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Contents

Foreword

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1   Scope

The present specification describes the protocol for the NEF Northbound interface between the NEF and the AF. The NEF Northbound interface and the related stage 2 functional requirements are defined in 3GPP TS 23.502 [2].

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 23.502: "Procedures for the 5G system".

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

[4]   3GPP TS 29.122: "T8 reference point for northbound Application Programming Interfaces (APIs)".

[5]   Open API Initiative, "OpenAPI 3.0.0 Specification", https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md.

[6]   3GPP TS 33.501: "Security architecture and procedures for 5G System".

[7]   3GPP TS 29.514: "5G System; Policy Authorization Service; Stage 3".

[8]   3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[9]   3GPP TS 29.521: "5G System; Binding Support Management Service; Stage 3".

[10]   3GPP TS 29.505: "5G System; Usage of the Unified Data Repository services for Subscription Data; Stage 3".

[11]   3GPP TS 23.222: "Common API Framework for 3GPP Northbound APIs; Stage 2".

[12]   3GPP TS 29.222: "Common API Framework for 3GPP Northbound APIs; 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
BDT   Background Data Transfer

CAPIF	Common API Framework
CP	Communication Pattern
DN	Data Network
DNAI	DN Access Identifier
DNN	Data Network Name
GPSI	Generic Public Subscription Identifier
NEF	Network Exposure Function
PCF	Policy Control Function
PCRF	Policy and Charging Rule Function
PFD	Packet Flow Description
PFDF	Packet Flow Description Function
REST	Representational State Transfer
SCEF	Service Capability Exposure Function
S-NSSAI	Single Network Slice Selection Assistance Information
UDR	Unified Data Repository
UP	User Plane

4 NEF Northbound Interface

4.1 Overview

The NEF Northbound interface is between the NEF and the AF. It specifies RESTful APIs that allow the AF to access the services and capabilities provided by 3GPP network entities and securely exposed by the NEF.

This document also specifies the procedures triggered at the NEF by API requests from the AF and by event notifications received from 3GPP network entities.

The stage 2 level requirements and signalling flows for the NEF Northbound interface are defined in 3GPP TS 23.502 [2].

The NEF Northbound interface supports the following procedures:

- Procedures for Monitoring

- Procedures for Device Triggering

- Procedures for resource management of Background Data Transfer

- Procedures for CP Parameters Provisioning

- Procedures for PFD Management

- Procedures for Traffic Influence

Which correspond to the following services respectively, supported by the NEF as defined in 3GPP TS 23.502 [2]:

- Nnef_EventExposure service

- Nnef_Trigger service

- Nnef_BDTPNegotiation service

- Nnef_ParameterProvision service

- Nnef_PFDmanagement service

- Nnef_TrafficInfluence service

4.2 Reference model

The NEF Northbound interface resides between the NEF and the AF as depicted in figure 4.2.1. The overall NEF architecture is depicted in 3GPP TS 23.502 [2]. An AF can get services from multiple NEFs, and an NEF can provide service to multiple AFs.

NOTE: The AF can be provided by the third party.
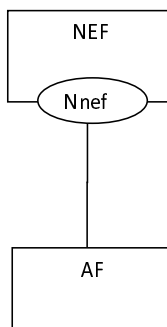
Figure 4.2-1: Reference Architecture for the Nnef Service; SBI representation

Figure 4.2-2: Reference Architecture for the Nnef Service; reference point representation

4.3 Functional elements

4.3.1 NEF

The Network Exposure Function (NEF) is a functional element that supports the following functionalities:

- The NEF shall securely expose network capabilities and events provided by 3GPP NFs to AF.

- The NEF shall provide a means for the AF to securely provide information to 3GPP network and may authenticate, authorize and assist in throttling the AF.

- The NEF shall be able to translate the information received from the AF to the one sent to internal 3GPP NFs, and vice versa.

- The NEF shall support to expose information (collected from other 3GPP NFs) to the AF.

- The NEF may support a PFD Function which allows the AF to provision PFD(s) and may store and retrieve PFD(s) in the UDR. The NEF further provisions PFD(s) to the SMF.

A specific NEF instance may support one or more of the functionalities described above and consequently an individual NEF may support a subset of the APIs specified for capability exposure.

NOTE: The NEF can access the UDR located in the same PLMN as the NEF.

4.3.2 AF

The Application Function (AF) may interact with the 3GPP Core Network via the NEF in order to access network capabilities.

4.4 Procedures over NEF Northbound Interface

4.4.1 Introduction

All procedures that operate across the NEF Northbound interface, as specified in 3GPP TS 23.502 [2], are specified in the following subclauses.

4.4.2 Procedures for Monitoring

The procedures for monitoring as described in subclause 4.4.3 of 3GPP TS 29.122 [4] shall be applicable in 5GS with the following differences:

- description of the SCS/AS applies to the AF;

- description of the SCEF applies to the NEF;

- description of the HSS applies to the UDM, and the NEF shall interact with the UDM by using Nudm_EventExposure service;

- description of the MME/SGSN applies to the AMF, and the NEF shall interact with the AMF by using Namf_EventExposure service;

- description about the PCRF is not applicable.

4.4.3 Procedures for Device Triggering

The procedures for device triggering as described in subclause 4.4.6 of 3GPP TS 29.122 [4] shall be applicable in 5G with the following differences:

- description of the SCS/AS applies to the AF;

- description of the SCEF applies to the NEF;

- description of the HSS applies to the UDM;

- the NEF shall interact with the UDM by using the Nudm_SDM service and the Nudm_UECM service; and

- the NEF acts as MTC-IWF.

4.4.4 Procedures for resource management of Background Data Transfer

The procedures for resource management of Background Data Transfer (BDT) in 5GS are described in subclause 4.4.3 3GPP TS 29.122 [4] with the following differences:

- description of the SCEF applies to the NEF;

- description of the PCRF applies to the PCF; and

- the NEF shall interact with the PCF by using Npcf_BDTPolicyControl service.

4.4.5 Procedures for CP Parameters Provisioning

The procedures for CP parameters provisioning as described in subclause 4.4.9 of 3GPP TS 29.122 [4] shall be applicable in 5G with the following differences:

- description of the SCS/AS applies to the AF;

- description of the SCEF applies to the NEF;

- description of the HSS applies to the UDM;

- the NEF shall interact with the UDM by using Nudm_ParameterProvision service.

4.4.6 Procedures for PFD Management

The procedures for PFD management as described in subclause 4.4.10 of 3GPP TS 29.122 [4] shall be applicable for 5GS with the following differences:

- description of the SCEF applies to the NEF; and

- the NEF (PFDF) shall interact with the UDR for PFD management by using Nudr_DataRepository service. The PFDF is functionality within the NEF.

4.4.7 Procedures for Traffic Influence

4.4.7.1 General

In order to create a resource for the Traffic Influence, the AF shall send an HTTP POST message to the NEF to the resource "Traffic Influence Subscription", the body of the HTTP POST message may include the AF Service Identifier, external Group Identifier, external Identifier, anyUE Indication, the UE IP address, GPSI, DNN, S-NSSAI, Application Identifier or traffic filtering information, Subscribed Event, Notification destination address, a list of geographic zone identifier(s), AF Transaction Identifier, a list of DNAI(s), routing profile ID(s) or N6 traffic routing information, Indication of application relocation possibility, type of notifications, Temporal and spatial validity conditions. The Notification destination address shall be included if the Subscribed Event is included in the HTTP request message.

In order to update an existing traffic influence subscription, the AF shall send an HTTP PUT or PATCH message to the resource "Individual Traffic Influence Subscription" requesting to change the traffic influence parameters.

In order to delete an existing traffic influence subscription, the AF shall send an HTTP DELETE message to the NEF to the resource "Individual Traffic Influence Subscription".

Upon receipt of the HTTP request from the AF, if the AF is authorized, the NEF shall perform the mapping as described in 3GPP TS 23.501 [3], and then perform as described in subclause 4.4.7.2 if the request is for an individual UE or perform as described in subclause 4.4.7.3 if the request is for multiple UEs.

If the NEF receives a UP management event notification from the PCF or the SMF indicating the subscribed event is detected, the NEF shall send an HTTP POST message including the notified event (e.g. a DNAI has changed) to the AF. The AF shall respond with an HTTP response to confirm the notification destination received during creation of the subscription.

4.4.7.2 AF request for an individual UE

Upon receipt of the above AF request which is for an individual UE, the NEF may interact with the BSF to retrieve the related PCF information by invoking the Nbsf_Management_Discovery service operation as described in 3GPP TS 29.521 [9], if the NEF receives an error code from the BSF, the NEF shall not create, update or delete the resource and shall respond to the SCS/AS with a status code set to 500 Internal Server Error.

After receiving a successful response from the BSF, the NEF shall interact with the PCF by invoking the Npcf_PolicyAuthorization service as described in 3GPP TS 29.514 [7]. After receiving a successful response from the PCF, the NEF shall,

- for the HTTP POST request, create a resource "Individual Traffic Influence Subscription" which represents the traffic influence subscription, addressed by a URI that contains the AF Identifier and an NEF-created subscription identifier, and shall respond to the AF with a 201 Created status code, including a Location header field containing the URI for the created resource. The AF shall use the URI received in the Location header in subsequent requests to the NEF to refer to this traffic influence subscription.

- for the HTTP PUT or PATCH request, update a resource "Individual Traffic Influence Subscription" which represents the traffic influence subscription, and shall responds to the AF with a 200 OK status code.

- for the HTTP DELETE request, remove all properties of the resource and delete the corresponding active resource "Individual Traffic Influence Subscription" which represents the traffic influence subscription, then shall responds to the AF with a 204 No Content status code.

If the NEF receives a response with an error code from the PCF, the SCEF shall not create, update or delete the resource and shall respond to the SCS/AS with a status code set to 500 Internal Server Error.

4.4.7.3 AF request for multiple UEs

Upon receipt of the AF request, if the request is for a group of UEs or any UE, the NEF may interact with the UDR by invoking the Nudr_DataRepository service as described in 3GPP TS 29.505 [10], if the NEF receives an error code from the UDR, the NEF shall not create, update or delete the resource and shall respond to the SCS/AS with a status code set to 500 Internal Server Error.

After receiving a successful response from the UDR, the NEF shall,

- for the HTTP POST request, create a resource "Individual Traffic Influence Subscription" which represents the traffic influence subscription, addressed by a URI that contains the AF Identifier and an NEF-created subscription identifier, and shall respond to the AF with a 201 Created status code, including a Location header field containing the URI for the created resource. The AF shall use the URI received in the Location header in subsequent requests to the NEF to refer to this traffic influence subscription.

- for the HTTP PUT or PATCH request, update a resource "Individual Traffic Influence Subscription" which represents the traffic influence subscription, and shall responds to the AF with a 200 OK status code.

- for the HTTP DELETE request, delete the corresponding active resource "Individual Traffic Influence Subscription" which represents the traffic influence subscription, and shall responds to the AF with a 204 No Content status code.

5 NEF Northbound APIs

5.1 Introduction

The NEF Northbound APIs are a set of APIs defining the related procedures and resources for the interaction between the NEF and the AF.

5.2 Information applicable to several APIs

The usage of HTTP and content type, as specified in subclauses 5.2.2 and 5.2.3 of 3GPP TS 29.122 [4] respectively, shall be applicable for NEF Northbound APIs.

The notification, error handling, feature negotiation, HTTP custom headers as specified in subclauses 5.2.5, 5.2.6, 5.2.7, 5.2.8 of 3GPP TS 29.122 [4] respectively, shall be applicable for NEF Northbound APIs except that the SCEF is replaced by the NEF and the SCS/AS by the AF.

The conventions for Open API specification files as specified in subclause 5.2.10 of 3GPP TS 29.122 [4] shall be applicable for NEF Northbound APIs.

5.3 Reused APIs

This subclause describes the northbound APIs which are applicable for both EPS and 5GS.

Table 5.3.1-1: Reused APIs applicable for both EPS and 5GS

API Name	Differences
ResourceManagementOfBdt	
PfdManagement	
MonitoringEvent	
DeviceTriggering	
CpProvisioning	The "ExpectedUMT_5G" feature as described in subclause 5.11.4 of 3GPP TS 29.122 [4] shall be supported in 5G.

5.4 TrafficInfluence API

5.4.1 Resources

5.4.1.1 Overview

This subclause describes the structure for the Resource URIs as shown in figure 5.4.1.1-1 and the resources and HTTP methods used for the TrafficInfluence API.
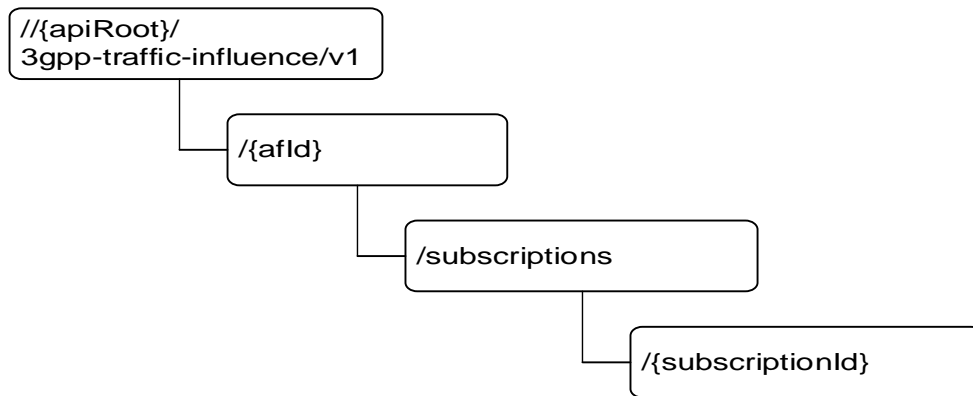
Figure 5.4.1.1-1: Resource URI structure of the TrafficInfluence API

Table 5.4.1.1-1 provides an overview of the resources and HTTP methods applicable for the TrafficInfluence API.

Table 5.4.1.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method	Description
Traffic Influence Subscription	3gpp-traffic-Influence/v1/{afId}/subscriptions	GET	Read all subscriptions for a given AF
		POST	Create a new subscription to traffic influence
Individual Traffic Influence Subscription	3gpp-traffic-Influence/v1/{afId}/subscriptions/{subscriptionId}	GET	Read the subscription to the traffic influence
		PUT	Modify all of the properties of an existing subscription to an traffic influence
		PATCH	Modify part of the properties of an existing subscription to an traffic influence
		DELETE	Delete the subscription to the traffic influence

5.4.1.2 Resource: Traffic Influence Subscription

5.4.1.2.1 Introduction

This resource allows a AF to read all active traffic influence subscribtions for the given AF.

5.4.1.2.2 Resource Definition

Resource URI: **{apiRoot}/3gpp-traffic-influence/v1/{afId}/subscriptions**

This resource shall support the resource URI variables defined in table 5.4.1.2.2-1.

Table 5.4.1.2.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	Subclause 5.2.4 of 3GPP TS 29.122 [4].
afId	Identifier of the AF.

5.4.1.2.3 Resource Methods

5.4.1.2.3.1 General

The following subclauses specify the resource methods supported by the resource as described in subclause 5.4.1.2.3.

5.4.1.2.3.2 GET

The GET method allows to read all active subscriptions for a given AF. The AF shall initiate the HTTP GET request message and the NEF shall respond to the message.

This method shall support the URI query parameters specified in table 5.4.1.2.3.2-1.

Table 5.4.1.2.3.2-1: 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 5.4.1.2.3.2-2 and the response data structures and response codes specified in table 5.4.1.2.3.2-3.

Table 5.4.1.2.3.2-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
N/A			

Table 5.4.1.2.3.2-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
array(TrafficInfluSub)		0..N	200 OK	The subscription information for the AF in the request URI are returned.
NOTE: In addition to the above response codes, the NEF can also send the HTTP response codes in table 5.2.6-1 of 3GPP TS 29.122 [4].				

5.4.1.2.3.3 POST

The POST method creates a new subscription resource to traffic influence subscription for a given AF. The AF shall initiate the HTTP POST request message and the NEF shall respond to the message. The NEF shall construct the URI of the created resource.

This method shall support the request data structures specified in table 5.4.1.2.3.3-1 and the response data structures and response codes specified in table 5.4.1.2.3.3-2.

Table 5.4.1.2.3.3-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
TrafficInfluSub	M	1	Parameters to register a subscription to influencing traffic routing and/or notification about UP management events with the NEF.

Table 5.4.1.2.3.3-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TrafficInfluSub	M	1	201 Created	The subscription was created successfully. The URI of the created resource shall be returned in the "Location" HTTP header.
NOTE: In addition to the above response codes, the NEF can also send the HTTP response codes in table 5.2.6-1 of 3GPP TS 29.122 [4].				

5.4.1.3 Resource: Individual Traffic Influence Subscription

5.4.1.3.1 Introduction

This resource allows a AF to register a subscription to influencing traffic routing and/or notification about UP management events with the NEF.

5.4.1.3.2 Resource Definition

Resource URI: **{apiRoot}/3gpp-traffic-influence/v1/{afId}/subscriptions/{subscriptionId}**

This resource shall support the resource URI variables defined in table 5.4.1.3.2-1.

Table 5.4.1.3.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	Subclause 5.2.4 of 3GPP TS 29.122 [4].
afId	Identifier of the AF.
subscriptionId	Identifier of the subscription resource of type string.

5.4.1.3.3 Resource Methods

5.4.1.3.3.1 General

The following subclauses specify the resource methods supported by the resource as described in subclause 5.4.1.3.3.

5.4.1.3.3.2 GET

The GET method allows to read the active subscription for a given AF and subscription Id. The AF shall initiate the HTTP GET request message and theNEF shall respond to the message.

This method shall support the URI query parameters specified in table 5.4.1.3.3.2-1.

Table 5.4.1.3.3.2-1: 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 5.4.1.3.3.2-2 and the response data structures and response codes specified in table 5.4.1.3.3.2-3.

Table 5.4.1.3.3.2-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
N/A			

Table 5.4.1.3.3.2-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TrafficInfluSub	M	1	200 OK	The subscription information for the AF in the request URI are returned.

NOTE: In addition to the above response codes, the NEF can also send the HTTP response codes in table 5.2.6-1 of 3GPP TS 29.122 [4].

5.4.1.3.3.3 PUT

The PUT method modifies an existing subscription resource to update a subscription. The AF shall initiate the HTTP PUT request message and the NEF shall respond to the message.

This method shall support the request data structures specified in table 5.4.1.3.3.3-1 and the response data structures and response codes specified in table 5.4.1.3.3.3-2.

Table 5.4.1.3.3.3-1: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
TrafficInfluSub	M	1	Modify an existing subscription to influencing traffic routing and/or notification about UP management events with the NEF.

Table 5.4.1.3.3.3-2: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TrafficInfluSub	M	1	200 OK	The subscription was updated successfully.
NOTE: In addition to the above response codes, the NEF can also send the HTTP response codes in table 5.2.6-1 of 3GPP TS 29.122 [4].				

5.4.1.3.3.4 PATCH

The PATCH method allows to change some properties of an existing traffic influence subscription. The AF shall initiate the HTTP PATCH request message and the NEF shall respond to the message.

This method shall support the request data structures specified in table 5.4.1.3.3.4-1 and the response data structures and response codes specified in table 5.4.1.3.3.4-2.

Table 5.4.1.3.3.4-1: Data structures supported by the PATCH Request Body on this resource

Data type	P	Cardinality	Description
TrafficInfluSubPatch	M	1	Partial update of a subscription to influencing traffic routing and/or notifications about UP management events with the SCEF.

Table 5.4.1.3.3.4-2: Data structures supported by the PATCH Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TrafficInfluSub	M	1	200 OK	The subscription was modified successfully.
NOTE: In addition to the above response codes, the NEF can also send the HTTP response codes in table 5.2.6-1 of 3GPP TS 29.122 [4].				

5.4.1.3.3.5 DELETE

The DELETE method deletes the traffic influence subscription for a given AF. The AF shall initiate the HTTP DELETE request message and the NEF shall respond to the message.

This method shall support the URI query parameters specified in table 5.4.1.3.3.5-1.

Table 5.4.1.3.3.5-1: 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 5.4.1.3.3.5-2 and the response data structures and response codes specified in table 5.4.1.3.3.5-3.

Table 5.4.1.3.3.5-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
N/A			

Table 5.4.1.3.3.5-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
N/A			204 No Content	The subscription was terminated successfully.
NOTE: In addition to the above response codes, the NEF can also send the HTTP response codes in table 5.2.6-1 of 3GPP TS 29.122 [4].				

5.4.2 Notifications

5.4.2.1 Introduction

Upon receipt of a UP management event notification from the PCF or the SMF indicating the subscribed event (e.g. a DNAI has changed) is detected, the NEF shall send an HTTP POST message including the notified event to the AF. The NEF and the AF shall support the notification mechanism as described in subclause 5.2.5 of 3GPP TS 29.122 [4].

5.4.2.2 Event Notification

URI: {notificationUrl}

The operation shall support the URI variables defined in table 5.4.2.2-1.

Table 5.4.2.2-1: URI variables

Name	Definition
notificationUrl	Callback reference provided by the AF during creation of the subscription.

5.4.2.3 Operation Definition

5.4.2.3.1 Notification via HTTP POST

This method shall support the request data structures specified in table 5.4.2.3.1-1 and the response data structures and response codes specified in table 5.4.2.3.1-2.

Table 5.4.2.3.1-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
EventNotification	M	1	The UP management event notification is provided by the NEF to the AF.

Table 5.4.2.3.1-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
N/A			204 No Content	The event notification is received successfully.

5.4.2.3.2 Notification via Websocket

If supported by both AF and NEF and successfully negotiated, the EventNotification may alternatively be delivered through the Websocket mechanism as defined in subclause 5.2.5.4 of 3GPP TS 29.122 [4].

5.4.3   Data Model

5.4.3.1   General

This subclause specifies the application data model supported by the TrafficInfluence API.

5.4.3.2   Reused data types

The data types reused by the TrafficInfluence API from other specifications are listed in table 5.4.3.2-1.

Table 5.4.3.2-1: Re-used Data Types

Data type	Reference	Comments
Dnai	3GPP TS 29.571 [8]	Identifies a DNAI.
Dnn	3GPP TS 29.571 [8]	Identifies a DNN.
ExternalId	3GPP TS 29.122 [4]	External Identifier for a UE.
ExternalGroupId	3GPP TS 29.122 [4]	External Group Identifier for a user group.
FlowInfo	3GPP TS 29.122 [4]	Contains the data flow information.
Gpsi	3GPP TS 29.571 [8]	Identifies a GPSI.
Ipv4Addr	3GPP TS 29.122 [4]	Identifies an IPv4 address.
Ipv6Addr	3GPP TS 29.122 [4]	Identifies an IPv6 address.
Link	3GPP TS 29.122 [4]	Identifies a referenced resource.
MacAddr48	3GPP TS 29.571 [8]	Identifies a MAC address.
Port	3GPP TS 29.122 [4]	Identifies a port number.
Snssai	3GPP TS 29.571 [8]	Identifies the S-NSSAI.
WebsockNotifConfig	3GPP TS 29.122 [4]	Contains the configuration parameters to set up notification delivery over Websocket protocol.

5.4.3.3   Structured data types

5.4.3.3.1   Introduction

This clause defines the structured data types to be used in resource representations.

5.4.3.3.2   Type: TrafficInfluSub

This type represents a traffic influence subscription. The same structure is used in the subscription request and subscription response.

Table 5.4.3.3.2-1: Definition of type TrafficInfluSub

Attribute name	Data type	P	Cardinality	Description	Applicability (NOTE 1)
afServiceId	string	O	0..1	Identifies a service on behalf of which the AF is issuing the request.	
afTransId	string	O	0..1	Identifies an NEF Northbound interface transaction, generated by the AF.	
appReloIndication	boolean	O	0..1	Identifies whether an application can be relocated once a location of the application has been selected.	
dnn	Dnn	O	0..1	Identifies a DNN.	
snssai	Snssai	O	0..1	Identifies an S-NSSAI.	
externalGroupId	ExternalGroupId	O	0..1	Identifies a group of users. (NOTE 2)	
anyUEInd	boolean	O	0..1	Identifies whether the AF request applies to any UE. This attribute shall set to "true" if applicable for any UE, otherwise, set to "false". (NOTE 2)	
subscribedEvents	array(SubscribedEvent)	O	0..N	Identifies the requirement to be notified of a UP path management event and the activity.	
gpsi	Gpsi	O	0..1	Identifies a user. (NOTE 2)	
ipv4Addr	Ipv4Addr	O	0..1	Identifies the IPv4 address. (NOTE 2)	
Ipv6Addr	Ipv6Addr	O	0..1	Identifies the IPv6 address. (NOTE 2)	
macAddr	MacAddr48	O	0..1	Identifies the MAC address.	
notifyType	NotifyType	O	0..1	Identifies a type of notification regarding UP patch management event.	
notificationDestination	Link	C	0..1	Contains the Callback URL to receive the notification from the NEF. It shall be present if the "subscribedEvents" is present.	
requestTestNotification	boolean	O	0..1	Set to true by the SCS/AS to request the SCEF to send a test notification as defined in subclause 5.2.5.3 of 3GPP TS 29.122 [4]. Set to false or omitted otherwise.	Notification_test_event
websockNotifConfig	WebsockNotifConfig	O	0..1	Configuration parameters to set up notification delivery over Websocket protocol.	Notification_websocket

self	Link	C	0..1	Link to this resource. This parameter shall be supplied by the NEF in HTTP responses that include an object of TrafficInfluSub type	
trafficFilters	array(FlowInfo)	O	0..N	Identifies packet filters.	
trafficRoutes	array(TrafficRoute)	M	1..N	Identifies the N6 traffic routing requirement.	
validStartTime	DateTime	O	0..1	Identifies when the traffic routings are start to be applicable.	
validEndTime	DateTime	O	0..1	Identifies when the traffic routings are not applicable.	
validGeoZoneIds	array(string)	M	1..N	Identifies a geographic zone that the AF request applies only to the traffic of UE(s) located in this specific zone.	
NOTE 1: Properties marked with a feature as defined in subclause 5.4.5 are applicable as described in subclause 5.2.7 of 3GPP TS 29.122 [4]. If no feature is indicated, the related property applies for all the features.					
NOTE 2: One of individual UE identifier (i.e. "gpsi", "ipv4Addr", "ipv6Addr" or "externalId"), External Group Identifier (i.e. "exterGroupId") or any UE indication "anyUeInd" shall be included.					

5.4.3.3.3 Type: TrafficInfluSubPatch

This type represents a subscription of traffic influence parameters provided by the AF to the NEF. The structure is used for HTTP PATCH request.

Table 5.4.3.3.3-1: Definition of type TrafficInfluSubPatch

Attribute name	Data type	P	Cardinality	Description	Applicability
afTransId	string	O	0..1	Identifies an NEF Northbound interface transaction, generated by the AF.	
appReloIndication	boolean	O	0..1	Identifies whether an application can be relocated once a location of the application has been selected. (NOTE)	
trafficFilter	FlowInfo	O	0..1	Identifies a packet filter.	
trafficRoutes	array(TrafficRoute)	O	0..N	Identifies the N6 traffic routing requirement. (NOTE)	
validStartTime	DateTime	O	0..1	Identifies when the traffic routings are start to be applicable. (NOTE)	
validEndTime	DateTime	O	0..1	Identifies when the traffic routings are not applicable. (NOTE)	
validGeoZoneIds	array(string)	O	0..N	Identifies a geographic zone that the AF request applies only to the traffic of UE(s) located in this specific zone. (NOTE)	
NOTE: The value of the property shall be set to NULL for removal.					

5.4.3.3.4 Type: TrafficRoute

Table 5.4.3.3.4-1: Definition of type TrafficRoute

Attribute name	Data type	P	Cardinality	Description
dnai	Dnai	M	1	Identifies a DNAI.
routingProfileId	integer	O	0..1	Identifies an N6 traffic routing profile associated with the DNAI. (NOTE)
trafficRouteInfo	TrafficRouteInfo	O	0..1	Identifies a set of N6 traffic routing information associated with the DNAI. (NOTE)
NOTE: Either the "routingProfileId" or the "trafficRouteInfo" shall be provided.				

5.4.3.3.5 Type: TrafficRouteInfo

Table 5.4.3.3.5-1: Definition of type TrafficRouteInfo

Attribute name	Data type	P	Cardinality	Description
Ipv6Addr	Ipv6Addr	M	1	Identifies an IPv6 address of Data Network.
portNum	Port	M	1	Identifies a UDP port number of N6 tunnel end in the Data Network.

5.4.3.3.6 Type: EventNotification

Table 5.4.3.3.6-1: Definition of type EventNotification

Attribute name	Data type	P	Cardinality	Description	Applicability (NOTE)
afTransId	string	O	0..1	Identifies an NEF Northbound interface transaction, generated by the AF.	
activityStatus	boolean	O	0..1	Identifies whether the AF request is active or inactive. Shall be present if the "subscribedEvent" sets to "ACTIVITY".	
notifyType	NotifyType	M	1	Identifies the type of notification regarding UP patch management event.	
sourceTrafficRoute	TrafficRoute	O	0..1	Identifies the N6 traffic routing information associated to the source DNAI. Shall be present if the "subscribedEvent" sets to "CHANGE_OF_DNAI".	
subscribedEvent	SubscribedEvent	M	1	Identifies a UP path management event the AF requested to be notified of.	
targetTrafficRoute	TrafficRoute	O	0..1	Identifies the N6 traffic routing information associated to the target DNAI. Shall be present if the "subscribedEvent" sets to "CHANGE_OF_DNAI".	
NOTE: Properties marked with a feature as defined in subclause 5.4.5 are applicable as described in subclause 5.2.7 of 3GPP TS 29.122 [4]. If no feature is indicated, the related property applies for all the features.					

5.4.3.4 Simple data types and enumerations

5.4.3.4.1 Introduction

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

5.4.3.4.2 Simple data types

The simple data types defined in table 5.4.4.4.2-1 shall be supported.

Table 5.4.3.4.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

5.4.3.4.3 Enumeration: SubscribedEvent

The enumeration SubscribedEvent represents the type of UP patch management events of which the AF requests to be notified. It shall comply with the provisions defined in table 5.4.3.4.3-1.

Table 5.4.3.4.3-1: Enumeration SubscribedEvent

Enumeration value	Description
ACTIVITY	The AF requests to be notified when the AF request become active or inactive in the SMF.
CHANGE_OF_DNAI	The AF requests to be notified when the DNAI changes for the PDU session.

5.4.3.4.4 Enumeration: NotifyType

The enumeration NotifyType represents the type of notifications regarding UP patch management events. It shall comply with the provisions defined in table 5.4.3.4.4-1.

Table 5.4.3.4.4-1: Enumeration NotifyType

Enumeration value	Description
EARLY	The AF requests to be notified before the UP path is configured.
LATE	The AF requests to be notified after the UP path is configured.
EARLY_LATE	The AF requests to be notified before and after the UP path is configured.

5.4.4 Used Features

The table below defines the features applicable to the TrafficInfluence API. Those features are negotiated as described in subclause 5.2.7 of 3GPP TS 29.122 [4].

Table 5.4.4-1: Features used by TrafficInfluence API

Feature number	Feature Name	Description
1	Notification_websocket	The delivery of notifications over Websocket is supported as described in 3GPP TS 29.122 [4]. This feature requires that the Notification_test_event feature is also supported.
2	Notification_test_event	The testing of notification connection is supported as described in 3GPP TS 29.122 [4].

6 Security

TLS (IETF RFC 5246 [4]) shall be used to support the security communication between the NEF and the AF over NEF Northbound interface as defined in subclause 12 of 3GPP TS 33.501 [6].

7 Using Common API Framework

When CAPIF is used with an NEF that is used for external exposure, the NEF shall support the following as defined in 3GPP TS 29.222 [12]:

- the API exposing function and related APIs over CAPIF-2/2e and CAPIF-3 reference points;

- the API publishing function and related APIs over CAPIF-4 reference point;

- the API management function and related APIs over CAPIF-5 reference point; and

- at least one of the security methods for authentication and authorization, and related security mechanisms.

In a centralized deployment as defined in 3GPP TS 23.222 [11], where the CAPIF core function and API provider domain functions are co-located, the interactions between the CAPIF core function and API provider domain functions may be independent of CAPIF-3, CAPIF-4 and CAPIF-5 reference points.

Annex A (normative): OpenAPI representation for NEF Northbound APIs

A.1 General

This Annex is based on the OpenAPI 3.0.0 specification [5] and provides corresponding representations of all APIs defined in the present specification.

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

A.2 TrafficInfluence API

```
openapi: 3.0.0
info:
  title: 3gpp-traffic-influence
  version: "v1"
externalDocs:
  description: Documentation
  url: 'http://www.3gpp.org/ftp/Specs/archive/29_series/29.522/'
servers:
  - url: https://{apiRoot}/3gpp-traffic-influence/v1
    variables:
      apiRoot:
        default: demohost.com
        description: apiRoot as defined in subclause 5.2.4 of 3GPP TS 29.122, excluding the https://
part.

paths:
  /{afId}/subscriptions:
    get:
      summary: read all of the active subscriptions for the AF
      tags:
        - TrafficInfluence API SCS/AS level GET Operation
      parameters:
        - name: afId
          in: path
          description: Identifier of the AF
          required: true
          schema:
            type: string
      responses:
        '200':
          description: OK.
          content:
            application/json:
              schema:
                type: array
                items:
                  $ref: '#/components/schemas/TrafficInfluSub'
        default:
          description: Unexpected error
          content:
            application/problem+json:
              schema:
                $ref: 'TS29122_CommonData.yaml#/components/schemas/ProblemDetails'

    post:
      summary: Creates a new subscription resource
      tags:
        - TrafficInfluence API Subscription level POST Operation
      parameters:
        - name: afId
          in: path
          description: Identifier of the AF
          required: true
          schema:
            type: string
      requestBody:
        description: Request to create a new subscription resource
        required: true
        content:
          application/json:
```

```
              schema:
                $ref: '#/components/schemas/TrafficInfluSub'
        callbacks:
          notificationDestination:
            '{request.body#/notificationDestination}':
              post:
                requestBody:  # contents of the callback message
                  required: true
                  content:
                    application/json:
                      schema:
                        $ref: '#/components/schemas/EventNotification'
                responses:
                  '204':
                    description: No Content (successful notification)
        responses:
          '201':
            description: Created (Successful creation of subscription)
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/TrafficInfluSub'
          default:
            description: Unexpected error
            content:
              application/problem+json:
                schema:
                  $ref: 'TS29122_CommonData.yaml#/components/schemas/ProblemDetails'

  /{afId}/subscriptions/{subscriptionId}:
    get:
      summary: read an active subscriptions for the SCS/AS and the subscription Id
      tags:
        - TrafficInfluence API Subscription level GET Operation
      parameters:
        - name: afId
          in: path
          description: Identifier of the AF
          required: true
          schema:
            type: string
        - name: subscriptionId
          in: path
          description: Identifier of the subscription resource
          required: true
          schema:
            type: string
      responses:
        '200':
          description: OK (Successful get the active subscription)
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/TrafficInfluSub'
        default:
          description: Unexpected error
          content:
            application/problem+json:
              schema:
                $ref: 'TS29122_CommonData.yaml#/components/schemas/ProblemDetails'

    put:
      summary: Updates/replaces an existing subscription resource
      tags:
        - TrafficInfluence API subscription level PUT Operation
      parameters:
        - name: afId
          in: path
          description: Identifier of the AF
          required: true
          schema:
            type: string
        - name: subscriptionId
          in: path
          description: Identifier of the subscription resource
          required: true
          schema:
            type: string
```

```
      requestBody:
        description: Parameters to update/replace the existing subscription
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/TrafficInfluSub'
      responses:
        '200':
          description: OK (Successful update of the subscription)
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/TrafficInfluSub'
        default:
          description: Unexpected error
          content:
            application/problem+json:
              schema:
                $ref: 'TS29122_CommonData.yaml#/components/schemas/ProblemDetails'

    patch:
      summary: Updates/replaces an existing subscription resource
      tags:
        - TrafficInfluence API subscription level PATCH Operation
      requestBody:
        required: true
        content:
          application/merge-patch+json:
            schema:
              $ref: '#/components/schemas/TrafficInfluSubPatch'
      parameters:
        - name: afId
          in: path
          description: Identifier of the AF
          required: true
          schema:
            type: string
        - name: subscriptionId
          in: path
          description: Identifier of the subscription
          required: true
          schema:
            type: string
      responses:
        '200':
          description: OK. The subscription was modified successfully.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/TrafficInfluSub'
        default:
          description: Unexpected error
          content:
            application/problem+json:
              schema:
                $ref: 'TS29122_CommonData.yaml#/components/schemas/ProblemDetails'

    delete:
      summary: Deletes an already existing subscription
      tags:
        - TrafficInfluence API Subscription level DELETE Operation
      parameters:
        - name: afId
          in: path
          description: Identifier of the AF
          required: true
          schema:
            type: string
        - name: subscriptionId
          in: path
          description: Identifier of the subscription resource
          required: true
          schema:
            type: string
      responses:
        '204':
          description: No Content (Successful deletion of the existing subscription)
```

```
              default:
                description: Unexpected error
                content:
                  application/problem+json:
                    schema:
                      $ref: 'TS29122_CommonData.yaml#/components/schemas/ProblemDetails'

components:
  schemas:
    TrafficInfluSub:
      type: object
      properties:
        afServiceId:
          type: string
          description: Identifies a service on behalf of which the AF is issuing the request.
        afTransId:
          type: string
          description: Identifies an NEF Northbound interface transaction, generated by the AF.
        appReloIndication:
          type: boolean
          description: Identifies whether an application can be relocated once a location of the
application has been selected.
        dnn:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
        snssai:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
        externalGroupId:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/ExternalGroupId'
        anyUEInd:
          type: boolean
          description: Identifies whether the AF request applies to any UE. This attribute shall set
to "true" if applicable for any UE, otherwise, set to "false".
        subscribedEvents:
          type: array
          items:
            $ref: '#/components/schemas/SubscribedEvent'
          minItems: 0
          description: Identifies the requirement to be notified of a UP path management event and
the activity.
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        ipv4Addr:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Ipv4Addr'
        ipv6Addr:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Ipv6Addr'
        macAddr:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/macAddr48'
        notifyType:
          $ref: '#/components/schemas/NotifyType'
        notificationDestination:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Link'
        requestTestNotification:
          type: boolean
          description: Set to true by the SCS/AS to request the SCEF to send a test notification as
defined in subclause 5.2.5.3. Set to false or omitted otherwise.
        websockNotifConfig:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/WebsockNotifConfig'
        self:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Link'
        trafficFilter:
          type: array
          items:
            $ref: 'TS29122_CommonData.yaml#/components/schemas/FlowInfo'
          minItems: 0
          description: Identifies packet filters.
        trafficRoutes:
          type: array
          items:
            $ref: '#/components/schemas/TrafficRoute'
          minItems: 1
          description: Identifies the N6 traffic routing requirement.
        validStartTime:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/DateTime'
        validEndTime:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/DateTime'
        validGeoZoneIds:
          type: array
          items:
```

```
                type: string
                minItems: 1
                description: Identifies a geographic zone that the AF request applies only to the traffic
of UE(s) located in this specific zone.
          required:
            - trafficRoutes
            - validGeoZoneIds
    TrafficInfluSubPatch:
      type: object
      properties:
        afTransId:
          type: string
          description: Identifies an NEF Northbound interface transaction, generated by the AF.
        appReloIndication:
          type: boolean
          description: Identifies whether an application can be relocated once a location of the
application has been selected.
        trafficFilter:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/FlowInfo'
        trafficRoutes:
          type: array
          items:
            $ref: '#/components/schemas/TrafficRoute'
          minItems: 1
          description: Identifies the N6 traffic routing requirement.
        validStartTime:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/DateTime'
        validEndTime:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/DateTime'
        validGeoZoneIds:
          type: array
          items:
            type: string
          minItems: 0
          description: Identifies a geographic zone that the AF request applies only to the traffic
of UE(s) located in this specific zone.
    TrafficRoute:
      type: object
      properties:
        dnai:
          type: string
          description: Identifies an NEF Northbound interface transaction, generated by the AF.
        routingProfileId:
          type: integer
          description: Identifies an N6 traffic routing profile associated with the DNAI.
        trafficRouteInfo:
          $ref: '#/components/schemas/TrafficRouteInfo'
      required:
        - dnai
    TrafficRouteInfo:
      type: object
      properties:
        ipv6Addr:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Ipv6Addr'
        portNum:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Port'
    EventNotification:
      type: object
      properties:
        afTransId:
          type: string
          description: Identifies an NEF Northbound interface transaction, generated by the AF.
        activityStatus:
          type: boolean
          description: Identifies whether the AF request is active or inactive. Shall be present if
the "subscribedEvent" sets to "ACTIVITY".
        notifyType:
          $ref: '#/components/schemas/NotifyType'
        sourceTrafficRoute:
          $ref: '#/components/schemas/TrafficRoute'
        subscribedEvent:
          $ref: '#/components/schemas/SubscribedEvent'
        targetTrafficRoute:
          $ref: '#/components/schemas/TrafficRoute'
      required:
        - notifyType
        - subscribedEvent
    SubscribedEvent:
```

```
      anyOf:
      - type: string
        enum:
          - ACTIVITY
          - CHANGE_OF_DNAI
      - type: string
      description: >
        Possible values are
        - ACTIVITY: The AF requests to be notified when the AF request become active or inactive in
the SMF.
        - CHANGE_OF_DNAI: The AF requests to be notified when the DNAI changes for the PDU session.
    NotifyType:
      anyOf:
      - type: string
        enum:
          - EARLY
          - LATE
          - EARLY_LATE
      - type: string
      description: >
        Possible values are
        - ACTIVITY: The AF requests to be notified before the UP path is configured.
        - LATE: The AF requests to be notified after the UP path is configured.
        - EARLY_LATE: The AF requests to be notified before and after the UP path is configured.
```

Annex B (informative): Change history

Change history							
Date	Meeting	TDoc.	CR	Rev	Cat	Subject/Comment	New
2018-03	CT3#95					TS Skeleton	0.0.0
2018-03	CT3#95					Inclusion of C3-181332 and TS skeleton of Network Exposure Function Northbound APIs in C3-181362.	0.1.0
2018-04	CT3#96					Inclusion of C3-182407, C3-182408, C3-182504, C3-182418, C3-182505, C3-182443, C3-182421, C3-182422, C3-182501 and editorial changes from Rapporteur.	0.2.0
2018-05	CT3#97					Inclusion of C3-183187, C3-183773, C3-183774, C3-183553, C3-183826, C3-183329, C3-183776, C3-183827, C3-183778, C3-183605 and editorial changes from Rapporteur.	0.3.0
2018-06	CT#80					TS sent to plenary for approval	1.0.0
2018-06	CT#80					TS approved by plenary	15.0.0

History

Document history		
V15.0.0	July 2018	Publication