or prefix as "adIpv4Addr" attribute or "adIpv6Prefix" attribute, respectively; and/or
- b) released UE IP address or prefix as "reIpv4Addr" attribute or "reIpv6Prefix" attribute, respectively;

4. for an access type change:

- a) new access type as "accType" attribute;
 - 5. for a PLMN Change:
 - a) new PLMN as "plmnId" attribute;
 - 6. for a PDU Session Release:
 - a) ID of the released PDU session as "pduSeId" attribute;
 - b) DNN of the released PDU session as "dnn" attribute, if the "PduSessionStatus" feature is supported;
 - c) the type of the released PDU session as "pduSessType" attribute, if the "PduSessionStatus" feature is supported;
 - d) UE IPv4 address as "ipv4Addr" attribute and/or IPv6 information (IPv6 prefix(es) or IPv6 address(es)) as "ipv6Prefixes" or "ipv6Addrs" attributes, if the released PDU session type is IP and the "PduSessionStatus" feature is supported;
 - e) S-NSSAI of the released PDU session as "snssai" attribute, if the "EneNA" feature is supported and "snssai" attribute is present in the subscribed "NsmfEventExposure" data type; and
 - f) the current RAT Type of the released PDU Session, if available and the "EnPduSesRatType" feature is supported.
 - 7. the time at which the event was observed encoded as "timeStamp" attribute;
 - 8. the SUPI as the "supi" attribute if the subscription applies to a group of UE(s) or any UE. If the "WlanPerformanceExt_AIML" feature is supported, the "supi" attribute may also be included for a single UE when the subscription applies to the "WLAN_INFO" event;
 - 9. if available, the GPSI as the "gpsi" attribute if the subscription applies to a group of UE(s) or any UE;
 - 10. for a Downlink Data Delivery Status, if the "DownlinkDataDeliveryStatus" feature is supported:
 - a) the downlink data delivery status as "dddStatus" attribute;
 - b) the downlink data descriptors impacted by the downlink data delivery status change within the "dddTraDescriptor" attribute; and
 - c) for downlink data delivery status "BUFFERED". the estimated maximum waiting time as "maxWaitTime" attribute;
 - 11. for a Communication Failure, if the "CommunicationFailure" feature is supported:
 - a) the detailed communication failure information (e.g. 5G SM cause) as "commFailure" attribute; and
 - 12. for QoS Monitoring event, if the "QoSMonitoring" feature is supported:
 - a) the uplink packet delays within the "ulDelays" attribute; and/or
 - b) the downlink packet delays within the "dlDelays" attribute; and/or
 - c) the round trip packet delays within the "rtDelays" attribute; or
- NOTE 8: The UPF reports one UL, DL and/or round-trip packet delay measurement for each periodic and/or event-triggered report as described in 3GPP TS 29.244 [23]. i.e, the SMF can include only one element within the "ulDelays", "dlDelays", and/or "rtDelays" array(s), each one with the received report from the UPF for the UL, DL and/or round trip delay(s).
- d) if the feature "PacketDelayFailureReport" is supported, the packet delay measurement failure indicator within the "pdmf" attribute; and/or
 - e) if the feature "EnQoSMon" is supported, UL and/or DL congestion information within the "ulCongInfo" attribute and "dlCongInfo" attribute; and/or

- f) if the feature "EnQoSMon" is supported, UL and/or DL data rate measurement within the "ulDataRate" attribute and/or "dlDataRate" attribute.

NOTE 9: The SMF gets the knowledge of the NF service consumer support of "QoSMonitoring", "PacketDelayFailureReport" and "EnQoSMon" features as described in 3GPP TS 29.512 [14].

NOTE 10: QoS Monitoring notification can be the result of an implicit subscription of the PCF on behalf of the NEF/AF as part of setting PCC rule(s) via the Npcf_SMPolicyControl service (see clause 4.2.3.25 of 3GPP TS 29.512 [14]).

13. for a PDU Session Establishment, if the "PduSessionStatus" feature is supported:

- a) ID of the established PDU session as "pduSeId" attribute;
- b) DNN of the established PDU session as "dnn" attribute;
- c) the type of the established PDU session as "pduSessType" attribute;
- d) UE IPv4 address as "ipv4Addr" attribute and/or IPv6 information (IPv6 prefix(es) or IPv6 address(es)) as "ipv6Prefixes" or "ipv6Addrs" attributes if available at PDU session establishment; and
- e) S-NSSAI of the established PDU session as "snssai" attribute, if the "EneNA" feature is supported and "snssai" attribute is present in the subscribed "NsmfEventExposure" data type; and
- f) the current RAT Type of the established PDU Session, if available and the "EnPduSesRatType" feature is supported.

14. for a QFI allocation, if the "QfiAllocation" feature is supported, or for a QFI deallocation or a QoS flow change if the "QoSAssistance" feature is supported:

- a) QFI of the allocated QoS Flow ID for the application as "qfi" attribute or, if the "EnQfiAllocation" feature is also supported, the 5QI of the allocated QoS Flow ID for the application as "5qi" attribute;
- b) DNN of the allocated PDU session as "dnn" attribute;
- c) Slice of the allocated PDU session as "snssai" attribute;
- d) The description of the application traffic as "appId", "fDescs" or "ethfDescs" attribute; and
- e) ID of the allocated PDU session as "pduSeId" attribute if the subscription was for a UE, a group of UEs, or any UE, and not for a specific PDU Session;
- f) To obtain the PDU Session information, if the "PduSessionInfo" feature is supported:
 - i) the information about the UE access type provided as "accessType" attribute;
 - ii) the information about the PDU Session Type in the "pduSessType" attribute and/or the SSC mode in the "sscMode" attribute associated with the application provided as "appId" attribute; and/or
 - iii) the information about the PDU Session associated list of access types as "pduAccTypes" attribute, if the "MultipleAccessTypes" feature is also supported.
- g) if the "QoSAssistance" feature is supported, the QoS parameters of the QoS flow in the "qosPara" attribute.

15. for an RAT type change event, if the "EneNA" feature and/or "EnPduSesRatType" feature is supported:

- a) new RAT type as "ratType" attribute;

16. for a SM congestion control experience for PDU Session, if the "SMCCE" feature is supported:

- a) DNN of the PDU session as "dnn" attribute if DNN based SMCC is applied
or Slice of the allocated PDU session as "snssai" attribute if S-NSSAI based SMCC is applied;
- b) Time window representing a start time and a stop time of the data collection period as "timeWindow" attribute;

- c) The information of the SM NAS requests from UE as "smNasFromUe" attribute when only one message is included in the time window, and the additional message(s) in the "addSmNasFromUes" attribute with the "SMCCE_Ext" feature support when multiple messages are included in the time window; and
- d) The information of the SM NAS messages from SMF with backoff timer as "smNasFromSmf" attribute when only one message is included in the time window, and the additional messages(s) in the "addSmNasFromSmfs" attribute with the "SMCCE_Ext" feature support when multiple messages are included in the time window;

17. for transactions dispersion collection, if the Dispersion feature is supported:

- a) The transactions dispersion information collected as "transacInfos" attribute; and
- b) The UE IP address as "ueIpAddr" attribute if it is available and requested in the subscription;

18. for redundant transmission experience of PDU Session, if the "RedundantTransmissionExp" feature is supported:

- a) DNN associated with URLLC service for the PDU session as "dnn" attribute; and
- b) UP with redundant transmission setup as "upRedTrans" attribute;

19. for WLAN information on PDU Session, if the "WlanPerformance" feature is supported:

- a) SSID or BSSID that the PDU session is related to as "ssid" or "bssid" attribute; and
- b) start time or end time of the PDU Session for WLAN as "startWlan" or "endWlan" attribute;

20. for obtaining the UPF information, if the "ServiceExperience" and/or "DnPerformance" feature is supported:

- a) the information of the UPF serving the UE provided as "upfInfo" attribute.

21. for obtaining the User Plane status information, if the "UeCommunication" feature is supported:

- a) the information about the User Plane status provided as "pduSessInfos" attribute.

22. for a satellite backhaul category change, if the "EnSatBackhaulCategoryChg" feature is supported:

- a) satellite backhaul category as "satBackhaulCat" attribute.

23. for traffic correlation, if the "CommonEASDNAI" feature is supported:

- a) the traffic correlation information in the "trafCorreInfo" attribute, if the "notifUri" attribute, "notifCorrId" attribute and "tfcCorrId" attribute are provided in the PCC rule, and the common EAS is not provided in the PCC rule or the SMF decides to trigger EAS discovery for the set of UE(s).

NOTE 11: Traffic correlation notification can be the result of an implicit subscription of the PCF on behalf of the NEF as part of setting PCC rule(s) via the Npcf_SMPolicyControl service (see clause 4.2.6.2.6.2 of 3GPP TS 29.512 [14]).

- an URI for further AF acknowledgement in the "ackUri" attribute if the SMF determines to wait for the AF acknowledgement before activating the new UP path associated with the new DNAI.

NOTE 12: Based on the indication of AF acknowledgment to be expected in the PCC rules received from the PCF and local configuration, the SMF may determine to wait for the AF acknowledgement before activating the new UP path associated with the new DNAI.

24. for a traffic route requirement installation outcome notification, if the "TraffRouteReqOutcome" feature is supported:

- a) the information indicating the installation outcome of the traffic routing requirements within the "traffRouteReqOutcome" attribute.
- b) the source DNAI and/or target DNAI within the "sourceDnai" attribute and "targetDnai" attribute respectively, if the DNAI is changed;

- c) if available, for the source DNAI, the N6 traffic routing information related to the UE within the "sourceTraRouting" attribute; and
- d) if available, for the target DNAI, the N6 traffic routing information related to the UE within the "targetTraRouting" attribute;

NOTE 13: The Traffic Routing Requirement Installation Outcome Notification i.e. N6 traffic routing requirements installation outcome, can be the result of an implicit subscription of the PCF on behalf of the NEF/AF as part of setting PCC rule(s) via the Npcf_SMPolicyControl service (see clause 4.2.6.2.6.2 of 3GPP TS 29.512 [14]).

25. for a simultaneous connectivity failure notification, if the "SimConnFailure" feature is supported:

- a) the source DNAI and/or target DNAI within the "sourceDnai" attribute and "targetDnai" attribute respectively, if the DNAI is changed;

NOTE 14: The Simultaneous Connectivity Failure Notification can be the result of an implicit subscription of the PCF on behalf of the NEF/AF as part of setting PCC rule(s) via the Npcf_SMPolicyControl service (see clause 4.2.6.2.6.2 of 3GPP TS 29.512 [14]).

26. for the Energy Consumption Information event, if the "Energy" feature is supported:

- a) the list of the Data Volume information set(s) within the "dataVolInfoData" attribute, which shall include for each set the UL/DL Data Volume and the associated (I-)UPF ID(s), and may include the associated gNB ID;
- b) the SMF only reports the Energy Consumption Information of the UP resources for the PDU sessions of the UE that are over the 3GPP access;
- c) if the PDU session (or the PDN connection over EPS, if handled at an SMF+PGW-C) is over non-3GPP access, the data volume shall be set to 0 and the gNB ID information shall not be provided;
- d) in the case of MA PDU sessions, the SMF shall not include in the report the UL/DL Data volume related to the traffic over the Non-3GPP access leg, and the serving gNB ID, if provided, corresponds to the traffic over the 3GPP access leg;
- e) in case Network Slice Replacement takes place for the S-NSSAI of the PDU session with the initial S-NSSAI replaced by an Alternative S-NSSAI without PDU session re-establishment, the SMF continues the reporting and includes in the reports the Energy Consumption Information of the Alternative S-NSSAI; and
- f) in case all the PDU session(s) related to the Energy Consumption Information event subscription are released, the SMF shall terminate the Energy Consumption Information event subscription and inform the NF service consumer by including the "terminationInd" attribute set to "true", optionally together with the "terminationCause" attribute set to "PDU_SESSION_RELEASE";

27. for signalling information, if the "SignallingInfo" feature is supported:

- a) the usage information of UE IP address resources as "usageInfo" attribute;
- b) the load information of connected UPFs as "loadInfos" attribute;
- c) the number of received Session Report from UPF as "numSessRep" attribute;
- d) the session-related state transitions as "stateTransitions" attribute;
- e) the signalling information of the SMF as "nfSignalInfo" attribute; and/or
- f) the UE-associated SMF timers as "smfTimers" attribute.

Upon the reception of an HTTP POST request with "{notifUri}" as URI and an NsmfEventExposureNotification data structure as request body, the notified NF shall send an HTTP "204 No Content" response for a successful processing.

If errors occur when processing the HTTP POST request, the notified NF shall send the HTTP error response as specified in clause 5.7.

If the feature "ES3XX" is not supported and,

- if the notified NF is not able to handle the Notification but another unknown NF could possibly handle the notification, it shall reply with an HTTP "404 Not found" error response.

NOTE 15: An AMF as NF service consumer and/or notified NF can change.

- if the SMF becomes aware that a new NF service consumer is requiring notifications (e.g. via the "404 Not found" response, or via Namf_Communication service AMFStatusChange Notifications, see 3GPP TS 29.518 [13], or via link level failures or via the Nnrf_NFDiscovery Service (using the service name and GUAMI obtained during the creation of the subscription) to discover the other AMFs within the AMF set) specified in 3GPP TS 29.510 [12]), and the SMF knows alternate or backup IPv4 Address(es), IPv6 Address(es) or FQDN(s) where to send Notifications (e.g. via "altNotifIpv4Adrs", "altNotifIpv6Adrs" or "altNotifFqdns" attributes received when the subscription was created), the SMF shall exchange the authority part of the Notification URI with one of those addresses and shall use that URI in any subsequent communication. If the SMF received a "404 Not found" response, the SMF should resend the failed notification to that URI.

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

- if the SMF receives a "307 Temporary Redirect" response, the SMF shall resend the failed event notification request using the received URI in the Location header field as Notification URI. Subsequent event notifications, triggered after the failed one, shall be sent to the Notification URI provided by the NF service consumer during the corresponding subscription creation/update; or
- if the SMF receives a "308 Permanent Redirect" response, the SMF shall resend the failed event notification request and send the subsequent event notification using the received URI in the Location header field as Notification URI.

If the SMF in the VPLMN needs to send an event notification to the NEF in the HPLMN, it may normalize the event based on roaming agreements when required before provisioning the event report to the NEF of the HPLMN.

NOTE 16: void.

4.2.3 Nsmf_EventExposure_Subscribe Service Operation

4.2.3.1 General

This service operation is used by an NF service consumer to subscribe to event notifications on a specific PDU Session, or for all PDU Sessions of one UE, group of UE(s) or any UE, or to modify an existing subscription.

The following procedures using the Nsmf_EventExposure_Subscribe service operation are supported:

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

4.2.3.2 Creating a new subscription

Figure 4.2.3.2-1 illustrates the creation of a subscription.

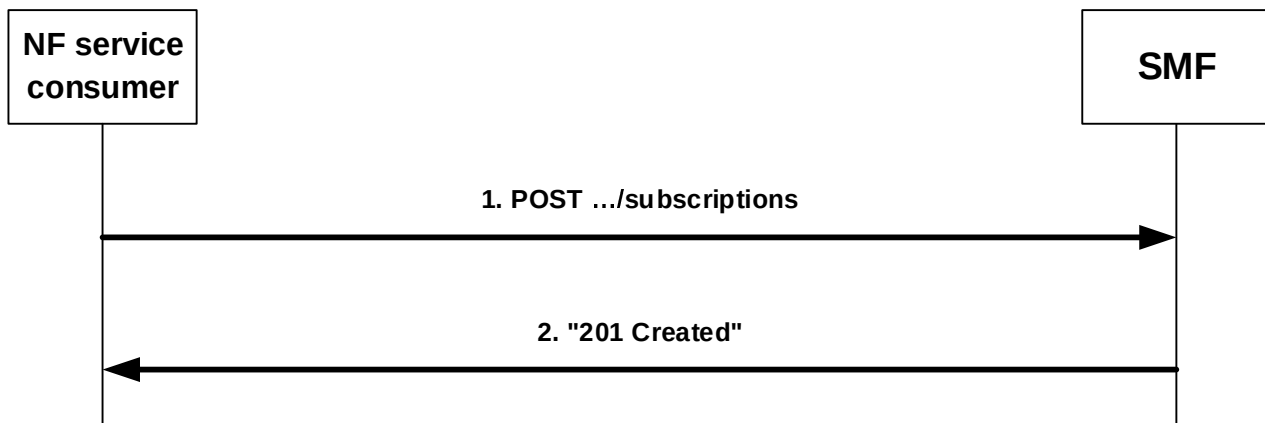


Figure 4.2.3.2-1: Creation of a subscription

To subscribe to event notifications, the NF service consumer shall send an HTTP POST request with: "{apiRoot}/nsmf-event-exposure/v1/subscriptions" as Resource URI and the NsmfEventExposure data structure as request body that shall include:

- if the subscription applies to events related to a single PDU session for a UE, the PDU Session ID of that PDU session as "pduSeId" attribute and the UE identification as "supi" or "gpsi" attribute;
- if the subscription applies to events not related to a single PDU session, the Network Function instance identity if "UPEAS" feature is supported and the "eventSubs" attribute contains an entry with the "event" set to the value "UPF_EVENT", and identification of UEs to which the subscription applies via:
 - a) identification of a single UE by SUPI as "supi" attribute or GPSI as "gpsi" attribute;
 - b) identification of a group of UE(s) via a "groupId" attribute; or
 - c) identification of any UE via the "anyUeInd" attribute set to true;

NOTE 1: The identification of any UE does not apply for local breakout roaming scenarios where the SMF is located in the VPLMN and the NF service consumer is located in the HPLMN.

- if the "EnergySys" feature is supported and the "eventSubs" attribute contains an entry with the "event" attribute set to the value "ENERGY_USAGE_DATA", the identification of UE to which the subscription applies via:
 - a) identification of a single UE by SUPI as "supi" attribute;
- an URI where to receive the requested notifications as "notifUri" attribute;
- a Notification Correlation Identifier provided by the NF service consumer for the requested notifications as "notifId" attribute; and
- if the NF service consumer is an AMF, the GUAMI encoded as "guami" attribute;
- a description of the subscribed events as "eventSubs" attribute that for each event shall include:
 - a) an event identifier as "event" attribute; and
 - b) for event "UP_PATH_CH", whether the subscription is for early, late, or early and late notifications of UP path reconfiguration in the "dnaiChgType" attribute;
 - c) for event "DDDS", the traffic descriptor(s) of the downlink data source in the "dddTraDescriptors" attribute; and that may include:
 - a) for event "DDDS", the subscribed delivery statuses in the "dddStati" attribute;
 - b) for event "QFI_ALLOC", "QFI_DEALLOCATION", "QOS_FLOW_CHANGE", or "DISPERSION", the application identifiers in the "appIds" attribute;
 - c) for event "SMCC_EXP", the data collection target period in the "targetPeriod" attribute;

- d) for event "DISPERSION", the UE IP Address in the "ueIpAddr" attribute, the indication of transaction dispersion collection in the "transacDispInd" attribute and the requested transaction metrics in the "transacMetrics" attribute;
- e) for event "WLAN_INFO", the data collection target period in the "targetPeriod" attribute;
- f) for event "RED_TRANS_EXP", the data collection target period in the "targetPeriod" attribute;
- g) for event "UPF_EVENT", the UPF event exposure information in the "upfEvents" attribute. If the "BERMS" feature is supported, it may also provide an indication that the bundling of event reports in UPF notifications is requested to be allowed by including the "bundlingAllowed" attribute set to "true", optionally together with a notification URI for bundled notifications within the "bundledEventNotifyUri" attribute, and a bundling identifier within the "bundleId" attribute;

NOTE 2: The SMF uses the attributes related to notification bundling to set the equivalent attributes of Nupf_EventExposure when it later invokes this service, and the UPF handles these attributes to perform notification bundling as described in 3GPP TS 29.564 [26] clauses 5.2.2.2.2 and 5.2.2.3.4.

- h) for event "QOS_MON", the Application Identifier in the "appIds" of the application for which the QoS flows are to be monitored and an indication within the "defQosSupp" attribute to inform whether the NF service consumer supports to receive QoS Flow performance information for the QoS Flow associated with the default QoS rule if there are no measurements available for the provided Application Identifier included within the "appIds" attribute;
- i) for the "ENERGY_USAGE_DATA" event, the identifier of the application within the "appIds" or the service data flow information within the "flowDescs", for which the uplink/downlink data volume information is collected and notified;

NOTE 2A: The user-plane Energy Consumption Information reporting interval used by the involved SMF(s) is the network-wide configurable starting time and interval T.

- j) for the "SIGNALLING_INFO" event, the time windows for which the NF service consumer is requesting to receive signalling information in the "tw" attribute if the "SignallingInfo" feature is supported; and/or
- k) a reference identifier within the "referenceId" attribute, if the "EnhEventMgmt" feature is supported.

NOTE 3: Explicit subscription to "UPF_EVENT" and "QOS_MON" events as described in this clause implies the direct notification from the UPF as specified in 3GPP TS 29.564 [26].

NOTE 4: Void.

The NsmfEventExposure data structure as request body may also include:

- if the NF service consumer is an AMF:
 - a) the name of a service produced by the AMF that expects to receive the notifications about subscribed events encoded as "serviceName" attribute;
 - b) Alternate or backup IPv4 Address(es) where to send Notifications encoded as "altNotifIpv4Addrs" attribute;
 - c) Alternate or backup IPv6 Address(es) where to send Notifications encoded as "altNotifIpv6Addrs" attribute;
 - d) Alternate or backup FQDN(s) where to send Notifications encoded as "altNotifFqdns" attribute;
- a Data Network Name as "dnn" attribute;
- a single Network Slice Selection Assistance Information as "snssai" attribute;
- an identification of network area by "networkArea" attribute, if the feature AreaFilter or the feature UPEAS is supported and the "anyUeInd" attribute is provided and set to true;

NOTE 5: Care needs to be taken with regards to load and major signalling caused when requesting Any UE. This could be achieved via utilization of some event filters (e.g. Area of Interest), a specific DNN, S-NSSAI or sampling ratio as part of Event Reporting Information.

- a Data Network Identifier as "dnai" attribute, if the feature UPEAS is supported;

- the SSID that the PDU session is related to as "ssid" attribute, if the feature UPEAS is supported;
- the BSSID that the PDU session is related to as "bssid" attribute, if the feature UPEAS is supported;
- the UPF identifier as "upfId" attribute, if the feature UPEAS is supported;
- immediate reporting flag as "ImmeRep" attribute;

NOTE 6: For the "PDU_SES_EST" event subscription, the "ImmeRep" attribute needs to be included to enable the SMF to report the current available "PDU_SES_EST" event information for the subscribed PDU Session which is already established.

- event notification method (periodic, one time, on event detection) as "notifMethod" attribute;
- maximum Number of Reports as "maxReportNbr" attribute;
- monitoring Duration as "expiry" attribute;
- repetition Period for periodic reporting as "repPeriod" attribute;
- sampling ratio as "sampRatio" attribute;
- partitioning criteria for partitioning the UEs before performing sampling as "partitionCriteria" attribute if the EneNA feature is supported;
- group reporting guard time as "grpRepTime" attribute;
- a notification flag as "notifFlag" attribute if the EneNA feature is supported;
- notification muting exception instructions within the "notifFlagInstruct" attribute, if the EnhDataMgmt feature is supported and the "notifFlag" attribute is provided and set to "DEACTIVATE";
- UDR Restart Indication as "udrRestartInd" attribute; if the "UDRRestProc" feature is supported; and/or
- if the "EnergySys" feature is supported and the "eventSubs" attribute contains an entry with the "event" attribute set to the value "ENERGY_USAGE_DATA":
 - the S-NSSAI within the "snssai" attribute; and/or
 - the DNN within the "dnn" attribute.

Upon the reception of an HTTP POST request with: "{apiRoot}/nsmf-event-exposure/v1/subscriptions" as Resource URI and NsmfEventExposure data structure as request body, the SMF shall:

- create a new subscription;
- assign a subscription correlation ID;
- select an expiry time that is equal to or less than the expiry time potentially received in the request;
- store the subscription;
- if the feature "UPEAS" is supported, and if the NF service consumer subscribed to "QOS_MON" event, the SMF shall check if there is an active PCC rule that includes a Data Collection Application Identifier as described in 3GPP TS 29.512 [14] that matches the Application Identifier received within "appIds" attribute. If there is an active PCC rule, the SMF shall allow the NF service consumer to receive QoS monitoring reports enabled by that PCC rule. If no PCC rule is identified and the "defQosSupp" attribute was received and set to true, the SMF may instruct the UPF to perform QoS monitoring for the QoS Flow associated to the default QoS rule as described in 3GPP TS 29.244 [23]. If no PCC rule is identified and the "defQosSupp" attribute was received and set to false or not received, the SMF may, based on local configuration, reject the request by sending the NO_ACTIVE_PCC_RULE error described in clause 5.7 or include the "qosMonPending" indication set to true in the response to inform the NF service consumer that the reporting will be activated when the measurements are enabled by a PCC rule;

NOTE 7: The reporting can be activated when a new PCC rule is installed or an existing one is modified with QoS monitoring information that includes the Data Collection Application Identifier related to the subscription. In this case the SMF will act as if the new subscription is received from the NF service consumer.

- if the feature "UPEAS" is supported and the "upfEvents" attribute is provided, the SMF shall subscribe to the UPF for the respective UPF events as described in 3GPP TS 29.564 [26]. If the "upfEvents" attribute is provided together with the "networkArea" attribute in the EventSubscription data type, the SMF shall subscribe to the UPF for the respective UPF events only when the UE is located in the indicated area. When the UE leaves the indicated area, the SMF shall unsubscribe those events from the UPF as described in 3GPP TS 29.564 [26].

NOTE 8: To know when a UE enters or leaves the indicated area, the SMF can subscribe to the respective AMF Event Exposure event.

- if the feature "EnUPEAS" is supported, and the "remainingDataReports" attribute within the "upfEvents" attribute is provided, the SMF shall forward the remaining data reporting indication to the UPF for the respective UPF events as described in 3GPP TS 29.564 [26].
- when the "Energy" feature is supported and the NF service consumer has subscribed to the "ENERGY_USAGE_DATA" event and provided target application traffic related information, either in the form of an identifier of the target application traffic within the "appIds" attribute or the target service data flow information within the "flowDescs" attribute, for which the requested uplink/downlink data volume information collection and reporting is requested, then if the received target application identifier or target service data flow information cannot be matched to the corresponding PCC rule(s) by the SMF:
 - the SMF may, based on local configuration, map the received application identifier within the "appIds" attribute or service data flow information within the "flowDescs" attribute to the corresponding PCC rule(s); or
 - if such mapping based on local configuration is not possible, the SMF may be unable to determine the matching or overlapping PCC rule(s) and PDR(s) and may reject the subscription to this event by sending the "APP_TRAFFIC_MISMATCH_ISSUE" application error as defined in clause 5.7;
- send an HTTP "201 Created" response with NsmfEventExposure data structure as response body and a Location header field containing the URI of the created individual subscription resource, i.e. "{apiRoot}/nsmf-event-exposure/v1/subscriptions/{subId}";
- if the feature "ERIR" is not supported, and if the "ImmeRep" attribute is included and set to true in the request, the SMF shall immediately notify the recipient of notification(s) subscribed in the "notifUri" attribute of the current available value(s) using the Nsmf_EventExposure_Notify service operation, as defined in clause 4.2.2.1;
- if the feature "ERIR" is supported, and if the "ImmeRep" attribute is included and set to true, the SMF may immediately notify the NF service consumer with the current available value(s) for the subscribed event(s) within the HTTP "201 Created" response as shown in figure 4.2.3.2-1, step 2. The "NsmfEventExposure" data type in the response may include the corresponding event(s) notification within the "eventNotifs" attribute.
- if the sampling ratio attribute, as "sampRatio", is included in the subscription without a "partitionCriteria" attribute, the SMF shall select a random subset of UEs among the target UEs according to the sampling ratio and only report the event(s) related to the selected subset of UEs. If the "partitionCriteria" attribute is additionally included, then the SMF shall first partition the UEs according to the value of the "partitionCriteria" attribute and then select a random subset of UEs from each partition according to the sampling ratio and only report the event(s) related to the selected subsets of UEs;
- when the group reporting guard time attribute, as "grpRepTime", is included in the subscription, the SMF shall accumulate all the event reports for the target UEs until the group reporting guard time expires. Then the SMF shall notify the NF service consumer using the Nsmf_EventExposure_Notify service operation, as described in clause 4.2.2.2; and
- if the "notifFlag" attribute is included and set to "DEACTIVATE" in the request, the SMF shall mute the event notification and store the available events until the NF service consumer requests to retrieve them by setting the "notifFlag" attribute to "RETRIEVAL" or until a muting exception occurs (e.g. full buffer). When a muting exception occurs, the SMF may consider the contents of the "notifFlagInstruct" attribute (if provided) and/or local configuration to determine its actions. If the EnhDataMgmt feature is supported and the SMF accepts the muting instructions provided in the "notifFlag" and/or the "notifFlagInstruct" attributes, it may indicate the

applied muting notification settings within the "mutingSetting" attribute in the response. If the SMF does not accept the muting instructions provided in the "notifFlag" and/or the "notifFlagInstruct" attributes, it shall send an HTTP "403 Forbidden" error response including the "cause" attribute set to "MUTING_INSTR_NOT_ACCEPTED"; and

- if the "UDRRestProc" feature is supported, the "udrRestartInd" attribute was provided and set to "true" in the corresponding request and the SMF determines that there is an existing identical "Individual SMF Notification Subscription" resource, then the SMF shall not create a new subscription and shall return within the response body of the HTTP "201 Created" status code the NsmfEventExposure data structure including the representation of this existing identical resource, and a Location header field containing the URI of this existing identical resource.

If the SMF received an GUAMI, the SMF may subscribe to GUAMI changes using the AMFStatusChange service operation of the Namf_Communication service specified in 3GPP TS 29.518 [13], and it may use the Nnrf_NFDiscovery Service specified in 3GPP TS 29.510 [12] (using the obtained GUAMI and possibly service name) to query the other AMFs within the AMF set.

If errors occur when processing the HTTP POST request, the SMF shall send an HTTP error response as specified in clause 5.7.

4.2.3.3 Modifying an existing subscription

Figure 4.2.3.3-1 illustrates the modification of an existing subscription.

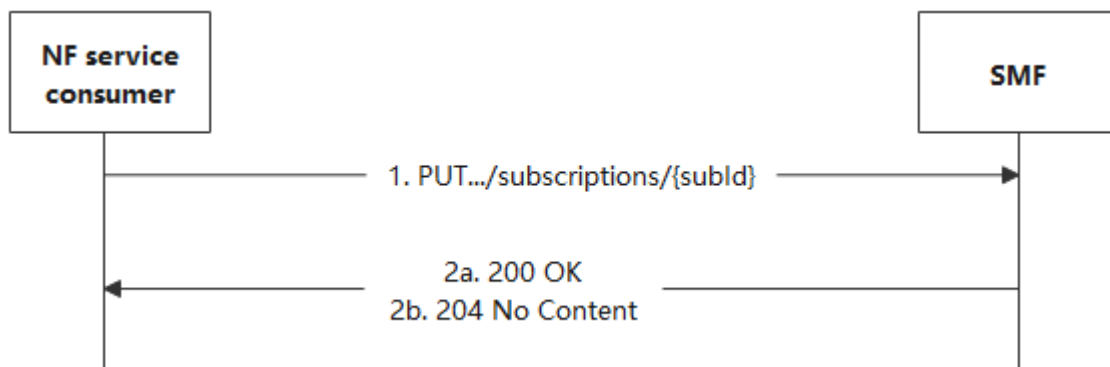


Figure 4.2.3.3-1: Modification of an existing subscription

To modify an existing subscription to event notifications, the NF service consumer shall send an HTTP PUT request with: "{apiRoot}/nsmf-event-exposure/v1/subscriptions/{subId}" as Resource URI, where "{subId}" is the subscription correlation ID of the existing subscription, and NsmfEventExposure data structure as request body as described in clause 4.2.3.2.

NOTE 1: An alternate NF service consumer than the one that requested the generation of the subscription resource can send the PUT. For instance, an AMF as NF service consumer can change.

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

When the "notifFlag" attribute is included and set to "DEACTIVATE" in the request, the SMF shall mute the event notification and store the available events until the NF service consumer requests to retrieve them by setting the "notifFlag" attribute to "RETRIEVAL" or until a muting exception occurs (e.g. full buffer). When a muting exception occurs, the SMF may consider the contents of the "notifFlagInstruct" attribute (if provided) and/or local configuration to determine its actions; if the "notifFlag" attribute is set to "RETRIEVAL" in the request, the SMF shall send the stored events to the NF service consumer, mute the event notification again and store available events; if the "notifFlag" attribute is set to "ACTIVATE" and the event notifications are muted (due to a previously received "DECATIVATE" value), the SMF shall unmute the event notification, i.e. start sending again notifications for available events. If the EnhDataMgmt feature is supported and the SMF accepts the muting instructions provided in the "notifFlag" and/or the "notifFlagInstruct" attributes, it may indicate the applied muting notification settings within the "mutingSetting" attribute in the response. If the SMF does not accept the muting instructions provided in the "notifFlag" and/or the

"notifFlagInstruct" attributes, it shall send an HTTP "403 Forbidden" error response including the "cause" attribute set to "MUTING_INSTR_NOT_ACCEPTED".

When the "ImmeRep" attribute set to true is included in the subscription and the subscribed event(s) are available:

- if the feature "ERIR" is not supported, the SMF shall immediately notify the in the "notifUri" attribute in the "notifUri" attribute with the current available value(s) for the subscribed event(s) using the Nsmf_EventExposure_Notify service operation, as described in clause 4.2.2.1.
- if the feature "ERIR" is supported, the SMF may immediately notify the NF service consumer with the current available value(s) for the subscribed event(s) within the HTTP "200 OK" response as shown in figure 4.2.3.3-1, step 2a. The "NsmfEventExposure" data type may include the corresponding event(s) notification within the "eventNotifs" attribute.

NOTE 3: Only the newly added event(s) needs to be reported during the subscription update.

NOTE 4: For the "PDU_SES_EST" event subscription, the "ImmeRep" attribute needs to be included to enable the SMF to report the current available "PDU_SES_EST" event information for the subscribed PDU Session which is already established.

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

When the "grpRepTime" attribute is included in the request, the SMF shall accumulate all the event reports for the target UEs until the group reporting guard time expires. Then the SMF shall notify the NF service consumer using the Nsmf_EventExposure_Notify service operation, as described in clause 4.2.2.2.

When the "expiry" attribute is included in the request, the SMF shall select an expiry time that is equal to or less than the expiry time received in the request.

Upon the reception of an HTTP PUT request with: "{apiRoot}/nsmf-event-exposure/v1/subscriptions/{subId}" as Resource URI and NsmfEventExposure data structure as request body, if the received HTTP request is successfully processed and accepted, the SMF shall:

- update the concerned subscription; and
- send an HTTP "200 OK" response with a response body containing a representation of the updated subscription in the NsmfEventExposure data structure or send a HTTP "204 No Content".

If errors occur when processing the HTTP PUT request, the SMF shall send an HTTP error response as specified in clause 5.7.

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

4.2.4 Nsmf_EventExposure_UnSubscribe Service Operation

4.2.4.1 General

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

The following procedure using the Nsmf_EventExposure_UnSubscribe service operation is supported:

- unsubscription from event notifications.

4.2.4.2 Unsubscription from event notifications

Figure 4.2.4.2-1 illustrates the unsubscription from event notifications.

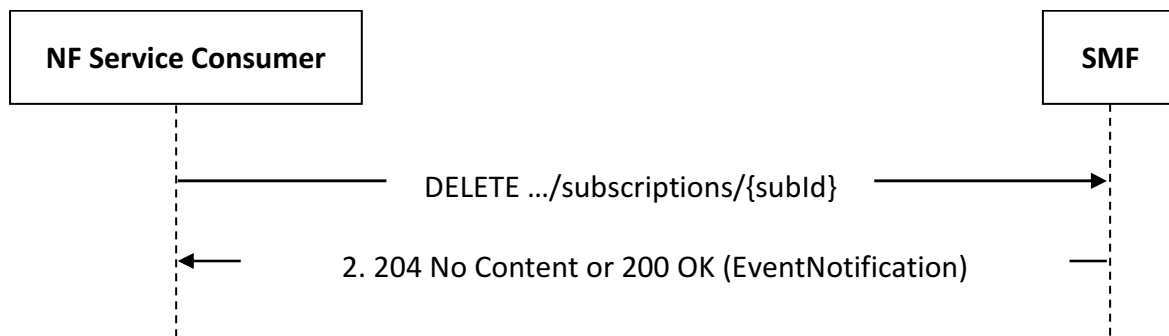


Figure 4.2.4.2-1: Unsubscription from event notifications

To unsubscribe from event notifications, the NF service consumer shall send an HTTP DELETE request with: "{apiRoot}/nsmf-event-exposure/v1/subscriptions/{subId}" as Resource URI, where "{subId}" is the subscription correlation ID of the existing subscription that is to be deleted.

Upon the reception of the HTTP DELETE request with: "{apiRoot}/nsmf-event-exposure/v1/subscriptions/{subId}" as Resource URI, if the received HTTP request is successfully processed and accepted, the SMF shall:

- remove the corresponding subscription; and
- return either:
 - an HTTP "204 No Content" status code; or
 - if the "Energy" feature is supported and the "ENERGY_USAGE_DATA" event was subscribed, an HTTP "200 OK" response with the response body containing the last notification of the Energy Consumption Information as specified in clause 4.2.2.2.

If errors occur when processing the HTTP DELETE request, the SMF shall send an HTTP error response as specified in clause 5.7.

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

4.2.5 Nsmf_EventExposure_AppRelocationInfo Service Operation

4.2.5.1 General

The Nsmf_EventExposure_AppRelocationInfo service operation enables the NF service consumer to acknowledge the notification of subscribed events on the related PDU session from the SMF.

The following procedure using the Nsmf_EventExposure_AppRelocationInfo service operation is supported:

- acknowledgement of notification about subscribed events.

4.2.5.2 Acknowledgement of Notification about subscribed events

Figure 4.2.5.2-1 illustrates the acknowledgement of notification about subscribed events.

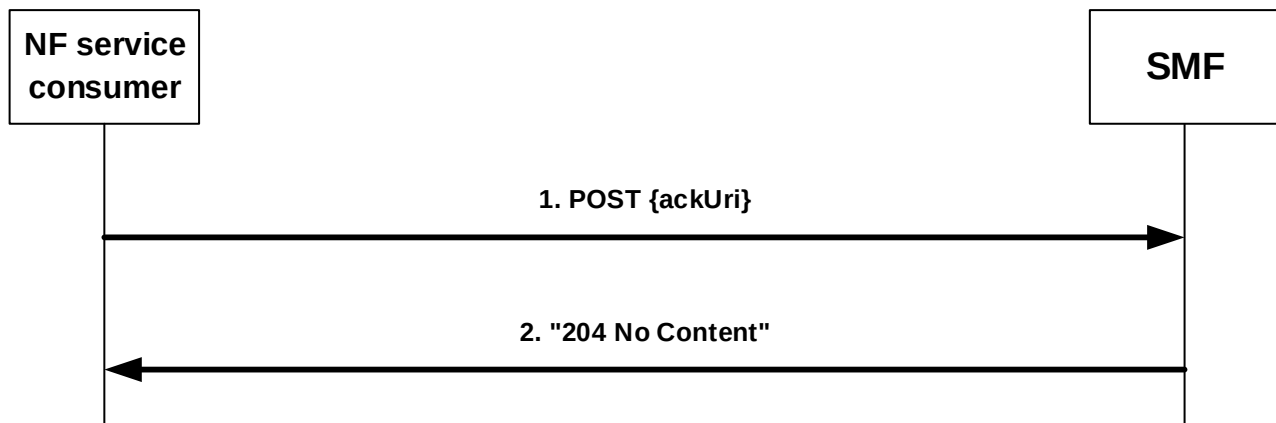


Figure 4.2.5.2-1: Acknowledgement of Notification about subscribed events

In order to acknowledge the SMF of the application relocation information after the handling of a notification about UP path change event, an NF service consumer shall send an HTTP POST request to the callback URI "{ackUri}" as previously provided by the SMF in an attribute within the NsmfEventExposureNotification data during UP path change notification procedure as defined in clause 4.2.2.2.

The request body contains the AckOfNotify data structure that shall include:

- Notification correlation ID provided by the SMF during UP path change notification, as "notifId" attribute; and
- information about the AF acknowledgement within the "ackResult" attribute that shall contain result status of the application relocation as "afStatus" attribute. If the "afStatus" attribute sets to "SUCCESS", the N6 traffic routing information associated to the target DNAI may be included as "trafficRoute" attribute and, if the "ULBuffering" feature is supported, an indication that buffering of uplink traffic to the target DNAI is needed may be included as "upBuffInd" attribute and, if the feature "EASIPreplacement" is supported, EAS IP replacement information may be included as "easIpReplaceInfos" attribute. If the application relocation is not completed on time, the "afStatus" attribute shall set to the corresponding failure cause;

and may include:

- an identifier of UE (i.e. SUPI or GPSI), if available and the subscription does not applies to a group of UE(s) or any UE; and- information about the IP address within the "remoteImsAddress" attribute to support UE-Satellite-UE communication in IMS, if available and if the feature "UeSatUeComm" is supported.

NOTE The NF service consumer gets the knowledge of the support of "ULBuffering" and/or "EASIPreplacement" negotiated features as part of the notification of the subscribed events as described in clause 4.2.2.2.

Upon the reception of an HTTP POST request with AckOfNotify data structure as request body, the SMF shall send an HTTP "204 No Content" response for a succesfull processing.

If errors occur when processing the HTTP POST request, the SMF shall send an HTTP error response as specified in clause 5.7.

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

5 Nsmf_EventExposure API

5.1 Introduction

The Session Management Event Exposure Service shall use the Nsmf_EventExposure API.

The API URI of the Nsmf_EventExposure API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests from the NF service consumer towards the SMF 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 "nsmf-event-exposure".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 5.3.

5.2 Usage of HTTP

5.2.1 General

HTTP/2, IETF RFC 9113 [8], 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 [10] specification of HTTP messages and content bodies for the Nsmf_EventExposure is contained in Annex A.2.

5.2.2 HTTP standard headers

5.2.2.1 General

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

5.2.2.2 Content type

JSON, IETF RFC 8259 [9], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [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 [18].

5.2.3 HTTP custom headers

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

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

5.3 Resources

5.3.1 Resource Structure

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

Figure 5.3.1-1 depicts the resource URIs structure for the Nsmf_EventExposure API.

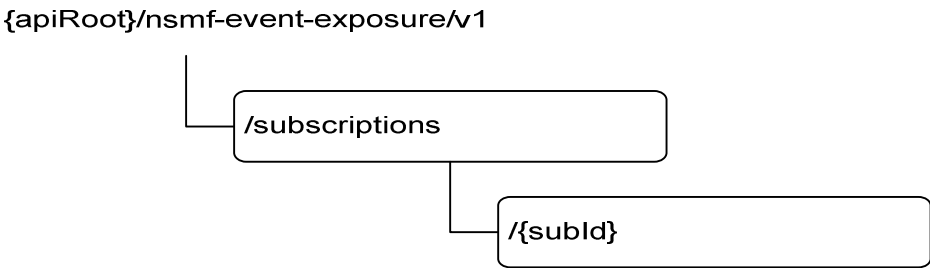


Figure 5.3.1-1: Resource URI structure of the Nsmf_EventExposure API

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

Table 5.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
SMF Notification Subscriptions	/subscriptions	POST	Create a new Individual SMF Notification Subscription resource.
Individual SMF Notification Subscription	/subscriptions/{subId}	GET	Read an Individual SMF Notification Subscription resource.
		PUT	Modify an existing Individual SMF Notification Subscription resource.
		DELETE	Delete an Individual SMF Notification Subscription resource and cancel the related subscription.

5.3.2 Resource: SMF Notification Subscriptions

5.3.2.1 Description

The SMF Notification Subscriptions resource represents the collection of subscriptions to the SMF event exposure service at a given SMF.

5.3.2.2 Resource definition

Resource URI: {apiRoot}/nsmf-event-exposure/v1/subscriptions

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

Table 5.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.1.

5.3.2.3 Resource Standard Methods

5.3.2.3.1 POST

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

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

Name	Data type	P	Cardinality	Description
n/a				

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

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

Data type	P	Cardinality	Description
NsmfEventExposure	M	1	Create a new Individual SMF Notification Subscription resource.

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

Data type	P	Cardinality	Response codes	Description
NsmfEventExposure	M	1	201 Created	The creation of an Individual SMF Notification Subscription resource is confirmed and a representation of that resource is returned.
ProblemDetails	O	0..1	403 Forbidden	(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] also apply.				
NOTE 2: Failure cases are described in clause 5.7.				

Table 5.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/nsmf-event-exposure/v1/subscriptions/{subId}

5.3.2.4 Resource Custom Operations

None.

5.3.3 Resource: Individual SMF Notification Subscription

5.3.3.1 Description

The SMF Notification Subscriptions resource represents a single subscription to the SMF event exposure service.

5.3.3.2 Resource definition

Resource URI: {apiRoot}/nsmf-event-exposure/v1/subscriptions/{subId}

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

Table 5.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 5.1
subId	SubId	Identifies the "Individual SMF Notification Subscription" resource.

5.3.3.3 Resource Standard Methods

5.3.3.3.1 GET

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

Table 5.3.3.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.3.3.3.1-2 and the response data structures and response codes specified in table 5.3.3.3.1-3.

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

Data type	P	Cardinality	Description
n/a			

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

Data type	P	Cardinality	Response codes	Description
NsmfEventExposure	M	1	200 OK	A representation of the SMF Notification Subscription matching the subId is returned.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual SMF Notification Subscription retrieval. Applicable if the feature "ES3XX" is supported. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual SMF Notification Subscription retrieval. Applicable if the feature "ES3XX" is supported. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the GET method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				
NOTE 2: The RedirectResponse data structure may be provided by an SCP (refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 5.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

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

Table 5.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

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

5.3.3.3.2 PUT

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

Table 5.3.3.3.2-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.3.3.3.2-2 and the response data structures and response codes specified in table 5.3.3.3.2-3.

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

Data type	P	Cardinality	Description
NsmfEventExposure	M	1	Modify the existing Individual SMF Notification Subscription resource matching the subId according to the representation in the NsmfEventExposure

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

Data type	P	Cardinality	Response codes	Description
NsmfEventExposure	M	1	200 OK	Successful case: The Individual SMF Notification Subscription resource matching the subId was modified and a representation is returned.
n/a			204 No Content	Successful case: The Individual SMF Notification Subscription resource matching the subId was modified.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual SMF Notification Subscription modification. Applicable if the feature "ES3XX" is supported. (NOTE 3)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual SMF Notification Subscription modification. Applicable if the feature "ES3XX" is supported. (NOTE 3)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the PUT method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				
NOTE 2: Failure cases are described in clause 5.7.				
NOTE 3: The RedirectResponse data structure may be provided by an SCP (refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 5.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

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

Table 5.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

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

5.3.3.3.3 DELETE

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

Table 5.3.3.3.3-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.3.3.3.3-2 and the response data structures and response codes specified in table 5.3.3.3.3-3.

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

Data type	P	Cardinality	Description
n/a			

Table 5.3.3.3-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
EventNotification	M	1	200 OK	Successful case. The "Individual SMF Notification Subscription" resource was successfully deleted and the last event notification is returned in the response body. (NOTE 3)
n/a			204 No Content	Successful case: The Individual SMF Notification Subscription resource matching the subId was deleted.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual SMF Notification Subscription deletion. Applicable if the feature "ES3XX" is supported. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual SMF Notification Subscription deletion. Applicable if the feature "ES3XX" is supported. (NOTE 2)
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.				
NOTE 2: The RedirectResponse data structure may be provided by an SCP (refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]).				
NOTE 3: This status code may be returned in the HTTP DELETE response only if the "Energy" feature is supported and the "ENERGY_USAGE_DATA" event was subscribed.				

Table 5.3.3.3-4: Headers supported by the 307 Response Code on this resource

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

Table 5.3.3.3-5: Headers supported by the 308 Response Code on this resource

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

5.3.3.4 Resource Custom Operations

None.

5.4 Custom Operations without associated resources

None.

5.5 Notifications

5.5.1 General

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

Table 5.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Event Notification	{notifUri}	POST	Provides information about observed events.
Acknowledgement of event notification	{ackUri}	POST	Provides acknowledgement of event notification

5.5.2 Event Notification

5.5.2.1 Description

The Event Notification is used by the SMF to report one or several observed Events to a recipient of notification(s) that a NF service consumer has subscribed to such Notifications.

NOTE 1: The definition of "callbacks" in the OpenAPI specification found in clause A.2 associated to the POST method of the "SMF Notification Subscriptions" resource is used as the notification request for both explicit and implicit subscriptions.

NOTE 2: For implicit subscriptions, the PCF can have previously stored in the SMF the notification URI to be used in the notifications initiated by the SMF. See 3GPP TS 29.512 [14] for the details.

5.5.2.2 Target URI

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

Table 5.5.2.2-1: Callback URI variables

Name	Data type	Definition
notifUri	Uri	The Notification Uri as assigned either within the Individual SMF Notification Subscription Resource during the explicit subscription service operation and described within the NsmfEventExposure type (see table 5.6.2.2-1) or assigned during the implicit subscription via the provisioning of the subscription information within the PCC Rule from the PCF (see 3GPP TS 29.512 [14]) or within the Traffic Influence Data from the V-NEF (see 3GPP TS 29.591 [25]).

5.5.2.3 Standard Methods

5.5.2.3.1 POST

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

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

Name	Data type	P	Cardinality	Description
n/a				

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

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

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

Table 5.5.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The receipt of the Notification is acknowledged.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during the event notification. Applicable if the feature "ES3XX" is supported. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during the event notification. Applicable if the feature "ES3XX" is supported. (NOTE 2)
ProblemDetails	O	0..1	404 Not Found	The NF service consumer can use this response when the notification can be sent to another host.
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] also apply.				
NOTE 2: The RedirectResponse data structure may be provided by an SCP (refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 5.5.2.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected. May be included if the feature "ES3XX" is supported.

Table 5.5.2.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected

5.5.3 Acknowledgement of event notification

5.5.3.1 Description

The Acknowledgement of Event Notification is used by the NF service consumer to acknowledge the SMF about handling result of the event notification (e.g. UP path change).

5.5.3.2 Target URI

The Callback URI "{ackUri}" shall be used with the callback URI variables defined in table 5.5.3.2-1.

Table 5.5.3.2-1: Callback URI variables

Name	Data type	Definition
ackUri	Uri	Acknowledgement Uri as assigned during the procedure of notification about subscribed events and described within the NsmfEventExposureNotification data type (see table 5.6.2.3-1).

5.5.3.3 Standard Methods

5.5.3.3.1 POST

This method shall support the URI query parameters specified in table 5.5.3.3.1-1.

Table 5.5.3.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 5.5.3.3.1-2 and the response data structures and response codes specified in table 5.5.3.3.1-3.

Table 5.5.3.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
AckOfNotify	M	1	Acknowledgement information of event notification

Table 5.5.3.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The receipt of the acknowledgement is successful.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during acknowledgement of notification. Applicable if the feature "ES3XX" is supported. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during acknowledgement of notification. Applicable if the feature "ES3XX" is supported. (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] also apply.				
NOTE 2: The RedirectResponse data structure may be provided by an SCP (refer to clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 5.5.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative SMF (service) instance towards which the acknowledgement should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	String	O	0..1	Identifier of the target SMF (service) instance towards which the acknowledgement request is redirected

Table 5.5.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	String	M	1	Contains an alternative URI representing the end point of an alternative SMF (service) instance towards which the acknowledgement should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	String	O	0..1	Identifier of the target SMF (service) instance towards which the acknowledgement request is redirected

5.6 Data Model

5.6.1 General

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

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

Table 5.6.1-1: Nsmf_EventExposure specific Data Types

Data type	Section defined	Description	Applicability
AckOfNotify	5.6.2.7	Acknowledgement information of event notification	
AppliedSmccType	5.6.3.6	The type of applied SM congestion control.	SMCCE
EventNotification	5.6.2.5	Describes notifications about a single event that occurred.	
EventSubscription	5.6.2.4	Represents the subscription to a single event	
IpAddrUsageInfo	5.6.2.17	The usage information of UE IP address resources.	SignallingInfo
NotificationMethod	5.6.3.4	Represents the notification methods that can be subscribed	
NsmfEventExposure	5.6.2.2	Represents an Individual SMF Notification Subscription resource	
NsmfEventExposureNotification	5.6.2.3	Describes Notifications about events that occurred.	
PduSessionInfo	5.6.2.12	Represents session information.	UeCommunication
PduSessionInformation	5.6.2.11	Represents the PDU session related information.	UeCommunication
PduSessionStatus	5.6.3.8	Status of the PDU Session.	UeCommunication
SmfEvent	5.6.3.3	Represents the types of events that can be subscribed	
SubId	5.6.3.2	Identifies an Individual SMF Notification Subscription.	
SmNasFromSmf	5.6.2.9	Describes the information of the SM NAS messages from SMF with backoff timer	SMCCE
SmNasFromUe	5.6.2.8	Describes the information of the SM NAS requests from UE	SMCCE
StateTransitionInfo	5.6.2.18	Represents session-related state transition information.	SignallingInfo
TrafficCorrelationNotification	5.6.2.14	Represents the traffic correlation Information for Notification.	CommonEASD NAI
TraffRouteReqOutcome	5.6.2.15	Represents the installation outcome of the requested traffic routing, requirements.	TraffRouteReq Outcome
TransactionInfo	5.6.2.10	UE Session Management transaction information.	Dispersion
TransactionMetric	5.6.3.7	Metric on UE Session Management transactions.	Dispersion
UpfInformation	5.6.2.13	The information of the UPF serving the UE.	ServiceExperience DnPerformance Energy
DataVolumeInformation	5.6.2.16	Represents the Data Volume information.	Energy
TerminationCause	5.6.3.9	Represents the reason to terminate the subscription.	Energy

Table 5.6.1-2 specifies data types re-used by the Nsmf_EventExposure service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nsmf_EventExposure service based interface.

Table 5.6.1-2: Nsmf_EventExposure re-used Data Types

Data type	Reference	Comments	Applicability
5Qi	3GPP TS 29.571 [11]	The 5G QoS Identifier.	EnQfiAllocation
AccessType	3GPP TS 29.571 [11]	Represents the access type.	
AddrFqdn	3GPP TS 29.571 [11]	Represents the IP address and/or FQDN.	ServiceExperience DnPerformance Energy
AfResultInfo	3GPP TS 29.522 [20]	Represents application handling information.	
ApplicationId	3GPP TS 29.571 [11]	The application identifier.	QfiAllocation PduSessionInfo Dispersion UPEAS Energy
BitRate	3GPP TS 29.571 [11]	Represents the bit rate.	EnQoSMon
CommunicationFailure	3GPP TS 29.518 [13]	Represents the communication failure information.	CommunicationFailure
DateTime	3GPP TS 29.571 [11]	Represents a date and a time.	
DIDataDeliveryStatus	3GPP TS 29.571 [11]	Status of downlink data delivery	DownlinkDataDeliveryStatus
DddTrafficDescriptor	3GPP TS 29.571 [11]	Traffic descriptor of source of downlink data	DownlinkDataDeliveryStatus
Dnai	3GPP TS 29.571 [11]	Represents a DNAI.	
DnaiChangeType	3GPP TS 29.571 [11]	Describes the types of DNAI change.	
Dnn	3GPP TS 29.571 [11]	Represents a DNN	
DurationSec	3GPP TS 29.571 [11]	Represents a time duration expressed in seconds.	
EthFlowDescription	3GPP TS 29.514 [22]	Ethernet flow description	QfiAllocation
FlowDescription	3GPP TS 29.514 [22]	IP flow description	QfiAllocation Energy
Fqdn	3GPP TS 29.571 [11]	FQDN	
GNbId	3GPP TS 29.571 [11]	Represents the gNB Identifier.	Energy
Gpsi	3GPP TS 29.571 [11]	Represents a GPSI.	
GroupId	3GPP TS 29.571 [11]	Represents the identifier of a group or UEs.	
Guami	3GPP TS 29.571 [11]	Globally Unique AMF Identifier	
IpAddr	3GPP TS 29.571 [11]	UE IP address.	Dispersion CommonEASDNAI
Ipv4Addr	3GPP TS 29.571 [11]	Represents an IPv4 address.	
Ipv6Addr	3GPP TS 29.571 [11]	Represents an IPv6 address.	
Ipv6Prefix	3GPP TS 29.571 [11]	Represents an IPv6 prefix.	
MacAddr48	3GPP TS 29.571 [11]	MAC Address.	
MutingExceptionInstructions	3GPP TS 29.571 [11]	Contains instructions to be executed upon the occurrence of an event muting exception (e.g. full buffer).	EnhDataMgmt
MutingNotificationsSettings	3GPP TS 29.571 [11]	Contains setting related to the muting of notifications.	EnhDataMgmt
NetworkAreaInfo	3GPP TS 29.554 [27]	Identifies the network area.	AreaFilter UPEAS
NfInstanceId	3GPP TS 29.571 [11]	Instance identity of the Network Function	UPEAS CommonEASDNAI
NfLoadLevelInformation	3GPP TS 29.520 [29]	Contains information about the NF load level.	SignallingInfo
NfSignallingInfo	3GPP TS 29.571 [11]	Indicates the signalling information.	SignallingInfo
NotificationFlag	3GPP TS 29.571 [11]	Notification flag.	EneNA
PartitioningCriteria	3GPP TS 29.571 [11]	Used to partition UEs before applying sampling.	EneNA
PduSessionId	3GPP TS 29.571 [11]	Represents the identifier of a PDU Session.	
PduSessionType	3GPP TS 29.571 [11]	PDU session type.	PduSessionStatus PduSessionInfo
PlmnIdNid	3GPP TS 29.571 [11]	Identification of a network: the PLMN Identifier or the SNPN Identifier (the PLMN Identifier and the NID).	
ProblemDetails	3GPP TS 29.571 [11]	Represents error related information.	
Qfi	3GPP TS 29.571 [11]	QoS flow identifier.	QfiAllocation

QosPara	3GPP TS 29.520 [29]	Represents the QoS parameter set.	QoSAssistance
RatType	3GPP TS 29.571 [11]	RAT type.	EneNA EnPduSesRatType
RedirectResponse	3GPP TS 29.571 [11]	Contains redirection related information.	ES3XX
Referenceld	3GPP TS 29.503 [30]	Represents the Reference ID.	EnhEventMgmt
RouteInformation	3GPP TS 29.571 [11]	Contains an IP address.	UeSatUeComm
RouteToLocation	3GPP TS 29.571 [11]	A traffic route to/from an DNAI	
SamplingRatio	3GPP TS 29.571 [11]	Sampling Ratio.	
SatelliteBackhaulCategory	3GPP TS 29.571 [11]	Indicates the satellite backhaul category or non-satellite backhaul.	EnSatBackhaulCategoryChg
ServiceName	3GPP TS 29.510 [12]	Name of the service instance.	
Snssai	3GPP TS 29.571 [11]	S-NSSAI	
SscMode	3GPP TS 29.571 [11]	SSC Mode selected for the PDU Session.	PduSessionInfo
Supi	3GPP TS 29.571 [11]	Represents a SUPI.	
SupportedFeatures	3GPP TS 29.571 [11]	Used to negotiate the applicability of the optional features defined in table 5.8-1.	
TimerInfo	3GPP TS 29.520 [29]	Represents timer information.	SignallingInfo
TimeWindow	3GPP TS 29.122 [24]	A start time and a stop time of a time window.	SMCCE SignallingInfo RedundantTransmissionExp WlanPerformance
Uint32	3GPP TS 29.571 [11]	Represents an unsigned 32-bit integer.	BERMS
UInteger	3GPP TS 29.571 [11]	Represents an unsigned integer.	
UpfEvent	3GPP TS 29.564 [26]	Contains UPF event information.	UPEAS
Uri	3GPP TS 29.571 [11]	Represents a URI.	
VolumeTimedReport	3GPP TS 29.571 [11]	Represents the UL/DL data volume information of a PDU Session.	Energy

5.6.2 Structured data types

5.6.2.1 Introduction

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

5.6.2.2 Type NsmfEventExposure

Table 5.6.2.2-1: Definition of type NsmfEventExposure

Attribute name	Data type	P	Cardinalit y	Description	Applicability
supi	Supi	C	0..1	Subscription Permanent Identifier. (NOTE 1) (NOTE 8) (NOTE 9)	
gpsi	Gpsi	C	0..1	Generic Public Subscription Identifier (NOTE 1) (NOTE 8) This IE is not applicable to "SMCC_EXP" event.	
anyUeInd	boolean	C	0..1	This IE shall be present if the event subscription is applicable to any UE. It indicates whether the event subscription is applicable to any UE: - "true": the event subscription is applicable to any UE; - "false"(default): the event subscription is not applicable to any UE. (NOTE 1) (NOTE 4) (NOTE 7)	
groupId	GroupId	C	0..1	Identifies a group of UEs. (NOTE 1)	
pduSeld	PduSessionId	C	0..1	PDU session ID (NOTE 1)	
dnn	Dnn	C	0..1	Data Network Name. (NOTE 9)	
snssai	Snssai	C	0..1	A single Network Slice Selection Assistance Information. (NOTE 4) (NOTE 9)	
dnai	Dnai	O	0..1	Data network access identifier.	UPEAS
ssid	string	O	0..1	SSID that the PDU session is related to.	UPEAS
bssid	string	O	0..1	BSSID that the PDU session is related to.	UPEAS
upfId	string	O	0..1	Identifies the UPF.	UPEAS
nfId	NfInstanceId	C	0..1	Indicates the instance identity of the NF creating the subscription. It shall be provided if the "eventSubs" attribute contains an entry with the "event" set to the value "UPF_EVENT".	UPEAS
subId	SubId	C	0..1	Subscription ID. This parameter shall be supplied by the SMF in HTTP responses that include an object of NsmfEventExposure type.	
notifId	string	M	1	Notification Correlation ID provided by the NF service consumer. (NOTE 2)	
notifUri	Uri	M	1	Identifies the recipient of Notifications sent by the SMF.	
altNotifIpv4Addrs	array(Ipv4Addr)	O	1..N	Alternate or backup IPv4 Address(es) where to send Notifications.	
altNotifIpv6Addrs	array(Ipv6Addr)	O	1..N	Alternate or backup IPv6 Address(es) where to send Notifications.	
altNotifFqdns	array(Fqdn)	O	1..N	Alternate or backup FQDN(s) where to send Notifications.	
eventSubs	array(EventSubscription)	M	1..N	Subscribed events. (NOTE 4)	

eventNotifs	array(EventNotification)	O	1..N	Represents the SMF Events to be reported in the Nsmf_EventExposure_Subscribe response. May be present when the "ERIR" feature is supported and the "ImmeRep" attribute set to true is included in the subscription request.	ERIR
ImmeRep	boolean	O	0..1	Indicates whether immediate reporting of the current status of the subscribed event. - Set to "true": it is requested that the current status of the subscribed event is immediately reported. - Set to "false": the current status of the subscribed event is not requested to be immediately reported. - Default value is "false" if omitted. (NOTE 6)	
notifMethod	NotificationMethod	O	0..1	If "notifMethod" is not supplied, the default value "ON_EVENT_DETECTION" applies. (NOTE 4) (NOTE 5) (NOTE 10)	
maxReportNbr	UInteger	O	0..1	If omitted, there is no limit. (NOTE 4) (NOTE 5)	
expiry	DateTime	C	0..1	This attribute indicates the expiry time of the subscription, after which the SMF shall not send any event notifications and the subscription becomes invalid. It may be included in an event subscription request and may be included in an event subscription response based on operator policies. If an expiry time was included in the request, then the expiry time returned in the response should be less than or equal to that value. If the expiry time is not included in the response, the NF service consumer shall not associate an expiry time for the subscription. (NOTE 4)	
repPeriod	DurationSec	C	0..1	This attribute indicates the reporting period. Shall be provided if the notification method is set to "PERIODIC". (NOTE 10)	
guami	Guami	C	0..1	The Globally Unique AMF Identifier (GUAMI) shall be provided by an AMF as NF service consumer.	

serviceName	ServiceName	O	0..1	If the NF service consumer is an AMF, it should provide the name of a service produced by the AMF that makes use of the notification about subscribed events.	
supportedFeatures	SupportedFeatures	C	0..1	Contains the list of supported feature(s) among the ones defined in clause 5.8. This attribute shall be present only when feature negotiation needs to take place.	
sampRatio	SamplingRatio	O	0..1	Indicates the ratio of the random subset to target UEs, event reports only relates to the subset.	
partitionCriteria	array(PartitioningCriteria)	O	1..N	Defines criteria for partitioning the UEs in order to apply the sampling ratio for each partition. It may only be included in event subscription requests when the "sampRatio" attribute is also provided. (NOTE 3)	EneNA
grpRepTime	DurationSec	O	0..1	Indicates the time for which the SMF aggregates the event reports detected by the UEs in a group and report them together to the NF service consumer.	
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. Default: "ACTIVATE"	EneNA
notifFlagInstruct	MutingExceptionInstructions	O	0..1	Contains instructions to be executed upon the occurrence of an event muting exception (e.g. full buffer). It may only be provided if the "notifFlag" is provided and set to "DEACTIVATE".	EnhDataMgmt
mutingSetting	MutingNotificationsSettings	O	0..1	Contains settings related to the muting of notifications. It may only be provided in the NF service producer response and only if the muting instructions provided in the "notifFlag" and/or the "notifFlagInstruct" attributes are accepted.	EnhDataMgmt

defQosSupp	boolean	O	0..1	Indicates whether the NF service consumer requests to receive QoS Flow performance information for the QoS Flow associated with the default QoS rule if there are no measurements available for the provided Application Identifier included within the "applds" attribute. - Set to "true": NF service consumer requests to receive QoS Flow performance information for the QoS Flow associated with the default QoS rule. - Set to "false": NF service consumer does not request to receive QoS Flow performance information for the QoS Flow associated with the default QoS rule. - Default value is "false" if omitted.	UPEAS
qosMonPending	boolean	O	0..1	Indicates whether the reporting will be activated when the measurements are enabled by a PCC rule. - Set to "true": the reporting will be activated when the measurements are enabled by a PCC rule. It shall be always set to "true" when present. It may only be provided in the response.	UPEAS
udrRestartInd	boolean	O	0..1	Indicates whether the Event Exposure subscription was initiated by the UDM due to a UDR restart. - "true" indicates that the subscription creation request message is sent by the UDM due to UDR data restoration. Therefore, the Event Exposure Subscription may already exist at the SMF. - "false" indicates that this subscription message is not motivated by a UDR data restoration procedure. - The default value is "false" if this attribute is omitted.	UDRRestProc

- NOTE 1: If the event subscription applies for a specific PDU session, the PDU session of a single UE (pduSeld, and gpsi/supi) shall be included; otherwise one and only one of a single UE (gpsi/supi), a group of UEs (groupId), or anyUeInd set to true shall be included.
- NOTE 2: If the UDM as NF service consumer subscribes to event (e.g. downlink data delivery status, PDU Session Establishment, PDU Session Release) on behalf of AF/NEF, the value of the "notifId" attribute shall be set to the same value as the value of the "notifyCorrelationId" attribute received from the AF/NEF as defined in subclause 6.4.6.2.2 of 3GPP TS 29.503 [30].
- NOTE 3: For a given type of partitioning criteria, the UE shall belong to only one single partition as long as it is served by the NF service producer.
- NOTE 4: If EneNA feature is supported, when the "snssai" attribute is presented together with "anyUeInd" attribute and the "eventSubs" attribute contains "PDU_SES_EST" and "PDU_SES_REL", then only the "ON_EVENT_DETECTION" value is applicable in the "notifMethod" attribute together with "maxReportNbr" attribute and/or "expiry" attribute presence.
- NOTE 5: The attribute "maxReportNbr" is not applicable when the value of "notifMethod" is set to "ONE_TIME".
- NOTE 6: The attribute does not follow the related naming convention (i.e. "lowerCamel") defined in clause 5.1.4 of 3GPP TS 29.501 [7]. This attribute is however kept as currently defined in this specification for backward compatibility considerations.
- NOTE 7: When the "anyUeInd" attribute is present and set to "true", the SMF does not consider the PDU Session(s) for which it is acting as I-SMF when it selects the PDU Session(s).
- NOTE 8: Void.
- NOTE 9: If the "Energy" feature is supported and one of the subscribed events within the "eventSubs" attribute is the "ENERGY_USAGE_DATA" event, then the "supi" attribute shall be present, and the "snssai" attribute and/or the "dnn" attribute may be present.
- NOTE 10: When the "Energy" feature is supported, the only applicable value for the "notifMethod" attribute is "PERIODIC" and the "repPeriod" attribute's value shall be ignored as the reporting period is pre-configured at the SMF.

5.6.2.3 Type NsmfEventExposureNotification

Table 5.6.2.3-1: Definition of type NsmfEventExposureNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
notifId	string	M	1	Notification correlation ID used to identify the subscription which the notification is corresponding to. It shall be set to the same value as: - the "notifId" attribute of NsmfEventExposure data type or the value of "notifCorrelId" within the UpPathChgEvent data type defined in 3GPP TS 29.512 [14], - the value of "notifCorrelId" in the "tfcCorrelInfo" attribute within the TrafficControlData data type defined in 3GPP TS 29.512 [14], - the value of "notifCorrelId" in the "simConnFailEvent" attribute within the TrafficControlData data type defined in 3GPP TS 29.512 [14], - the value of "notifyCorrelId" within the QosMonitoringData data type defined in 3GPP TS 29.512 [14], - the value of "upPathChgNotifCorrelId" attribute contained in the "trafficInfluData" attribute included in the TrafficInfluDataNotif data type within the TrafficInfluDataNotify data type defined in 3GPP TS 29.591 [25], or the value of "notifCorrelId" within the TraffRouteReqOutcomeEvent data type defined in 3GPP TS 29.512 [14].	
eventNotifs	array(EventNotification)	M	1..N	Notifications about Individual Events	
ackUri	Uri	O	0..1	The URI provided by the SMF for the AF acknowledgement. If present, it only applies to the "UP_PATH_CH" event indicated in the "eventNotifs" attribute.	

5.6.2.4

Type EventSubscription

Table 5.6.2.4-1: Definition of type EventSubscription

Attribute name	Data type	P	Cardinality	Description	Applicability
event	SmfEvent	M	1	Subscribed events	
referenceId	ReferenceId	O	0..1	Indicates the reference identifier of the event. (NOTE 5)	EnhEventMgmt
dnaiChgType	DnaiChangeType	C	0..1	For event UP path change, this attribute indicates whether the subscription is for early, late, or early and late DNAI change notification shall be supplied if the subscribed event is set to "UP_PATH_CH".	
dddTraDescriptors	array(DddTrafficDescriptor)	C	1..N	The traffic descriptor(s) of the downlink data source. Shall be included for event "DDDS".	DownlinkDataDeliveryStatus
dddStatus	array(DIDataDeliveryStatus)	O	1..N	May be included for event "DDDS". The subscribed statuses (discarded, transmitted, buffered) for the event. If omitted all statuses are subscribed.	DownlinkDataDeliveryStatus
applds	array(ApplicationId)	O	1..N	May be included for event "QFI_ALLOC", "QFI_DEALLOCATION", "QOS_FLOW_CHANGE", "DISPERSION", "ENERGY_USAGE_DATA" or "QOS_MON". (NOTE 1) (NOTE 3)	QfiAllocation Dispersion PduSessionInfo UPEAS Energy
networkArea	NetworkAreaInfo	O	0..1	Identification of network area to which the subscription applies.	AreaFilter UPEAS
targetPeriod	TimeWindow	O	0..1	Indicates the data collection target period. May be included for event "SMCC_EXP", "RED_TRANS_EXP" or "WLAN_INFO".	SMCCE RedundantTransmissionExp WlanPerformance
tw	array(TimeWindow)	O	1..N	Contains the time windows for which the NF service consumer is requesting to receive signalling information. It may only be provided if the SIGNALLING_INFO event is subscribed. If omitted, the SMF determines the time windows for which the signalling information is reported based on local configuration.	SignallingInfo
transacDispInd	boolean	O	0..1	Indicates the subscription for UE transaction dispersion collection, if it is included and set to "true". Default value is "false". May be included for event "DISPERSION".	Dispersion
transacMetrics	array(TransactionMetric)	O	1..N	Requested transaction metrics. May be included for event "DISPERSION".	Dispersion
uelpAddr	IpAddr	O	0..1	Indicates the UE IP address. May be included for event "DISPERSION".	Dispersion

upfEvents	array(UpfEvent)	O	1..N	Indicates the exposure information related to UPF events. May be included for event "UPF_EVENT". (NOTE 2) (NOTE 4)	UPEAS
bundlingAllowed	boolean	O	0..1	This attribute may be included for event "UPF_EVENT" and indicates whether it is requested to allow the bundling of event reports in UPF notifications. Possible values: - "true": it is requested to allow the bundling of event reports in UPF notifications. The presence of this attribute with the value "false" shall be prohibited.	BERMS
bundleId	Uint32	O	0..1	This attribute may be included for event "UPF_EVENT" if the "bundlingAllowed" attribute is provided and the NF service consumer wants to allow to bundle event reports of specific (but not all) subscriptions. When present, this attribute shall contain an identifier identifying the subscriptions whose event reports may be bundled together.	BERMS
bundledEventNotifyUri	Uri	O	0..1	This attribute may be included for event "UPF_EVENT" if the "bundlingAllowed" attribute is provided. It shall be present if the NF service consumer provides a distinct "notifId" per SMF event exposure subscription. When present, this attribute indicates the URI to be used by the UPF for sending notifications with bundled events.	BERMS
flowDescs	array(FlowDescription)	O	1..N	Contains the IP flow description allowing the encoding of multiple UL and/or DL flow(s). Each entry of the array describes a single IP flow. This attribute may be present only when the "event" attribute is set to "ENERGY_USAGE_DATA". (NOTE 3)	Energy

NOTE 1:	Only one instance of "ApplicationId" shall be provided when the event is either "QOS_MON" or "ENERGY_USAGE_DATA".
NOTE 2:	If the "UPEAS feature" is supported and the "immediateFlag" attribute within the "upfEvents" attribute is provided, the "ImmeRep" attribute within the NsmfEventExposure data type is not applicable.
NOTE 3:	When the "Energy" feature is supported and the "event" attribute is set to "ENERGY_USAGE_DATA", these attributes are mutually exclusive and only one of them may be present.
NOTE 4:	The "remainingDataReports" attribute within the "upfEvents" attribute applies only if the EnUPEAS feature is supported. The "skipReportInstruction" attribute within the "upfEvents" attribute applies only if the SEER feature is supported. The "inclRatType" and "ratTypeList" attributes within the "upfEvents" attribute apply only if the RATTE feature is supported.
NOTE 5:	If the UDM as NF service consumer subscribes to events (e.g., downlink data delivery status, PDU Session Establishment, PDU Session Release) on behalf of the AF/NEF, the UDM may provide the "referenceld" attribute set to the same value as the value of the "referenceld" attribute received from the AF/NEF as defined in clause 6.4.6.2.4 of 3GPP TS 29.503 [30].

5.6.2.5 Type EventNotification

Table 5.6.2.5-1: Definition of type EventNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
event	SmfEvent	M	1	Event that is notified.	
referenceId	ReferenceId	O	0..1	Indicates the reference identifier of the event.	EnhEventMgmt
timeStamp	DateTime	M	1	Time at which the event is observed.	
supi	Supi	C	0..1	Subscription Permanent Identifier. It is included when the subscription applies to a group of UE(s) or any UE. (NOTE 9)	
gpsi	Gpsi	C	0..1	Identifies a GPSI. It shall contain an MSISDN. It is included when it is available and the subscription applies to a group of UE(s) or any UE. This IE is not applicable to "SMCC_EXP" event.	
uelpAddr	IpAddr	C	0..1	Indicates the UE IP address, It is included for event "DISPERSION" when it is available and requested in the subscription.	Dispersion
transacInfos	array(TransactionInfo)	C	1..N	Transaction Information. Shall be included for event "DISPERSION".	Dispersion
sourceDnai	Dnai	C	0..1	Source DN Access Identifier. Shall be included for events "UP_PATH_CH", "TRAFF_ROUTE_REQ_OUTCOME", and "SIM_CONN_FAIL", if the DNAI changed. (NOTE 1, NOTE 2)	
targetDnai	Dnai	C	0..1	Target DN Access Identifier. Shall be included for events "UP_PATH_CH", "TRAFF_ROUTE_REQ_OUTCOME", and "SIM_CONN_FAIL", if the DNAI changed. (NOTE 1, NOTE 2)	
dnaiChgType	DnaiChangeType	C	0..1	DNAI Change Type. Shall be included for event "UP_PATH_CH".	
traffRouteReqOutcome	TraffRouteReqOutcome	C	0..1	Contains the installation outcome of requested traffic routing requirements. This attribute shall be present when the event is set to "TRAFF_ROUTE_REQ_OUTCOME".	TraffRouteReqOutcome
candidateDnaIs	array(Dnai)	O	1..N	The candidate DNAI(s) for the PDU Session. May be included for event "UP_PATH_CH".	CommonEASDNAI

easRediscoverInd	boolean	O	0..1	Indication of EAS re-discovery. If present and set to "true", it indicates the EAS re-discovery is performed, e.g. due to change of common EAS. Default value is "false" if omitted.	CommonEASDNAI
candDnaisPriorityInd	boolean	O	0..1	If provided and set to "true", it indicates that the candidate DNAIs provided in the "candidateDnais" attribute are in descending priority order, i.e. the lower the array index the higher the priority of the respective DNAI. If omitted, the default value is "false". It may only be provided if the "candidateDnais" attribute is provided and the "dnaiChgType" attribute is set to the value "EARLY".	CommonEASDNAI
trafCorrelInfo	TrafficCorrelationNotification	C	0..1	Contains traffic correlation information for notification. It shall be provided if the event attribute has the value "TRAFFIC_CORRELATION".	CommonEASDNAI
sourceUeIpv4Addr	Ipv4Addr	O	0..1	The IPv4 Address of the served UE for the source DNAI. May be included for event "UP_PATH_CH".	
sourceUeIpv6Prefix	Ipv6Prefix	O	0..1	The Ipv6 Address Prefix of the served UE for the source DNAI. May be included for event "UP_PATH_CH".	
targetUeIpv4Addr	Ipv4Addr	O	0..1	The IPv4 Address of the served UE for the target DNAI. May be included for event "UP_PATH_CH".	
targetUeIpv6Prefix	Ipv6Prefix	O	0..1	The Ipv6 Address Prefix of the served UE for the target DNAI. May be included for event "UP_PATH_CH".	
sourceTraRouting	RouteToLocation	C	0..1	N6 traffic routing information for the source DNAI. Shall be included for events "UP_PATH_CH" and "TRAFF_ROUTE_REQ_OUTCOME" if available (NOTE 2).	
targetTraRouting	RouteToLocation	C	0..1	N6 traffic routing information for the target DNAI. Shall be included for events "UP_PATH_CH" and "TRAFF_ROUTE_REQ_OUTCOME" if available (NOTE 2).	
ueMac	MacAddr48	O	0..1	UE MAC address. May be included for event "UP_PATH_CH".	
adlIpv4Addr	Ipv4Addr	O	0..1	Added IPv4 Address(es). May be included for event "UE_IP_CH".	
adlIpv6Prefix	Ipv6Prefix	O	0..1	Added Ipv6 Address Prefix(es). May be included for event "UE_IP_CH".	

relpv4Addr	Ipv4Addr	O	0..1	Removed IPv4 Address(es). May be included for event "UE_IP_CH".	
relpv6Prefix	Ipv6Prefix	O	0..1	Removed Ipv6 Address Prefix(es). May be included for event "UE_IP_CH".	
plmnId	PlmnIdNid	C	0..1	New PLMN Identifier or the SNPN Identifier. Shall be included for event "PLMN_CH". It shall be included for event "UP_PATH_CH" to contain the new serving PLMN identifier, if the "HR-SBO" feature is supported and the UE has moved to a serving PLMN where local traffic offloading is allowed. (NOTE 7)	
accType	AccessType	C	0..1	New Access Type. Shall be included for event "AC_TY_CH" and may be included for events "QFI_ALLOC", "QFI_DEALLOCATION", and "QOS_FLOW_CHANGE".	
pduAccTypes	array(AccessType)	O	1..N	The list of Access Types used for the PDU session. May be included for events "QFI_ALLOC", "QFI_DEALLOCATION", and "QOS_FLOW_CHANGE". (NOTE 10)	MultipleAccessTypes
pduSeld	PduSessionId	C	0..1	PDU session ID. Shall be included for event "PDU_SES_REL" and "PDU_SES_EST". It shall also be included for events "QFI_ALLOC", "QFI_DEALLOCATION", and "QOS_FLOW_CHANGE" if the subscription was for a UE, a group of UEs, or any UE, and not for a specific PDU Session.	
ratType	RatType	C	0..1	Contains the RAT Type. It shall contain either: - the new RAT Type if the event is "RAT_TY_CH" and the "EneNA" feature and/or "EnPduSesRatType" feature is supported, or - the current RAT Type if the event is either "PDU_SES_REL" or "PDU_SES_EST" and the "EnPduSesRatType" feature is supported.	EneNA EnPduSesRatType
dddStatus	DIDataDeliveryStatus	C	0..1	Downlink data delivery status (discarded, transmitted, buffered). Shall be included for event "DDDS".	DownlinkDataDeliveryStatus

maxWaitTime	DateTime	C	0..1	The estimated maximum waiting time for downlink data delivery. Shall be included for event "DDDS" with status "BUFFERED".	DownlinkDataDeliveryStatus
dddTraDescriptor	DddTrafficDescriptor	C	0..1	The downlink data descriptor impacted by downlink data delivery status change. Shall be included for event "DDDS".	DownlinkDataDeliveryStatus
commFailure	CommunicationFailure	C	0..1	Describes the communication failure cause for the UE. Shall be included for event "COMM_FAIL".	CommunicationFailure
ipv4Addr	Ipv4Addr	O	0..1	IPv4 address. May be included for event "PDU_SES_REL" or "PDU_SES_EST".	PduSessionStatus
ipv6Prefixes	array(Ipv6Prefix)	O	1..N	IPv6 prefixes. May be included for event "PDU_SES_REL" or "PDU_SES_EST". (NOTE 3)	PduSessionStatus
ipv6Addrs	array(Ipv6Addr)	O	1..N	IPv6 addresses. May be included for event "PDU_SES_REL" or "PDU_SES_EST". (NOTE 3)	PduSessionStatus
pduSessType	PduSessionType	C	0..1	PDU session type. Shall be included for events "PDU_SES_REL" and "PDU_SES_EST". (NOTE 8)	PduSessionStatus PduSessionInfo
sscMode	SscMode	O	0..1	Represents the SSC mode of the PDU Session. It may be included for events "QFI_ALLOC", "QFI_DEALLOCATION", and "QOS_FLOW_CHANGE". (NOTE 8)	PduSessionInfo QfiAllocation
qfi	Qfi	C	0..1	QoS flow identifier. May be included for events "QFI_ALLOC", "QFI_DEALLOCATION", and "QOS_FLOW_CHANGE". (NOTE 12)	QfiAllocation
applId	ApplicationId	O	0..1	Contains the application identifier. May be included for events "QFI_ALLOC", "QFI_DEALLOCATION", and "QOS_FLOW_CHANGE". (NOTE 4) (NOTE 8)	QfiAllocation PduSessionInfo
ethFlowDescs	array(EthFlowDescription)	O	1..N	Descriptor(s) for non-IP traffic in which only ethernet flow description is defined. It allows the encoding of multiple UL and/or DL flows. Each entry of the array describes a single Ethernet flow. May be included for events "QFI_ALLOC", "QFI_DEALLOCATION", and "QOS_FLOW_CHANGE" when the description of the Ethernet traffic requires multiple UL and/or DL flows. (NOTE 4)	MultipleFlowDescriptions

ethfDescs	array(EthFlowDescription)	O	1..2	Contains the flow description for the Uplink and/or Downlink Ethernet flows. May be included for events "QFI_ALLOC", "QFI_DEALLOCATION", and "QOS_FLOW_CHANGE". (NOTE 4)	QfiAllocation
flowDescs	array(FlowDescription)	O	1..N	Descriptor(s) of IP traffic. It allows the encoding of multiple UL and/or DL flows. Each entry of the array describes a single IP flow. May be included for events "QFI_ALLOC", "QFI_DEALLOCATION", and "QOS_FLOW_CHANGE", when the description of the IP traffic requires multiple UL and/or DL flows. (NOTE 4)	MultipleFlowDescriptions
fDescs	array(FlowDescription)	O	1..2	Contains the flow description for the Uplink and/or Downlink IP flows. May be included for events "QFI_ALLOC", "QFI_DEALLOCATION", and "QOS_FLOW_CHANGE". (NOTE 4)	QfiAllocation
dnn	Dnn	C	0..1	Data network name. Shall be included for events "QFI_ALLOC", "QFI_DEALLOCATION", and "QOS_FLOW_CHANGE". May be included for event "PDU_SES_REL" or "PDU_SES_EST". Shall be included to indicate the DNN associated with URLLC service for event "RED_TRANS_EXP". Shall be included if DNN based SMCC is applied. It shall be included for event "UP_PATH_CH" to contain the HPLMN DNN, if the "HR-SBO" feature is supported and the UE has moved to a serving PLMN where local traffic offloading is allowed.	QfiAllocation, PduSessionStatus RedundantTransmissionExp SMCCE HR-SBO
snssai	Snssai	C	0..1	Identifies the slice information. Shall be included for events "QFI_ALLOC", "QFI_DEALLOCATION", and "QOS_FLOW_CHANGE". Shall be included if S-NSSAI based SMCC is applied. It shall be included for event "UP_PATH_CH" to contain the HPLMN S-NSSAI, if the "HR-SBO" feature is supported and the UE has moved to a serving PLMN where local traffic offloading is allowed.	QfiAllocation EneNA SMCCE HR-SBO

ulDelays	array(Uinteger)	O	1..N	Uplink packet delay in units of milliseconds. May be included for event "QOS_MON". (NOTE 5)	QoSMonitoring
dlDelays	array(Uinteger)	O	1..N	Downlink packet delay in units of milliseconds. May be included for event "QOS_MON". (NOTE 5)	QoSMonitoring
ulCongInfo	Uinteger	O	0..1	Uplink congestion information. Percentage of packets that UPF uses for ECN marking for L4S (without "%" sign). May be included for event "QOS_MON".	EnQoSMon
dlCongInfo	Uinteger	O	0..1	Downlink congestion information. Percentage of packets that UPF uses for ECN marking for L4S (without "%" sign). May be included for event "QOS_MON".	EnQoSMon
rtDelays	array(Uinteger)	O	1..N	Round trip delay in units of milliseconds. May be included for event "QOS_MON". (NOTE 5)	QoSMonitoring
ulDataRate	BitRate	O	0..1	Uplink data rate. May be included for event "QOS_MON".	EnQoSMon
dlDataRate	BitRate	O	0..1	Downlink data rate. May be included for event "QOS_MON".	EnQoSMon
timeWindow	TimeWindow	C	0..1	Time window representing a start time and a stop time of the data collection period. Shall be included for event "SMCC_EXP".	SMCCE
smNasFromUe	SmNasFromUe	C	0..1	Information on the SM NAS messages that SMF receives from UE for PDU Session. Shall be included for event "SMCC_EXP".	SMCCE
addSmNasFromUes	array(SmNasFromUe)	C	1..N	Information on the additional SM NAS messages that SMF receives from UE for PDU Session. Shall be included for event "SMCC_EXP" when multiple SM NAS messages that SMF receives from UE for PDU Session are included in the time window of the "timeWindow" attribute.	SMCCE_Ext
smNasFromSmf	SmNasFromSmf	C	0..1	Information on the SM congestion control applied SM NAS messages that SMF sends to UE for PDU Session. Shall be included for event "SMCC_EXP".	SMCCE
addSmNasFromSmfs	array(SmNasFromSmf)	C	1..N	Information on the additional SM congestion control applied SM NAS messages that SMF sends to UE for PDU Session. Shall be included for event "SMCC_EXP" when multiple SM NAS messages that SMF sends to UE for PDU Session are included in the time window of the "timeWindow" attribute.	SMCCE_Ext

upRedTrans	boolean	C	0..1	Indicates whether the redundant transmission is setup or terminated. Set to "true" if the redundant transmission is setup, otherwise set to "false" if the redundant transmission is terminated. Default value is "false" if omitted. Shall be included for event "RED_TRANS_EXP".	RedundantTransmissionExp
ssid	string	C	0..1	SSID that the PDU session is related to. (NOTE 6)	WlanPerformance
bssid	string	C	0..1	BSSID that the PDU session is related to. (NOTE 6)	WlanPerformance
startWlan	DateTime	C	0..1	The time stamp that indicates when the existing PDU Session's access type changes to WLAN or when the new PDU Session for WLAN is established. (NOTE 6)	WlanPerformance
endWlan	DateTime	C	0..1	The time stamp that indicates when the existing WLAN based PDU Session's access type is not WLAN any more or when the PDU Session for WLAN is released. (NOTE 6)	WlanPerformance
pduSessInfos	array(PduSessionInformation)	C	1..N	The PDU session related information. It shall be included for event "UP_STATUS_INFO".	UeCommunication
upfInfo	UpfInformation	C	0..1	The information of the UPF serving the UE. Shall be included for event "UPF_INFO".	ServiceExperienceDnPerformance
pdmf	boolean	O	0..1	Packet delay measurement failure indicator. When set to true, it indicates that a packet delay failure has occurred, i.e. no measurement result is available during the reporting period. Default value is false if omitted. May be included for event "QOS_MON".	PacketDelayFailureReport
satBackhaulCat	SatelliteBackhaulCategory	C	0..1	The satellite backhaul category or non-satellite backhaul used for the PDU session. Shall be included for event "SATB_CH".	EnSatBackhaulCategoryChg
supportedFeatures	SupportedFeatures	C	0..1	List of negotiated features supported by the SMF and NF service consumer as described in clause 5.8. This parameter shall be supplied by the SMF when the SMF detects that at least one feature related to an implicit subscription is supported by both the SMF and the NF service consumer.	
targetAfId	string	O	0..1	Identifier of the Application Function responsible for the target DNAI. May be included for event "UP_PATH_CH" if the target DNAI is not known to the source AF.	EasRelocationEnh
5qi	5Qi	O	0..1	The 5G QoS Identifier. May be included for event "QFI_ALLOC", "QFI_DEALLOCATION", and "QOS_FLOW_CHANGE". (NOTE 12) (NOTE 14)	EnQfiAllocation

dataVollInfoData	array(DataVolumeInformation)	C	1..N	Contains the list of data volume information set(s). This attribute shall be present only when the "event" attribute is set to "ENERGY_USAGE_DATA".	Energy
usageInfo	IpAddrUsageInfo	O	0..1	Indicates the usage information of UE IP address resources. May be included for event "SIGNALLING_INFO".	SignallingInfo
loadInfos	array(NfLoadLevelInformation)	O	1..N	Each element indicates the load level information of connected UPFs. May be included for event "SIGNALLING_INFO". (NOTE 13)	SignallingInfo
numSessRep	UInteger	O	0..1	Contains the number of received Session Report from UPF triggered by DL packet in case of PDU Session is in 5GCM-idle state. May be included for event "SIGNALLING_INFO".	SignallingInfo
stateTransitions	array(StateTransitionInfo)	O	1..N	Contains information about session-related state transitions of specific UEs. May be included for event "SIGNALLING_INFO".	SignallingInfo
nfSignalInfo	NfSignallingInfo	O	0..1	Indicates the signalling information of the SMF per SMF service, e.g. the number of requests to each service and related statistics (e.g. successful vs failed responses, etc.). May be included for event "SIGNALLING_INFO".	SignallingInfo
qosPara	QosPara	O	0..1	Contains the used QoS parameters. May be included for event "QFI_ALLOC", "QFI_DEALLOCATION" or "QOS_FLOW_CHANGE". (NOTE 14)	QoSAssistance
smfTimers	array(TimerInfo)	O	1..N	Contains information related to UE-associated SMF timers.	SignallingInfo
terminationInd	boolean	C	0..1	Indicates that the subscription to the Energy Consumption Information event is terminated. - "true" indicates that the subscription to the Energy Consumption Information event is terminated. The presence of this attribute set to the value "false" is prohibited. This attribute shall be present only when the "event" attribute is set to "ENERGY_USAGE_DATA".	Energy
terminationCause	TerminationCause	O	0..1	Indicates the reason to terminate the subscription to the Energy Consumption Information event. This attribute may be present only when the "terminationInd" attribute is present.	Energy

NOTE 1:	If the DNAI is not changed while the N6 traffic routing information is changed, the "sourceDnai" attribute and "targetDnai" attribute shall not be provided.
NOTE 2:	The change from the UP path status where no DNAI applies to a status where a DNAI applies indicates the activation of the related AF request and therefore only the target DNAI and N6 traffic routing information is provided in the event notification; the change from the UP path status where a DNAI applies to a status where no DNAI applies indicates the de-activation of the related AF request and therefore only the source DNAI and N6 traffic routing information is provided in the event notification.
NOTE 3:	If provided, either ipv6Prefixes or ipv6Addrs shall be present.
NOTE 4:	Only one of the "applId", "ethfDescs", "ethFlowDescs", "flowDescs" or "fDescs" attributes shall be provided.
NOTE 5:	In this release of the specification one element may be included in the array as specified in clause 4.2.2.2.
NOTE 6:	If notified event is "WLAN_INFO", then one of the "ssid" or "bssid" attribute and one of the "startWlan" or "endWlan" attribute shall be present.
NOTE 7:	The SNPN Identifier consists of the PLMN Identifier and the NID.
NOTE 8:	When the subscribed event is "QFI_ALLOC", "QFI_DEALLOCATION", or "QOS_FLOW_CHANGE", and the PduSessionInfo feature is supported, if the "pduSessType" attribute and/or "sscMode" attribute is included, the associated "applId" attribute shall be provided.
NOTE 9:	If the "WlanPerformanceExt_AIML" feature is supported, the "supi" attribute may also be included for a single UE when the subscription applies to the "WLAN_INFO" event.
NOTE 10:	If multiple Access Types are used for the PDU Session and the "MultipleAccessTypes" feature is supported, the SMF shall include each PDU Session Access Type in the "pduAccTypes" attribute.
NOTE 11:	Void.
NOTE 12:	The "qfi" attribute and "5qi" attribute are mutually exclusive, either "qfi" attribute or "5qi" attribute shall be included for event "QFI_ALLOC", "QFI_DEALLOCATION", or "QOS_FLOW_CHANGE".
NOTE 13:	The "nfLoadAvgInAoi", "snssai" and "confidence" attributes within the entries of the "loadInfos" attribute are not applicable in this release of the specification, and the other attributes are provided based on the values that are known to the SMF.
NOTE 14:	The attribute "qosParamSetId" within the "qosPara" attribute is not applicable. The attribute "5qi" within the "qosPara" attribute take the precedence if the attribute "5qi" within the EventNotification data type is also included.

5.6.2.6 void.

5.6.2.7 Type AckOfNotify

Table 5.6.2.7-1: Definition of type AckOfNotify

Attribute name	Data type	P	Cardinality	Description	Applicability
notifId	string	M	1	Notification correlation ID provided by the SMF during UP path change notification.	
ackResult	AfResultInfo	M	1	Identifies the result of application layer handling.	
supi	Supi	O	0..1	Subscription Permanent Identifier.	
gpsi	Gpsi	O	0..1	Identifies a GPSI.	
remoteImsAddress	RouteInformation	O	0..1	Contains the IP Address for the IMS AGW IP address.	UeSatUeComm

5.6.2.8 Type SmNasFromUe

Table 5.6.2.8-1: Definition of type SmNasFromUe

Attribute name	Data type	P	Cardinality	Description	Applicability
smNasType	string	M	1	The type of SM NAS message transmitted by UE (e.g. PDU Session Establishment Request, PDU Session Modification Request, etc.).	
timeStamp	DateTime	M	1	Indicates the time stamp when SMF receives SM NAS message from UE.	

5.6.2.9 Type SmNasFromSmf

Table 5.6.2.9-1: Definition of type SmNasFromSmf

Attribute name	Data type	P	Cardinality	Description	Applicability
smNasType	string	M	1	The type of SM NAS message with backoff timer provided to UE (e.g. PDU Session Establishment Reject, PDU Session Modification Reject, PDU Session Release Command, etc.).	
timeStamp	DateTime	M	1	Indicates the time stamp when SMF sends SM NAS message to UE.	
backoffTimer	DurationSec	M	1	Indicates the value of backoff timer provided to UE in terms of time units of seconds.	
appliedSmccType	AppliedSmccType	M	1	The type of applied SM congestion control, i.e. DNN based congestion control or S-NSSAI based congestion control.	

5.6.2.10 Type TransactionInfo

Table 5.6.2.10-1: Definition of type TransactionInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
transaction	UInteger	M	1	Number of transactions.	
snssai	Snssai	O	0..1	Identifier of the network slice.	
applds	array(ApplicationId)	O	1..N	Application Identifiers.	
transacMetrics	array(TransactionMetric)	O	1..N	Indicates Session Management Transaction metrics.	

5.6.2.11 Type PduSessionInformation

Table 5.6.2.11-1: Definition of type PduSessionInformation

Attribute name	Data type	P	Cardinality	Description	Applicability
pduSessId	PduSessionId	C	0..1	Identification of PDU Session. It shall be provided if available.	
sessInfo	PduSessionInfo	C	0..1	Represents session information. It shall be provided if available.	

5.6.2.12 Type PduSessionInfo

Table 5.6.2.12-1: Definition of type PduSessionInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
n4SessId	string	C	0..1	Identification of N4 Session. It shall be provided if available.	
sessInactiveTimer	DurationSec	C	0..1	The value of the session inactivity timer. It shall be provided if available.	
pduSessStatus	PduSessionStatus	C	0..1	Status of the PDU Session. It shall be provided if available.	

5.6.2.13 Type UpfInformation

Table 5.6.2.13-1: Definition of type UpfInformation

Attribute name	Data type	P	Cardinality	Description	Applicability
upfId	string	C	0..1	Identifies the UPF. (NOTE 1) (NOTE 2)	
upfAddr	AddrFqdn	C	0..1	Represents the IP address/FQDN of the UPF. (NOTE 1) (NOTE 2)	
NOTE 1: At least one of the "upfId" attribute and "upfAddr" attribute shall be included.					
NOTE 2: The "upfId" attribute and "upfAddr" attribute may indicate an anchor UPF of the PDU session containing the QoS flow.					

5.6.2.14 Type: TrafficCorrelationNotification

Table 5.6.2.14-1: Definition of type TrafficCorrelationNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
smfId	NfInstanceId	M	1	Identifies the SMF Id sending the notification.	
tfCorrId	string	M	1	Identification of traffic correlation.	
dnais	array(Dnai)	C	1..N	Identification(s) of user plane access to DN(s) which the subscription applies. (NOTE 2)	
easFqdn	Fqdn	C	0..1	The Fqdn of the EAS. (NOTE 1) (NOTE 2)	
easIpAddr	IpAddr	C	0..1	Indicates the EAS IP address based on EASDF procedure. (NOTE 1) (NOTE 2)	
pduSessionNbr	UInteger	M	1	Indicates the number of PDU sessions that the SMF is serving for the UE(s).	
NOTE 1: The "easFqdn" attribute and the "easIpAddr" attribute are mutually exclusive.					
NOTE 2: At least one of the "dnais" attribute and the EAS ID ("easFqdn" attribute or "easIpAddr" attribute) shall be provided.					

5.6.2.15 Type TraffRouteReqOutcome

Table 5.6.2.15-1: Definition of type TraffRouteReqOutcome

Attribute name	Data type	P	Cardinality	Description	Applicability
succTrafficFlows	array(FlowDescription)	O	1..N	Contains the descriptor(s) of the IP traffic for which the requested traffic routing requirements were successfully installed. (NOTE 1)	
succEthTrafficFlows	array(EthFlowDescription)	O	1..N	Contains the descriptor(s) of Ethernet traffic for which the requested traffic routing requirements were successfully installed. (NOTE 1)	
failedTrafficFlows	array(FlowDescription)	O	1..N	Contains the descriptor(s) of IP traffic for which the requested traffic routing requirements failed to be installed. (NOTE 2)	
failedEthTrafficFlows	array(EthFlowDescription)	O	1..N	Contains the descriptor(s) of Ethernet traffic for which the requested traffic routing requirements failed to be installed. (NOTE 2)	
NOTE 1: These attributes are mutually exclusive and only one of them may be present.					
NOTE 2: These attributes are mutually exclusive and only one of them may be present.					

5.6.2.16 Type: DataVolumeInformation

Table 5.6.2.16-1: Definition of type DataVolumeInformation

Attribute name	Data type	P	Cardinality	Description	Applicability
dataVol	VolumeTimedReport	M	1	Contains the UL/DL data usage information of a PDU Session. (NOTE 1)	
upflids	array(UpflInformation)	M	1..N	Contains the identification information of the (I-)UPF(s) associated to the reported data volume information within the "dataVol" attribute.	
gNBId	GNbId	C	0..1	Contains the identifier of the gNB serving the UE to which the reported data volume information within the "dataVol" attribute is related. (NOTE 2)	
NOTE 1: The value of the "downlinkVolume" and "uplinkVolume" attributes within the VolumeTimedReport data structure shall be set to 0 when the PDU session is over a non-3GPP access type.					
NOTE 2: This attribute shall be present only when the PDU session is over a 3GPP access type.					

5.6.2.17 Type: IpAddrUsageInfo

Table 5.6.2.17-1: Definition of type IpAddrUsageInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
ipv4AllocNum	UInteger	O	0..1	The number of allocated IPv4 addresses.	
ipv6AllocNum	UInteger	O	0..1	The number of allocated IPv6 addresses.	
ipv4Usage	UInteger	O	0..1	The percentage of the allocated IPv4 addresses.	
ipv6Usage	UInteger	O	0..1	The percentage of the allocated IPv6 addresses.	
ueIpNum	UInteger	O	0..1	The number of UE IP address.	
prohibitTimeWins	array(TimeWindow)	O	1..N	The time intervals when the allocation of IP is prohibited.	

5.6.2.18 Type StateTransitionInfo

Table 5.6.2.18-1: Definition of type StateTransitionInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	C	0..1	Identifies a UE. (NOTE 1)	
groupId	GroupId	C	0..1	Identifies a UE Group. (NOTE 1)	
transType	SmfEvent	M	1	Indicates the session-related transition type. (NOTE 2)	
numOfTran	UInteger	C	0..1	Represents the number of transitions indicated by the "transType" attribute which were observed. (NOTE 3)	
pctUes	UInteger	C	0..1	Represents the percentage of the UEs of the UE group indicated by the "groupId" attribute for which the transition indicated by the "transType" attribute has been observed. It may only be provided if the "groupId" attribute is provided. (NOTE 3)	
NOTE 1: Exactly one of these attributes shall be included.					
NOTE 2: Only the "PDU_SES_REL", "PLMN_CH", "COMM_FAIL" and "PDU_SES_EST" values are applicable.					
NOTE 3: At least one of these attributes shall be provided.					

5.6.3 Simple data types and enumerations

5.6.3.1 Introduction

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

5.6.3.2 Simple data types

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

Table 5.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability
SubId	string	Identifies an Individual SMF Notification Subscription. To enable that the value is used as part of a URI, the string shall only contain characters allowed according to the "lower-with-hyphen" naming convention defined in 3GPP TS 29.501 [5]. In an OpenAPI [10] schema, the format shall be designated as "SubId".	

5.6.3.3 Enumeration: SmfEvent

Table 5.6.3.3-1: Enumeration SmfEvent

Enumeration value	Description	Applicability
AC_TY_CH	Access Type Change	
UP_PATH_CH	UP Path Change	
PDU_SES_REL	PDU Session Release	
PLMN_CH	PLMN Change	
UE_IP_CH	UE IP address change	
RAT_TY_CH	RAT Type Change	EneNA EnPduSesRatType
DDDS	Downlink data delivery status	DownlinkDataDeliveryStatus
COMM_FAIL	Communication failure	CommunicationFailure
PDU_SES_EST	PDU Session Establishment	PduSessionStatus
QFI_ALLOC	QFI allocation	QfiAllocation
QOS_MON	QoS Monitoring	QoSMonitoring
SMCC_EXP	SM congestion control experience for PDU Session	SMCCE
DISPERSION	Session Management transaction dispersion	Dispersion
RED_TRANS_EXP	Redundant transmission experience for PDU Session	RedundantTransmissionExp
WLAN_INFO	WLAN information on PDU session for which Access Type is NON_3GPP_ACCESS and RAT Type is TRUSTED_WLAN	WlanPerformance
UPF_INFO	The UPF information, including the UPF ID/address/FQDN information.	ServiceExperienceDnPerformance
UP_STATUS_INFO	User Plane status information	UeCommunication
UPF_EVENT	UPF event subscribed via SMF. (NOTE)	UPEAS
SATB_CH	Indicates that the SMF has detected a change between different satellite category, or non-satellite backhaul	EnSatBackhaulCategoryChg
TRAFFIC_CORRELATION	Indicates that the SMF provides 5GC determined traffic correlation information for a set of UEs identified by Traffic Correlation ID.	CommonEASDnAI
TRAFF_ROUTE_REQ_OUTCOME	Indicates the report of the installation outcome of the requested traffic routing requirements.	TrafficRouteReqOutcome
SIM_CONN_FAIL	Indicates that simultaneous connectivity over the source and target PDU Session Anchor failed to be established during a PDU Session Anchor change. If the simultaneous connectivity is successfully established, no notifications are sent.	SimConnFailure
QFI_DEALLOCATION	QFI deallocation.	QoSAssistance
QOS_FLOW_CHANGE	QoS flow change.	QoSAssistance
ENERGY_USAGE_DATA	Indicates that the SMF event is the Energy Consumption Information.	Energy
SIGNALLING_INFO	Indicates the report of Service Signalling characteristics.	SignallingInfo
NOTE: UPF_EVENT shall only be used for "USER_DATA_USAGE_MEASURES" and "USER_DATA_USAGE_TRENDS" event types in 3GPP TS 29.564 [26].		

5.6.3.4 Enumeration: NotificationMethod

The enumeration NotificationMethod represents the notification methods that can be subscribed. It shall comply with the provisions defined in table 5.6.3.4-1.

Table 5.6.3.4-1: Enumeration NotificationMethod

Enumeration value	Description	Applicability
PERIODIC	The notification is periodically sent.	
ONE_TIME	The notification is only sent one time.	
ON_EVENT_DETECTION	The notification is sent each time the event is detected.	

5.6.3.5 void.

5.6.3.6 Enumeration: AppliedSmccType

Table 5.6.3.6-1: Enumeration AppliedSmccType

Enumeration value	Description	Applicability
DNN_CC	Indicates the DNN based congestion control.	
SNSSAI_CC	Indicates the S-NSSAI based congestion control.	

5.6.3.7 Enumeration: TransactionMetric

Table 5.6.3.7-1: Enumeration TransactionMetric

Enumeration value	Description	Applicability
PDU_SES_EST	Indicates the PDU Session Establishment	
PDU_SES_AUTH	Indicates the PDU Session Authentication	
PDU_SES_MODIF	Indicates the PDU Session Modification	
PDU_SES_REL	Indicates the PDU Session Release	

5.6.3.8 Enumeration: PduSessionStatus

Table 5.6.3.8-1: Enumeration PduSessionStatus

Enumeration value	Description	Applicability
ACTIVATED	Indicates the PDU Session status is activated.	
DEACTIVATED	Indicates the PDU Session status is deactivated.	

5.6.3.9 Enumeration: TerminationCause

The enumeration TerminationCause represents the reason to terminate the subscription. It shall comply with the provisions defined in table 5.6.3.9-1.

Table 5.6.3.9-1: Enumeration TerminationCause

Enumeration value	Description	Applicability
PDU_SESSION_RELEASE	Indicates that the subscription to the Energy Consumption Information event is terminated due to all the related PDU session(s) being released.	

5.7 Error handling

5.7.1 General

For the Nsmf_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 Nsmf_EventExposure API.

5.7.2 Protocol Errors

No specific procedures for the Nsmf_EventExposure service are specified.

5.7.3 Application Errors

The application errors defined for the Nsmf_EventExposure service are listed in Table 5.7.3-1.

Table 5.7.3-1: Application errors

Application Error	HTTP status code	Description
MUTING_INSTR_NOT_ACCEPTED	403 Forbidden	Indicates that the muting instructions received by the NF service consumer cannot be accepted.
NO_ACTIVE_PCC_RULE	403 Forbidden	Indicates that QoS monitoring cannot be performed because there is no PCC rule active for the application.
APP_TRAFFIC_MISMATCH_ISSUE	403 Forbidden	Indicates that the SMF cannot process the request due to the SMF not being able to determine the PCC rule(s) matching or overlapping with the received target application traffic information.

5.8 Feature negotiation

The optional features in table 5.8-1 are defined for the Nsmf_EventExposure API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 5.8-1: Supported Features

Feature number	Feature Name	Description
1	DownlinkDataDeliveryStatus	This feature indicates support for the "Downlink data delivery status" event.
2	CommunicationFailure	This feature indicates support for the "communication failure" event.
3	PduSessionStatus	This feature indicates support for the PDU session establishment event and enhancement (PDU session type, IP address) for the PDU session release event.
4	QfiAllocation	This feature indicates support for the "QFI allocation" event.
5	QoSMonitoring	This feature indicates support for the "QoS Monitoring" event. (NOTE 1) (NOTE 3)
6	ES3XX	Extended Support for 3xx redirections. This feature indicates the support of redirection for any service operation, according to Stateless NF procedures as specified in clauses 6.5.3.2 and 6.5.3.3 of 3GPP TS 29.500 [4] and according to HTTP redirection principles for indirect communication, as specified in clause 6.10.9 of 3GPP TS 29.500 [4].
7	EneNA	This feature indicates support for exposing information required the enhancements of network data analytics requirements.
8	ULBuffering	This feature indicates support for Uplink buffering indication. (See NOTE 2)
9	SMCCE	This feature indicates support for Session Management Congestion Control Experience for PDU Session.
10	Dispersion	This feature indicates support for Session Management transactions dispersion.
11	ERIR	Indicates the support of immediate report of the available subscribed event(s) within the subscription response to the NF service consumer.
12	RedundantTransmissionExp	This feature indicates support for Redundant Transmission Experience.
13	WlanPerformance	This feature indicates support for WLAN information on PDU Session for which Access Type is NON_3GPP_ACCESS and RAT Type is TRUSTED_WLAN, to support WLAN performance analytics.
14	EASIPreplacement	This feature indicates the support of provisioning of EAS IP replacement info. (See NOTE 2)
15	BIUMR	This feature bit indicates whether the NF Service Consumer (e.g. SMF) and PCF supports Binding Indication Update for multiple resource contexts specified in clauses 6.12.1 and 5.2.3.2.6 of 3GPP TS 29.500 [4].
16	UeCommunication	This feature indicates the support exposing information required by UE communication analytics, i.e. User Plane status information.
17	ServiceExperience	This feature indicates the support for exposing UPF information required e.g. by QoS Sustainability analytics. (NOTE 4)
18	DnPerformance	This feature indicates the support for exposing UPF information required e.g. by QoS Sustainability analytics. (NOTE 4)
19	MultipleFlowDescriptions	This feature indicates the support of the report of multiple UL and/or DL flows.
20	PacketDelayFailureReport	This feature indicates the support of packet delay failure report as part of QoS Monitoring procedures. This feature requires that QoSMonitoring feature is supported. (NOTE 1)
21	CommonEASDNAI	This feature indicates support of enhancements of UP path change event notification. (NOTE 1)
22	PduSessionInfo	This feature indicates support for PDU Session parameters information.
23	EnhDataMgmt	Indicates the support of enhanced data management mechanisms. Supporting this feature also requires the support of feature EneNA.
24	WlanPerformanceExt_AIML	This feature indicates support for the enhancements of WLAN performance supporting AIML, including support of analytics per UE granularity. Supporting this feature also requires the support of feature WlanPerformance.
25	EasRelocationEnh	This feature indicates enhanced support of EAS relocation procedures via additional information about the AFs that are responsible for certain EAS.

26	UPEAS	This feature indicates the support of UPF enhancements for exposure.
27	EnSatBackhaulCategoryChg	This feature indicates the support of notification of a change between different satellite backhaul categories, or dynamic satellite backhaul categories, or between satellite backhaul and non-satellite backhaul.
28	Void	
29	AreaFilter	This feature indicates support for using an area as a subscription filter.
30	MultipleAccessTypes	This feature indicates the support of providing list of Access Type(s) used for the PDU Session. This is used for MA PDU sessions as well.
31	EnQfiAllocation	Indicates the enhancement on "QFI allocation" event including support of 5QI. Supporting this feature also requires the support of feature QfiAllocation.
32	EnQoSMon	This feature indicates the support of enhanced QoS monitoring functionality, i.e. the report of the congestion information, and/or, the data rate information monitoring. (NOTE 1) (NOTE 3) This feature requires that QoSMonitoring feature is supported.
33	HR-SBO	This feature indicates the support of extensions to User Plane Path Change event notifications to support Home Routed sessions with Session Breakout. (NOTE 2)
34	EnUPEAS	This feature indicates the support of UPF enhancements for exposure during UPF relocation and PDU Session release. The following functionalities are supported: - provision the remaining data reporting indication for the UPF_EVENT event type. This feature requires that UPEAS feature is supported.
35	TrafficRouteReqOutcome	This feature indicates the support for reporting the installation outcome of the requested traffic routing requirements. (NOTE 1)
36	UeSatUeComm	This feature indicates the support of reporting about serving satellite identity for UE-Satellite-UE communication in IMS.
37	SimConnFailure	This feature indicates the support of Simultaneous Connectivity failure events. (NOTE 1)
38	QoSAssistance	This feature indicates the support of QFI deallocation and QoS flow change events, and indicates the enhancement on "QFI allocation" event including support of QoS parameter set. This feature requires the support of the EnQfiAllocation feature.
39	Energy	This feature indicates the support of the Energy consumption information exposure feature. The following functionalities are supported: - Support of energy consumption information reporting.
40	SignallingInfo	This feature indicates the support of signalling information events.
41	EnhEventMgmt	This feature indicates the support of enhanced event management. The following functionalities are supported: - supporting the reference Id per event.
42	UDRRestProc	This feature indicates the support of UDR Restoration Procedures. The following functionalities are supported: - Supporting the provisioning of the UDR Restart Indication.
43	BERMS	This feature indicates the support of notifications bundling. The following functionalities are supported: - provide information related to the bundling of event reports in UPF notifications. This feature requires the support of the UPEAS feature.

44	EnPduSesRatType	This feature indicates the support of including the RAT Type for the PDU Session. The following functionalities are supported: - supporting to provide the current RAT Type as part of the reporting of the PDU Session Establishment/Release event. - supporting to report the RAT Type change to the UDM/NEF. This feature requires the support of the PduSessionStatus feature
45	SEER	This feature indicates the support of skipping event exposure reporting at the UPF. The following functionalities are supported: - provide information related to the skipping of UPF notifications. This feature requires the support of the UPEAS feature.
46	RATTE	This feature indicates the RAT Type information Exposure for UPF event exposure reporting. The following functionalities are supported: - Provide RAT Type information for UPF event reporting. This feature requires the support of the UPEAS feature.
47	SMCCE_Ext	This feature indicates support for the enhancement of Session Management Congestion Control Experience for PDU Session. The following functionalities are supported: - supporting the enhancement for multiple SM NAS messages within the same time window in the EventNotification. This feature requires the support of the SMCCE feature.
NOTE 1: SMF determines the support of this feature by the NF service consumer as part of the implicit subscription information provided by the PCF as described in 3GPP TS 29.512 [14]. NOTE 2: NF service consumers determine the support of this feature as part of the notification of the implicitly subscribed events as described in clause 4.2.2.2. NOTE 3: The negotiation of this feature may be explicit (via Nsmf_EventExposure_Subscribe service operation) or implicit as described in NOTE 1. NOTE 4: The features "ServiceExperience" and "DnPerformance" indicate the support of exactly the same functionality of exposing UPF information, but they are both kept for backwards compatibility purposes. An NF service consumer may use these features for any purpose that requires UPF Information and not only for the calculation of QoS Sustainability analytics.		

5.9 Security

As indicated in 3GPP TS 33.501 [15] and 3GPP TS 29.500 [4], the access to the Nsmf_EventExposure API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [16]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [12]) plays the role of the authorization server.

If OAuth2 is used, an NF service consumer, prior to consuming services offered by the Nsmf_EventExposure API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [12], 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 Nsmf_EventExposure service.

The Nsmf_EventExposure API defines a single scope "nsmf-event-exposure" for the entire service, and it does not define any additional scopes at resource or operation level.

Annex A (normative): OpenAPI specification

A.1 General

The present Annex contains an OpenAPI [10] specification of HTTP messages and content bodies used by the Nsmf_EventExposure API.

This Annex shall take precedence when being discrepant to other parts of the specification with respect to the encoding of information elements and methods within the API.

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

Informative copies of the OpenAPI specification file contained in this 3GPP Technical Specification are available on a Git-based repository that uses the GitLab software version control system (see clause 5B of the 3GPP TR 21.900 [19] and clause 5.3.1 of the 3GPP TS 29.501 [5] for further information).

A.2 Nsmf_EventExposure API

openapi: 3.0.0

info:

version: 1.4.1
title: Nsmf_EventExposure
description: |
Session Management Event Exposure Service.
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All rights reserved.

externalDocs:

description: 3GPP TS 29.508 V19.6.0; 5G System; Session Management Event Exposure Service.
url: https://www.3gpp.org/ftp/Specs/archive/29_series/29.508/

servers:

- url: '{apiRoot}/nsmf-event-exposure/v1'
variables:
apiRoot:
default: <https://example.com>
description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

security:

- {}
- oAuth2ClientCredentials:
- nsmf-event-exposure

paths:

/subscriptions:
post:
operationId: CreateIndividualSubscription
summary: Create an individual subscription for event notifications from the SMF
tags:
- Subscriptions (Collection)
requestBody:
required: true
content:
application/json:
schema:
\$ref: '#/components/schemas/NsmfEventExposure'
responses:
'201':
description: Created.
headers:
Location:
description: >
Contains the URI of the newly created resource, according to the structure

```

    {apiRoot}/nsmf-event-exposure/v1/subscriptions/{subId}
    required: true
    schema:
      type: string
  content:
    application/json:
      schema:
        $ref: '#/components/schemas/NsmfEventExposure'
  '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:
    $ref: 'TS29571_CommonData.yaml#/components/responses/default'
callbacks:
  myNotification:
    '{$request.body#/notifUri}':
      post:
        requestBody:
          required: true
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/NsmfEventExposureNotification'
  responses:
    '204':
      description: No Content, Notification was successful.
    '307':
      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
    '308':
      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '502':
      $ref: 'TS29571_CommonData.yaml#/components/responses/502'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
callbacks:
  afAcknowledgement:
    '{$request.body#/ackUri}':
      post:
        requestBody: # contents of the callback message

```

```

        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AckOfNotify'
      responses:
        '204':
          description: No Content (successful acknowledgement)
        '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'

/subscriptions/{subId}:
  parameters:
    - name: subId
      in: path
      description: Event Subscription ID
      required: true
      schema:
        $ref: '#/components/schemas/SubId'
  get:
    operationId: GetIndividualSubscription
    summary: Read an individual subscription for event notifications from the SMF
    tags:
      - IndividualSubscription (Document)
    responses:
      '200':
        description: OK. Resource representation is returned
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NsmfEventExposure'
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '406':
        $ref: 'TS29571_CommonData.yaml#/components/responses/406'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':

```

```

    $ref: 'TS29571_CommonData.yaml#/components/responses/503'
  default:
    $ref: 'TS29571_CommonData.yaml#/components/responses/default'
put:
  operationId: ReplaceIndividualSubscription
  summary: Replace an individual subscription for event notifications from the SMF
  tags:
    - IndividualSubscription (Document)
  requestBody:
    required: true
    content:
      application/json:
        schema:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NsmfEventExposure'
  responses:
    '200':
      description: OK. Resource was successfully modified and representation is returned
      content:
        application/json:
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/NsmfEventExposure'
    '204':
      description: No Content. Resource was successfully modified
    '307':
      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
    '308':
      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '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:
  operationId: DeleteIndividualSubscription
  summary: Delete an individual subscription for event notifications from the SMF
  tags:
    - IndividualSubscription (Document)
  responses:
    '200':
      description: OK. Resource was successfully deleted and representation is returned
      content:
        application/json:
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/EventNotification'
    '204':
      description: No Content. Resource was successfully deleted
    '307':
      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
    '308':
      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '429':

```

```

    $ref: 'TS29571_CommonData.yaml#/components/responses/429'
  '500':
    $ref: 'TS29571_CommonData.yaml#/components/responses/500'
  '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:
          nsmf-event-exposure: Access to the Nsmf_EventExposure API

```

schemas:

```

NsmfEventExposure:
  description: >
    Represents an Individual SMF Notification Subscription resource. The serviceName property
    corresponds to the serviceName in the main body of the specification.
  type: object
  properties:
    supi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
    gpsi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
    anyUeInd:
      type: boolean
      description: >
        Any UE indication. This IE shall be present if the event subscription is applicable to
        any UE. Default value "false" is used, if not present.
    groupId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
    pduSeId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/PduSessionId'
    dnn:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
    snssai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
    dnai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
    ssid:
      type: string
      description: SSID that the PDU session is related to.
    bssid:
      type: string
      description: BSSID that the PDU session is related to.
    upfId:
      type: string
      description: UPF identity.
    nfId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
    subId:
      $ref: '#/components/schemas/SubId'
    notifId:
      type: string
      description: Notification Correlation ID assigned by the NF service consumer.
    notifUri:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
    altNotifIpv4Addrs:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
        description: Alternate or backup IPV4 address(es) where to send Notifications.
        minItems: 1
    altNotifIpv6Addrs:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Addr'
        description: Alternate or backup IPV6 address(es) where to send Notifications.
        minItems: 1

```

```

altNotifFqdns:
  type: array
  items:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Fqdn'
  minItems: 1
  description: Alternate or backup FQDN(s) where to send Notifications.
eventSubs:
  type: array
  items:
    $ref: '#/components/schemas/EventSubscription'
  minItems: 1
  description: Subscribed events
eventNotifs:
  type: array
  items:
    $ref: '#/components/schemas/EventNotification'
  minItems: 1
ImmeRep:
  type: boolean
notifMethod:
  $ref: '#/components/schemas/NotificationMethod'
maxReportNbr:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
expiry:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
repPeriod:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
guami:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Guami'
serveName:
  $ref: 'TS29510_Nnrf_NFManagement.yaml#/components/schemas/ServiceName'
supportedFeatures:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
sampRatio:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
partitionCriteria:
  type: array
  items:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/PartitioningCriteria'
  minItems: 1
  description: Criteria for partitioning the UEs before applying the sampling ratio.
grpRepTime:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
notifFlag:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/NotificationFlag'
notifFlagInstruct:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/MutingExceptionInstructions'
mutingSetting:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/MutingNotificationsSettings'
defQosSupp:
  type: boolean
  description: >
    Indicates whether the NF service consumer requests to receive QoS Flow performance
    information for the QoS Flow associated with the default QoS rule if there are no
    measurements available for the provided Application Identifier included in the appIds
    attribute. Set to "true" if NF service consumer requests to receive QoS Flow
    performance information for the QoS Flow associated with the default QoS rule, otherwise
    Set to "false" to indicate if NF service consumer does not request to receive QoS Flow
    Performance information for the QoS Flow associated with the default QoS rule. Default
    value is "false" if omitted.
qosMonPending:
  type: boolean
  enum:
    - true
  description: >
    Indicates whether the reporting will be activated when the measurements are
    enabled by a PCC rule. Set to "true" indicates that the reporting will be activated.
    It may only be provided in the response.
udrRestartInd:
  type: boolean
  default: false
  description: >
    Indicates whether the Event Exposure subscription was initiated by the UDM due to a UDR
    restart.
    "true" indicates that the subscription creation request message is sent by the UDM due
    to
    the
    UDR data restoration. Therefore, the Event Exposure Subscription may already exist at

```

SMF.
 "false" indicates that this subscription message is not motivated by a UDR data restoration procedure.

The default value is "false" if this attribute is omitted

required:

- notifId
- notifUri
- eventSubs

NsmfEventExposureNotification:

description: Represents notifications on events that occurred.

type: object

properties:

notifId:

type: string

description: Notification correlation ID

eventNotifs:

type: array

items:

\$ref: '#/components/schemas/EventNotification'

minItems: 1

description: Notifications about Individual Events

ackUri:

\$ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'

required:

- notifId
- eventNotifs

EventSubscription:

description: Represents a subscription to a single event.

type: object

properties:

event:

\$ref: '#/components/schemas/SmfEvent'

referenceId:

\$ref: 'TS29503_Nudm_EE.yaml#/components/schemas/ReferenceId'

dnaiChgType:

\$ref: 'TS29571_CommonData.yaml#/components/schemas/DnaiChangeType'

dddTraDescriptors:

type: array

items:

\$ref: 'TS29571_CommonData.yaml#/components/schemas/DddTrafficDescriptor'

minItems: 1

dddStati:

type: array

items:

\$ref: 'TS29571_CommonData.yaml#/components/schemas/DlDataDeliveryStatus'

minItems: 1

appIds:

type: array

items:

\$ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'

minItems: 1

networkArea:

\$ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'

targetPeriod:

\$ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'

tws:

type: array

items:

\$ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'

minItems: 1

transacDispInd:

type: boolean

description: >

Indicates the subscription for UE transaction dispersion collectionon, if it is included and set to "true". Default value is "false".

transacMetrics:

type: array

items:

\$ref: '#/components/schemas/TransactionMetric'

description: Indicates Session Management Transaction metrics.

minItems: 1

ueIpAddr:

\$ref: 'TS29571_CommonData.yaml#/components/schemas/IpAddr'

upfEvents:

type: array

items:

```

    $ref: 'TS29564_Nupf_EventExposure.yaml#/components/schemas/UpfEvent'
    description: Indicates UPF event exposure information.
    minItems: 1
  bundlingAllowed:
    type: boolean
    enum:
      - true
    description: >
      This attribute may be included for event "UPF_EVENT" and indicates whether it is
      requested to allow the bundling of event reports in UPF notifications. Possible values:
      - "true": it is requested to allow the bundling of event reports in UPF notifications.
      The presence of this attribute with the value "false" shall be prohibited.
  bundleId:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint32'
  bundledEventNotifyUri:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
  flowDescs:
    type: array
    items:
      $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/FlowDescription'
      description: Descriptor(s) of IP traffic.
      minItems: 1
  required:
    - event

EventNotification:
  description: Represents a notification related to a single event that occurred.
  type: object
  properties:
    event:
      $ref: '#/components/schemas/SmfEvent'
    referenceId:
      $ref: 'TS29503_Nudm_EE.yaml#/components/schemas/ReferenceId'
    timeStamp:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    supi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
    gpsi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
    ueIpAddr:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/IpAddr'
    transacInfos:
      type: array
      items:
        $ref: '#/components/schemas/TransactionInfo'
        description: Transaction information.
        minItems: 1
    sourceDnai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
    targetDnai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
    dnaiChgType:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DnaiChangeType'
    traffRouteReqOutcome:
      $ref: '#/components/schemas/TraffRouteReqOutcome'
    candidateDnais:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
      minItems: 1
      description: The candidate DNAI(s) for the PDU Session.
    candDnaisPrioInd:
      type: boolean
      description: >
        If provided and set to true, it indicates that the candidate DNAs provided
        in the candidateDnais attribute are in descending priority order, i.e.,
        the lower the array index the higher the priority of the respective DNAI.
        If omitted, the default value is false.
    easRediscoverInd:
      type: boolean
      description: >
        Indication of EAS re-discovery. If present and set to "true", it indicates the EAS
        re-discovery is performed, e.g. due to change of common EAS. Default value is "false" if
        omitted.
    trafCorreInfo:
      $ref: '#/components/schemas/TrafficCorrelationNotification'
    sourceUeIpv4Addr:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'

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```

sourceUeIpv6Prefix:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Prefix'
targetUeIpv4Addr:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
targetUeIpv6Prefix:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Prefix'
sourceTraRouting:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/RouteToLocation'
targetTraRouting:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/RouteToLocation'
ueMac:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/MacAddr48'
adIpv4Addr:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
adIpv6Prefix:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Prefix'
reIpv4Addr:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
reIpv6Prefix:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Prefix'
plmnId:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/PlmnIdNid'
accType:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/AccessType'
pduAccTypes:
  type: array
  items:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/AccessType'
  minItems: 1
pduSeId:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/PduSessionId'
ratType:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/RatType'
dddStatus:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/DlDataDeliveryStatus'
dddTraDescriptor:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/DddTrafficDescriptor'
maxWaitTime:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
commFailure:
  $ref: 'TS29518_Namf_EventExposure.yaml#/components/schemas/CommunicationFailure'
ipv4Addr:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
ipv6Prefixes:
  type: array
  items:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Prefix'
  minItems: 1
ipv6Addrs:
  type: array
  items:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv6Addr'
  minItems: 1
pduSessType:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/PduSessionType'
sscMode:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/SscMode'
qfi:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Qfi'
appId:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
ethFlowDescs:
  type: array
  items:
    $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/EthFlowDescription'
  minItems: 1
  description: >
    Descriptor(s) for non-IP traffic. It allows the encoding of multiple UL and/or DL flows.
    Each entry of the array describes a single Ethernet flow.
ethfDescs:
  type: array
  items:
    $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/EthFlowDescription'
  minItems: 1
  maxItems: 2
  description: >
    Contains the UL and/or DL Ethernet flows. Each entry of the array describes a single
    Ethernet flow.

```

```

flowDescs:
  type: array
  items:
    $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/FlowDescription'
  minItems: 1
  description: >
    Descriptor(s) for IP traffic. It allows the encoding of multiple UL and/or DL flows.
    Each entry of the array describes a single IP flow.
fDescs:
  type: array
  items:
    $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/FlowDescription'
  minItems: 1
  maxItems: 2
  description: >
    Contains the UL and/or DL IP flows. Each entry of the array describes a single
    IP flow.
dnn:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
snssai:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
ulDelays:
  type: array
  items:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
  minItems: 1
dlDelays:
  type: array
  items:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
  minItems: 1
rtDelays:
  type: array
  items:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
  minItems: 1
ulCongInfo:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
dlCongInfo:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
ulDataRate:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
dlDataRate:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/BitRate'
timeWindow:
  $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
smNasFromUe:
  $ref: '#/components/schemas/SmNasFromUe'
addSmNasFromUes:
  type: array
  items:
    $ref: '#/components/schemas/SmNasFromUe'
  minItems: 1
smNasFromSmf:
  $ref: '#/components/schemas/SmNasFromSmf'
addSmNasFromSmfs:
  type: array
  items:
    $ref: '#/components/schemas/SmNasFromSmf'
  minItems: 1
upRedTrans:
  type: boolean
  description: >
    Indicates whether the redundant transmission is setup or terminated. Set to "true" if
    the redundant transmission is setup, otherwise set to "false" if the redundant
    transmission is terminated. Default value is "false" if omitted.
ssId:
  type: string
bssId:
  type: string
startWlan:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
endWlan:
  $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
pduSessInfos:
  type: array
  items:
    $ref: '#/components/schemas/PduSessionInformation'

```

```

    minItems: 1
  upfInfo:
    $ref: '#/components/schemas/UpfInformation'
  pdmf:
    type: boolean
    description: >
      Represents the packet delay measurement failure indicator. Default value is false
      if omitted.
  satBackhaulCat:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/SatelliteBackhaulCategory'
  supportedFeatures:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
  targetAfId:
    type: string
    description: Identifier of the Application Function responsible for the target DNAI.
  5qi:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/5qi'
  qosPara:
    $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/QosPara'
  dataVolInfoData:
    type: array
    items:
      $ref: '#/components/schemas/DataVolumeInformation'
    minItems: 1
  usageInfo:
    $ref: '#/components/schemas/IpAddrUsageInfo'
  loadInfos:
    type: array
    items:
      $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NfLoadLevelInformation'
    minItems: 1
  numSessRep:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
  stateTransitions:
    type: array
    items:
      $ref: '#/components/schemas/StateTransitionInfo'
    minItems: 1
  nfSignalInfo:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/NfSignallingInfo'
  smfTimers:
    type: array
    items:
      $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/TimerInfo'
    minItems: 1
  terminationInd:
    type: boolean
    enum:
      - true
    description: >
      Indicates that the subscription to the Energy Consumption Information event is
      terminated.
      "true" indicates that the subscription to the Energy Consumption Information event is
      terminated.
      The presence of this attribute set to the value false is prohibited.
  terminationCause:
    $ref: '#/components/schemas/TerminationCause'
  required:
    - event
    - timeStamp
  not:
    required: [ipv6Prefixes, ipv6Addrs]

StateTransitionInfo:
  description: Represents session-related state transition information.
  type: object
  properties:
    supi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
    groupId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
    tranType:
      $ref: '#/components/schemas/SmfEvent'
    numOfTran:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
    pctUes:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'

```

```
required:
- transType
allof:
- oneOf:
  - required: [supi]
  - required: [groupId]
- anyOf:
  - required: [numOfTran]
  - required: [pctUes]

SubId:
  type: string
  format: SubId
  description: >
    Identifies an Individual SMF Notification Subscription. To enable that the value is used as
    part of a URI, the string shall only contain characters allowed according to the
    "lower-with-hyphen" naming convention defined in 3GPP TS 29.501. In an OpenAPI schema, the
    format shall be designated as "SubId".

AckOfNotify:
  description: Represents an acknowledgement information of an event notification.
  type: object
  properties:
    notifId:
      type: string
    ackResult:
      $ref: 'TS29522_TrafficInfluence.yaml#/components/schemas/AfResultInfo'
    supi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
    gpsi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
    remoteImsAddress:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/RouteInformation'
  required:
  - notifId
  - ackResult

SmNasFromUe:
  description: >
    Represents information on the SM NAS messages that SMF receives from UE for PDU Session.
  type: object
  properties:
    smNasType:
      type: string
    timeStamp:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
  required:
  - smNasType
  - timeStamp

SmNasFromSmf:
  description: >
    Represents information on the SM congestion control applied SM NAS messages that SMF sends
    to UE for PDU Session.
  type: object
  properties:
    smNasType:
      type: string
    timeStamp:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    backoffTimer:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
    appliedSmccType:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/AppliedSmccType'
  required:
  - smNasType
  - timeStamp
  - backoffTimer
  - appliedSmccType

TransactionInfo:
  description: Represents SMF Transaction Information.
  type: object
  properties:
    transaction:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
    snssai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
```

```
    appIds:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
      minItems: 1
    transacMetrics:
      type: array
      items:
        $ref: '#/components/schemas/TransactionMetric'
      minItems: 1
    required:
      - transaction

PduSessionInformation:
  description: Represents the PDU session related information.
  type: object
  properties:
    pduSessId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/PduSessionId'
    sessInfo:
      $ref: '#/components/schemas/PduSessionInfo'

PduSessionInfo:
  description: Represents session information.
  type: object
  properties:
    n4SessId:
      type: string
      description: The identifier of the N4 session for the reported PDU Session.
    sessInactiveTimer:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
    pduSessStatus:
      $ref: '#/components/schemas/PduSessionStatus'

UpfInformation:
  description: Represents the ID/address/FQDN of the UPF.
  type: object
  properties:
    upfId:
      type: string
    upfAddr:
      $ref: 'TS29517_Naf_EventExposure.yaml#/components/schemas/AddrFqdn'

TrafficCorrelationNotification:
  description: Represents notifications for 5GC determined Traffic Correlation Information.
  type: object
  properties:
    smfId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
    tfcCorrId:
      type: string
      description: >
        Identification of a set of UEs accessing the application identified by the
        Application Identifier or traffic filtering information.
    dnais:
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
      minItems: 1
    easFqdn:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Fqdn'
    easIpAddr:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/IpAddr'
    pduSessionNbr:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
  required:
    - smfId
    - pduSessionNbr
    - tfcCorrId
  anyOf:
    - required: [dnais]
    - oneOf:
      - required: [easFqdn]
      - required: [easIpAddr]

TraffRouteReqOutcome:
  description: >
    Represents the installation outcome of the requested traffic routing requirements.
```

```

type: object
properties:
  succTrafficFlows:
    type: array
    items:
      $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/FlowDescription'
    minItems: 1
  succEthTrafficFlows:
    type: array
    items:
      $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/EthFlowDescription'
    minItems: 1
  failedTrafficFlows:
    type: array
    items:
      $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/FlowDescription'
    minItems: 1
  failedEthTrafficFlows:
    type: array
    items:
      $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/EthFlowDescription'
    minItems: 1
  allOf:
    - not:
        required: [succTrafficFlows, succEthTrafficFlows]
    - not:
        required: [failedTrafficFlows, failedEthTrafficFlows]

DataVolumeInformation:
  description: Represents the Data Volume information.
  type: object
  properties:
    dataVol:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/VolumeTimedReport'
    upfIds:
      type: array
      items:
        $ref: '#/components/schemas/UpfInformation'
      minItems: 1
    gNBId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/GNBId'
  required:
    - dataVol
    - upfIds

IpAddrUsageInfo:
  description: Indicates the usage information of UE IP address resources.
  type: object
  properties:
    ipv4AllocNum:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
    ipv6AllocNum:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
    ipv4Usage:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
    ipv6Usage:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
    ueIpNum:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/UInteger'
    prohibitTimeWins:
      type: array
      items:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
      minItems: 1

SmfEvent:
  anyOf:
    - type: string
      enum:
        - AC_TY_CH
        - UP_PATH_CH
        - PDU_SES_REL
        - PLMN_CH
        - UE_IP_CH
        - RAT_TY_CH
        - DDDS
        - COMM_FAIL
        - PDU_SES_EST

```

- QFI_ALLOC
- QOS_MON
- SMCC_EXP
- DISPERSION
- RED_TRANS_EXP
- WLAN_INFO
- UPF_INFO
- UP_STATUS_INFO
- UPF_EVENT
- SATB_CH
- TRAFFIC_CORRELATION
- TRAFF_ROUTE_REQ_OUTCOME
- SIM_CONN_FAIL
- QFI_DEALLOCATION
- QOS_FLOW_CHANGE
- ENERGY_USAGE_DATA
- SIGNALLING_INFO

- type: string

description: >

This string provides forward-compatibility with future extensions to the enumeration and is not used to encode content defined in the present version of this API.

description: |

Represents the types of events that can be subscribed.

Possible values are:

- AC_TY_CH: Access Type Change.
- UP_PATH_CH: UP Path Change.
- PDU_SES_REL: PDU Session Release.
- PLMN_CH: PLMN Change.
- UE_IP_CH: UE IP address change.
- RAT_TY_CH: RAT Type Change.
- DDDS: Downlink data delivery status.
- COMM_FAIL: Communication Failure.
- PDU_SES_EST: PDU Session Establishment.
- QFI_ALLOC: QFI allocation.
- QOS_MON: QoS Monitoring.
- SMCC_EXP: SM congestion control experience for PDU Session.
- DISPERSION: Session Management transaction dispersion.
- RED_TRANS_EXP: Redundant transmission experience for PDU Session.
- WLAN_INFO: WLAN information on PDU session for which Access Type is NON_3GPP_ACCESS and RAT Type is TRUSTED_WLAN.
- UPF_INFO: The UPF information, including the UPF ID/address/FQDN information.
- UP_STATUS_INFO: The User Plane status information.
- UPF_EVENT: UPF event subscribed via SMF.
- SATB_CH: Satellite backhaul category change.
- TRAFFIC_CORRELATION: Indicates that the SMF provides 5GC determined traffic correlation information for a set of UEs identified by Traffic Correlation ID.
- TRAFF_ROUTE_REQ_OUTCOME: Indicates the report of the installation outcome of the requested traffic routing requirements.
- SIM_CONN_FAIL: Indicates that the simultaneous connectivity over the source and the target PDU Session Anchor failed to be established during a PDU Session Anchor change.
- QFI_DEALLOCATION: QFI deallocation.
- QOS_FLOW_CHANGE: QoS flow change.
- ENERGY_USAGE_DATA: Indicates that the SMF event is the Energy Consumption Information.
- SIGNALLING_INFO: Indicates the report of Service Signalling characteristics.

NotificationMethod:

anyOf:

- type: string

enum:

- PERIODIC
- ONE_TIME
- ON_EVENT_DETECTION

- type: string

description: >

This string provides forward-compatibility with future extensions to the enumeration and is not used to encode content defined in the present version of this API.

description: |

Represents the notification methods that can be subscribed.

Possible values are:

- PERIODIC: The notification is periodically sent.
- ONE_TIME: The notification is only sent one time.
- ON_EVENT_DETECTION: The notification is sent each time the event is detected.

AppliedSmccType:

anyOf:

- type: string

```
enum:
  - DNN_CC
  - SNSSAI_CC
description: >
  This string indicates the type of applied SM congestion control.
- type: string
description: >
  This string provides forward-compatibility with future
  extensions to the enumeration and is not used to encode
  content defined in the present version of this API.
description: |
  Represents the type of applied SM congestion control.
  Possible values are:
  - DNN_CC: Indicates the DNN based congestion control.
  - SNSSAI_CC: Indicates the S-NSSAI based congestion control.

TransactionMetric:
anyOf:
- type: string
  enum:
    - PDU_SES_EST
    - PDU_SES_AUTH
    - PDU_SES_MODIF
    - PDU_SES_REL
- type: string
description: >
  This string provides forward-compatibility with future extensions to the enumeration
  and is not used to encode content defined in the present version of this API.
description: |
  Represents the metric on UE Session Management transactions.
  Possible values are:
  - PDU_SES_EST: PDU Session Establishment.
  - PDU_SES_AUTH: PDU Session Authentication.
  - PDU_SES_MODIF: PDU Session Modification.
  - PDU_SES_REL: PDU Session Release

PduSessionStatus:
anyOf:
- type: string
  enum:
    - ACTIVATED
    - DEACTIVATED
- type: string
description: >
  This string provides forward-compatibility with future extensions to the enumeration
  and is not used to encode content defined in the present version of this API.

description: |
  Represents the status of the PDU Session.
  Possible values are:
  - ACTIVATED: PDU Session status is activated.
  - DEACTIVATED: PDU Session status is deactivated.

TerminationCause:
anyOf:
- type: string
  enum:
    - PDU_SESSION_RELEASE
- type: string
description: >
  This string provides forward-compatibility with future extensions to the enumeration
  and is not used to encode content defined in the present version of this API.

description: |
  Represents the reason to terminate the subscription.
  Possible values are:
  - PDU_SESSION_RELEASE: Indicates that the subscription to the Energy Consumption Information
    event is terminated due to all the related PDU session(s) being released.
```

Annex B (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2017-10						TS skeleton of Session Management Event Exposure Service specification	0.0.0
2017-10	CT3#92					C3-175326, C3-175327 and C3-175281	0.1.0
2017-12	CT3#93					C3-176071, C3-176240, C3-176316, C3-176242, C3-176243, C3-176244, C3-176317 and C3-176318	0.2.0
2018-01	CT3#94					C3-180034, C3-180196 and C3-180197	0.3.0
2018-03	CT3#95	C3-181366				Inclusion of P-CRs agreed in CT3#95: C3-181214, C3-181215, C3-181216, C3-181217, C3-181354, C3-181353.	0.4.0
2018-04	CT3#96					C3-182315, C3-182316, C3-182144, C3-182317	0.5.0
2018-05	CT3#97					C3-183452, C3-183451, C3-183829, C3-183453, C3-183454, C3-183283 and C3-183455.	0.6.0
2018-06	CT#80	CP-181039				TS sent to plenary for approval	1.0.0
2018-06	CT#80	CP-181039				TS approved by plenary	15.0.0
2018-09	CT#81	CP-182015	0001	2	F	DNAI change notification type	15.1.0
2018-09	CT#81	CP-182015	0002	4	F	Completion of Error Codes in OpenAPI file	15.1.0
2018-09	CT#81	CP-182015	0003		F	Definition of DNAI	15.1.0
2018-09	CT#81	CP-182015	0004	2	F	Stateless AMF support updates	15.1.0
2018-09	CT#81	CP-182015	0007	1	F	Encoding of the "N6 traffic routing information"	15.1.0
2018-09	CT#81	CP-182033	0008	2	F	Addition of Time Stamp	15.1.0
2018-09	CT#81	CP-182015	0009	1	F	Update of resource figure	15.1.0
2018-09	CT#81	CP-182015	0010		F	Update of resource figure	15.1.0
2018-12	CT#82	CP-183205	0011	6	F	Correction to the event subscription	15.2.0
2018-12	CT#82	CP-183205	0012	4	F	Correction to the AF influence traffic steering control	15.2.0
2018-12	CT#82	CP-183137	0013	5	F	Immediate reporting flag	15.2.0
2018-12	CT#82	CP-183205	0014	2	F	UE ID in the notification	15.2.0
2018-12	CT#82	CP-183205	0015	1	F	Correction to the overview	15.2.0
2018-12	CT#82	CP-183205	0016	2	F	Correction to the NF consumer	15.2.0
2018-12	CT#82	CP-183205	0017	1	F	Location Header	15.2.0
2018-12	CT#82	CP-183205	0018		F	Data for notification	15.2.0
2018-12	CT#82	CP-183205	0019	1	F	NotificationMethod	15.2.0
2018-12	CT#82	CP-183205	0020	1	F	Correction of apiName	15.2.0
2018-12	CT#82	CP-183205	0021		F	Default value for apiRoot	15.2.0
2018-12	CT#82	CP-183205	0023		F	API version	15.2.0
2018-12	CT#82	CP-183205	0024	1	F	ExternalDocs OpenAPI field	15.2.0
2018-12	CT#82	CP-183205	0025		F	Location header field in OpenAPI	15.2.0
2018-12	CT#82	CP-183205	0026	1	F	Security	15.2.0
2018-12	CT#82	CP-183205	0027		F	supported content types	15.2.0
2018-12	CT#82	CP-183205	0028	2	F	HTTP Error responses	15.2.0
2018-12	CT#82	CP-183205	0029	1	F	Monitoring identities	15.2.0
2018-12	CT#82	CP-183205	0030		F	Correction to the names of data types	15.2.0
2018-12	CT#82	CP-183205	0031		F	Report of Ethernet UE address	15.2.0
2019-03	CT#83	CP-190117	0032	1	F	Correction of name of security scope	15.3.0
2019-03	CT#83	CP-190117	0033	2	F	API version update for Rel-15	15.3.0
2019-03	CT#83	CP-190117	0034	1	F	Correction of URIs in resource structure table and figure	15.3.0
2019-06	CT#84	CP-191074	0037	3	F	Correct condition for DNAI in UP path change	15.4.0
2019-06	CT#84	CP-191074	0038	1	F	Precedence of OpenAPI file	15.4.0
2019-06	CT#84	CP-191074	0041	1	F	Correction of Misplaced Location header in OpenAPI file	15.4.0
2019-06	CT#84	CP-191074	0043	2	F	API version Update	15.4.0
2019-06	CT#84	CP-191074	0044	1	F	Copyright Note in YAML file	15.4.0
2019-06	CT#84	CP-191070	0039	3	B	Downlink data delivery status event	16.0.0
2019-06	CT#84	CP-191071	0040	3	B	AF acknowledgement of UP path event notification	16.0.0
2019-06	CT#84	CP-191101	0042	2	F	API version Update	16.0.0
2019-09	CT#85	CP-192169	0045		B	Add communication failure event	16.1.0
2019-09	CT#85	CP-192141	0046	1	A	Correct SMF event exposure service name	16.1.0
2019-09	CT#85	CP-192157	0047	1	B	Enhancement of event reporting information	16.1.0
2019-09	CT#85	CP-192157	0048	2	B	Support for Service Experience	16.1.0
2019-09	CT#85	CP-192159	0049	1	B	I-SMF notification to SMF	16.1.0
2019-09	CT#85	CP-192220	0050	3	B	Notification of downlink data delivery status	16.1.0
2019-09	CT#85	CP-192138	0051	2	B	AF acknowledgement of UP path event notification	16.1.0
2019-09	CT#85	CP-192173	0054		F	OpenAPI version update for TS 29.508 Rel-16	16.1.0
2019-12	CT#86	CP-193183	0056		A	Usage of the "serviceName" attribute	16.2.0
2019-12	CT#86	CP-193197	0057		F	Data type of the "serviceName" attribute	16.2.0
2019-12	CT#86	CP-193181	0058	1	B	OpenAPI file update to support AF acknowledgement	16.2.0
2019-12	CT#86	CP-193181	0059	3	F	Update of AFRelocationAck feature	16.2.0
2019-12	CT#86	CP-193201	0060	1	B	I-SMF applicable event	16.2.0
2019-12	CT#86	CP-193183	0062	1	A	Correction on 307 error, 29.508	16.2.0
2019-12	CT#86	CP-193212	0064		F	Update of API version and TS version in OpenAPI file	16.2.0
2020-03	CT#87e	CP-200220	0065	1	B	Update of the Availability after DDN Failure event	16.3.0

2020-03	CT#87e	CP-200230	0066	1	B	Update of the DDD status event	16.3.0
2020-03	CT#87e	CP-200202	0067	1	B	QoS Monitoring Report	16.3.0
2020-03	CT#87e	CP-200198	0068		B	Support PDU session establishment event	16.3.0
2020-03	CT#87e	CP-200198	0070		F	V-SMF applicable event	16.3.0
2020-03	CT#87e	CP-200241	0071	2	B	QFI allocation event	16.3.0
2020-03	CT#87e	CP-200211	0072		F	DDD status for I-SMF	16.3.0
2020-03	CT#87e	CP-200216	0073		F	Update of OpenAPI version and TS version in externalDocs field	16.3.0
2020-06	CT#88e	CP-201210	0075	1	F	Correction to the DDD status event	16.4.0
2020-06	CT#88e	CP-201246	0077	1	F	Correct presence condition in event subscription	16.4.0
2020-06	CT#88e	CP-201244	0078	1	F	Storage of YAML files in ETSI Forge	16.4.0
2020-06	CT#88e	CP-201210	0079		F	Monitoring event normalization in roaming case	16.4.0
2020-06	CT#88e	CP-201256	0080	1	F	URI of the Nsmf_EventExposure service	16.4.0
2020-06	CT#88e	CP-201213	0081	1	F	Correction to QoS Monitoring report	16.4.0
2020-06	CT#88e	CP-201216	0083		A	Notification Uri and subId resource URI	16.4.0
2020-06	CT#88e	CP-201216	0085	1	A	OpenAPI: adding Location header field in 307 response	16.4.0
2020-06	CT#88e	CP-201233	0086	1	B	FQDN of alternate or backup AMF	16.4.0
2020-06	CT#88e	CP-201210	0087		B	Add DNN and Slice filter	16.4.0
2020-06	CT#88e	CP-201210	0088		F	Correct presence condition for snssai	16.4.0
2020-06	CT#88e	CP-201213	0089	1	F	Add missing event	16.4.0
2020-06	CT#88e	CP-201244	0092		F	Optionality of ProblemDetails	16.4.0
2020-06	CT#88e	CP-201244	0093	1	F	Supported headers, Resource Data type, Operation Name	16.4.0
2020-06	CT#88e	CP-201255	0095		F	Update of OpenAPI version and TS version in externalDocs field	16.4.0
2020-09	CT#89e	CP-202050	0096	1	F	notifId used for QoS monitoring report	16.5.0
2020-09	CT#89e	CP-202048	0097		F	Correction to detection of downlink data delivery status change	16.5.0
2020-09	CT#89e	CP-202067	0100		F	Remove UP path change for I-SMF	16.5.0
2020-09	CT#89e	CP-202209	0101	1	F	Subscribed delivery status	16.5.0
2020-09	CT#89e	CP-202073	0098		F	Successful status code	17.0.0
2020-12	CT#90e	CP-203139	0103	1	A	Essential corrections and alignments	17.1.0
2020-12	CT#90e	CP-203139	0105	1	A	Storage of YAML files in 3GPP Forge	17.1.0
2020-12	CT#90e	CP-203108	0107		A	Correction to ddd status when the SMF buffers the data	17.1.0
2020-12	CT#90e	CP-203113	0110	1	A	Corrections on resourceURI	17.1.0
2020-12	CT#90e	CP-203108	0112	1	A	notifId provided by the UDM for CIoT events	17.1.0
2021-03	CT#91e	CP-210191	0115	1	A	Support of stateless NFs	17.2.0
2021-03	CT#91e	CP-210218	0118		F	OpenAPI reference	17.2.0
2021-03	CT#91e	CP-210219	0119		F	Clarification on optional HTTP custom headers	17.2.0
2021-03	CT#91e	CP-210189	0121	1	A	Correction to DDD status event detection	17.2.0
2021-03	CT#91e	CP-210189	0123		A	Correction to DDD status event subscription	17.2.0
2021-03	CT#91e	CP-210221	0124	1	F	Ambiguous concept of NF service consumer terminology	17.2.0
2021-03	CT#91e	CP-210219	0125	1	F	Adding some missing description fields to data type definitions in OpenAPI specification files	17.2.0
2021-03	CT#91e	CP-210194	0128		A	alignment of dnaIChgType attribute	17.2.0
2021-03	CT#91e	CP-210240	0130		F	Update of OpenAPI version and TS version in externalDocs field	17.2.0
2021-06	CT#92e	CP-211221	0131	2	B	Partitioning criteria for applying sampling in specific UE partitions in SMF exposure	17.3.0
2021-06	CT#92e	CP-211221	0132	1	B	Support of Mute Reporting	17.3.0
2021-06	CT#92e	CP-211200	0134	1	A	Temporary and Permanent Redirection	17.3.0
2021-06	CT#92e	CP-211243	0135	1	F	Removal of resource URI in Notification Acknowledgement procedure	17.3.0
2021-06	CT#92e	CP-211221	0136	1	B	Nsmf_EventExposure supports RAT Type Change Event	17.3.0
2021-06	CT#92e	CP-211265	0138		F	Update of OpenAPI version and TS version in externalDocs field	17.3.0
2021-09	CT#93e	CP-212220	0139	1	F	Correction of URI structure	17.4.0
2021-09	CT#93e	CP-212221	0141	1	A	Missing PDU Session ID from QFI allocation event notifications	17.4.0
2021-09	CT#93e	CP-212198	0142	2	B	Adding uplink buffering indication for Application Relocation	17.4.0
2021-09	CT#93e	CP-212203	0143	1	F	Corrections for RAT Type exposure	17.4.0
2021-09	CT#93e	CP-212223	0144		F	Update of OpenAPI version and TS version in externalDocs field	17.4.0
2021-12	CT#94e	CP-213227	0145	1	B	Update input data collection for Slice load level information	17.5.0
2021-12	CT#94e	CP-213228	0146	2	B	New event for SM congestion control experience	17.5.0
2021-12	CT#94e	CP-213238	0148		A	The <apiName> of the Nsmf_EventExposure API	17.5.0
2021-12	CT#94e	CP-213223	0149	1	B	Adding EAS IP replacement information in AppRelocationInfo	17.5.0
2021-12	CT#94e	CP-213228	0150	1	B	Adding DCCF as SMF event exposure NF service consumer	17.5.0
2021-12	CT#94e	CP-213239	0151		F	Adding missing conditions on features for notifications about subscribed events	17.5.0
2021-12	CT#94e	CP-213244	0152		F	Handling of implicit subscriptions	17.5.0
2021-12	CT#94e	CP-213215	0154	1	A	Essential correction to immediate report	17.5.0

2021-12	CT#94e	CP-213228	0155	1	B	Transactions dispersion information collected from serving SMF	17.5.0
2021-12	CT#94e	CP-213246	0156		F	Update of OpenAPI version and TS version in externalDocs field	17.5.0
2022-03	CT#95e	CP-220195	0159	4	B	Event report in the subscription response	17.6.0
2022-03	CT#95e	CP-220189	0161	1	B	Support Redundant Transmission Experience	17.6.0
2022-03	CT#95e	CP-220189	0162	1	B	Support new event on WLAN information	17.6.0
2022-03	CT#95e	CP-220190	0163	1	F	Corrections related to SMCCE	17.6.0
2022-03	CT#95e	CP-220190	0164	1	F	Corrections related to Dispersion	17.6.0
2022-03	CT#95e	CP-220192	0165	1	D	Correction of SMCC and other abbreviations	17.6.0
2022-03	CT#95e	CP-220186	0166	1	F	Handling of supported features for Edge Computing	17.6.0
2022-03	CT#95e	CP-220175	0168		A	Corrections related to URLLC	17.6.0
2022-03	CT#95e	CP-220201	0169		B	Updating Binding Indication for multiple resource contexts feature	17.6.0
2022-03	CT#95e	CP-220191	0170		B	Provide PDU session information for supporting the UE communication analytics	17.6.0
2022-03	CT#95e	CP-220192	0171	1	B	Support UPF information for service experience and DN performance analytics	17.6.0
2022-03	CT#95e	CP-220194	0172		F	Update of info and externalDocs fields	17.6.0
2022-06	CT#96	CP-221154	0173	1	F	Formatting of description fields	17.7.0
2022-06	CT#96	CP-221154	0174		F	Using the common data type for FQDN	17.7.0
2022-06	CT#96	CP-221157	0175		F	Inaccurate condition for immediate reporting	17.7.0
2022-06	CT#96	CP-221129	0176		F	Correction to the notifFlag attribute in subscription modification	17.7.0
2022-06	CT#96	CP-221129	0177		F	Completion of subscription modification procedure	17.7.0
2022-06	CT#96	CP-221129	0178		F	missing applicable RED_TRANS_EXP event for targetPeriod attribute	17.7.0
2022-06	CT#96	CP-221130	0179	1	B	Resolve editor's note on Redundant Transmission Experience event	17.7.0
2022-06	CT#96	CP-221130	0180		F	Corrections to SMCCE	17.7.0
2022-06	CT#96	CP-221133	0181		F	Muting notifications correction	17.7.0
2022-06	CT#96	CP-221157	0182	1	F	Correction to the reported flows	17.7.0
2022-06	CT#96	CP-221151	0183		F	Update of info and externalDocs fields	17.7.0
2022-09	CT#97e	CP-222123	0184	1	F	Alignment with the SBI template	17.8.0
2022-12	CT#98e	CP-223173	0186	1	F	User Plane Status Information event handling	17.9.0
2022-12	CT#98e	CP-223177	0188		F	Adding support of SNPN	17.9.0
2022-12	CT#98e	CP-223188	0190		F	Update of info and externalDocs fields	17.9.0
2022-12	CT#98e	CP-223191	0187		F	Adding the mandatory error code 502 Bad Gateway	18.0.0
2022-12	CT#98e	CP-223192	0189	1	F	Enumeration definitions in the OpenAPI file	18.0.0
2022-12	CT#98e	CP-223189	0191		F	Update of info and externalDocs fields	18.0.0
2023-03	CT#99	CP-230166	0192		F	Adding missing presence condition for IPv6 addresses and prefixes	18.1.0
2023-03	CT#99	CP-230175	0196	1	F	Clarification regarding maxReportNbr	18.1.0
2023-03	CT#99	CP-230176	0197	1	F	Correct the event name for downlink data delivery status	18.1.0
2023-03	CT#99	CP-230174	0198		F	Corrections on subscription notification	18.1.0
2023-03	CT#99	CP-230174	0199		F	Corrections on PDU Session Establishment	18.1.0
2023-03	CT#99	CP-230166	0200		F	Correction of the description fields in enumerations	18.1.0
2023-03	CT#99	CP-230145	0202		A	Missing presence condition for transacInfos attribute	18.1.0
2023-03	CT#99	CP-230174	0204		F	Alignment of packet delay report	18.1.0
2023-03	CT#99	CP-230175	0209	1	F	Support of indirect feature negotiation	18.1.0
2023-03	CT#99	CP-230173	0211	1	A	Correction on handling of Packet Delay Failure report Threshold	18.1.0
2023-03	CT#99	CP-230166	0212		F	Corrections to attributes not respecting the naming convention	18.1.0
2023-03	CT#99	CP-230137	0213	1	B	Support of common DNAI selection by AF	18.1.0
2023-03	CT#99	CP-230161	0217		F	Update of info and externalDocs fields	18.1.0
2023-06	CT#100	CP-231124	0215	2	B	Support NWDAF assisted URSPs in Service Experience	18.2.0
2023-06	CT#100	CP-231135	0218	1	B	Prioritization of candidate DNAIs	18.2.0
2023-06	CT#100	CP-231136	0219	3	B	Indicating target AF in UP path change events	18.2.0
2023-06	CT#100	CP-231125	0220	1	B	Event muting enhancements for SMF event exposure	18.2.0
2023-06	CT#100	CP-231135	0222	1	B	Support NWDAF assisted URSPs in Service Experience	18.2.0
2023-06	CT#100	CP-231135	0225	1	B	Complete common DNAI and EAS selection	18.2.0
2023-06	CT#100	CP-231127	0226	1	B	Enhancements to WLAN performance event	18.2.0
2023-06	CT#100	CP-231157	0227	1	B	Subscription to UPF notifications via SMF	18.2.0
2023-06	CT#100	CP-231132	0228	1	F	HTTP redirection clause correction	18.2.0
2023-06	CT#100	CP-231183	0229	1	B	Support of SMF event exposure related to dynamic satellite backhaul	18.2.0
2023-06	CT#100	CP-231128	0230	1	B	Input data support of End-to-end data volume transfer time analytics	18.2.0
2023-06	CT#100	CP-231141	0231		F	Update of info and externalDocs fields	18.2.0
2023-09	CT#101	CP-232250	0233	2	B	Support of the Congestion Information Monitoring	18.3.0
2023-09	CT#101	CP-232085	0234		F	Update of info and externalDocs fields	18.3.0
2023-12	CT#102	CP-233225	0232	3	B	Supporting data collection for PDU Session Traffic Analytics	18.4.0

2023-12	CT#102	CP-233224	0235	1	B	Collect list of Access Types used for the PDU session from SMF	18.4.0
2023-12	CT#102	CP-233224	0236	1	B	Support of 5QI collection from SMF	18.4.0
2023-12	CT#102	CP-233233	0237	1	F	Support of the new feature name EnQoSMon	18.4.0
2023-12	CT#102	CP-233239	0238		B	Supporting SMF Traffic Correlation Notification	18.4.0
2023-12	CT#102	CP-233228	0239		F	Update HTTP RFC 7540 obsoleted by IETF RFC 9113	18.4.0
2023-12	CT#102	CP-233249	0240		F	Corrections to the inputs of subscription to UPF events	18.4.0
2023-12	CT#102	CP-233228	0241	1	F	Update HTTP RFC 7807 obsoleted by IETF RFC 9457	18.4.0
2023-12	CT#102	CP-233254	0242	1	A	Correction of anyUeInd attribute	18.4.0
2023-12	CT#102	CP-233249	0243	1	B	Support of explicit QoS monitoring subscription	18.4.0
2023-12	CT#102	CP-233237	0244		F	Update of info and externalDocs fields	18.4.0
2024-03	CT#103	CP-240158	0248		F	Clarification of feature dependency on QoSMonitoring for EnQoSMon	18.5.0
2024-03	CT#103	CP-240158	0249	1	B	indirect feature negotiation for EnQoSMon	18.5.0
2024-03	CT#103	CP-240158	0250	1	F	Corrections for congestion monitoring	18.5.0
2024-03	CT#103	CP-240184	0252	1	F	Add reference to 29.564 for direct notification from the UPF	18.5.0
2024-03	CT#103	CP-240170	0253	2	A	Corrections on QoS monitoring reports	18.5.0
2024-03	CT#103	CP-240172	0256	1	F	EAS discovery and selection correction	18.5.0
2024-03	CT#103	CP-240172	0257	1	B	User Plane Path Change notifications for HR-SBO	18.5.0
2024-03	CT#103	CP-240184	0258	1	B	Updates to UPF event subscription	18.5.0
2024-03	CT#103	CP-240166	0259		F	Update of info and externalDocs fields	18.5.0
2024-06	CT#104	CP-241093	0260		F	Callback correction in the Nsmf_EventExposure API	18.6.0
2024-06	CT#104	CP-241091	0261	1	B	Access type change for MA PDU session update	18.6.0
2024-06	CT#104	CP-241114	0263		F	Aol based search feature dependency	18.6.0
2024-06	CT#104	CP-241101	0264	1	F	Missing applicable feature	18.6.0
2024-06	CT#104	CP-241087	0265		B	UP path change notification for HR-SBO	18.6.0
2024-06	CT#104	CP-241087	0266		F	Corrections on traffic correlation notify	18.6.0
2024-06	CT#104	CP-241093	0267	1	F	Corrections on presence condition	18.6.0
2024-06	CT#104	CP-241114	0268		F	Support of UPF event subscribe	18.6.0
2024-06	CT#104	CP-241091	0270	2	B	Updates to support E2E data volume transfer time analytics	18.6.0
2024-06	CT#104	CP-241077	0271	1	B	Support QoS Sustainability in a fine granularity area	18.6.0
2024-06	CT#104	CP-241129	0274	1	A	Wrong attribute name	18.6.0
2024-06	CT#104	CP-241095	0275		F	Implicit subscription to PacketDelayFailureReport feature	18.6.0
2024-06	CT#104	CP-241092	0276	1	F	Unused feature removal	18.6.0
2024-06	CT#104	CP-241088	0277	1	F	Applicability of User Plane Path Change event	18.6.0
2024-06	CT#104	CP-241085	0280		F	Update of info and externalDocs fields	18.6.0
2024-09	CT#105	CP-242122	0282		F	Removal of incorrect NOTE for QoS Monitoring report	18.7.0
2024-09	CT#105	CP-242119	0283		F	Corrections on collecting the UPF information from the SMF	18.7.0
2024-09	CT#105	CP-242118	0281		F	Correct presence field for some of the attributes	19.0.0
2024-12	CT#106	CP-243090	0284	1	F	Corrections of attribute and data type for Dispersion	19.1.0
2024-12	CT#106	CP-243082	0285		F	Correction to UPEAS	19.1.0
2024-12	CT#106	CP-243090	0286		F	Various corrections	19.1.0
2024-12	CT#106	CP-243093	0288		A	Correction of wrong attribute	19.1.0
2024-12	CT#106	CP-243122	0291	2	A	Corrections on the support of SNPN	19.1.0
2024-12	CT#106	CP-243090	0292	1	F	Various corrections on Nsmf_EventExposure API	19.1.0
2024-12	CT#106	CP-243099	0293	1	B	Support of relocation reporting for UPF relocation	19.1.0
2024-12	CT#106	CP-243088	0296	1	F	Data sources correction	19.1.0
2024-12	CT#106	CP-243082	0300	1	F	SMF event exposure architecture corrections	19.1.0
2024-12	CT#106	CP-243132	0302	1	A	User Plane event subscription with intermediate SMF	19.1.0
2024-12	CT#106	CP-243275	0303	2	B	Support for traffic routing outcome report	19.1.0
2024-12	CT#106	CP-243083	0304	1	F	User Plane event subscriptions targeting any UE	19.1.0
2024-12	CT#106	CP-243100	0305	1	B	Clarifications on the EAS discovery	19.1.0
2024-12	CT#106	CP-243147	0308		F	Update of info and externalDocs fields	19.1.0
2025-01	CT#106	-	-	-	-	Corrects partially incorrect implementation of CRs on Nsmf_EventExposure API in the specification document file and YAML file.	19.1.1
2025-03	CT#107	CP-250099	0310	1	B	Support of serving satellite identification in UE-SAT-UE communication	19.2.0
2025-03	CT#107	CP-250090	0311		B	Update of upfRelocReplInd attribute	19.2.0
2025-03	CT#107	CP-250141	0312	2	F	Correction of traffic routing outcome report	19.2.0
2025-03	CT#107	CP-250080	0313	1	F	Unnecessary indirect feature negotiation for UP_PATH_CH event	19.2.0
2025-03	CT#107	CP-250080	0314		F	Update of exposure events for I-SMF	19.2.0
2025-03	CT#107	CP-250089	0317		A	Corrections on the WLAN information	19.2.0
2025-03	CT#107	CP-250086	0318	1	F	Corrections on the boolean attributes	19.2.0
2025-03	CT#107	CP-250129	0321		F	Update of info and externalDocs fields	19.2.0
2025-06	CT#108	CP-251082	0325	1	B	Simultaneous Connectivity failure events	19.3.0
2025-06	CT#108	CP-251082	0326		F	UP Path Change notification corrections	19.3.0
2025-06	CT#108	CP-251083	0327	1	F	SMF event subscriptions targeting any UE	19.3.0
2025-06	CT#108	CP-251092	0328		F	Reusing common data type Satelliteld	19.3.0
2025-06	CT#108	CP-251086	0329	1	B	Support of QoS parameters reporting	19.3.0

2025-06	CT#108	CP-251092	0330	3	B	Support of SMF event exposure related to UE-Satellite-UE communication	19.3.0
2025-06	CT#108	CP-251091	0331	1	B	Support of Energy Consumption Information	19.3.0
2025-06	CT#108	CP-251091	0335	1	B	Support of EIF as NF Service Consumer	19.3.0
2025-06	CT#108	CP-251104	0336	1	F	Correction to the remaining data reporting indication	19.3.0
2025-06	CT#108	CP-251086	0337	1	B	Support of UE related Context Data and NF specific Data collection	19.3.0
2025-06	CT#108	CP-251086	0338	1	B	Support of signalling information collection for signalling storm analytics	19.3.0
2025-06	CT#108	CP-251090	0339	1	F	Corrections on the applicable features for the reused data types	19.3.0
2025-06	CT#108	CP-251090	0340	1	B	Updates to Notification Correlation ID and Reference ID	19.3.0
2025-06	CT#108	CP-251113	0344		A	Wrong attribute name	19.3.0
2025-06	CT#108	CP-251091	0346		B	EIF's Unsubscription of Energy Consumption Information from SMF	19.3.0
2025-06	CT#108	CP-251231	0347		F	Update of info and externalDocs fields	19.3.0
2025-09	CT#109	CP-252074	0348	1	B	SMF Event Exposure subscription context resynchronization	19.4.0
2025-09	CT#109	CP-252077	0349	1	F	Corrections related to Energy	19.4.0
2025-09	CT#109	CP-252081	0350	1	F	Removal of satellite ID from serving satellite change notification	19.4.0
2025-09	CT#109	CP-252077	0351	1	F	SMF reports energy consumption information periodically	19.4.0
2025-09	CT#109	CP-252072	0352		F	Re-used data types correction	19.4.0
2025-09	CT#109	CP-252110	0353	1	B	Enabling the bundling of UP event notifications	19.4.0
2025-09	CT#109	CP-252074	0355	1	B	Enhance RAT Type support for PDU Session	19.4.0
2025-09	CT#109	CP-252073	0356	1	F	Corrections to Supported Features	19.4.0
2025-09	CT#109	CP-252077	0357	1	B	Updates to the Energy Consumption Information event	19.4.0
2025-09	CT#109	CP-252077	0358	2	F	Access type for energy consumption information	19.4.0
2025-09	CT#109	CP-252073	0360	1	F	Corrections on the attribute name	19.4.0
2025-09	CT#109	CP-252113	0361		F	Update of info and externalDocs fields	19.4.0
2025-12	CT#110	CP-253035	0363	3	B	Updates and corrections to Energy Consumption information exposure	19.5.0
2025-12	CT#110	CP-253031	0369	2	F	Incorrect presence condition of pduSessType attribute	19.5.0
2025-12	CT#110	CP-253022	0370	2	F	Correction of QoS parameters reporting	19.5.0
2025-12	CT#110	CP-253055	0372		F	Skip notifications support	19.5.0
2025-12	CT#110	CP-253055	0373	1	F	RAT Type information exposure support	19.5.0
2025-12	CT#110	CP-253031	0374		F	Missing data type applicability	19.5.0
2025-12	CT#110	CP-253022	0375	1	F	Correct attribute names	19.5.0
2025-12	CT#110	CP-253036	0376	1	F	Correction of wrong TS reference	19.5.0
2025-12	CT#110	CP-253194	0377	4	B	Resolve EN for QoS profile	19.5.0
2025-12	CT#110	CP-253024	0379	4	F	Signalling Storm Analytics data collection from SMF	19.5.0
2025-12	CT#110	CP-253064	0383		F	Update of info and externalDocs fields	19.5.0
2026-03	CT#111	CP-260073	0388	1	F	Handling of subscription termination due to PDU session release	19.6.0
2026-03	CT#111	CP-260054	0392	1	A	Corrections to SmNasFromSmf and TransactionInfo	19.6.0
2026-03	CT#111	CP-260065	0393	2	F	Corrections to SmNasFromUe and SmNasFromSmf	19.6.0
2026-03	CT#111	CP-260073	0394	1	F	Application information mismatch in PCC-rule for energy subscription	19.6.0
2026-03	CT#111	CP-260073	0395	1	F	Correction to application identifier for energy subscription	19.6.0
2026-03	CT#111	CP-260066	0396	1	F	QFI allocation, change, and deallocation parameters corrections	19.6.0
2026-03	CT#111	CP-260081	0399		F	Update of info and externalDocs fields	19.6.0

History

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