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Contents

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 7540: "Hypertext Transfer Protocol Version 2 (HTTP/2)".

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

[10] OpenAPI, "OpenAPI 3.0.0 Specification", https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md.

[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".

[18] IETF RFC 7807: "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".

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
DDD	Downlink Data Delivery
DNAI	DN Access Identifier
DNN	Data Network Name
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
NRF	Network Repository Function
NSSAI	Network Slice Selection Assistance Information
NWDAF	Network Data Analytics Function
SMF	Session Management Function
SUPI	Subscription Permanent Identifier
S-NSSAI	Single Network Slice Selection Assistance Information
PCF	Policy Control Function
PRA	Presence Reporting Area
QFI	QoS Flow Identifier
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 consumer NFs to subscribe and unsubscribe for events on a PDU session; and
- notifies consumer NFs with a corresponding subscription about observed events on the PDU session.

The types of observed events applicable for (H-)SMF include:

- UP path change (e.g. addition and/or removal of PDU session anchor);
- access type change;
- PLMN change;
- PDU session release;
- PDU session establishment;
- Downlink data delivery status (for non-roaming);
- UE IP address/prefix change;
- QFI allocation; and/or
- QoS monitoring.

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

- Downlink data delivery status.

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

- UP path change (e.g. addition and/or removal of PDU session anchor); and/or
- Downlink data delivery status.

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),

Known consumer of the Nsmf_EventExposure service are:

- Network Exposure Function (NEF),
- Access and Mobility Management Function (AMF),
- Application Function (AF),
- Unified Data Management (UDM), and

- Network Data Analytics Function (NWDAF).

The PCF accesses the Session Management Event Exposure Service at the SMF via the N7 Reference point.

NOTE: The PCF can implicitly subscribe on behalf of the AF and NEF to the UP_PATH_CH event by including the information on AF subscription within the PCC rule.

Editor´s note: Implicit subscription of the PCF for the "downlink data delivery status" event is ffs to solve issues related to the interactions with traffic descriptors for that event with traffic descriptors supplied by PCC.

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

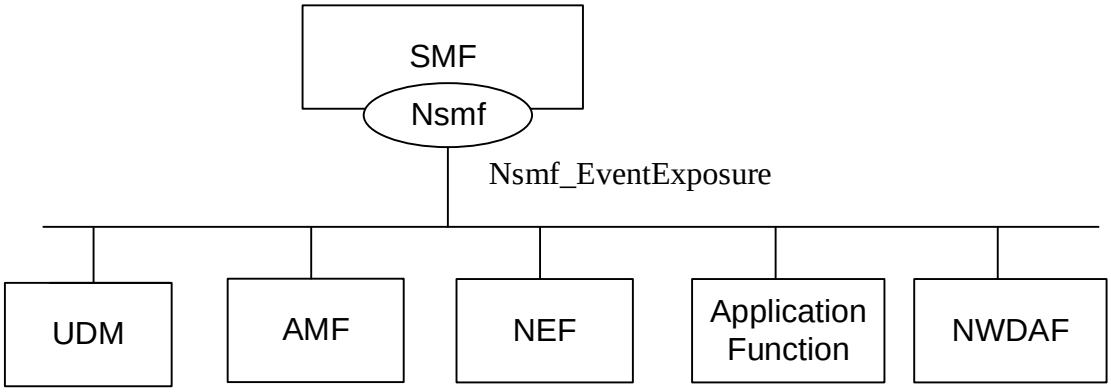

Figure 4.1.2-1: Reference Architecture for the Nsmf_EventExposure Service; SBI representation

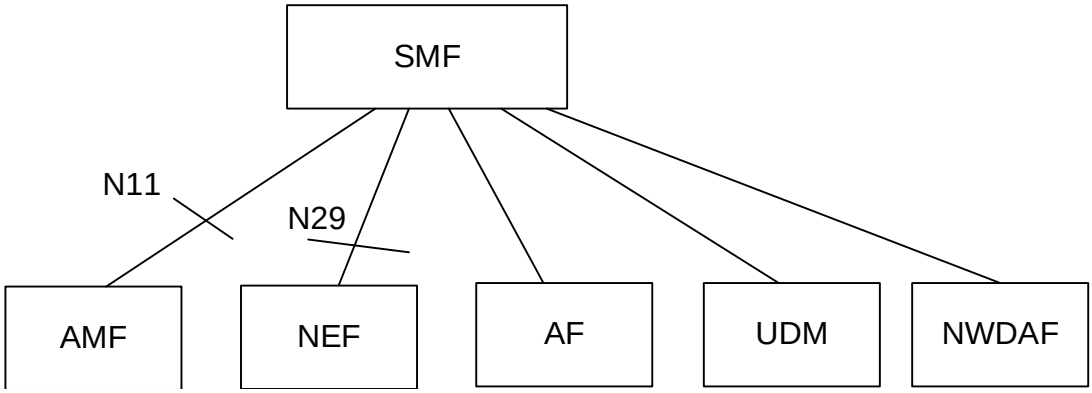

Figure 4.1.2-2: Reference Architecture for the Nsmf_EventExposure Service: reference point representation

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 a means to securely expose the services and capabilities provided by 3GPP network functions for e.g. 3rd parties or internal exposure.

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 based on event subscription, provided by AMF, SMF, PCF, UDM, AF (directly or via NEF), and OAM;
- retrieve information about NFs;
- On demand provision of analytics to consumers, as indicated in clause 6, 3GPP TS 23.288 [21].

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

4.2.2 Nsmf_EventExposure_Notify Service Operation

4.2.2.1 General

The Nsmf_EventExposure_Notify service operation enables notification to NF service consumers that the previously subscribed event on the related PDU session occurred.

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 "downlink data delivery status" feature,
  - the event "downlink data delivery status" is subscribed,
  - the traffic descriptor of the downlink data source has 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 the UPF buffer the downlink packets. The SMF shall provide the traffic descriptor in the PDR and request the UPF to report the traffic information (e.g. Source IP address, Source port number) of the buffered downlink packets and/or the discarded packets matching the received traffic descriptor. By comparing the traffic information reported by the UPF with the traffic descriptor received in the corresponding event subscription, the SMF shall determine whether that subscribed event with delivery status "DISCARDED" and/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 descriptor received in the correspond event subscription.

Figure 4.2.2.2-1 illustrates the notification about subscribed events.

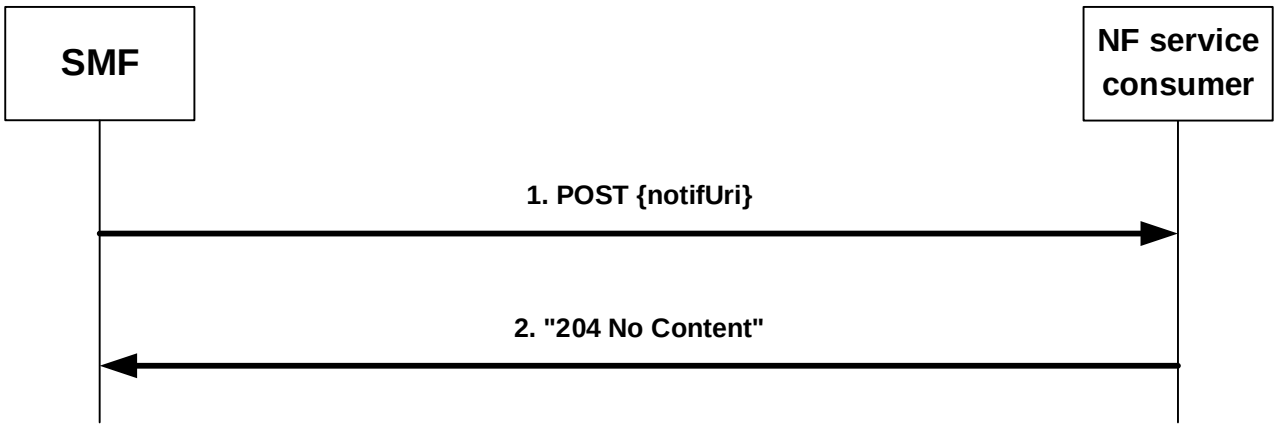

Figure 4.2.2.2-1: Notification about subscribed events

If the SMF observes PDU Session related event(s) for which an NF service consumer has subscribed to, 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 as defined in subclause 4.2.6.2.6.2 of 3GPP TS 29.512 [14], 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;

  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 (NOTE 3); 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 (NOTE 3), for the source DNAI, N6 traffic routing information related to the UE as "sourceTraRouting" attribute;

     f) if available (NOTE 3), for the target DNAI, N6 traffic routing information related to the UE as "targetTraRouting" attribute; and

     g) if the PDU Session type is Ethernet, the MAC address of the UE in the "ueMac" attribute;

NOTE 1: 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 subclause 4.2.6.2.6.2 of 3GPP TS 29.512 [14]).

NOTE 2: If the DNAI is not changed while the N6 traffic routing information change, the source DNAI and target DNAI are not provided.

NOTE 3: 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.

  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 release PDU session as "dnn" attribute, if the "PduSessionStatus" feature is supported;

     c) The type of the release PDU session as "pduSessType" attribute, if the "PduSessionStatus" feature is supported; and

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;

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;
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:
    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:
    a) the detailed communication failure information (e.g. 5G SM cause) as "commFailure" attribute; and
12. for QoS Monitoring:
    a) one or two uplink packet delays within the "ulDelays" attribute; or
    b) one or two downlink packet delays within the "dlDelays" attribute; or
    c) one or two round trip packet delays within the "rtDelays" attribute.

    NOTE 4: 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 subclause 4.2.6.2.6.18 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 release PDU session as "dnn" attribute;
    c) The type of the release PDU session as "pduSessType" attribute; and
    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;
14. for a QFI allocation:
    a) QFI of the allocated QoS Flow ID for the application as "qfi" attribute;
    b) DNN of the allocated PDU session as "dnn" attribute;
    c) Slice of the allocated PDU session as "snssai" attribute; and
    d) The description of the application traffic as "appId", "fDescs" or "ethfDescs" attribute;

- 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 5: 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.

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

If the NF service consumer is not able to handle the Notification but knows by implementation specific means that another service consumer is able to handle the notification, it shall reply with an HTTP "307 temporary redirect" error response pointing to the new NF service consumer URI. If the NF service consumer is not able to handle the Notification but another unknown service consumer could possibly handle the notification, it shall reply with an HTTP "404 Not found" error response.

NOTE 6: An AMF as service consumer can change.

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.

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 query 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 "altNotifIpv4Addrs", "altNotifIpv6Addrs" 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 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.

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 for event notifications on a specified 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.

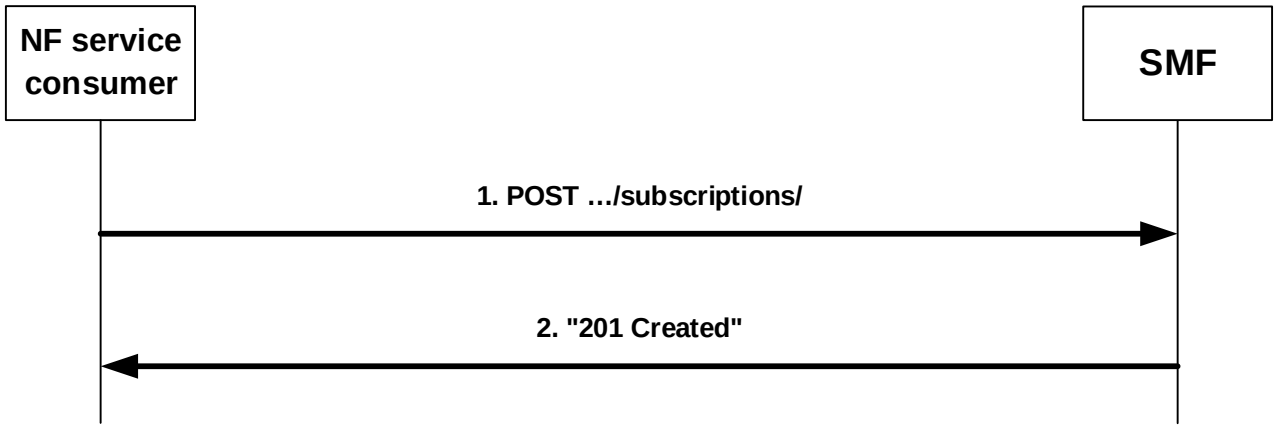

Figure 4.2.3.2-1: Creation of a subscription

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, 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.

- an URI where to receive the requested notifications as "notifUri" attribute;
- a Notification Correlation Identifier assigned by the NF service consumer for the requested notifications as "notifId" attribute; 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 change, whether the subscription is for early, late, or early and late notifications of UP path reconfiguration in the "dnaiChType" attribute;

  and that may include:

  a) for event "downlink data delivery status", the traffic descriptor(s) of the downlink data source in the "dddTraDescriptors" attribute;

  b) for event "downlink data delivery status", the subscribed delivery stati in the "ddsStati" attribute; and

  c) for event "QFI allocation", the application identifiers in the "appIds" attribute.

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 notification 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;
- Immediate reporting flag as "ImmeRep" attribute;
- 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; and/or
- group reporting guard time as "grpRepTime" 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 or less than a possible expiry time in the request;
- store the subscription;
- send a 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 "ImmeRep" attribute is included and set to true in the request, the SMF shall report the current available value(s) for the subscribed event(s) as defined in subclause 4.2.3.1;
- if the sampling ratio as the "sampRatio" attribute is included in the subscription, the SMF shall select a random subset of UEs among target UEs according to the sampling ratio and only report the event(s) related to the selected subset UEs; and
- When the group reporting guard time as the "grpRepTime" attribute is included in the subscription, the SMF shall accumulate all of 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 subclause 4.2.2.2.

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.

4.2.3.3 Modifying an existing subscription

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

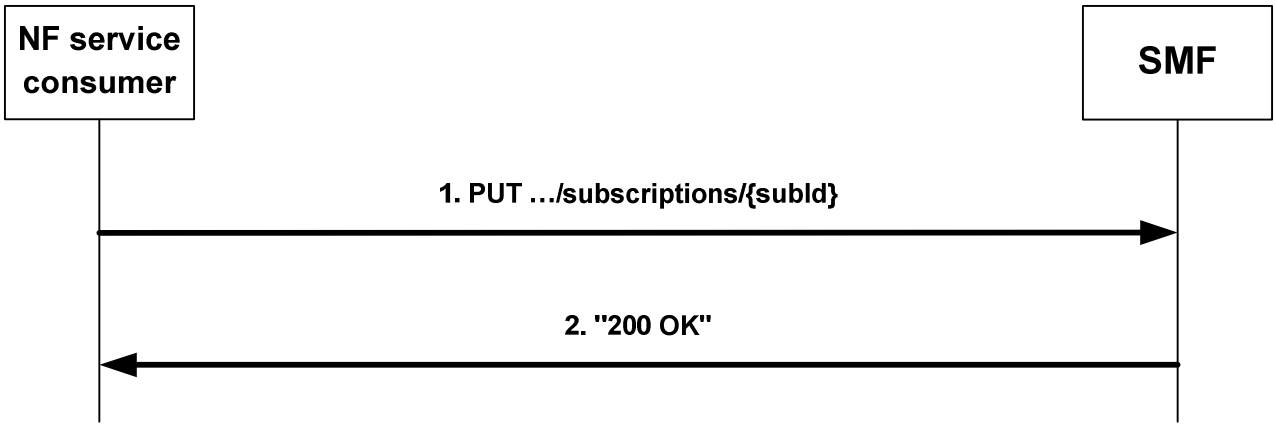

Figure 4.2.3.3-1: Modification of an existing subscription

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 subclause 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 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.

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, the SMF shall:

- store the subscription; and
- send a HTTP "200 OK" response with NsmfEventExposure data structure as response body.

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.

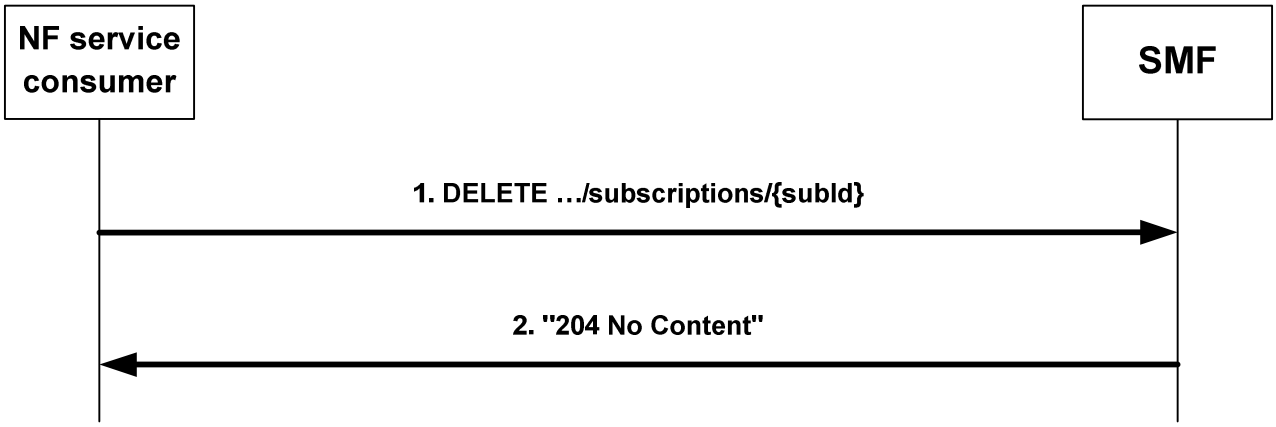

Figure 4.2.4.2-1: Unsubscription from event notifications

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, the SMF shall:

- remove the corresponding subscription; and
- send an HTTP "204 No Content" response.

4.2.5 Nsmf_EventExposure_AppRelocationInfo Service Operation

4.2.5.1 General

The Nsmf_EventExposure_AppRelocationInfo service operation enables NF service consumer to acknowledge the notification of subscribed event 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.

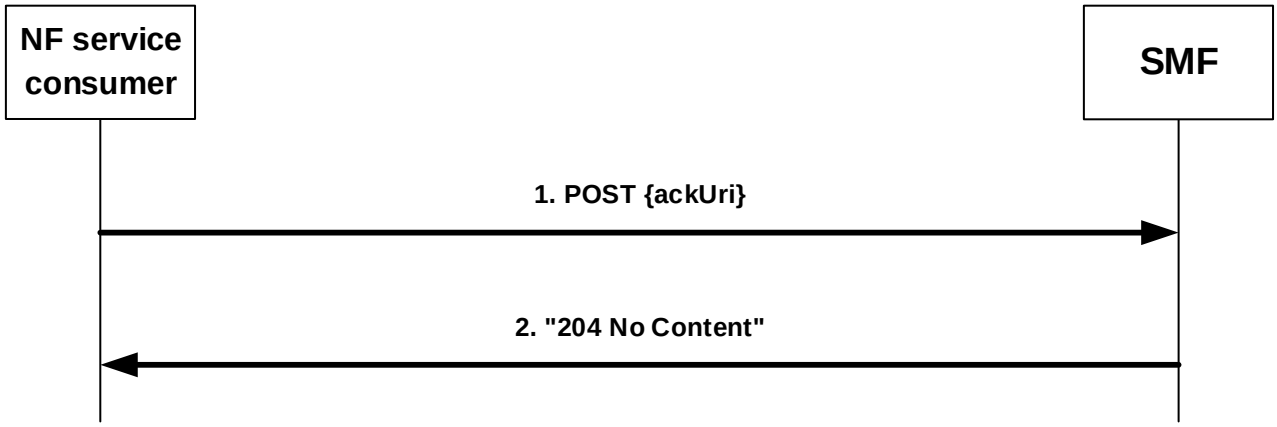

Figure 4.2.5.2-1: Acknowledgement of Notification about subscribed events

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

The AckOfNotify data structure as request body that shall include:

- Notification correlation ID provided by the NF service consumer during UP path change notification, as "notifId" attribute;
- an identifier of UE (i.e. SUPI or GPSI) if available and the subscription applies to a group of UE(s) or any UE; 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. If the application relocation is not completed on time, the "afStatus" attribute shall set to the corresponding failure cause.

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

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 subclause 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 subclause 5.3.

5.2 Usage of HTTP

5.2.1 General

HTTP/2, IETF RFC 7540 [8], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in subclause 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.

5.2.2 HTTP standard headers

5.2.2.1 General

See subclause 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 subclause 5.4 of 3GPP TS 29.500 [4]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 7807 [18].

5.2.3 HTTP custom headers

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

5.3 Resources

5.3.1 Resource Structure

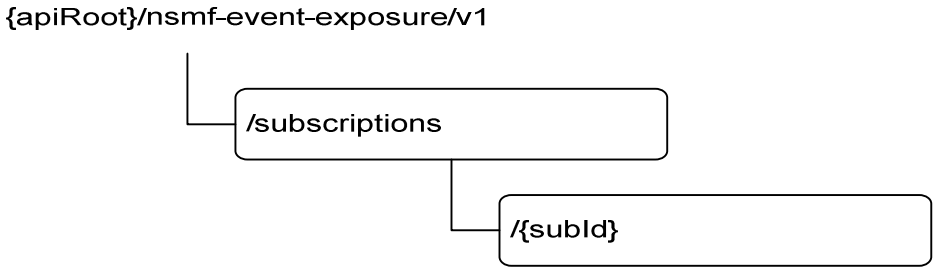

Figure 5.3.1-1: Resource URI structure of the Nsmf_EventExposure API

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	{apiRoot}/ nsmf-event-exposure/ v1/ subscriptions	POST	Create a new Individual SMF Notification Subscription resource.
Individual SMF Notification Subscription	{apiRoot}/ nsmf-event-exposure/ v1/ 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 all 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 subclause 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.
NOTE: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

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 subclause 5.1
subId	string	Identifies a subscription to the SMF event exposure service formatted as defined for the SubId type in table 5.6.3.2-1.

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.
NOTE: 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.				

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.
NOTE: 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.				

5.3.3.3.3 DELETE

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

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

Name	Data type	P	Cardinality	Description
n/a				

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

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

Data type	P	Cardinality	Description
n/a			

Table 5.3.3.3.3-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case: The Individual SMF Notification Subscription resource matching the subId was deleted.
NOTE: The manadatory HTTP error status code for the DELETE method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

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 subclause 6.2 of 3GPP TS 29.500 [4] and subclause 4.6.2.3 of 3GPP TS 29.501 [5].

Table 5.5.1-1: Notifications overview

Notification	Custom operation URI	Mapped HTTP method	Description
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 NF service consumer that has subscribed to such Notifications via the Individual SMF Notification Subscription Resource.

5.5.2.2 Target URI

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

Table 5.5.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
notifUri	Uri	The Notification Uri as assigned within the Individual SMF Notification Subscription Resource and described within the NsmfEventExposure type (see table 5.6.2.2-1).

5.5.2.3 Standard Methods

5.5.2.3.1 POST

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

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

Name	Data type	P	Cardinality	Description
n/a				

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

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

Data type	P	Cardinality	Description
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.
n/a			307 temporary redirect	The NF service consumer shall generate a Location header field containing a URI pointing to another NF service consumer to which the notification should be send.
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: 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.				

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	The URI of the resource located on the NF service consumer pointing to another NF service consumer to which the notification should be send.

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 Notification URI **"{ackUri}"** shall be used with the resource URI variables defined in table 5.5.3.2-1.

Table 5.5.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
ackUri	Uri	Acknowledgement Uri as assigned during the procedure of notification about subscribed events and described within the NsmfEventExposureNotificationtype (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.
NOTE: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.				

5.6 Data Model

5.6.1 General

This subclause 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
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	
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.	
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.	

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
AccessType	3GPP TS 29.571 [11]		
AfResultInfo	3GPP TS 29.522 [20]	Represents application handling information.	
ApplicationId	3GPP TS 29.571 [11]	The application identifier.	QfiAllocation
CommunicationFailure	3GPP TS 29.518 [TS29518]	Represents the communication failure information.	CommunicationFailure
DateTime	3GPP TS 29.571 [11]		
DlDataDeliveryStatus	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]		
DnaiChangeType	3GPP TS 29.571 [11]	Describes the types of DNAI change.	
Dnn	3GPP TS 29.571 [11]		QfiAllocation, PduSessionStatus
DurationSec	3GPP TS 29.571 [11]		
EthFlowDescription	3GPP TS 29.514 [22]	Ethernet flow description	QfiAllocation
FlowDescription	3GPP TS 29.514 [22]	IP flow description	QfiAllocation
Fqdn	3GPP TS 29.510 [12]	FQDN	
Gpsi	3GPP TS 29.571 [11]		
GroupId	3GPP TS 29.571 [11]		
Guami	3GPP TS 29.571 [11]	Globally Unique AMF Identifier	
Ipv4Addr	3GPP TS 29.571 [11]		
Ipv6Addr	3GPP TS 29.571 [11]		
Ipv6Prefix	3GPP TS 29.571 [11]		
MacAddr48	3GPP TS 29.571 [11]	MAC Address.	
PduSessionId	3GPP TS 29.571 [11]		
PduSessionType	3GPP TS 29.571 [11]	PDU session type.	PduSessionStatus
PlmnId	3GPP TS 29.571 [11]		
Qfi	3GPP TS 29.571 [11]	QoS flow identifier.	QfiAllocation
ProblemDetails	3GPP TS 29.571 [11]		
RouteToLocation	3GPP TS 29.571 [11]	A traffic route to/from an DNAI	
SamplingRatio	3GPP TS 29.571 [11]	Sampling Ratio.	
ServiceName	3GPP TS 29.510 [12]	Name of the service instance.	
Snssai	3GPP TS 29.571 [11]	S-NSSAI	QfiAllocation
Supi	3GPP TS 29.571 [11]		
SupportedFeatures	3GPP TS 29.571 [11]	Used to negotiate the applicability of the optional features defined in table 5.8-1.	
Uinteger	3GPP TS 29.571 [11]		
Uri	3GPP TS 29.571 [11]		

5.6.2 Structured data types

5.6.2.1 Introduction

This subclause 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	Cardinality	Description	Applicability
supi	Supi	C	0..1	Subscription Permanent Identifier (NOTE)	
gpsi	Gpsi	C	0..1	Generic Public Subscription Identifier (NOTE)	
anyUeInd	boolean	C	0..1	This IE shall be present if the event subscription is applicable to any UE. Default value "false" is used, if not present (NOTE)	
groupId	GroupId	C	0..1	Identifies a group of UEs. (NOTE)	
pduSeId	PduSessionId	C	0..1	PDU session ID (NOTE)	
dnn	Dnn	O	0..1	Data Network Name.	
snssai	Snssai	O	0..1	A single Network Slice Selection Assistance Information.	
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 assigned by the NF service consumer.	
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	
ImmeRep	boolean	O	0..1	It is included and set to true if the immediate reporting of the current status of the subscribed event, if available is required.	
notifMethod	NotificationMethod	O	0..1	If "notifMethod" is not supplied, the default value "ON_EVENT_DETECTION" applies.	
maxReportNbr	Uinteger	O	0..1	If omitted, there is no limit.	
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.	
repPeriod	DurationSec	C	0..1	Is supplied for notification Method "periodic".	
guami	Guami	C	0..1	The Globally Unique AMF Identifier (GUAMI) shall be provided by an AMF as 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	List of Supported features used as described in subclause 5.8. This parameter shall be supplied by NF service consumer and SMF in the POST request that request the creation of an SMF Notification Subscriptions resource and the related reply, respectively.	
sampRatio	SamplingRatio	O	0..1	Indicates the ratio of the random subset to target UEs, event reports only relates to the subset.	
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.	
NOTE: If the event subscription applies for a specific PDU session, the PDU session of a single UE (pduSeId, 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.					

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 "notifCorreId" within the UpPathChgEvent 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	
dnaiChType	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.	
dddTraDescriptors	array(DddTrafficDescriptor)	C	1..N	The traffic descriptor(s) of the downlink data source. Shall be included for event "downlink data delivery status".	DownlinkDataDeliveryStatus
dddStati	array(DlDataDeliveryStatus)	O	1..N	May be included for event "downlink data delivery status". The subscribed stati (discarded, transmitted, buffered) for the event. If omitted all stati are subscribed.	DownlinkDataDeliveryStatus
appIds	array(ApplicationId)	O	1..N	May be included for event "QFI allocation".	QfiAllocation

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.	
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.	
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.	
sourceDnai	Dnai	C	0..1	Source DN Access Identifier. Shall be included for event "UP_PATH_CH" if the DNAI changed (NOTE 1, NOTE 2).	
targetDnai	Dnai	C	0..1	Target DN Access Identifier. Shall be included for event "UP_PATH_CH" if the DNAI changed (NOTE 1, NOTE 2).	
dnaiChgType	DnaiChangeType	C	0..1	DNAI Change Type. Shall be included for event "UP_PATH_CH".	
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 event "UP_PATH_CH" if available (NOTE 2).	
targetTraRouting	RouteToLocation	C	0..1	N6 traffic routing information for the target DNAI. Shall be included for event "UP_PATH_CH" if available (NOTE 2).	
ueMac	MacAddr48	O	0..1	UE MAC address. May be included for event "UP_PATH_CH".	
adIpv4Addr	Ipv4Addr	O	0..1	Added IPv4 Address(es). May be included for event "UE_IP_CH".	
adIpv6Prefix	Ipv6Prefix	O	0..1	Added Ipv6 Address Prefix(es). May be included for event "UE_IP_CH".	
reIpv4Addr	Ipv4Addr	O	0..1	Removed IPv4 Address(es). May be included for event "UE_IP_CH".	
reIpv6Prefix	Ipv6Prefix	O	0..1	Removed Ipv6 Address Prefix(es). May be included for event "UE_IP_CH".	
plmnId	PlmnId	C	0..1	New PLMN ID. Shall be included for event "PLMN_CH".	
accType	AccessType	C	0..1	New Access Type. Shall be included for event "AC_TY_CH".	
pduSeId	PduSessionId	C	0..1	PDU session ID. Shall be included for event "PDU_SES_REL" and "PDU_SES_EST".	
dddStatus	DlDataDeliveryStatus	C	0..1	Downlink data delivery status (discarded, transmitted, buffered). Shall be included for event "downlink data delivery status",	DownlinkDataDeliveryStatus

maxWaitTime	DateTime	C	0..1	The estimated maximum waiting time for downlink data delivery, Shall be included for event "downlink data delivery status" with status "BUFFERED".	DownlinkData DeliveryStatus
dddTraDescriptor	DddTrafficDescriptor	C	0..1	The downlink data descriptor impacted by downlink data delivery status change. Shall be included for event "downlink data delivery status"	DownlinkData DeliveryStatus
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 if the PduSessionStatus feature is supported.	PduSessionStatus
qfi	Qfi	C	0..1	QoS flow identifier. Shall be included for event "QFI_ALLOC".	QfiAllocation
appId	ApplicationId	O	0..1	Contains the application identifier. May be included for event "QFI_ALLOC". (NOTE 4)	QfiAllocation
ethfDescs	array(EthFlowDescription)	O	1..2	Contains the flow description for the Uplink and/or Downlink Ethernet flows. May be included for event "QFI_ALLOC". (NOTE 4)	QfiAllocation
fDescs	array(FlowDescription)	O	1..2	Contains the flow description for the Uplink and/or Downlink IP flows. May be included for event "QFI_ALLOC". (NOTE 4)	QfiAllocation
dnn	Dnn	C	0..1	Data network name, Shall be included for event "QFI_ALLOC". May be included for event "PDU_SES_REL" or "PDU_SES_EST".	QfiAllocation, PduSessionStatus
snssai	Snssai	C	0..1	Identifies the slice information. Shall be included for event "QFI_ALLOC".	QfiAllocation
ulDelays	array(Uinteger)	O	1..N	Uplink packet delay in units of milliseconds. (NOTE 5)	QoSMonitoring
dlDelays	array(Uinteger)	O	1..N	Downlink packet delay in units of milliseconds. (NOTE 5)	QoSMonitoring
rtDelays	array(Uinteger)	O	1..N	Round trip delay in units of milliseconds. (NOTE 5)	QoSMonitoring

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 appId, ethfDescs or fDescs shall be provided.
NOTE 5: In this release of the specification the maximum number of elements in the array is 2. If more than one value is received at one given point of time for UL packet delay, DL packet delay or round trip packet delay respectively, the SMF reports the minimum and maximum packet delays to the NEF/AF.

5.6.2.6 void.

5.6.2.7 Type AckOfNotify

Table 5.6.2.x-1: Definition of type AckOfNotify

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.	
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.	

5.6.3 Simple data types and enumerations

5.6.3.1 Introduction

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

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	
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

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.

5.7 Error handling

5.7.1 General

For the Nsmf_EventExposure API, HTTP error responses shall be supported as specified in subclause 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 subclauses 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

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 subclause 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.

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], subclause 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 hosted in ETSI Forge, that uses the GitLab software version control system (see clause 5B of the 3GPP TR 21.900 [19] and subclause 5.3.1 of the 3GPP TS 29.501 [5] for further information).

A.2 Nsmf_EventExposure API

```
openapi: 3.0.0
info:
  version: 1.1.0
  title: Nsmf_EventExposure
  description: |
    Session Management Event Exposure Service.
    © 2020, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 29.508 V16.4.0; 5G System; Session Management Event Exposure Service.
  url: http://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 subclause 4.4 of 3GPP TS 29.501
security:
  - {}
  - oAuth2ClientCredentials:
    - nsmf-event-exposure
paths:
  /subscriptions:
    post:
      operationId: CreateIndividualSubcription
      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'
        '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':
                 description: Temporary Redirect
                 headers:
                   Location:
                     description: 'The URI pointing to the endpoint of another NF service consumer
to which the notification should be sent.'
                     required: true
                     schema:
                       type: string
               '400':
                 $ref: 'TS29571_CommonData.yaml#/components/responses/400'
               '401':
                 $ref: 'TS29571_CommonData.yaml#/components/responses/401'
               '403':
                 $ref: 'TS29571_CommonData.yaml#/components/responses/403'
               '404':
                 $ref: 'TS29571_CommonData.yaml#/components/responses/404'
               '411':
                 $ref: 'TS29571_CommonData.yaml#/components/responses/411'
               '413':
                 $ref: 'TS29571_CommonData.yaml#/components/responses/413'
               '415':
                 $ref: 'TS29571_CommonData.yaml#/components/responses/415'
               '429':
                 $ref: 'TS29571_CommonData.yaml#/components/responses/429'
               '500':
                 $ref: 'TS29571_CommonData.yaml#/components/responses/500'
               '503':
                 $ref: 'TS29571_CommonData.yaml#/components/responses/503'
               default:
                 $ref: 'TS29571_CommonData.yaml#/components/responses/default'
             callbacks:
               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)
                      '400':
                        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
                      '401':
                        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
                      '403':
                        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
                      '404':
                        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
                      '411':
                        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
                      '413':
                        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
                      '415':
                        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
                      '429':
                        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
                      '500':
                        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
                      '503':
                        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
                      default:
                        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /subscriptions/{subId}:
    get:
      operationId: GetIndividualSubcription
      summary: Read an individual subscription for event notifications from the SMF
      tags:
        - IndividualSubscription (Document)
      parameters:
        - name: subId
          in: path
          description: Event Subscription ID
          required: true
          schema:
            type: string
      responses:
        '200':
          description: OK. Resource representation is returned
          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'
        '406':
          $ref: 'TS29571_CommonData.yaml#/components/responses/406'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
    put:
      operationId: ReplaceIndividualSubcription
      summary: Replace an individual subscription for event notifications from the SMF
      tags:
        - IndividualSubscription (Document)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/NsmfEventExposure'
      parameters:
        - name: subId
          in: path
          description: Event Subscription ID
```

```
          required: true
          schema:
            type: string
      responses:
        '200':
          description: OK. Resource was successfully modified and representation is returned
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/NsmfEventExposure'
        '204':
          description: No Content. Resource was successfully modified
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
    delete:
      operationId: DeleteIndividualSubcription
      summary: Delete an individual subscription for event notifications from the SMF
      tags:
        - IndividualSubscription (Document)
      parameters:
        - name: subId
          in: path
          description: Event Subscription ID
          required: true
          schema:
            type: string
      responses:
        '204':
          description: No Content. Resource was successfully deleted
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nsmf-event-exposure: Access to the Nsmf_EventExposure API
  schemas:
    NsmfEventExposure:
      description: Represents an Individual SMF Notification Subscription resource. The serviveName
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'
        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: 'TS29510_Nnrf_NFManagement.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
        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'
        serviveName:
          $ref: 'TS29510_Nnrf_NFManagement.yaml#/components/schemas/ServiceName'
        supportedFeatures:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
        sampRatio:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SamplingRatio'
        grpRepTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
      required:
        - notifId
        - notifUri
        - eventSubs
    NsmfEventExposureNotification:
      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:
    type: object
    properties:
      event:
        $ref: '#/components/schemas/SmfEvent'
      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
    required:
      - event
  EventNotification:
    type: object
    properties:
      event:
        $ref: '#/components/schemas/SmfEvent'
      timeStamp:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      supi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      gpsi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
      sourceDnai:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
      targetDnai:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnai'
      dnaiChgType:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DnaiChangeType'
      sourceUeIpv4Addr:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ipv4Addr'
      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/PlmnId'
      accType:
```

```
          $ref: 'TS29571_CommonData.yaml#/components/schemas/AccessType'
        pduSeId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/PduSessionId'
        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'
        qfi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Qfi'
        appId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationId'
        ethfDescs:
          type: array
          items:
            $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/EthFlowDescription'
          minItems: 1
          maxItems: 2
        fDescs:
          type: array
          items:
            $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/FlowDescription'
          minItems: 1
          maxItems: 2
        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
      required:
        - event
        - timeStamp
    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:
      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'
    required:
      - notifId
      - ackResult
  SmfEvent:
    anyOf:
    - type: string
      enum:
        - AC_TY_CH
        - UP_PATH_CH
        - PDU_SES_REL
        - PLMN_CH
        - UE_IP_CH
        - DDDS
        - COMM_FAIL
        - PDU_SES_EST
        - QFI_ALLOC
        - QOS_MON
    - type: string
      description: >
        This string provides forward-compatibility with future
        extensions to the enumeration but is not used to encode
        content defined in the present version of this API.
    description: >
      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
      - DDDS: Downlink data delivery status
      - COMM_FAIL: Communication Failure
      - PDU_SES_EST: PDU Session Establishment
      - QFI_ALLOC: QFI allocation
      - QOS_MON: QoS Monitoring
  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 but is not used to encode
        content defined in the present version of this API.
    description: >
      Possible values are
      - PERIODIC
      - ONE_TIME
      - ON_EVENT_DETECTION
```

Annex B (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New**
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 "serviveName" 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

History

Document history		
V16.4.0	August 2020	Publication