ETSI TS 129 530 V19.1.0 (2026-03)

TECHNICAL SPECIFICATION

5G;
5G System;
Application Function Artificial Intelligence/Machine Learning (AI/ML) Services;
Stage 3
(3GPP TS 29.530 version 19.1.0 Release 19)

Reference
RTS/TSGC-0329530vj10

Keywords
5G

ETSI

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

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

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

Intellectual Property Rights

Essential patents

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

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

Trademarks

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

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

Legal Notice

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

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

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

Modal verbs terminology

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

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

Contents

Foreword

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

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

Version x.y.z

where:

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

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

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

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

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

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

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies the stage 3 protocol and data model for the Naf Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the AF.

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.288 [14], 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3].

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

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

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

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

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

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

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

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

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

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

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

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

[11] IETF RFC 9113: "HTTP/2".

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

[13] IETF RFC 9457: "Problem Details for HTTP APIs".

[14] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[15] 3GPP TS 29.552: "5G System; Network Data Analytics signalling flows; Stage 3".

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

[17] 3GPP TS 29.523: "5G System; Policy Control Event Exposure Service; Stage 3".

[18] 3GPP TS 29.520: "5G System; Network Data Analytics Services; Stage 3".

[19] IETF RFC 9112: "HTTP/1.1".

[20] IETF RFC 9110: "HTTP Semantics".

[21] IETF RFC 9111: "HTTP Caching".

[22] 3GPP TS 29.122: "T8 reference point for Northbound APIs".

[23] 3GPP TS 29.554: "5G System; Background Data Transfer Policy Control Service; Stage 3".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

For the purpose of the present document, the terms and definitions given in clause 3 of 3GPP TS 23.288 [14] also apply, including the ones referencing other specifications.

3.2 Symbols

3.3 Abbreviations

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

AF	Application Function
AI/ML	Artificial Intelligence/Machine Learning
GPSI	Generic Public Subscription Identifier
NEF	Network Exposure Function
NWDAF	Network Data Analytics Function
REST	Representational State Transfer
VFL	Vertical Federated Learning

4 Overview

The Application Function Artificial Intelligence/Machine Learning (AI/ML) Services, as defined in 3GPP TS 23.288 [14], are provided by the Application Function (AF).

The following AI/ML services are specified for the AF:

Table 4.1-1: AI/ML Services provided by AF

Service Name	Description	Service Operations	Operation Semantics	Example Consumer(s)
Naf_VFLTraining	This service is provided by an AF acting as VFL client and enables an NF service consumer to request the AF to participate in VFL model training as VFL client and train a local model.	Subscribe(NOTE 1) Unsubscribe Notify	Subscribe / Notify	NWDAF, NEF

Naf_VFLInference	This service is provided by AF acting as VFL client and enables an NF service consumer to subscribe/unsubscribe for a VFL inference.	Subscribe(NOTE 2) Unsubscribe Notify	Subscribe / Notify	NWDAF, NEF
Naf_Inference	This service is provided by AF acting as VFL server and enables an NF service consumer to subscribe/unsubscribe for a VFL inference.	Subscribe(NOTE 3) Unsubscribe Notify	Subscribe / Notify	NWDAF, NEF
Naf_Training	This service is provided by AF acting as VFL server and enables an NF service consumer to subscribe/unsubscribe for a VFL training.	Subscribe Unsubscribe Notify	Subscribe / Notify	NWDAF, NEF
NOTE 1: This service implements also the Naf_VFLTraining_Request as specified in 3GPP TS 23.288 [14] by using immediate and one-time reporting requirement. NOTE 2: This service implements also the Naf_VFLInference_Request as specified in 3GPP TS 23.288 [14] by using immediate and one-time reporting requirement. NOTE 3: This service implements also the Naf_Inference_Request as specified in 3GPP TS 23.288 [14] by using immediate and one-time reporting requirement.				

5 Services offered by the AF

5.1 Introduction

The AF offers to other NFs the following services:

- Naf_VFLTraining;
- Naf_VFLInference;
- Naf_Training;
- Naf_Inference.

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

Table 5.1-1: API Descriptions

Service Name	Clause	Description	OpenAPI Specification File	apiName	Annex
Naf_VFLTraining	5.2	AF VFL Training service	TS29530_Naf_VFLTraining.yaml	naf-vfl-train	A.2
Naf_VFLInference	5.3	AF VFL Inference service	TS29530_Naf_VFLInference.yaml	naf-vflinference	A.3
Naf_Training	5.4	AF training service	TS29530_Naf_Training.yaml	naf-train	A.4
Naf_Inference	5.5	AF Inference service	TS29530_Naf_Inference.yaml	naf-inference	A.5

5.2 Naf_VFLTraining Service

5.2.1 Service Description

5.2.1.1 Overview

The Naf_VFLTraining service exposed by the AF acting as VFL client enables an NF service consumer to:

- request the creation/update of a VFL Training Subscription; and

- receive VFL Training related event(s) reporting.

5.2.1.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The Network Data Analytics Exposure architecture is defined in 3GPP TS 23.288 [14]. The VFL signalling flows are defined in 3GPP TS 29.552 [15].

The Naf_VFLTraining service is part of the Naf service-based interface exhibited by the trusted Application Function (AF) or untrusted Application Function (AF).

Known consumers of the Naf_VFLTraining service are:

- Network Data Analytics Function (NWDAF) when the AF is trusted.
- Network Exposure Function (NEF) when the AF is untrusted.

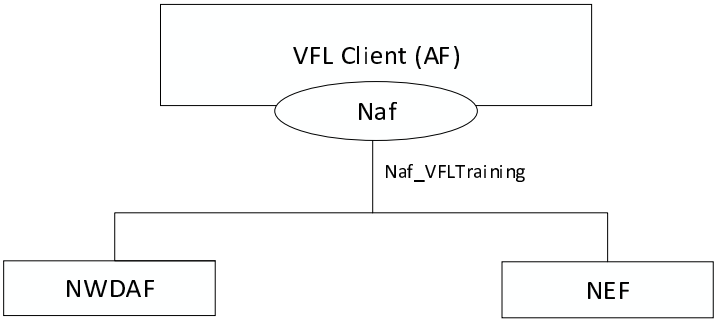

Figure 5.2.1.2-1: Reference Architecture for the Naf_VFLTraining service; SBI representation

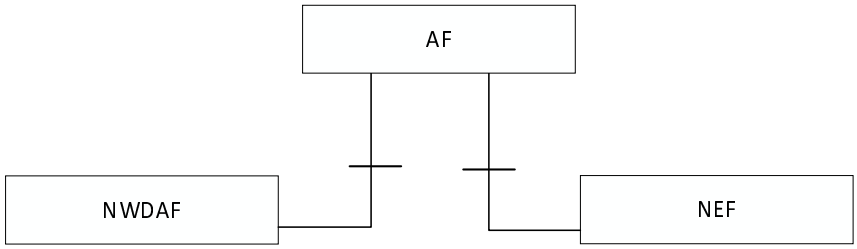

Figure 5.2.1.2-2: Reference Architecture for the Naf_VFLTraining service: reference point representation

5.2.1.3 Network Functions

5.2.1.3.1 Application Function (AF)

The Application Function (AF) acting as VFL client provides VFL training for different analytics events to NF service consumers.

The Application Function (AF) acting as VFL client allows NF service consumers to subscribe to and unsubscribe from VFL training event notifications.

5.2.1.3.2 NF Service Consumers

The Network Data Analytics Function (NWDAF) and Network Exposure Function (NEF) support (un)subscription to the notification of different VFL training events.

5.2.2 Service Operations

5.2.2.1 Introduction

The service operations defined for the Naf_VFLTraining service are shown in table 5.2.2.1-1.

Table 5.2.2.1-1: Naf_VFLTraining Service Operations

Service Operation Name	Description	Initiated by
Naf_VFLTraining_Subscribe	This service operation enables the NF service consumer to request the creation/update of a VFL Training Subscription.	e.g., NWDAF, NEF
Naf_VFLTraining_Unsubscribe	This service operation enables the NF service consumer to request the deletion of a VFL Training Subscription.	e.g., NWDAF, NEF
Naf_VFLTraining_Notify	This service operation enables the NF service consumer to receive VFL Training related event(s) reporting.	AF

5.2.2.2 Naf_VFLTraining_Subscribe

5.2.2.2.1 General

This service operation is used by an NF service consumer to request the creation/update of a VFL Training Subscription at the AF.

The following procedures are supported by the "Naf_VFLTraining_Subscribe" service operation:

- VFL Training Subscription Creation.
- VFL Training Subscription Update.

5.2.2.2.2 VFL Training Subscription Creation

Figure 5.2.2.2.2-1 depicts a scenario where an NF service consumer sends a request to the AF to request the creation of a VFL Training Subscription (see also clause 6.2H of 3GPP°TS°23.288°[14]).

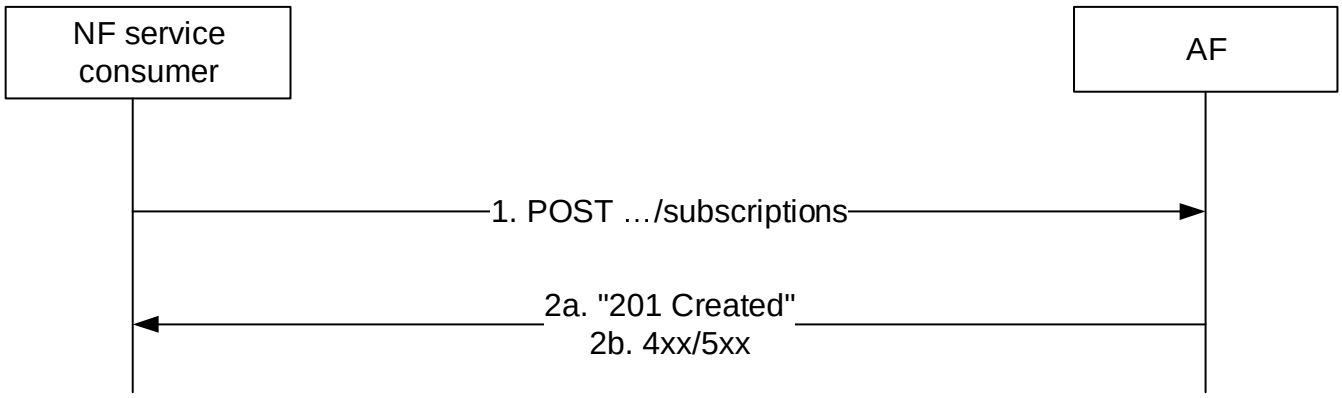

Figure 5.2.2.2.2-1: Procedure for VFL Training Subscription Creation

1. In order to subscribe to VFL Training, the NF service consumer shall send an HTTP POST request to the AF targeting the URI of the "VFL Training Subscriptions" collection resource, with the request body including the VflTrainingSubs data structure.

2a. Upon success, the AF shall respond with an HTTP "201 Created" status code with the response body containing a representation of the created "Individual VFL Training Subscription" resource within the VflTrainingSubs data structure, and an HTTP "Location" header field containing the URI of the created resource.

2b. On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the HTTP POST response body, as specified in clause 6.1.7.

5.2.2.2.3 VFL Training Subscription Update

Figure 5.2.2.2.3-1 depicts a scenario where an NF service consumer sends a request to the AF to request the update of an existing VFL Training Subscription (see also clause 6.2H of 3GPP°TS°23.288°[14]).

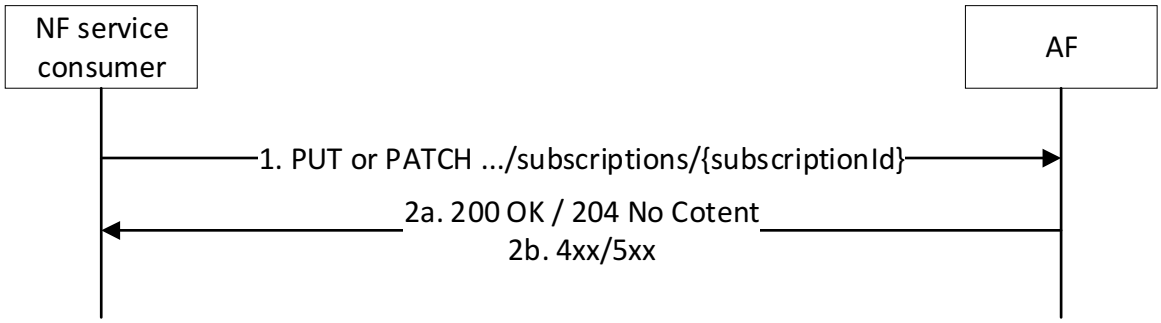

Figure 5.2.2.2.3-1: Procedure for VFL Training Subscription Update

1. In order to request the update of an existing VFL Training Subscription, the NF service consumer shall send an HTTP PUT/PATCH request to the AF, targeting the URI of the corresponding "Individual VFL Training Subscription" resource, with the request body including either:

   - the updated representation of the resource within the VflTrainingSubs data structure, in case the HTTP PUT method is used; or

   - the requested modifications to the resource within the VflTrainingSubsPatch data structure, in case the HTTP PATCH method is used.

2a. Upon success, the AF shall update the targeted "Individual VFL Training Subscription" resource accordingly and respond with either:

   - an HTTP "200 OK" status code with the response body containing a representation of the updated "Individual VFL Training Subscription" resource within the VflTrainingSubs data structure; or

   - an HTTP "204 No Content" status code.

2b. On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the HTTP PUT/PATCH response body, as specified in clause 6.1.7.

5.2.2.3 Naf_VFLTraining_Unsubscribe

5.2.2.3.1 General

This service operation is used by an NF service consumer to request the deletion of a VFL Training Subscription at the AF.

The following procedures are supported by the "Naf_VFLTraining_Unsubscribe" service operation:

- VFL Training Subscription Deletion.

5.2.2.3.2 VFL Training Subscription Deletion

Figure 5.2.2.3.2-1 depicts a scenario where an NF service consumer sends a request to the AF to delete an existing VFL Training Subscription (see also clause 6.2H of 3GPP°TS°23.288°[14]).

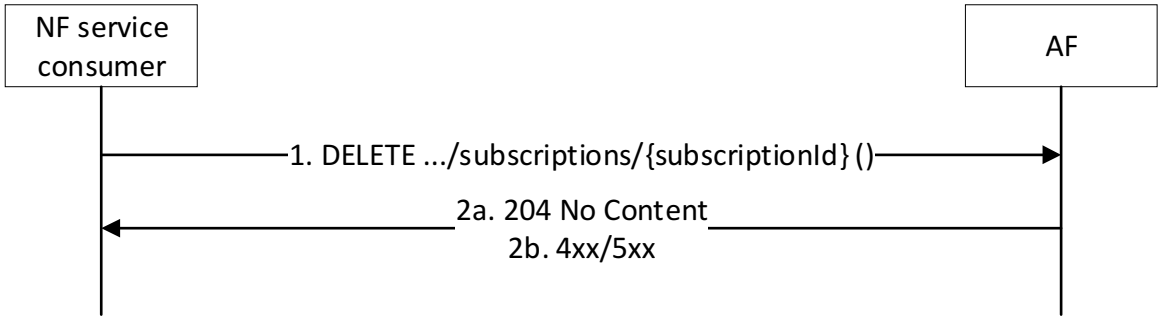

Figure 5.2.2.3.2-1: Procedure for VFL Training Subscription Deletion

1. In order to request the deletion of an existing VFL Training Subscription, the NF service consumer shall send an HTTP DELETE request to the AF targeting the URI of the corresponding "Individual VFL Training Subscription" resource.

2a. Upon success, the AF shall respond with an HTTP "204 No Content" status code.

2b. On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the HTTP DELETE response body, as specified in clause 6.1.7.

5.2.2.4 Naf_VFLTraining_Notify

5.2.2.4.1 General

This service operation is used by the AF to notify a previously subscribed service consumer on:

- VFL Training report(s).

The following procedures are supported by the "Naf_VFLTraining_Notify" service operation:

- VFL Training Notification.

5.2.2.4.2 VFL Training Notification

Figure 5.2.2.4.2-1 depicts a scenario where the AF sends a request to notify a previously subscribed service consumer on VFL Training report(s) (see also clause 6.2H of 3GPP°TS°23.288°[14]).

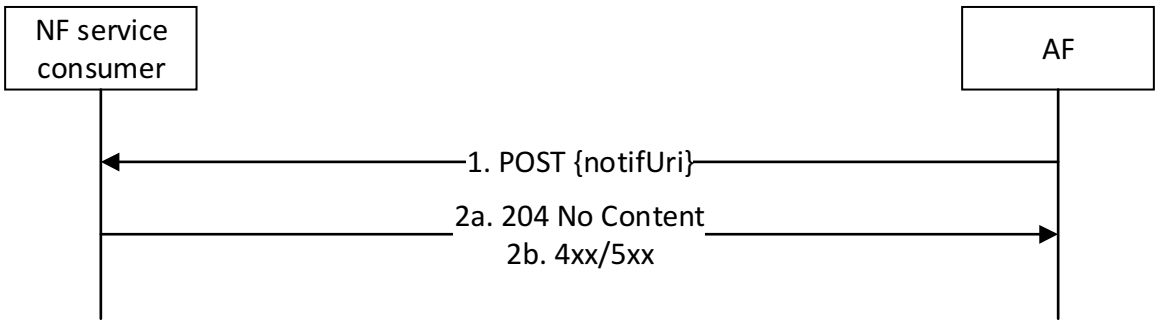

Figure 5.2.2.4.2-1: Procedure for VFL Training Notification

1. In order to notify a previously subscribed service consumer on VFL Training report(s), the AF shall send an HTTP POST request to the NF service consumer with the request URI set to "{notifUri}", where the "notifUri" variable is set to the value received from the NF service consumer during the creation/update of the corresponding VFL Training Subscription using the procedures defined in clauses 5.2.2.2, and the request body including the VflTrainingNotify data structure.

2a. Upon success, the NF service consumer shall respond to the AF with an HTTP "204 No Content" status code to acknowledge the reception of the notification.

2b. On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the HTTP POST response body, as specified in clause 6.1.7.

5.3 Naf_VFLInference Service

5.3.1 Service Description

5.3.1.1 Overview

The Naf_VFLInference service as defined in 3GPP TS 23.288 [14], is provided by the trusted Application Function (AF) or untrusted Application Function (AF) acting as VFL client.

This service allows the NF service consumers acting as VFL servers to:

- subscribe to and unsubscribe from different VFL inference events;
- modify VFL inference subscriptions; and
- be notified about events for corresponding VFL inference subscriptions.

5.3.1.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The Network Data Analytics Exposure architecture is defined in 3GPP TS 23.288 [14]. The VFL signalling flows are defined in 3GPP TS 29.552 [15].

The Naf_VFLInference service is part of the Naf service-based interface exhibited by the trusted Application Function (AF) or untrusted Application Function (AF).

Known consumers of the Naf_VFLInference service are:

- Network Data Analytics Function (NWDAF) when the AF is trusted.
- Network Exposure Function (NEF) when the AF is untrusted.

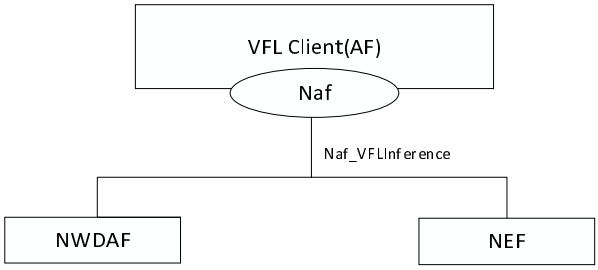

Figure 5.3.1.2-1: Reference Architecture for the Naf_VFLInference service; SBI representation

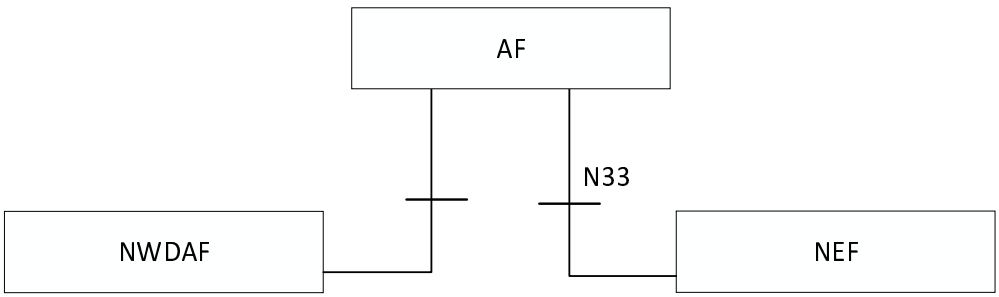

Figure 5.3.1.2-2: Reference Architecture for the Naf_VFLInference service: reference point representation

5.3.1.3 Network Functions

5.3.1.3.1 Application Function (AF)

The Application Function (AF), provides VFL inference for different analytics events to NF service consumers.

The Application Function (AF) allows NF service consumers to subscribe to and unsubscribe from one-time, periodic notification when a VFL inference event is detected.

5.3.1.3.2 NF Service Consumers

The Network Data Analytics Function (NWDAF) and Network Exposure Function (NEF) support (un)subscription to the notification of different VFL inference events.

5.3.2 Service Operations

5.3.2.1 Introduction

Table 5.3.2.1-1: Operations of the Naf_VFLInference service

Service operation name	Description	Initiated by
Naf_VFLInference_Subscribe	This service operation is used by an NF service consumer to subscribe to VFL inference events.	NF service consumer (NWDAF,NEF)
Naf_VFLInference_Unsubscribe	This service operation is used by an NF service consumer to unsubscribe from VFL inference event notifications.	NF service consumer (NWDAF,NEF)
Naf_VFLInference_Notify	This service operation is used by the AF to notify the VFL inference results to the NF service consumer which has subscribed to the event notifications.	AF

5.3.2.2 Naf_VFLInference_Subscribe service operation

5.3.2.2.1 General

The Naf_VFLInference_Subscribe service operation is used by an NF service consumer to request AF VFL client(s) to subscribe or update subscription for VFL inference event notifications from the AF acting as VFL client.

5.3.2.2.2 Subscription for VFL inference event notifications

Figure 5.3.2.2.2-1 shows a scenario where the NF service consumer sends a request to the AF to subscribe for VFL inference event notification(s) (as shown in 3GPP TS 23.288 [14]).

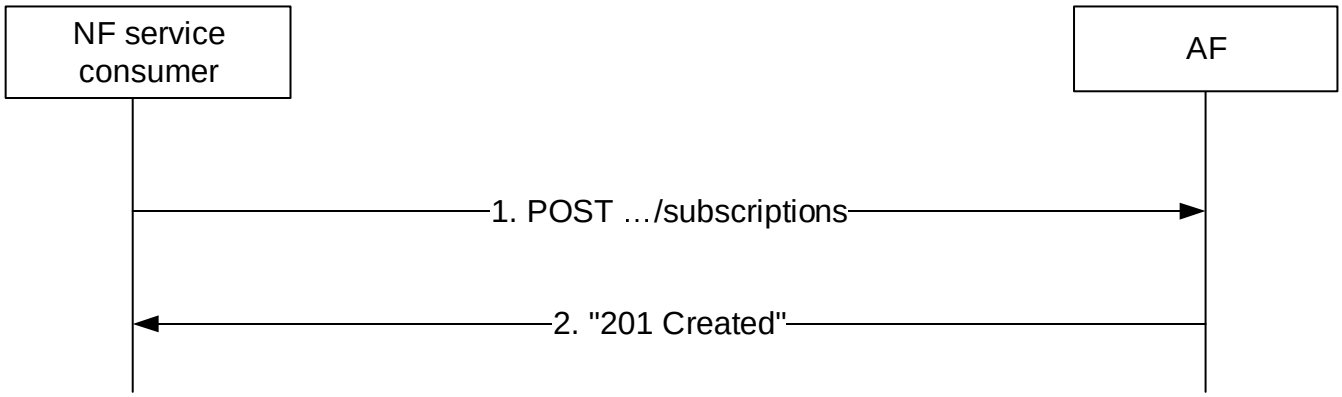

Figure 5.3.2.2.2-1: NF service consumer subscribes to VFL inference notifications

The NF service consumer shall invoke the Naf_VFLInference_Subscribe service operation to subscribe to VFL inference event notification(s). The NF service consumer shall send an HTTP POST request with "{apiRoot}/naf-vflinference/<apiVersion>/subscriptions" as Resource URI representing the "VFL Inference Subscriptions", as shown in figure 5.3.2.2.2-1, step 1, to create a subscription for an "Individual VFL Inference Subscription" according to the information in message body.

The VflInferSub data structure provided in the request body shall include:

- an URI where to receive the requested notifications as the "notifUri" attribute;
- a notification correlation identifier assigned by the NF service consumer for the requested notifications as "notifCorrId" attribute; and
- a description of the subscribed analytics event(s) as the "vflInferAnaSubs" attribute.

and may include:

- the VFL reporting information as the "reportingReqs" attribute; and

Upon the reception of an HTTP POST request with: "{apiRoot}/naf-vflinference/<apiVersion>/subscriptions" as Resource URI and VflInferSub data structure as request body, the AF shall create a new subscription and store the subscription.

If the AF created an "Individual VFL Inference Subscription" resource, the AF shall respond with "201 Created" with the message body containing a representation of the created subscription, as shown in figure 5.3.2.2.2-1, step 2. The AF shall include a Location HTTP header field. The Location header field shall contain the URI of the created subscription i.e. "{apiRoot}/naf-vflinference/<apiVersion>/subscriptions/{subscriptionId}".

If the immediate reporting indication is applicable during the event subscription considering the "reportingReqs" attribute in the VflInferSub and VflInferAnaSub data structures, the AF shall include the intermediate VFL inference results of the subscribed events, if available, as the "vflInferResults" attribute in the HTTP POST response.

If any error occurs when processing the HTTP POST request, the AF shall send an HTTP error response as specified in clause 6.2.7.

5.3.2.2.3 Update subscription for event notifications

Figure 5.3.2.2.3-1 shows a scenario that the NF service consumer sends an HTTP PUT request to the AF to modify an existing VFL inference subscription (as shown in 3GPP TS 23.288 [14]).

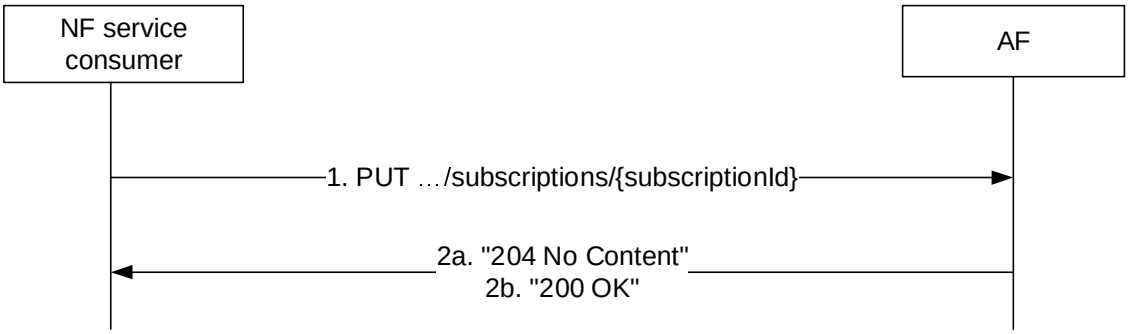

Figure 5.3.2.2.3-1: Modification of VFL inference events subscription information using HTTP PUT

The NF service consumer shall invoke the Naf_VFLInference_Subscribe service operation to modify an existing VFL inference subscription. The NF service consumer shall send an HTTP PUT request with: "{apiRoot}/naf-vflinference/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, where "{subscriptionId}" is the subscriptionId of the existing VFL inference subscription to be modified, to update an "Individual VFL Inference Subscription" according to the information in the message body. The VflInferSub data structure provided in the request body shall include the same contents as described in clause 5.3.2.2.2.

Upon receipt of an HTTP PUT request with: "{apiRoot}/naf-vflinference/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI and VflInferSub data type as request body, if the request is successfully processed and accepted, the AF shall:

- modify the concerned subscription; and
- store the subscription.

If the AF successfully processed and accepted the received HTTP PUT request, the AF shall update an "Individual VFL Inference Subscription" resource, and shall respond with:

- HTTP "204 No Content" response (as shown in figure 5.3.2.2.3-1, step 2a); or
- HTTP "200 OK" response (as shown in figure 5.3.2.2.3-1, step 2b) with a response body containing a representation of the updated subscription in the VflInferSub data type.

If the immediate reporting indication is applicable during the event subscription update considering the "reportingReqs" attribute in the VflInferSub and VflInferAnaSub data structures, the AF shall include the reports of the subscribed events, if available, as the "vflInferResults" attribute in the HTTP PUT response.

If any error occurs when processing the HTTP PUT request, the AF shall send an HTTP error response as specified in clause 6.2.7.

If the AF determines that the received HTTP PUT request needs to be redirected, the AF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.3.2.2.4 Partial update subscription for event notifications

Figure 5.3.2.2.4-1 shows a scenario that the NF service consumer sends an HTTP PATCH request to the AF to partial modify an existing VFL inference subscription (as shown in 3GPP TS 23.288 [14]).

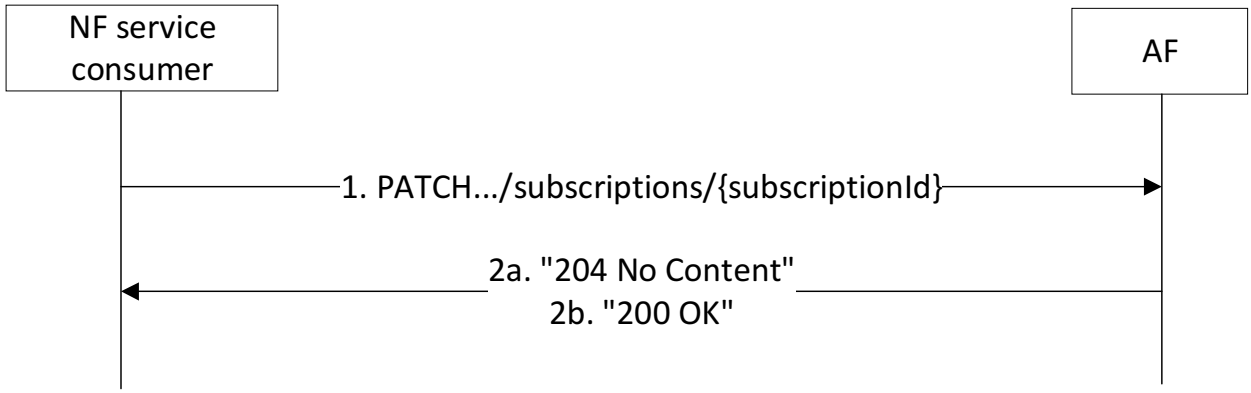

Figure 5.3.2.2.4-1: Partial modification of VFL inference subscription information using HTTP PATCH

The NF service consumer shall invoke the Naf_VFLInference_Subscribe service operation to partial modify an existing VFL inference subscription. The NF service consumer shall send an HTTP PATCH request with: "{apiRoot}/naf-vflinference/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, where "{subscriptionId}" is the subscriptionId of the existing VFL inference subscription to be modified, to update an "Individual VFL Inference Subscription" according to the information in the message body.

Upon receipt of an HTTP PATCH request with: "{apiRoot}/naf-vflinference/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI and VflInferSubPatch data type as request body, if the request is successfully processed and accepted, the AF shall:

- partial modify the concerned subscription; and
- store the subscription.

If the AF successfully processed and accepted the received HTTP PATCH request, the AF shall partially update an "Individual VFL Inference Subscription" resource, and shall respond with:

- HTTP "204 No Content" response (as shown in figure 5.3.2.2.4-1, step 2a); or
- HTTP "200 OK" response (as shown in figure 5.3.2.2.4-1, step 2b) with a response body containing a representation of the updated subscription in the VflInferSub data type.

If the immediate reporting indication is applicable during the event subscription update considering the "reportingReqs" attribute within the in the VflInferSub and VflInferAnaSub data structures on the event subscription or the event subscription update, the AF shall include the reports of the subscribed events, if available, as the "vflInferResults" attribute in the HTTP PATCH response.

If any error occurs when processing the HTTP PATCH request, the AF shall send an HTTP error response as specified in clause 6.2.7.

If the AF determines that the received HTTP PATCH request needs to be redirected, the AF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.3.2.3 Naf_VFLInference_Unsubscribe service operation

5.3.2.3.1 General

The Naf_VFLInference_Unsubscribe service operation is used by an NF service consumer to unsubscribe from VFL inference notifications.

5.3.2.3.2 Unsubscribe from VFL inference notifications

Figure 5.3.2.3.2-1 shows a scenario where the NF service consumer sends a request to the AF to unsubscribe from a VFL inference notification (see also 3GPP TS 23.288 [14]).

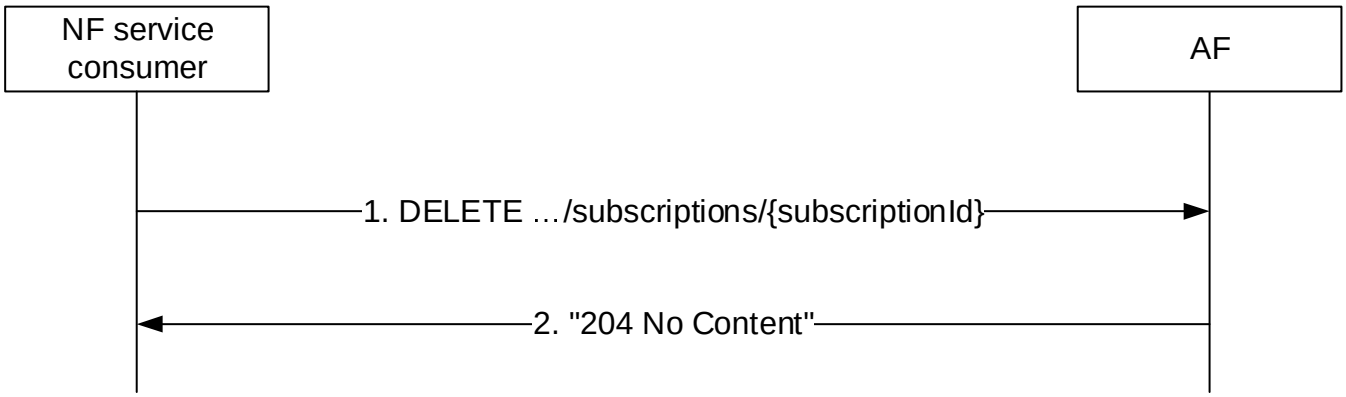

Figure 5.3.2.3.2-1: NF service consumer unsubscribes from VFL inference notifications

The NF service consumer shall invoke the Naf_VFLInference_Unsubscribe service operation to unsubscribe from VFL inference event notifications. The NF service consumer shall send an HTTP DELETE request with: "{apiRoot}/naf-vflinference/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, where "{subscriptionId}" is the subscriptionId of the existing VFL inference subscription that is to be deleted.

Upon the reception of an HTTP DELETE request, if the AF successfully processed and accepted the received HTTP DELETE request, the AF shall:

- remove the corresponding subscription; and
- respond with HTTP "204 No Content" status code.

If the AF determines the received HTTP DELETE request needs to be redirected, the AF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

If errors occur when processing the HTTP DELETE request, the AF shall send an HTTP error response as specified in clause 6.2.7.

5.3.2.4 Naf_VFLInference_Notify service operation

5.3.2.4.1 General

The Naf_VFLInference_Notify service operation is used by an AF to notify NF consumers about subscribed VFL inference events.

5.3.2.4.2 Notification about subscribed event

Figure 5.3.2.4.2-1 shows a scenario where the AF sends a request to the NF Service Consumer to notify for VFL inference event notifications (see also 3GPP TS 23.288 [14]).

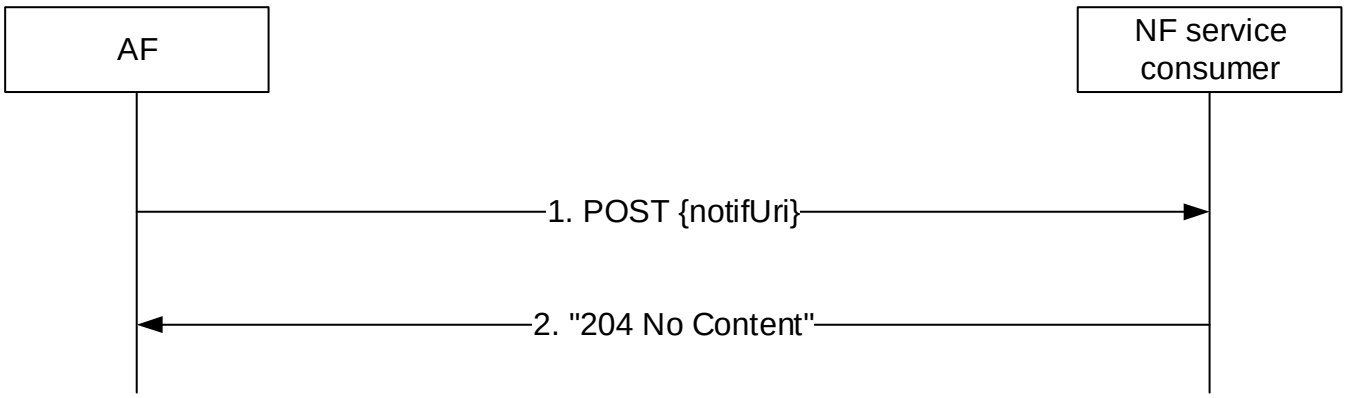

Figure 5.3.2.4.2-1: AF notifies the subscribed VFL inference event

The AF shall invoke the Naf_VFLInference_Notify service operation to notify about a subscribed VFL inference event. The AF shall send an HTTP POST request with "{notifUri}" received in the Naf_VFLInference_Subscribe service operation as Resource URI, as shown in figure 5.3.2.4.2-1, step 1. The VflInferNotif data structure provided in the request body that shall include:

- a notification correlation identifier as "notifCorrId" attribute;
- description of the notified event as "vflInferResults" attribute.

Upon the reception of an HTTP POST request, if the NF service consumer successfully processed and accepted the received HTTP POST request, the NF Service Consumer shall store the notification and respond with HTTP "204 No Content" status code.

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

If errors occur when processing the HTTP POST request, the NF service consumer shall send an HTTP error response as specified in clause 6.2.7.

5.4 Naf_Training Service

5.4.1 Service Description

5.4.1.1 Overview

The Naf_Training service exposed by the AF acting as VFL server and enables an NF service consumer to:

- request the creation/update of a Training subscription; and
- receive Training related event(s) reporting.

5.4.1.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The Network Data Analytics Exposure architecture is defined in 3GPP TS 23.288 [14]. The VFL signalling flows are defined in 3GPP TS 29.552 [15].

The Naf_Training service is part of the Naf service-based interface exhibited by the trusted Application Function (AF) or untrusted Application Function (AF).

Known consumers of the Naf_Training service are:

- Network Data Analytics Function (NWDAF) when the AF is trusted.
- Network Exposure Function (NEF) when the AF is untrusted.

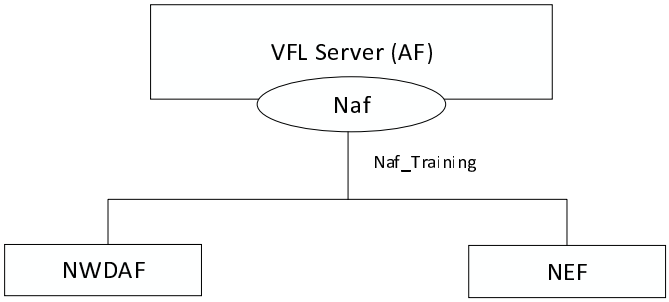

Figure 5.4.1.2-1: Reference Architecture for the Naf_Training service; SBI representation

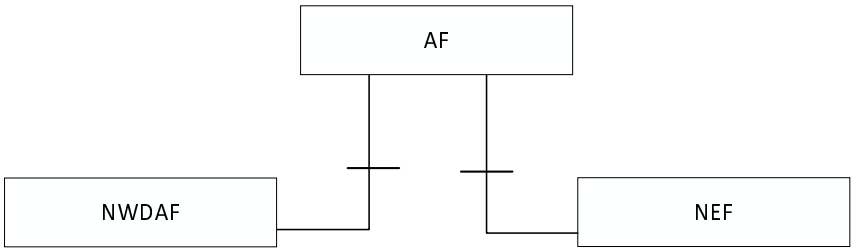

Figure 5.4.1.2-2: Reference Architecture for the Naf_Training service: reference point representation

5.4.1.3 Network Functions

5.4.1.3.1 Application Function (AF)

The Application Function (AF) acting as VFL server provides training for different analytics events to NF service consumers.

The Application Function (AF) acting as VFL server allows NF service consumers to subscribe to and unsubscribe from training event notifications.

5.4.1.3.2 NF Service Consumers

The Network Data Analytics Function (NWDAF) and Network Exposure Function (NEF) support (un)subscription to the notification of different training events.

5.4.2 Service Operations

5.4.2.1 Introduction

The service operations defined for the Naf_Training service are shown in table 5.4.2.1-1.

Table 5.4.2.1-1: Naf_Training Service Operations

Service Operation Name	Description	Initiated by
Naf_Training_Subscribe	This service operation enables the NF service consumer to request the creation/update of a Training Subscription.	e.g., NWDAF, NEF
Naf_Training_Unsubscribe	This service operation enables the NF service consumer to request the deletion of a Training Subscription.	e.g., NWDAF, NEF
Naf_Training_Notify	This service operation enables the NF service consumer to receive Training related event(s) reporting.	AF

5.4.2.2 Naf_Training_Subscribe

5.4.2.2.1 General

This service operation is used by an NF service consumer to request the creation/update of a Training Subscription at the AF.

The following procedures are supported by the "Naf_Training_Subscribe" service operation:

- Training Subscription Creation.
- Training Subscription Update.

5.4.2.2.2 Training Subscription Creation

Figure 5.4.2.2.2-1 depicts a scenario where an NF service consumer sends a request to the AF to request the creation of a Training Subscription (see also clause 6.2H of 3GPP°TS°23.288°[14]).

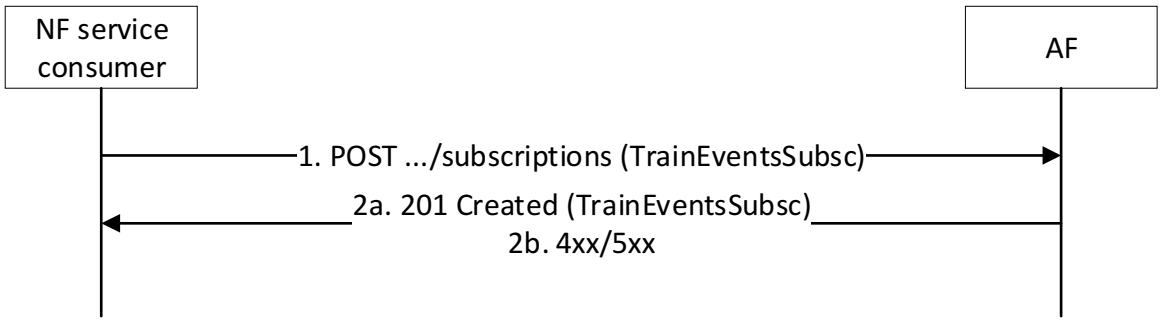

Figure 5.4.2.2.2-1: Procedure for Training Subscription Creation

1. In order to subscribe to Training, the NF service consumer shall send an HTTP POST request to the AF targeting the URI of the "Training Subscriptions" collection resource, with the request body including the TrainEventsSubsc data structure.

2a. Upon success, the AF shall respond with an HTTP "201 Created" status code with the response body containing a representation of the created "Individual Training Subscription" resource within the TrainEventsSubsc data structure, and an HTTP "Location" header field containing the URI of the created resource.

2b. On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the HTTP POST response body, as specified in clause 6.3.7.

5.4.2.2.3 Training Subscription Update

Figure 5.4.2.2.3-1 depicts a scenario where an NF service consumer sends a request to the AF to request the update of an existing Training Subscription (see also clause 6.2H of 3GPP°TS°23.288°[14]).

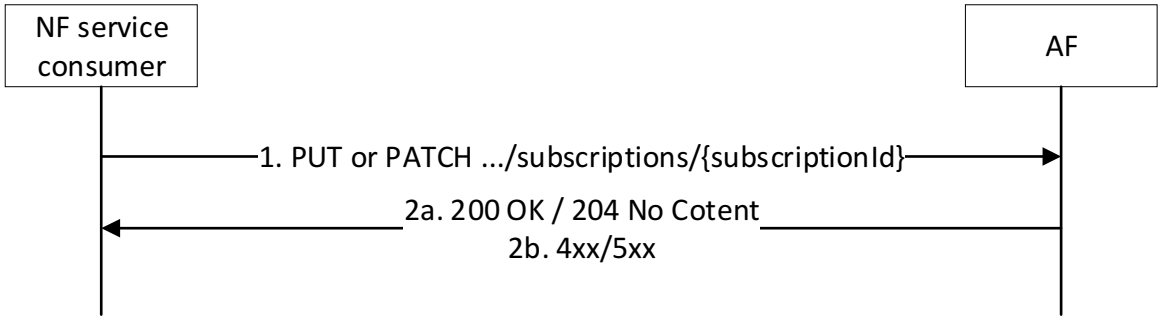

Figure 5.4.2.2.3-1: Procedure for Training Subscription Update

1. In order to request the update of an existing Training Subscription, the NF service consumer shall send an HTTP PUT/PATCH request to the AF, targeting the URI of the corresponding "Individual Training Subscription" resource, with the request body including either:

   - the updated representation of the resource within the TrainEventsSubsc data structure, in case the HTTP PUT method is used; or

   - the requested modifications to the resource within the TrainEventsSubscPatch data structure, in case the HTTP PATCH method is used.

2a. Upon success, the AF shall update the targeted "Individual Training Subscription" resource accordingly and respond with either:

   - an HTTP "200 OK" status code with the response body containing a representation of the updated "Individual Training Subscription" resource within the TrainEventsSubsc data structure; or

   - an HTTP "204 No Content" status code.

2b. On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the HTTP PUT/PATCH response body, as specified in clause 6.3.7.

5.4.2.3 Naf_Training_Unsubscribe

5.4.2.3.1 General

This service operation is used by an NF service consumer to request the deletion of a Training Subscription at the AF.

The following procedures are supported by the "Naf_Training_Unsubscribe" service operation:

- Training Subscription Deletion.

5.4.2.3.2 Training Subscription Deletion

Figure 5.4.2.3.2-1 depicts a scenario where an NF service consumer sends a request to the AF to delete an existing Training Subscription (see also clause 6.2H of 3GPP°TS°23.288°[14]).

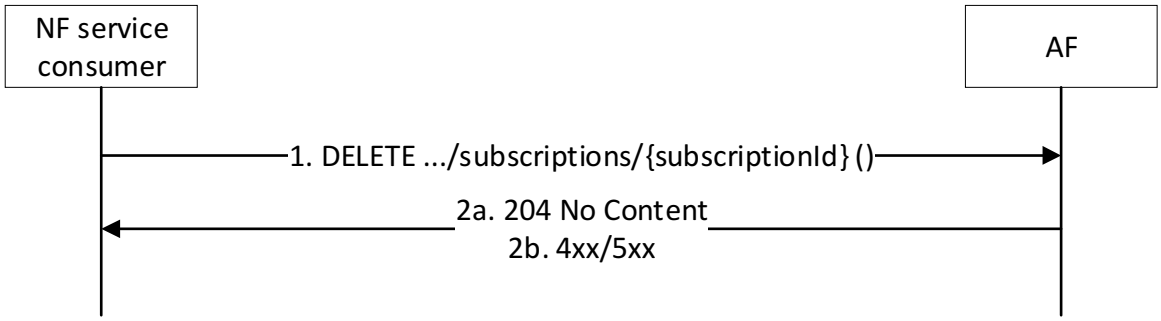

Figure 5.4.2.3.2-1: Procedure for Training Subscription Deletion

1. In order to request the deletion of an existing Training Subscription, the NF service consumer shall send an HTTP DELETE request to the AF targeting the URI of the corresponding "Individual Training Subscription" resource.

2a. Upon success, the AF shall respond with an HTTP "204 No Content" status code.

2b. On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the HTTP DELETE response body, as specified in clause 6.3.7.

5.4.2.4 Naf_Training_Notify

5.4.2.4.1 General

This service operation is used by the AF to notify a previously subscribed service consumer on:

- Training report(s).

The following procedures are supported by the "Naf_Training_Notify" service operation:

- Training Notification.

5.4.2.4.2 Training Notification

Figure 5.4.2.4.2-1 depicts a scenario where the AF sends a request to notify a previously subscribed service consumer on Training report(s) (see also clause 6.2H of 3GPP°TS°23.288°[14]).

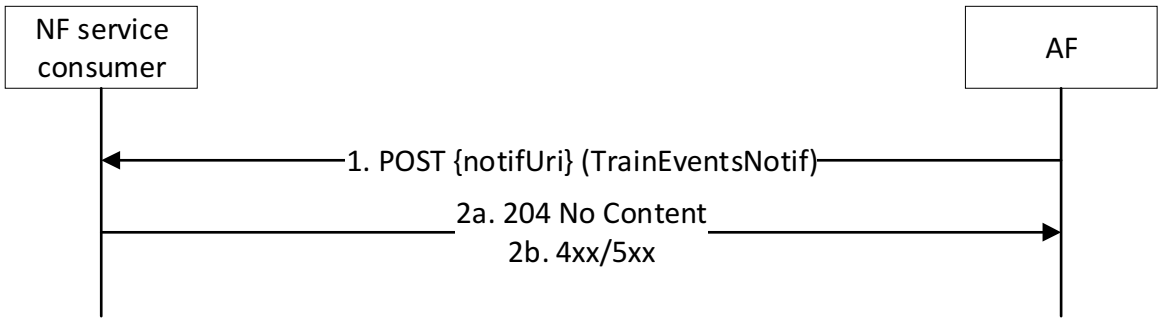

Figure 5.4.2.4.2-1: Procedure for Training Notification

1. In order to notify a previously subscribed service consumer on Training report(s), the AF shall send an HTTP POST request to the NF service consumer with the request URI set to "{notifUri}", where the "notifUri" variable is set to the value received from the NF service consumer during the creation/update of the corresponding Training Subscription using the procedures defined in clauses 5.4.2.2, and the request body including the TrainEventsNotif data structure.

2a. Upon success, the NF service consumer shall respond to the AF with an HTTP "204 No Content" status code to acknowledge the reception of the notification.

2b. On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the HTTP POST response body, as specified in clause 6.3.7.

5.5 Naf_Inference Service

5.5.1 Service Description

5.5.1.1 Overview

The Naf_Inference service as defined in 3GPP TS 23.288 [14], is provided by the Application Function (AF) acting as VFL server.

This service allows the NF service consumers to:

- subscribe to and unsubscribe from different inference events;
- modify inference subscriptions; and
- be notified about events for corresponding inference subscriptions.

5.5.1.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2]. The Network Data Analytics Exposure architecture is defined in 3GPP TS 23.288 [14]. The VFL signalling flows are defined in 3GPP TS 29.552 [15].

The Naf_Inference service is part of the Naf service-based interface exhibited by the trusted Application Function (AF) or untrusted Application Function (AF).

Known consumers of the Naf_Inference service are:

- Network Data Analytics Function (NWDAF) when the AF is trusted.
- Network Exposure Function (NEF) when the AF is untrusted.

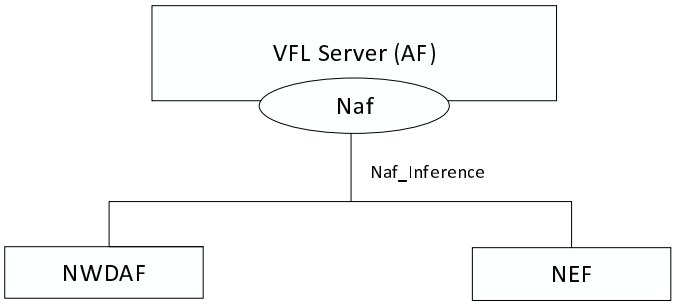

Figure 5.5.1.2-1: Reference Architecture for the Naf_Inference service; SBI representation

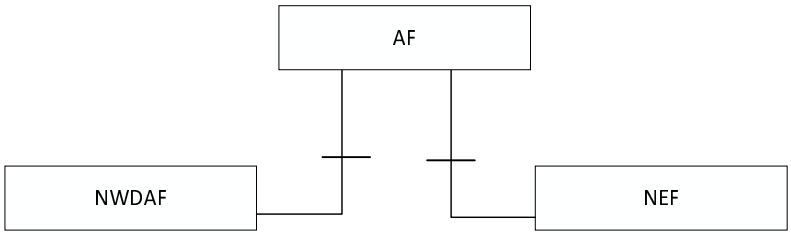

Figure 5.5.1.2-2: Reference Architecture for the Naf_Inference service: reference point representation

5.5.1.3 Network Functions

5.5.1.3.1 Application Function (AF)

The Application Function (AF) acting as VFL server provides inference for different analytics events to NF service consumers.

The Application Function (AF) acting as VFL server allows NF service consumers to subscribe to and unsubscribe from inference events.

5.5.1.3.2 NF Service Consumers

The Network Data Analytics Function (NWDAF) and Network Exposure Function (NEF) support (un)subscription to the notification of different inference events.

5.5.2 Service Operations

5.5.2.1 Introduction

Service operations defined for the Naf_Inference Service are shown in table 5.5.2-1.

Table 5.5.2-1: Naf_Inference Service Operations

Service Operation Name	Description	Initiated by
Naf_Inference_Subscribe	This service operation is used by an NF service consumer to subscribe to, or modify a subscription in the AF for Inference event notifications.	NF Consumer (i.e., NWDAF, NEF)
Naf_Inference_Unsubscribe	This service operation is used by an NF service consumer to unsubscribe from Inference event notifications.	NF Consumer (i.e., NWDAF, NEF)
Naf_Inference_Notify	This service operation is used by the AF to report Inference related event(s) to the NF service consumer which has subscribed to the event report service.	AF

5.5.2.2 Naf_Inference_Subscribe

5.5.2.2.1 General

The Naf_Inference_Subscribe service operation is used by an NF service consumer to request AF VFL servers(s) to subscribe or update subscription for inference event notifications from the AF acting as VFL server.

The following procedures are supported by the "Naf_Inference_Subscribe" service operation:

- Inference Subscription Creation.
- Inference Subscription Update.

5.5.2.2.2 Inference Subscription Creation

Figure 5.5.2.2.2-1 a scenario where an NF service consumer sends a request to the AF to request the creation of an Inference Subscription.

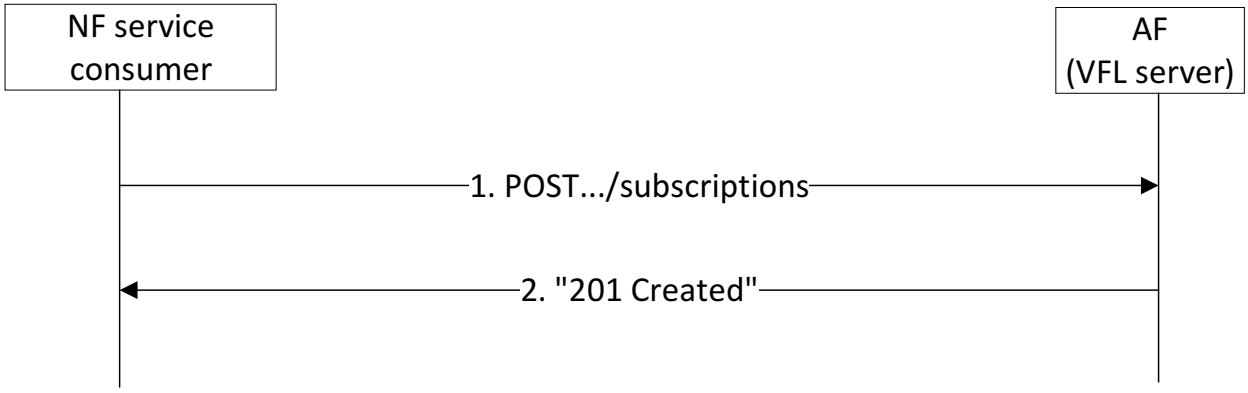

Figure 5.5.2.2.2-1: Procedure for Inference subscription

In order to subscribe to Inference event notifications, the NF service consumer shall send an HTTP POST request to the AF targeting the URI of the "Inference Subscriptions" collection resource, with the request body including the InferEventSubsc data structure as defined in clause 6.4.6.2.2.

Upon the reception of an HTTP POST request with: "{apiRoot}/naf-inference/<apiVersion>/subscriptions" as Resource URI and InferEventSubsc data structure as request body:

- If the VFL server is a trusted AF:
  - If no VFL model is already trained, the VFL server initiates VFL Training by sending Nnwdaf_VFLTraining_Subscribe towards NWDAF(s) acting as VFL Client(s).
  - If VFL model is already trained, the VFL server may decide to initiate the VFL inference procedure towards the selected NWDAF VFL client(s) by sending Nnwdaf_VFLInference_Subscribe.
- If the VFL server is an untrusted AF:
  - If no VFL model is already trained, the VFL server initiates VFL Training by sending for each NWDAF acting as VFL client an Nnef_VFLTraining_Subscribe request towards NEF indicating the identity of the NWDAF acting as VFL Client.
  - If VFL model is already trained, the VFL server may decide to initiate the VFL inference procedure. For each selected NWDAF VFL client the VFL server sends an Nnef_VFLInference_Subscribe request to the NEF indicating the identity of the NWDAF acting as VFL Client.

If no NWDAF VFL Client(s) are selected, the VFL server may generate the VFL inference results based only on its local trained ML model associated with the determined VFL correlation ID.

Upon success, the AF shall respond with an HTTP "201 Created" status code with the response body containing a representation of the created "Individual Inference Subscription" resource within the InferEventsSubsc data structure, and an HTTP "Location" header field containing the URI of the created resource.

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the HTTP POST response body, as specified in clause 6.4.7.

5.5.2.2.3 Inference Subscription Update

Figure 5.5.2.2.3-1 illustrates the modification of an existing subscription.

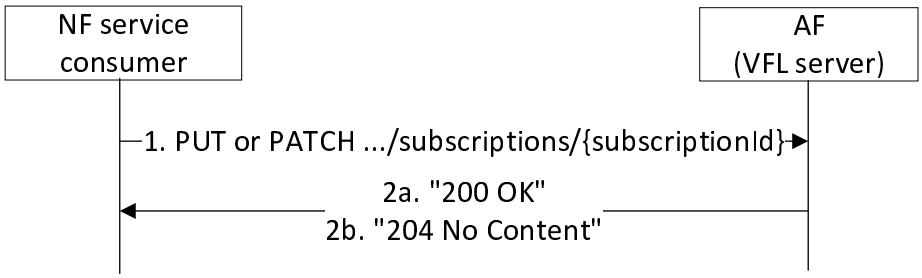

Figure 5.5.2.2.3-1: Modification of an existing subscription

In order to request the update of an existing inference subscription, the NF service consumer shall send an HTTP PUT/PATCH request to the AF, targeting the URI of the corresponding "Individual Inference Subscription" resource, with the request body including either:

- the updated representation of the resource within the InferEventSubsc data structure, in case the HTTP PUT method is used; or
- the requested modifications to the resource within the InferEventSubscPatch data structure, in case the HTTP PATCH method is used.

Upon receipt of the HTTP PUT/PATCH request from the NF service consumer the AF shall:-

- if the VFL server is a trusted AF and there are NWDAF VFL subscriptions associated to the AF inference subscription, the VFL updates those NWDAF VFL inference subscriptions by sending an Nnwdaf_VFLInference_Subscribe request towards each applicable NWDAF VFL client(s);

- if the VFL server is an untrusted AF and there are NWDAF VFL subscriptions associated to the AF inference subscription, the VFL updates those NWDAF VFL inference subscriptions by sending for each applicable NWDAF client an Nnef_VFLInference_Subscribe request to the NEF indicating the identity of the NWDAF VFL Client;

Upon success, the AF shall update the targeted "Individual Inference Subscription" resource accordingly and respond with either:

- an HTTP "200 OK" status code with the response body containing a representation of the updated "Individual Inference Subscription" resource within the InferEventsSubsc data structure; or

- an HTTP "204 No Content" status code.

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the HTTP PUT/PATCH response body, as specified in clause 6.4.7.

5.5.2.3 Naf_Inference_Unsubscribe

5.5.2.3.1 General

The Naf_Inference_Unsubscribe service operation is used by an NF service consumer to subscribe from inference notifications.

The following procedures are supported by the "Naf_Inference_Unsubscribe" service operation:

- Inference Subscription Deletion.

5.5.2.3.2 Inference Subscription Deletion

Figure 5.5.2.3.2-1 shows a scenario where the NF service consumer sends a request to the AF to unsubscribe from an inference notification (see also 3GPP TS 23.288 [14]).

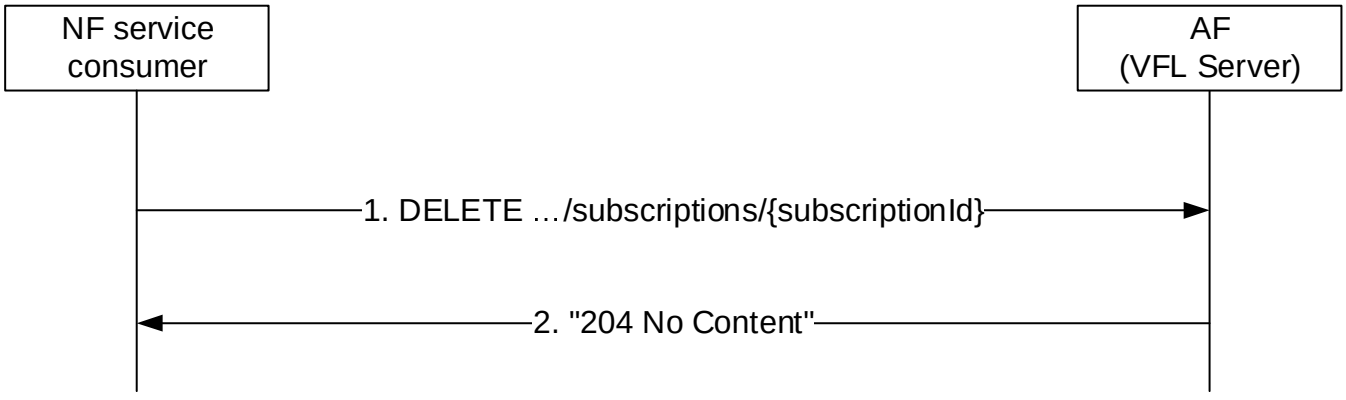

Figure 5.5.2.3.2-1: NF service consumer unsubscribes from inference notifications

In order to request the deletion of an existing Inference Subscription, the NF service consumer shall send an HTTP DELETE request to the AF targeting the URI of the corresponding "Individual Inference Subscription" resource.

Upon success, the AF shall respond with an HTTP "204 No Content" status code.

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the HTTP DELETE response body, as specified in clause 6.4.7.

5.5.2.4 Naf_Inference_Notify

5.5.2.4.1 General

The Naf_Inference_Notify service operation is used by an AF to notify NF consumers about subscribed inference events.

The following procedures are supported by the "Naf_Inference_Notify" service operation:

- Inference Notification.

5.5.2.4.2 Inference Notification

Figure 5.5.2.4.2-1 shows a scenario where the AF sends a request to the NF Service Consumer to notify for inference event notifications (see also 3GPP TS 23.288 [14]).

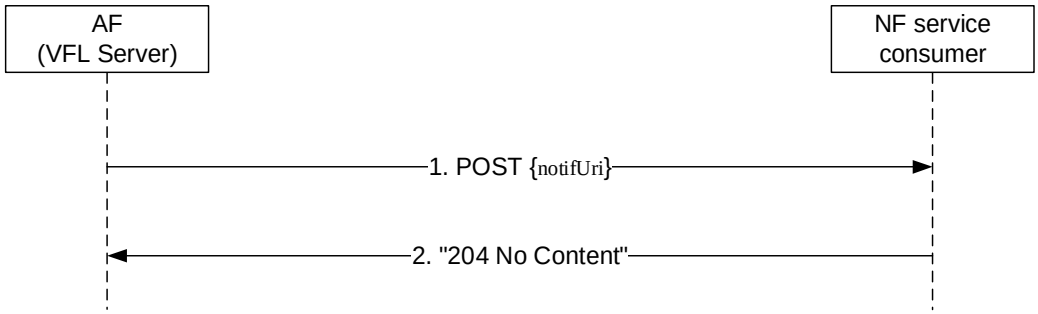

Figure 5.5.2.4.2-1: AF notifies the subscribed inference event

In order to notify a previously subscribed service consumer on Inference event(s), the AF shall send an HTTP POST request to the NF service consumer with the request URI set to "{notifUri}", where the "notifUri" variable is set to the value received from the NF service consumer during the creation/update of the corresponding Individual Inference Subscription resource using the procedures defined in clauses 5.5.2.2.2 and 5.5.2.2.3, and the request body including the InferNotif data structure.

Upon success, the NF service consumer shall respond to the AF with an HTTP "204 No Content" status code to acknowledge the reception of the notification.

On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the HTTP POST response body, as specified in clause 6.4.7.

6 API Definitions

6.1 Naf_VFLTraining Service API

6.1.1 Introduction

The Naf_VFLTraining shall use the Naf_VFLTraining API.

The API URI of the Naf_VFLTraining API shall be:

{apiRoot}/<apiName>/<apiVersion>

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

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

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "naf-vfl-train".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clauses 6.1.3 and 6.1.4.

6.1.2 Usage of HTTP

6.1.2.1 General

HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

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

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

6.1.2.2 HTTP standard headers

6.1.2.2.1 General

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

6.1.2.2.2 Content type

If the AF is untrusted, support of HTTP/1.1 (IETF RFC 9112 [19], IETF RFC 9110 [20] and IETF RFC 9111[21] over TLS is mandatory and support of HTTP/2 (IETF RFC 9113 [11]) over TLS is recommended. TLS shall be used as specified in clause 12.3 and clause 13.1 of 3GPP TS 33.501 [8].

If the AF is trusted, HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5.2 of 3GPP TS 29.500 [4].

HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

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

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

6.1.2.3 HTTP custom headers

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

6.1.3 Resources

6.1.3.1 Overview

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

Figure 6.1.3.1-1 depicts the resource URIs structure for the Naf_VFLTraining API.

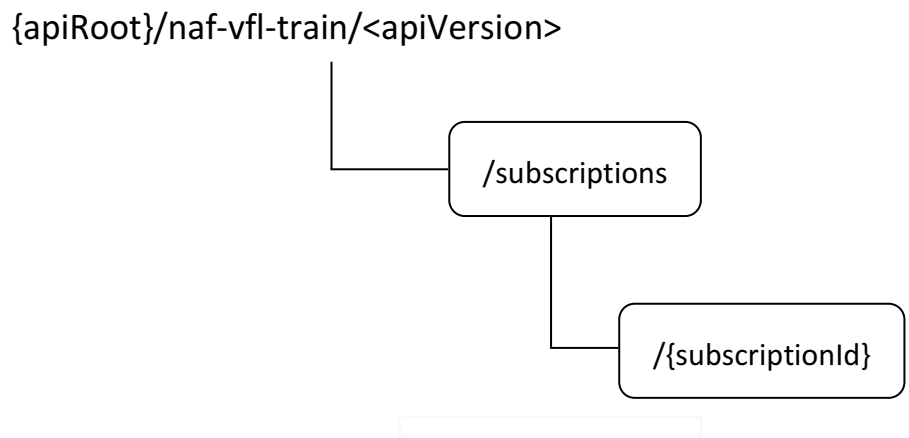

Figure 6.1.3.1-1: Resource URI structure of the Naf_VFLTraining API

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

Table 6.1.3.1-1: Resources and methods overview

Resource purpose/name	Resource URI (relative path after API URI)	HTTP method or custom operation	Description (service operation)
VFL Training Subscriptions	/subscriptions	POST	Create a new VFL Training Subscription.
Individual VFL Training Subscription	/subscriptions/{subscriptionId}	GET	Retrieve an existing "Individual VFL Training Subscription" resource.
		PUT	Request the update of an existing "Individual VFL Training Subscription" resource.
		PATCH	Request the modification of an existing "Individual VFL Training Subscription" resource.
		DELETE	Request the deletion of an existing "Individual VFL Training Subscription" resource.

6.1.3.2 Resource: VFL Training Subscriptions

6.1.3.2.1 Description

This resource represents the collection of VFL Training Subscription(s) managed by the AF.

6.1.3.2.2 Resource Definition

Resource URI: **{apiRoot}/naf-vfl-train/<apiVersion>/subscriptions**

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

Table 6.1.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.1.1.

6.1.3.2.3 Resource Standard Methods

6.1.3.2.3.1 POST

The HTTP POST method allows a service consumer to request the creation of a VFL Training Subscription at the AF.

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

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

Name	Data type	P	Cardinality	Description	Applicability
n/a					

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

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

Data type	P	Cardinality	Description
VflTrainingSubs	M	1	Represents the parameters to request the creation of a VFL Training Subscription.

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

Data type	P	Cardinality	Response codes	Description
VflTrainingSubs	M	1	201 Created	Successful case. The VFL Training Subscription is successfully created and a representation of the created "Individual VFL Training Subscription" resource shall be returned. An HTTP "Location" header that contains the URI of the created resource shall also be included.
ProblemDetails	O	0..1	403 Forbidden	(NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the HTTP POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: Failure cases are described in clause 6.1.7.				

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

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

6.1.3.2.4 Resource Custom Operations

There are no resource custom operations defined for this resource in this release of the specification.

6.1.3.3 Resource: Individual VFL Training Subscription

6.1.3.3.1 Description

This resource represents a VFL Training Subscription managed by the AF.

6.1.3.3.2 Resource Definition

Resource URI: **{apiRoot}/naf-vfl-train/<apiVersion>/subscriptions/{subscriptionId}**

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

Table 6.1.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.1.1.
subscriptionId	string	Represents the unique identifier of the "Individual VFL Training Subscription" resource.

6.1.3.3.3 Resource Standard Methods

6.1.3.3.3.1 GET

The GET method allows an NF service consumer to retrieve an existing "Individual VFL Training Subscription" resource managed by the AF.

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

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

Name	Data type	P	Cardinality	Description	Applicability
n/a					

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

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

Data type	P	Cardinality	Description
n/a			

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

Data type	P	Cardinality	Response codes	Description
VflTrainingSubs	M	1	200 OK	Successful case. The requested "Individual VFL Training Subscription" resource is returned.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the HTTP GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

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

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

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

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

6.1.3.3.3.2 PUT

The PUT method allows an NF service consumer to request the update of an existing "Individual VFL Training Subscription" resource managed by the AF.

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

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

Name	Data type	P	Cardinality	Description	Applicability
n/a					

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

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

Data type	P	Cardinality	Description
VflTrainingSubs	M	1	Contains the updated representation of the "Individual VFL Training Subscription" resource.

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

Data type	P	Cardinality	Response codes	Description
VflTrainingSubs	M	1	200 OK	Successful case. The "Individual VFL Training Subscription" resource is successfully updated and a representation of the updated resource is returned in the response body.
n/a			204 No Content	Successful case. The "Individual VFL Training Subscription" resource is successfully updated and no content is returned in the response body.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
NOTE 1: The mandatory HTTP error status codes for the HTTP PUT method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 6.1.7.				

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

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

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

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

6.1.3.3.3 PATCH

The PATCH method allows an NF service consumer to request the modification of an existing "Individual VFL Training Subscription" resource managed by the AF.

This method shall support the URI query parameters specified in table 6.1.3.3.3-1.

Table 6.1.3.3.3-1: URI query parameters supported by the PATCH method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.1.3.3.3.3-2 and the response data structures and response codes specified in table 6.1.3.3.3.3-3.

Table 6.1.3.3.3.3-2: Data structures supported by the PATCH Request Body on this resource

Data type	P	Cardinality	Description
VflTrainingSubsPatch	M	1	Contains the parameters to request the modification of the "Individual VFL Training Subscription" resource.

Table 6.1.3.3.3.3-3: Data structures supported by the PATCH Response Body on this resource

Data type	P	Cardinality	Response codes	Description
VflTrainingSubs	M	1	200 OK	Successful case. The "Individual VFL Training Subscription" resource is successfully modified and a representation of the updated resource is returned in the response body.
n/a			204 No Content	Successful case. The "Individual VFL Training Subscription" resource is successfully modified and no content is returned in the response body.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
NOTE 1: The mandatory HTTP error status codes for the HTTP PATCH method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 6.1.7.				

Table 6.1.3.3.3.3-4: Headers supported by the 307 Response Code on this resource

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

Table 6.1.3.3.3.3-5: Headers supported by the 308 Response Code on this resource

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

6.1.3.3.3.4 DELETE

The DELETE method allows an NF service consumer to request the deletion of an existing "Individual VFL Training Subscription" resource managed by the AF.

This method shall support the URI query parameters specified in table 6.1.3.3.3.4-1.

Table 6.1.3.3.3.4-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.1.3.3.3.4-2 and the response data structures and response codes specified in table 6.1.3.3.3.4-3.

Table 6.1.3.3.3.4-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.1.3.3.3.4-3: 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 VFL Training Subscription" resource is successfully deleted.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the HTTP DELETE method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.1.3.3.3.4-4: Headers supported by the 307 Response Code on this resource

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

Table 6.1.3.3.3.4-5: Headers supported by the 308 Response Code on this resource

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

6.1.4 Custom Operations without associated resources

There are no custom operations without associated resources defined for this API in this release of the specification.

6.1.5 Notifications

6.1.5.1 General

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

Table 6.1.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
VFL Training Notification	{notifUri}	POST	Enables the AF to notify a previously subscribed NF service consumer on VFL Training report(s).

6.1.5.2 VFL Training Notification

6.1.5.2.1 Description

The VFL Training Notification is used by the AF to notify a previously subscribed NF service consumer on VFL Training report(s).

6.1.5.2.2 Target URI

The Callback URI **"{notifUri}"** shall be used with the callback URI variables defined in table 6.1.5.2.2-1.

Table 6.1.5.2.2-1: Callback URI variables

Name	Definition
notifUri	Represents the callback URI encoded as a string formatted as a URI.

6.1.5.2.3 Standard Methods

6.1.5.2.3.1 POST

This method shall support the request data structures specified in table 6.1.5.2.3.1-1 and the response data structures and response codes specified in table 6.1.5.2.3.1-2.

Table 6.1.5.2.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
VflTrainingNotify	M	1	Represents the VFL Training Notification.

Table 6.1.5.2.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. The VFL Training Notification is successfully received.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.1.5.2.3.1-3: Headers supported by the 307 Response Code on this resource

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

Table 6.1.5.2.3.1-4: Headers supported by the 308 Response Code on this resource

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

6.1.6 Data Model

6.1.6.1 General

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

Table 6.1.6.1-1 specifies the data types defined for the Naf_VFLTraining service-based interface protocol.

Table 6.1.6.1-1: Naf_VFLTraining API specific Data Types

Data type	Clause defined	Description	Applicability
VflTrainingSubs	6.1.6.2.2	Represents a VFL Training Subscription.	
VflTrainingSubsPatch	6.1.6.2.3	Represents the requested modifications to a VFL Training Subscription.	

Table 6.1.6.1-2 specifies data types re-used by the Naf_VFLTraining 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 Naf_VFLTraining service-based interface.

Table 6.1.6.1-2: Naf_VFLTraining API re-used Data Types

Data type	Reference	Comments	Applicability
ReportingInformation	3GPP TS 29.523 [17]	Represents the event reporting requirements.	
SupportedFeatures	3GPP TS 29.571 [16]	Represents the list of supported feature(s) and used to negotiate the applicability of the optional features.	
Uri	3GPP TS 29.571 [16]	Represents a URI.	
VflTrainingNotify	3GPP TS 29.520 [18]	Represents a VFL Training Notification.	
VflTrainingSub	3GPP TS 29.520 [18]	Represents a VFL Training set.	

6.1.6.2 Structured data types

6.1.6.2.1 Introduction

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

6.1.6.2.2 Type: VflTrainingSubs

Table 6.1.6.2.2-1: Definition of type VflTrainingSubs

Attribute name	Data type	P	Cardinality	Description	Applicability
vflTrainSubs	array(VflTrainingSub)	M	1..N	Contains the subscribed VFL training set(s).	
notifUri	Uri	C	0..1	Represents the URI via which VFL Training related notifications shall be delivered. It shall be present if the "vflPreFlag" attribute is not included or set to "false".	
notifCorrId	string	C	0..1	Represents the notification Correlation Identifier. It shall be present if the "vflPreFlag" attribute is not included or set to "false".	
vflPreFlag	boolean	C	0..1	Indicates the subscription is for preparation of VFL, when it is included and set to "true". The default value is "false" if omitted. It shall be present when the service is for preparation of VFL. (NOTE)	
reportingReqs	ReportingInformation	O	0..1	Contains the reporting requirements applicable for VFL Training related reporting.	
trainReports	array(VflTrainingNotify)	O	1..N	Contains the VFL Training related event(s) report(s). This attribute may be present only if immediate reporting was requested via the "reportingReqs" attribute.	
suppFeat	SupportedFeatures	C	0..1	Contains the list of supported features among the ones defined in clause 6.1.8. This attribute shall be present only when feature negotiation is required.	
NOTE: When the service is for VFL preparation (the "vflPreFlag" attribute sets to "true"), the NF service producer shall send no notification until it is updated with the value of the "vflPreFlag" attribute as "false", and the "trainReports" attribute shall be absent in the HTTP POST response.					

6.1.6.2.3 Type: VflTrainingSubsPatch

Table 6.1.6.2.3-1: Definition of type VflTrainingSubsPatch

Attribute name	Data type	P	Cardinality	Description	Applicability
vflTrainSubs	array(VflTrainingSub)	O	1..N	Contains the updated subscribed VFL training set(s).	
notifUri	Uri	O	0..1	Contains the updated URI via which VFL Training related notifications shall be delivered.	
notifCorrId	string	O	0..1	Notification Correlation Identifier.	
reportingReqs	ReportingInformation	O	0..1	Contains the reporting requirements applicable for VFL Training related reporting.	

6.1.6.3 Simple data types and enumerations

6.1.6.3.1 Introduction

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

6.1.6.3.2 Simple data types

The simple data types defined in table 6.1.6.3.2-1 shall be supported.

Table 6.1.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.1.6.4 Data types describing alternative data types or combinations of data types

There are no data types describing alternative data types or combinations of data types defined for this API in this release of the specification.

6.1.6.5 Binary data

6.1.6.5.1 Binary Data Types

Table 6.1.6.5.1-1: Binary Data Types

Name	Clause defined	Content type

6.1.7 Error Handling

6.1.7.1 General

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

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

6.1.7.2 Protocol Errors

No specific procedures for the Naf_VFLTraining service are specified.

6.1.7.3 Application Errors

The application errors defined for the Naf_VFLTraining service are listed in Table 6.1.7.3-1.

Table 6.1.7.3-1: Application errors

Application Error	HTTP status code	Description	Applicability
OVERLOAD	403 Forbidden	Indicates the AF is overloaded.	
NOT_AVAILABLE_FOR_VFL_PROCESS	403 Forbidden	Indicates the AF is not available for the VFL process anymore.	
VFL_REQS_NOT_MET	403 Forbidden	Indicates the VFL training requirements are not met.	
NOTE: Including a "ProblemDetails" data structure with the "cause" attribute in the HTTP response is optional unless explicitly mandated in the service operation clauses.			

6.1.8 Feature negotiation

The optional features in table 6.1.8-1 are defined for the Naf_VFLTraining API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.1.8-1: Supported Features

Feature number	Feature Name	Description

6.1.9 Security

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

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

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 Naf_VFLTraining service.

The Naf_VFLTraining API defines a single scope "naf-vfl-train" for the entire service, and it does not define any additional scopes at resource or operation level.

6.1.10 HTTP redirection

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

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

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

6.2 Naf_VFLInference Service API

6.2.1 Introduction

The Naf_VFLInference service shall use the Naf_VFLInference API.

The API URI of the Naf_VFLInference API shall be:

{apiRoot}/<apiName>/<apiVersion>

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

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

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The<apiName> shall be "naf-vflinference".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 5.5.3.

6.2.2 Usage of HTTP

6.2.2.1 General

If the AF is untrusted, support of HTTP/1.1 (IETF RFC 9112 [19], IETF RFC 9110 [20] and IETF RFC 9111[21] over TLS is mandatory and support of HTTP/2 (IETF RFC 9113 [11]) over TLS is recommended. TLS shall be used as specified in clause 12.3 and clause 13.1 of 3GPP TS 33.501 [8].

If the AF is trusted, HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5.2 of 3GPP TS 29.500 [4].

HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

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

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

6.2.2.2 HTTP standard headers

6.2.2.2.1 General

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

6.2.2.2.2 Content type

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

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

6.2.2.3 HTTP custom headers

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

In this release of the specification, no specific custom headers are defined for the Naf_VFLInference service API.

6.2.3 Resources

6.2.3.1 Resource Structure

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

Figure 6.2.3.1-1 depicts the resource URIs structure for the Naf_VFLInference API.

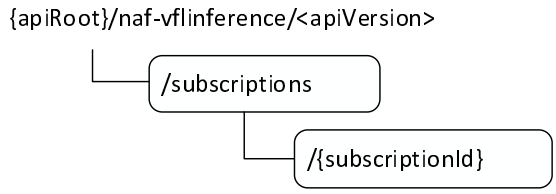

Figure 6.2.3.1-1: Resource URI structure of the Naf_VFLInference API

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

Table 6.2.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
VFL Inference Subscriptions	/subscriptions	POST	Creates a new Individual VFL Inference Subscription resource.
Individual VFL Inference Subscription	/subscriptions/{subscriptionId}	GET	Retrieve an existing Individual VFL Inference Subscription identified by subresource {subscriptionId}.
		PUT	Updates an existing Individual VFL Inference Subscription identified by subresource {subscriptionId}.
		PATCH	Modifies an existing Individual VFL Inference Subscription identified by subresource {subscriptionId}.
		DELETE	Deletes an Individual VFL Inference Subscription identified by subresource {subscriptionId}.

6.2.3.2 Resource: VFL Inference Subscriptions

6.2.3.2.1 Description

The VFL Inference Subscriptions resource represents all VFL Inference subscriptions to the Naf_VFLInference service at a given AF. The resource allows an NF service consumer to create a new Individual VFL Inference Subscription resource.

6.2.3.2.2 Resource definition

Resource URI: **{apiRoot}/naf-vflinference/<apiVersion>/subscriptions**

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

Table 6.2.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.2.1

6.2.3.2.3 Resource Standard Methods

6.2.3.2.3.1 POST

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

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

Name	Data type	P	Cardinality	Description
n/a				

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

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

Data type	P	Cardinality	Description
VflInferSub	M	1	Creates a new Individual VFL Inference Subscription resource.

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

Data type	P	Cardinality	Response codes	Description
VflInferSub	M	1	201 Created	The creation of an Individual VFL Inference Subscription resource is confirmed and a representation of that resource is returned.
ProblemDetails	O	0..1	403 Forbidden	(NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: Failure cases are described in clause 6.2.7.				

Table 6.2.3.2.3.1-4: 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}/naf-vflinference/<apiVersion>/subscriptions/{subscriptionId}

6.2.3.2.4 Resource Custom Operations

None in this release of the specification.

6.2.3.3 Resource: Individual VFL Inference Subscription

6.2.3.3.1 Description

The Individual VFL Inference Subscription resource represents a single VFL inference subscription to the Naf_VFLInference service at a given AF.

6.2.3.3.2 Resource definition

Resource URI: **{apiRoot}/naf-vflinference/<apiVersion>/subscriptions/{subscriptionId}**

The <apiVersion> shall be set as described in clause 6.2.1.

This resource shall support the resource URI variables defined in table 6.2.3.3.2-1.

Table 6.2.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.2.1.
subscriptionId	string	Identifies a VFL inference subscription to the Naf_VFLInference service.

6.2.3.3.3 Resource Standard Methods

6.2.3.3.3.1 GET

The GET method allows an NF service consumer to retrieve an existing "Individual VFL Inference Subscription" resource managed by the AF.

This method shall support the URI query parameters specified in table 6.2.3.3.3.1-1.

Table 6.2.3.3.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.2.3.3.3.1-2 and the response data structures and response codes specified in table 6.2.3.3.3.1-3.

Table 6.2.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.2.3.3.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
VflInferSub	M	1	200 OK	Successful case. The requested "Individual VFL Inference Subscription" resource is returned.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the HTTP GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.2.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

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

Table 6.2.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

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

6.2.3.3.3.2 PUT

This method shall support the URI query parameters specified in table 6.2.3.3.3.2-1.

Table 6.2.3.3.3.2-1: 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 6.2.3.3.3.2-2 and the response data structures and response codes specified in table 6.2.3.3.3.2-3.

Table 6.2.3.3.3.2-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
VflInferSub	M	1	Parameters to replace a subscription to VFL Subscription resource.

Table 6.2.3.3.3.2-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
VflInferSub	M	1	200 OK	The Individual VFL Subscription resource was modified successfully, and a representation of that resource is returned.
n/a			204 No Content	The Individual VFL Subscription resource was modified successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
NOTE 1: The mandatory HTTP error status codes for the PUT method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 6.2.7.				

Table 6.2.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

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

Table 6.2.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

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

6.2.3.3.3 PATCH

This method shall support the URI query parameters specified in table 6.2.3.3.3-1.

Table 6.2.3.3.3-1: URI query parameters supported by the PATCH method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.2.3.3.3-2 and the response data structures and response codes specified in table 6.2.3.3.3-3.

Table 6.2.3.3.3-2: Data structures supported by the PATCH Request Body on this resource

Data type	P	Cardinality	Description
VflInferSubPatch	M	1	Partial update of parameters to a subscription to VFL Inference Subscription resource.

Table 6.2.3.3.3.3-3: Data structures supported by the PATCH Response Body on this resource

Data type	P	Cardinality	Response codes	Description
VflInferSub	M	1	200 OK	The Individual VFL Inference Subscription resource was partial modified successfully and a representation of that resource is returned.
n/a			204 No Content	The Individual VFL Inference Subscription resource was partial modified successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
NOTE 1: The mandatory HTTP error status codes for the PATCH method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 6.2.7.				

Table 6.2.3.3.3.3-4: Headers supported by the 307 Response Code on this resource

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

Table 6.2.3.3.3.3-5: Headers supported by the 308 Response Code on this resource

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

6.2.3.3.4 DELETE

This method shall support the URI query parameters specified in table 6.2.3.3.4-1.

Table 6.2.3.3.4-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.2.3.3.4-2 and the response data structures and response codes specified in table 6.2.3.3.4-3.

Table 6.2.3.3.3.4-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description

Table 6.2.3.3.3.4-3: 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 VFL Subscription resource matching the subscriptionId was deleted.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the DELETE method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.2.3.3.3.4-4: Headers supported by the 307 Response Code on this resource

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

Table 6.2.3.3.3.4-5: Headers supported by the 308 Response Code on this resource

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

6.2.3.3.4 Resource Custom Operations

None in this release of the specification.

6.2.4 Custom Operations without associated resources

None in this release of the specification.

6.2.5 Notifications

6.2.5.1 General

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

Table 6.2.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Event Notification	{notifUri}	POST	Report one or several observed Events.

6.2.5.2 VFL Inference Event Notification

6.2.5.2.1 Description

The VFL Inference Event Notification is used by the AF to report one or several observed VFL Inference Events to a NF service consumer that has subscribed to such Notifications via the Individual VFL Inference Subscription Resource.

6.2.5.2.2 Operation Definition

Callback URI: **{notifUri}**

The operation shall support the callback URI variables defined in table 6.2.5.2.2-1, the request data structures specified in table 6.2.5.2.2-2 and the response data structure and response codes specified in table 6.2.5.2.2-3.

Table 6.2.5.2.2-1: Callback URI variables

Name	Data type	Definition
notifUri	Uri	The Notification Uri as assigned within the Individual VFL Inference Subscription.

Table 6.2.5.2.2-2: Data structures supported by the POST Request Body on this resource

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

Table 6.2.5.2.2-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The receipt of the Notification is acknowledged.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.2.5.2.2-4: Headers supported by the 307 Response Code on this resource

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

Table 6.2.5.2.2-5: Headers supported by the 308 Response Code on this resource

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

6.2.6 Data Model

6.2.6.1 General

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

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

Table 6.2.6.1-1: Naf_VFLInference specific Data Types

Data type	Section defined	Description	Applicability
VflInferSub	6.2.6.2.2	Represents a VFL inference subscription.	
VflInferSubPatch	6.2.6.2.3	Represents parameters to request the modification of a VFL inference subscription.	

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

Table 6.2.6.1-2: Naf_VFLInference re-used Data Types

Data type	Reference	Comments	Applicability
ReportingInformation	3GPP TS 29.523 [17]	Represents the type of reporting a subscription requires.	
RedirectResponse	3GPP TS 29.571 [16]	Contains redirection related information.	
SupportedFeatures	3GPP TS 29.571 [16]	Represents the list of supported features.	
Uri	3GPP TS 29.571 [16]	Represents a URI.	
VflInferAnaSub	3GPP TS 29.520 [18]	Represents the VFL inference subscription information for the subscribed analytics ID.	
VflInferNotif	3GPP TS 29.520 [18]	Represents notification of a VFL inference subscription.	
VflInferResult	3GPP TS 29.520 [18]	Represents intermediate VFL inference result per target.	

6.2.6.2 Structured data types

6.2.6.2.1 Introduction

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

6.2.6.2.2 Type VflInferSub

Table 6.2.6.2.2-1: Definition of type VflInferSub

Attribute name	Data type	P	Cardinality	Description	Applicability
notifCorrId	string	M	1	The value of Notification Correlation ID in the corresponding notification.	
notifUri	Uri	M	1	URI at which the NF service consumer requests to receive notifications.	
reportingReqs	ReportingInformation	O	0..1	Reporting requirement information of the VFL inference subscription.	
suppFeats	SupportedFeatures	C	0..1	List of Supported features used as described in clause 6.2.8. It shall be supplied by NF service consumer in the POST requests that request the creation of a VFL Subscriptions resource and shall be supplied by the AF in the reply of corresponding request.	
vflInferAnaSubs	array(VflInferAnaSub)	M	1..N	Contains the VFL inference subscription information for the subscribed analytics ID(s). (NOTE)	
vflInferResults	array(VflInferResult)	O	1..N	Represents intermediate VFL inference results. This attribute may be present only if immediate reporting was requested via the "reportingReqs" attribute.	
NOTE: The "intGroupIds" and "supis" attributes of the data type are not applicable for the AF services if the AF is an untrusted AF. The "exterGroupIds" and "gpsis" attributes of the data type are not applicable for the AF services if the AF is a trusted AF.					

6.2.6.2.3 Type VflInferSubPatch

Table 6.2.6.2.3-1: Definition of type VflInferSubPatch

Attribute name	Data type	P	Cardinality	Description	Applicability
notifUri	Uri	O	0..1	URI at which the NF service consumer requests to receive notifications.	
notifCorrId	string	O	0..1	The value of Notification Correlation ID in the corresponding notification.	
reportingReqs	ReportingInformation	O	0..1	Reporting requirements of the VFL inference subscription.	
vflInferAnaSubs	array(VflInferAnaSub)	O	1..N	Contains the VFL inference subscription information for the subscribed analytics ID(s). (NOTE)	
NOTE: The "intGroupIds" and "supis" attributes of the data type are not applicable for the AF services if the AF is an untrusted AF. The "exterGroupIds" and "gpsis" attributes of the data type are not applicable for the AF services if the AF is a trusted AF.					

6.2.6.3 Simple data types and enumerations

6.2.6.3.1 Introduction

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

6.2.6.3.2 Simple data types

The simple data types defined in table 5.1.6.3.2-1 shall be supported.

Table 6.2.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.2.7 Error handling

6.2.7.1 General

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

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

6.2.7.2 Protocol Errors

No specific procedures for the Naf_VFLInference service are specified.

6.2.7.3 Application Errors

The application errors defined for the Naf_VFLInference API are listed in table 6.2.7.3-1.

Table 6.2.7.3-1: Application errors

Application Error	HTTP status code	Description	Applicability
OVERLOAD	403 Forbidden	Indicates the AF is overloaded.	
NOT_AVAILABLE_FOR_VFL_PROCESS	403 Forbidden	Indicates the AF is not available for the VFL process anymore.	
VFL_REQS_NOT_MET	403 Forbidden	Indicates the VFL inference requirements are not met.	
NOTE: Including a "ProblemDetails" data structure with the "cause" attribute in the HTTP response is optional unless explicitly mandated in the service operation clauses.			

6.2.8 Feature negotiation

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

Table 6.2.8-1: Supported Features

Feature number	Feature Name	Description

6.2.9 Security

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

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

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

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

6.2.10 HTTP redirection

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

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

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

6.3 Naf_Training Service API

6.3.1 Introduction

The Naf_Training shall use the Naf_Training API.

The API URI of the Naf_Training API shall be:

{apiRoot}/<apiName>/<apiVersion>

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

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

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "naf-train".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clauses 6.3.3 and 6.3.4.

6.3.2 Usage of HTTP

6.3.2.1 General

HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

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

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

6.3.2.2 HTTP standard headers

6.3.2.2.1 General

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

6.3.2.2.2 Content type

If the AF is untrusted, support of HTTP/1.1 (IETF RFC 9112 [19], IETF RFC 9110 [20] and IETF RFC 9111[21] over TLS is mandatory and support of HTTP/2 (IETF RFC 9113 [11]) over TLS is recommended. TLS shall be used as specified in clause 12.3 and clause 13.1 of 3GPP TS 33.501 [8].

If the AF is trusted, HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5.2 of 3GPP TS 29.500 [4].

HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

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

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

6.3.2.3 HTTP custom headers

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

6.3.3 Resources

6.3.3.1 Overview

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

Figure 6.3.3.1-1 depicts the resource URIs structure for the Naf_Training API.

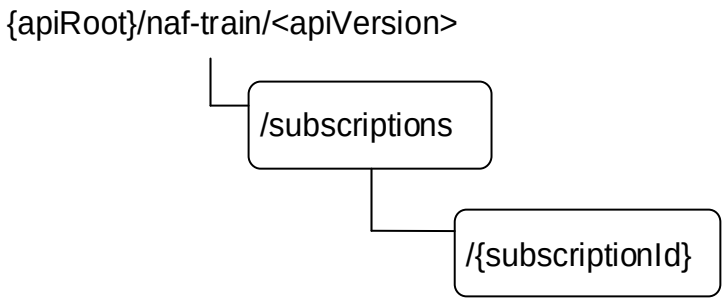

Figure 6.3.3.1-1: Resource URI structure of the Naf_Training API

Table 6.3.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.3.3.1-1: Resources and methods overview

Resource purpose/name	Resource URI (relative path after API URI)	HTTP method or custom operation	Description (service operation)
Training Subscriptions	/subscriptions	POST	Create a new Training Subscription.
Individual Training Subscription	/subscriptions/{subscriptionId}	GET	Retrieve an existing "Individual Training Subscription" resource.
		PUT	Request the update of an existing "Individual Training Subscription" resource.
		PATCH	Request the modification of an existing "Individual Training Subscription" resource.
		DELETE	Request the deletion of an existing "Individual Training Subscription" resource.

6.3.3.2 Resource: Training Subscriptions

6.3.3.2.1 Description

This resource represents the collection of Training Subscription(s) managed by the AF.

6.3.3.2.2 Resource Definition

Resource URI: **{apiRoot}/naf-train/<apiVersion>/subscriptions**

This resource shall support the resource URI variables defined in table 6.3.3.2.2-1.

Table 6.3.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.3.1.

6.3.3.2.3 Resource Standard Methods

6.3.3.2.3.1 POST

The HTTP POST method allows a service consumer to request the creation of a Training Subscription at the AF.

This method shall support the URI query parameters specified in table 6.3.3.2.3.1-1.

Table 6.3.3.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.3.3.2.3.1-2 and the response data structures and response codes specified in table 6.3.3.2.3.1-3.

Table 6.3.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
TrainEventsSubsc	M	1	Represents the parameters to request the creation of a Training Subscription.

Table 6.3.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TrainEventsSubsc	M	1	201 Created	Successful case. The Training Subscription is successfully created and a representation of the created "Individual Training Subscription" resource shall be returned. An HTTP "Location" header that contains the URI of the created resource shall also be included.
ProblemDetails	O	0..1	403 Forbidden	(NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the HTTP POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: Failure cases are described in clause 6.3.7.				

Table 6.3.3.2.3.1-4: 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}/naf-train/<apiVersion>/subscriptions/{subscriptionId}

6.3.3.2.4 Resource Custom Operations

There are no resource custom operations defined for this resource in this release of the specification.

6.3.3.3 Resource: Individual Training Subscription

6.3.3.3.1 Description

This resource represents a Training Subscription managed by the AF.

6.3.3.3.2 Resource Definition

Resource URI: **{apiRoot}/naf-train/<apiVersion>/subscriptions/{subscriptionId}**

This resource shall support the resource URI variables defined in table 6.3.3.3.2-1.

Table 6.3.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.3.1.
subscriptionId	string	Represents the unique identifier of the "Individual Training Subscription" resource.

6.3.3.3.3 Resource Standard Methods

6.3.3.3.3.1 GET

The GET method allows an NF service consumer to retrieve an existing "Individual Training Subscription" resource managed by the AF.

This method shall support the URI query parameters specified in table 6.3.3.3.3.1-1.

Table 6.3.3.3.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.3.3.3.3.1-2 and the response data structures and response codes specified in table 6.3.3.3.3.1-3.

Table 6.3.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.3.3.3.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TrainEventsSubsc	M	1	200 OK	Successful case. The requested "Individual Training Subscription" resource is returned.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the HTTP GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.30.9.1 of 3GPP TS 29.500 [4]).				

Table 6.3.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative AF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.30.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target AF (service) instance towards which the request is redirected.

Table 6.3.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative AF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.30.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target AF (service) instance towards which the request is redirected.

6.3.3.3.3.2 PUT

The PUT method allows an NF service consumer to request the update of an existing "Individual Training Subscription" resource managed by the AF.

This method shall support the URI query parameters specified in table 6.3.3.3.3.2-1.

Table 6.3.3.3.3.2-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.3.3.3.3.2-2 and the response data structures and response codes specified in table 6.3.3.3.3.2-3.

Table 6.3.3.3.3.2-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
TrainEventsSubsc	M	1	Contains the updated representation of the "Individual Training Subscription" resource.

Table 6.3.3.3.3.2-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TrainEventsSubsc	M	1	200 OK	Successful case. The "Individual Training Subscription" resource is successfully updated and a representation of the updated resource is returned in the response body.
n/a			204 No Content	Successful case. The "Individual Training Subscription" resource is successfully updated and no content is returned in the response body.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
NOTE 1: The mandatory HTTP error status codes for the HTTP PUT method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.30.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 6.3.7.				

Table 6.3.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

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

Table 6.3.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

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

6.3.3.3.3.3 PATCH

The PATCH method allows an NF service consumer to request the modification of an existing "Individual Training Subscription" resource managed by the AF.

This method shall support the URI query parameters specified in table 6.3.3.3.3.3-1.

Table 6.3.3.3.3.3-1: URI query parameters supported by the PATCH method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.3.3.3.3.3-2 and the response data structures and response codes specified in table 6.3.3.3.3.3-3.

Table 6.3.3.3.3.3-2: Data structures supported by the PATCH Request Body on this resource

Data type	P	Cardinality	Description
TrainEventsSubscPatch	M	1	Contains the parameters to request the modification of the "Individual Training Subscription" resource.

Table 6.3.3.3.3.3-3: Data structures supported by the PATCH Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TrainEventsSubsc	M	1	200 OK	Successful case. The "Individual Training Subscription" resource is successfully modified and a representation of the updated resource is returned in the response body.
n/a			204 No Content	Successful case. The "Individual Training Subscription" resource is successfully modified and no content is returned in the response body.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
NOTE 1: The mandatory HTTP error status codes for the HTTP PATCH method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 6.3.7.				

Table 6.3.3.3.3.3-4: Headers supported by the 307 Response Code on this resource

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

Table 6.3.3.3.3.3-5: Headers supported by the 308 Response Code on this resource

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

6.3.3.3.3.4 DELETE

The DELETE method allows an NF service consumer to request the deletion of an existing "Individual Training Subscription" resource managed by the AF.

This method shall support the URI query parameters specified in table 6.3.3.3.3.4-1.

Table 6.3.3.3.3.4-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.3.3.3.3.4-2 and the response data structures and response codes specified in table 6.3.3.3.3.4-3.

Table 6.3.3.3.3.4-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.3.3.3.3.4-3: 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 Training Subscription" resource is successfully deleted.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the HTTP DELETE method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.3.3.3.3.4-4: Headers supported by the 307 Response Code on this resource

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

Table 6.3.3.3.3.4-5: Headers supported by the 308 Response Code on this resource

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

6.3.4 Custom Operations without associated resources

There are no custom operations without associated resources defined for this API in this release of the specification.

6.3.5 Notifications

6.3.5.1 General

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

Table 6.3.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Training Notification	{notifUri}	POST	Enables the AF to notify a previously subscribed NF service consumer on Training report(s).

6.3.5.2 Training Notification

6.3.5.2.1 Description

The Training Notification is used by the AF to notify a previously subscribed NF service consumer on Training report(s).

6.3.5.2.2 Target URI

The Callback URI **"{notifUri}"** shall be used with the callback URI variables defined in table 6.3.5.2.2-1.

Table 6.3.5.2.2-1: Callback URI variables

Name	Definition
notifUri	Represents the callback URI encoded as a string formatted as a URI.

6.3.5.2.3 Standard Methods

6.3.5.2.3.1 POST

This method shall support the request data structures specified in table 6.3.5.2.3.1-1 and the response data structures and response codes specified in table 6.3.5.2.3.1-2.

Table 6.3.5.2.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
TrainEventsNotif	M	1	Represents the Training Notification.

Table 6.3.5.2.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. The Training Notification is successfully received.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.3.5.2.3.1-3: Headers supported by the 307 Response Code on this resource

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

Table 6.3.5.2.3.1-4: Headers supported by the 308 Response Code on this resource

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

6.3.6 Data Model

6.3.6.1 General

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

Table 6.3.6.1-1 specifies the data types defined for the Naf_Training service-based interface protocol.

Table 6.3.6.1-1: Naf_Training API specific Data Types

Data type	Clause defined	Description	Applicability
EventNotif	6.3.6.2.7	Represents notification on event training.	
EventSubsc	6.3.6.2.4	Represents an event training subscription.	
MlModelMonitorInfo	6.3.6.2.5	Represents the ML model monitoring information.	
TrainEventsNotif	6.3.6.2.6	Represents notification on training event(s) that occurred.	
TrainEventsSubsc	6.3.6.2.2	Represents event(s) training subscription.	
TrainEventsSubscPatch	6.3.6.2.3	Represents the requested modifications to an event training subscription.	

Table 6.3.6.1-2 specifies data types re-used by the Naf_Training 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 Naf_Training service-based interface.

Table 6.3.6.1-2: Naf_Training API re-used Data Types

Data type	Reference	Comments	Applicability
Accuracy	3GPP TS 29.520 [18]	Represents accuracy levels of interest for ML models.	
DateTime	3GPP TS 29.571 [16]	Identifies the time.	
DelayEventNotif	3GPP TS 29.520 [18]	Contains information related to the inability to provide the notification as requested.	
DurationSec	3GPP TS 29.571 [16]	Represents a time duration expressed in units of seconds.	
EventFilter	3GPP TS 29.520 [18]	Represents the event filters used to identify the subscribed analytics.	
InferenceDataForModelTrain	3GPP TS 29.520 [18]	Represents the inference data for model training.	
InputDataInfo	3GPP TS 29.520 [18]	Represents the metrics of the input data.	
MLModelMetric	3GPP TS 29.520 [18]	Represents the ML Model Metric.	
NetworkAreaInfo	3GPP TS 29.554 [23]	Identifies the network area.	
NwdafEvent	3GPP TS 29.520 [18]	Represents the NWDAF event.	
ReportingInformation	3GPP TS 29.523 [17]	Represents the event reporting requirements.	
SupportedFeatures	3GPP TS 29.571 [16]	Represents the list of supported feature(s) and used to negotiate the applicability of the optional features.	
TargetUeInformation	3GPP TS 29.520 [18]	Identifies the target UE information.	
TimeWindow	3GPP TS 29.122 [22]	Represents a time window.	
Uinteger	3GPP TS 29.571 [16]	Represents an unsigned integer.	
Uri	3GPP TS 29.571 [16]	Represents a URI.	
VflTermCause	3GPP TS 29.520 [18]	Identifies the VFL termination cause.	

6.3.6.2 Structured data types

6.3.6.2.1 Introduction

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

6.3.6.2.2 Type: TrainEventsSubsc

Table 6.3.6.2.2-1: Definition of type TrainEventsSubsc

Attribute name	Data type	P	Cardinality	Description	Applicability
trainEventSubs	map(EventSubsc)	M	1..N	Contains the subscribed training events. The key of the map shall be set to the value of the "event" attribute in the EventSubsc data structure.	
notifUri	Uri	M	1	Contains the URI via which the training related notifications shall be delivered.	
notifCorreId	string	M	1	The value of Notification Correlation ID in the corresponding notification.	
reportingReqs	ReportingInformation	O	0..1	Contains reporting requirement information of the subscription. If omitted, the default values within the ReportingInformation data type apply.	
eventNotifs	array(EventNotif)	O	1..N	Contains the training related even(s) report(s). This attribute may be present only if immediate reporting was requested via the "reportingReqs" attribute.	
suppFeat	SupportedFeatures	C	0..1	Contains the list of supported features among the ones defined in clause 6.3.8. This attribute shall be present only when feature negotiation is required.	

6.3.6.2.3 Type: TrainEventsSubscPatch

Table 6.3.6.2.3-1: Definition of type TrainEventsSubscPatch

Attribute name	Data type	P	Cardinality	Description	Applicability
trainEventSubs	map(EventSubsc)	O	1..N	Contains the updated subscribed training events. The key of the map shall be set to the value of the "event" attribute in the EventSubsc data structure.	
notifUri	Uri	O	0..1	Contains the updated URI via which the training related notifications shall be delivered.	
notifCorreId	string	O	0..1	The value of Notification Correlation ID in the corresponding notification.	
reportingReqs	ReportingInformation	O	0..1	Contains the reporting requirement information of the subscription.	

6.3.6.2.4 Type: EventSubsc

Table 6.3.6.2.4-1: Definition of type EventSubsc

Attribute name	Data type	P	Cardinality	Description	Applicability
event	NwdafEvent	M	1	Event that is subscribed.	
useCaseCxt	string	O	0..1	Indicates the context of usage of the analytics. The value and format of this parameter are not standardized.	
trainFilter	EventFilter	O	0..1	Identifies the training filter information for the monitored event.	
tgtUe	TargetUeInformation	O	0..1	Identifies target UE information. (NOTE)	
exterGroupIds	array(ExternalGroupId)	O	1..N	Identifies the external group of UE(s) to which the inference applies. (NOTE)	
repRatio	Uinteger	O	0..1	Minimum percentage of UEs whose data is used for training an ML model when the target of ML model reporting is a group of UEs. Minimum = 0. Maximum = 100.	
targetPeriod	TimeWindow	O	0..1	Indicates the time interval for which the ML model for the analytics is requested.	
inferInputData	InputDataInfo	O	0..1	Indicates the Inference Input Data information.	
timeModelNeeded	DateTime	O	0..1	Indicating the latest time when the consumer expects to receive the ML Model(s).	
modelMonInfo	MlModelMonitorInfo	O	0..1	Contains the ML Model Monitoring Information.	
accuLevel	Accuracy	O	0..1	Contains the accuracy level of interest.	
NOTE: The "gpsis" attribute within the TargetUeInformation data structure and "exterGroupIds" attribute are not applicable for the AF services if the AF is a trusted AF. The "intGroupIds" and "supis" attributes within the TargetUeInformation data structure are not applicable for the AF services if the AF is an untrusted AF.					

6.3.6.2.5 Type: MlModelMonitorInfo

Table 6.3.6.2.5-1: Definition of type MlModelMonitorInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
modelMetric	MLModelMetric	O	0..1	Indicates the ML model metric.	
accuThreshold	Uinteger	O	0..1	Accuracy reporting threshold. Indicates the accuracy threshold of the ML Model requested by the consumer Minimum = 0. Maximum = 100.	
accuPeriod	DurationSec	O	0..1	Indicates the periodic reporting time. (NOTE)	
storedData	InferenceDataForModelTrain	O	0..1	Indicates the inference data stored in the ADRF.	
NOTE: When present, this attribute shall take precedence over the periodic reporting time indicated by the "repPeriod" attribute within the "reportingReqs" attribute (of data type ReportingInformation) in the TrainEventsSubsc data type.					

6.3.6.2.6 Type: TrainEventsNotif

Table 6.3.6.2.6-1: Definition of type TrainEventsNotif

Attribute name	Data type	P	Cardinality	Description	Applicability
notifCorreId	string	M	1	Contains the notification correlation identifier.	
eventNotifs	array(EventNotif)	M	1..N	Contains the Training related event(s) notification(s).	

6.3.6.2.7 Type: EventNotif

Table 6.3.6.2.7-1: Definition of type EventNotif

Attribute name	Data type	P	Cardinality	Description	Applicability
event	NwdafEvent	M	1	Contains the identifier of the analytics to which the training notification is related.	
vflNotOnTimeInd	DelayEventNotif	O	0..1	Contains information indicating that the AF is not able to provide the training results within the maximum response time. (NOTE 1)(NOTE 2)	
trainingInd	boolean	O	0..1	Set to "true" to indicate that the ML model training is ongoing. Set to "false" to indicate that the ML model training is done. Default value is "false" if omitted. (NOTE 1)	
validityPeriod	TimeWindow	O	0..1	Indicates the time period when the provided ML model applies. (NOTE 1)	
spatialValidity	NetworkAreaInfo	O	0..1	Indicates the area where the provided ML model applies. (NOTE 1)	
repRatio	Uinteger	O	0..1	Minimum percentage of UEs whose data is used for training an ML model when the target of ML model reporting is a group of UEs. Minimum = 0. Maximum = 100. (NOTE 1)	
accMLModel	Uinteger	O	0..1	Indicates the accuracy value of the ML model. Minimum = 0. Maximum = 100. (NOTE 1)	
termCause	VflTermCause	O	0..1	Contains the termination cause. (NOTE 1)	
vflCorrId	string	O	0..1	Contains the VFL Correlation ID. (NOTE 1)	
NOTE 1: If the "termCause" attribute is present, the rest of the attributes indicated by this NOTE shall not be present. NOTE 2: The "ML_MODEL_TRAIN_FAILURE" value within the "delayCause" attribute in the "vflNotOnTimeInd" attribute is not applicable. The attributes within the "vflNotOnTimeInd" attribute apply for VFL here.					

6.3.6.3 Simple data types and enumerations

6.3.6.3.1 Introduction

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

6.3.6.3.2 Simple data types

The simple data types defined in table 6.3.6.3.2-1 shall be supported.

Table 6.3.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.3.6.4 Data types describing alternative data types or combinations of data types

There are no data types describing alternative data types or combinations of data types defined for this API in this release of the specification.

6.3.6.5 Binary data

6.3.6.5.1 Binary Data Types

Table 6.3.6.5.1-1: Binary Data Types

Name	Clause defined	Content type

6.3.7 Error Handling

6.3.7.1 General

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

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

6.3.7.2 Protocol Errors

No specific procedures for the Naf_Training service are specified.

6.3.7.3 Application Errors

The application errors defined for the Naf_Training service are listed in Table 6.3.7.3-1.

Table 6.3.7.3-1: Application errors

Application Error	HTTP status code	Description	Applicability
OVERLOAD	403 Forbidden	Indicates the AF is overloaded.	
NOTE: Including a "ProblemDetails" data structure with the "cause" attribute in the HTTP response is optional unless explicitly mandated in the service operation clauses.			

6.3.8 Feature negotiation

The optional features in table 6.3.8-1 are defined for the Naf_Training API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.3.8-1: Supported Features

Feature number	Feature Name	Description

6.3.9 Security

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

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

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 Naf_Training service.

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

6.3.10 HTTP redirection

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

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

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

6.4 Naf_Inference Service API

6.4.1 Introduction

The Naf_Inference service shall use the Naf_Inference API.

The API URI of the Naf_Inference API shall be:

{apiRoot}/<apiName>/<apiVersion>

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

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

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "naf-inference".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 6.4.3.

6.4.2 Usage of HTTP

6.4.2.1 General

If the AF is untrusted, support of HTTP/1.1 (IETF RFC 9112 [19], IETF RFC 9110 [20] and IETF RFC 9111[21] over TLS is mandatory and support of HTTP/2 (IETF RFC 9113 [11]) over TLS is recommended. TLS shall be used as specified in clause 12.3 and clause 13.1 of 3GPP TS 33.501 [8].

If the AF is trusted, HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5.2 of 3GPP TS 29.500 [4].

HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.5 of 3GPP TS 29.500 [4].

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

6.4.2.2 HTTP standard headers

6.4.2.2.1 General

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

6.4.2.2.2 Content type

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

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

6.4.2.3 HTTP custom headers

The mandatory HTTP custom header fields specified in clause 5.5.3.2 of 3GPP TS 29.500 [4] shall be supported, and the optional HTTP custom header fields specified in clause 5.5.3.3 of 3GPP TS 29.500 [4] may be supported.

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

6.4.3 Resources

6.4.3.1 Overview

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

Figure 6.4.3.1-1 depicts the resource URIs structure for the Naf_Inference API.

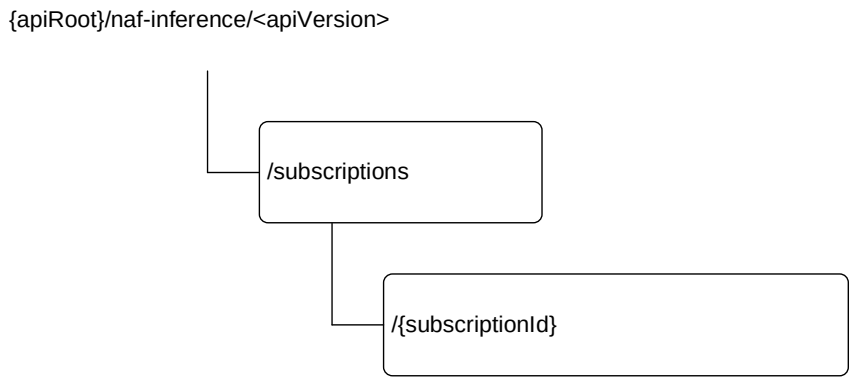

Figure 6.4.3.1-1: Resource URI structure of the Naf_Inference API

Table 6.4.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.4.3.1-1: Resources and methods overview

Resource purpose/name	Resource URI (relative path after API URI)	HTTP method or custom operation	Description (service operation)
Inference Subscriptions	/subscriptions	POST	Creates a new Individual Inference Subscription resource.
Individual Inference Subscription	/subscriptions/{subscriptionId}	PUT	Updates an existing Individual Inference Subscription identified by subresource {subscriptionId}.
		PATCH	Modifies an existing Individual Inference Subscription identified by subresource {subscriptionId}.
		DELETE	Deletes an Individual Inference Subscription identified by subresource {subscriptionId}.

6.4.3.2 Resource: Inference Subscriptions

6.4.3.2.1 Description

The Inference Subscriptions resource represents all Inference subscriptions to the Naf_Inference service at a given AF. The resource allows an NF service consumer to create a new Individual Inference Subscription resource.

6.4.3.2.2 Resource Definition

Resource URI: **{apiRoot}/naf-inference/<apiVersion>/subscriptions**

This resource shall support the resource URI variables defined in table 6.4.3.2.2-1.

Table 6.4.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.4.1

6.4.3.2.3 Resource Standard Methods

6.4.3.2.3.1 POST

This method shall support the URI query parameters specified in table 6.4.3.2.3.1-1.

Table 6.4.3.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.4.3.2.3.1-2 and the response data structures and response codes specified in table 6.4.3.2.3.1-3.

Table 6.4.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
InferEventSubsc	M	1	Contains the information required for the creation of a new Individual Inference Subscription resource. "intGroupIds" and "supis" target identities on "inferAnaSubs" attribute under this structure are not applicable to this API if the NF consumer is a NEF, i.e., the AF is an untrusted AF. "exterGroupIds" and "gpsis" target identities on "inferAnaSubs" attribute under this structure are not applicable to this API if the NF consumer is an NWDAF, i.e., the AF is a trusted AF.

Table 6.4.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
InferEventSubsc	M	1	201 Created	Contains the representation of the Individual Inference Subscription resource.
ProblemDetails	O	0..1	403 Forbidden	(NOTE 2)
NOTE 1: The mandatory HTTP error status code for the POST method listed in Table 5.5.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: Failure cases are described in clause 6.4.7.				

Table 6.4.3.2.3.1-4: 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}/naf-inference/<apiVersion>/subscriptions/{subscriptionId}

6.4.3.2.4 Resource Custom Operations

There are no resource custom operations defined for this resource in this release of the specification.

6.4.3.3 Resource: Individual Inference Subscription

6.4.3.3.1 Description

The Individual Inference Subscription resource represents a single inference subscription to the Naf_Inference service at a given AF.

6.4.3.3.2 Resource Definition

Resource URI: **{apiRoot}/naf-inference/<apiVersion>/subscriptions/{subscriptionId}**

This resource shall support the resource URI variables defined in table 6.4.3.3.2-1.

Table 6.4.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.4.1
subscriptionId	string	Identifies an inference subscription to the Naf_Inference service.

6.4.3.3.3 Resource Standard Methods

6.4.3.3.3.1 PUT

This method shall support the URI query parameters specified in table 6.4.3.3.3.1-1.

Table 6.4.3.3.3.1-1: 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 6.4.3.3.3.1-2 and the response data structures and response codes specified in table 6.4.3.3.3.1-3.

Table 6.4.3.3.3.1-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
InferEventSubsc	M	1	Parameters to replace a subscription to an Individual Inference Subscription resource.

Table 6.4.3.3.3.1-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
InferEventSubsc	M	1	200 OK	Successful case. The Individual Inference Subscription resource was modified successfully and a representation is returned. "intGroupIds" and "supis" target identities on "inferAnaSubs" attribute under this structure are not applicable to this API if the NF consumer is a NEF, i.e., the AF is an untrusted AF. "exterGroupIds" and "gpsis" target identities on "inferAnaSubs" attribute under this structure are not applicable to this API if the NF consumer is an NWDAF, i.e., the AF is a trusted AF.
n/a			204 No Content	Successful case. The Individual Inference Subscription resource was modified successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
NOTE 1: The mandatory HTTP error status codes for the PUT method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 6.4.7.				

Table 6.4.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

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

Table 6.4.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

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

6.4.3.3.3.2 PATCH

This method shall support the URI query parameters specified in table 6.4.3.3.3.2-1.

Table 6.4.3.3.3.2-1: URI query parameters supported by the PATCH method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.4.3.3.3.2-2 and the response data structures and response codes specified in table 6.4.3.3.3.2-3.

Table 6.4.3.3.3.2-2: Data structures supported by the PATCH Request Body on this resource

Data type	P	Cardinality	Description
InferEventSubscPatch	M	1	Partial update of parameters to a subscription to an Individual Inference Subscription resource

Table 6.4.3.3.3.2-3: Data structures supported by the PATCH Response Body on this resource

Data type	P	Cardinality	Response codes	Description
InferEventSubsc	M	1	200 OK	The Individual Inference Subscription resource was partial modified successfully and a representation of that resource is returned. "intGroupIds" and "supis" target identities on "inferAnaSubs" attribute under this structure are not applicable to this API if the NF consumer is a NEF, i.e., the AF is an untrusted AF. "exterGroupIds" and "gpsis" target identities on "inferAnaSubs" attribute under this structure are not applicable to this API if the NF consumer is an NWDAF, i.e., the AF is a trusted AF.
n/a			204 No Content	The Individual AF Inference Subscription resource was partial modified successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
NOTE 1: The mandatory HTTP error status codes for the PATCH method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 6.4.7.				

Table 6.4.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

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

Table 6.4.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

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

6.4.3.3.3 DELETE

This method shall support the URI query parameters specified in table 6.4.3.3.3-1.

Table 6.4.3.3.3-1: 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 6.4.3.3.3-2 and the response data structures and response codes specified in table 6.4.3.3.3-3.

Table 6.4.3.3.3-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.4.3.3.3-3: 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 Inference Subscription resource matching the subscriptionId was deleted.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status code for the DELETE method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.4.3.3.3-4: Headers supported by the 307 Response Code on this resource

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

Table 6.4.3.3.3.3-5: Headers supported by the 308 Response Code on this resource

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

6.4.3.2.4 Resource Custom Operations

There are no resource custom operations defined for this resource in this release of the specification.

6.4.4 Custom Operations without associated resources

There are no custom operations defined for this resource in this release of the specification.

6.4.5 Notifications

6.4.5.1 General

Notifications shall comply to clause 6.4 of 3GPP TS 29.500 [4] and clause 4.6.4.3 of 3GPP TS 29.501 [5].

Table 6.4.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Inference Notification	{notifUri}	POST	Provides Information about observed events.

6.4.5.5 Inference notification

6.4.5.5.1 Description

The Inference Event Notification is used by the AF to report one or several observed Inference Events to an NF service consumer that has subscribed to such Notifications via the Individual Inference Subscription resource.

6.4.5.5.2 Target URI

The Callback URI **"{notifUri}"** shall be used with the callback URI variables defined in table 6.4.5.5.2-1.

Table 6.4.5.5.2-1: Callback URI variables

Name	Definition
notifUri	String formatted as URI with the Callback Uri

6.4.5.5.3 Standard Methods

6.4.5.5.3.1 POST

This method shall support the request data structures specified in table 6.4.5.5.3.1-1 and the response data structures and response codes specified in table 6.4.5.5.3.1-1.

Table 6.4.5.5.3.1-2: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
InferNotif	M	1	Provides Information about observed events. "intGroupIds" and "supis" target identities on "inferResults" attribute under this structure are not applicable to this API if the NF consumer is a NEF, i.e., the AF is an untrusted AF. "exterGroupIds" and "gpsis" target identities on "inferResults" attribute under this structure are not applicable to this API if the NF consumer is an NWDAF, i.e., the AF is a trusted AF.

Table 6.4.5.5.3.1-3: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The receipt of the Notification is acknowledged.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during event notification. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during event notification. (NOTE 2)
NOTE: The mandatory HTTP error status codes for the POST method listed in Table 5.5.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.4.5.5.3.1-4: Headers supported by the 307 Response Code on this resource

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

Table 6.4.5.5.3.1-5: Headers supported by the 308 Response Code on this resource

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

6.4.6 Data Model

6.4.6.1 General

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

Table 6.4.6.1-1 specifies the data types defined for the Naf_Inference service based interface protocol.

Table 6.4.6.1-1: Naf_Inference specific Data Types

Data type	Clause defined	Description	Applicability
InferAnaSub	6.4.6.2.4	Represents notification of an inference subscription per analytics id.	
InferNotif	6.4.6.2.5	Represents notification of an inference subscription.	
InferEventSubsc	6.4.6.2.2	Represents an inference subscription.	
InferEventSubscPatch	6.4.6.2.3	Represents parameters to request the modification of an inference subscription.	
InferResult	6.4.6.2.6	Represents inference results.	

Table 6.4.6.1-2 specifies data types re-used by the Naf_Inference 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 Naf_Inference service based interface.

Table 6.4.6.1-2: Naf_Inference re-used Data Types

Data type	Reference	Comments	Applicability
DelayEventNotif	3GPP TS 29.520 [18]	Indicates that the AF is not able to complete inference within the maximum response time.	
AnalyticsMetadata	3GPP TS 29.520 [18]	Represents the types of analytics metadata information that can be requested.	
AnalyticsMetadataInfo	3GPP TS 29.520 [18]	Contains analytics metadata information required for analytics aggregation.	
DatasetStatisticalProperty	3GPP TS 29.520 [18]	Dataset statistical properties of the data used for inference.	
DateTime	3GPP TS 29.571 [16]	Represents a date and time.	
DurationSec	3GPP TS 29.571 [16]	Represents a time duration expressed in units of seconds.	
EventFilter	3GPP TS 29.520 [18]	Identifies the filter for the subscribed event.	
EventNotification	3GPP TS 29.520 [18]	Describes Notifications about events that occurred.	
EventReportingRequirement	3GPP TS 29.520 [18]	Represents the analytics reporting requirement information.	
ExternalGroupId	3GPP TS 29.571 [16]	External Group Identifier for a user group.	
Gpsi	3GPP TS 29.571 [16]	The GPSI for a UE.	
GroupId	3GPP TS 29.571 [16]	Identifies a group of UEs.	
NwdafEvent	3GPP TS 29.520 [18]	Describes the NWDAF Events.	
ReportingInformation	3GPP TS 29.523 [17]	Represents the type of reporting a subscription requires.	
RedirectResponse	3GPP TS 29.571 [16]	Contains redirection related information.	
Supi	3GPP TS 29.571 [16]	The SUPI for a UE.	
SupportedFeatures	3GPP TS 29.571 [16]	Represents the list of supported features.	
TimeWindow	3GPP TS 29.122 [22]	Represents a time window.	
Uinteger	3GPP TS 29.571 [16]	Unsigned Integer, i.e. only value 0 and integers above 0 are permissible.	
Uri	3GPP TS 29.571 [16]	Represents a URI.	
VflTermCause	3GPP TS 29.520 [18]	Represents a cause of termination.	

6.4.6.2 Structured data types

6.4.6.2.1 Introduction

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

6.4.6.2.2 Type InferEventSubsc

Table 6.4.6.2.2-1: Definition of type InferEventSubsc

Attribute name	Data type	P	Cardinality	Description	Applicability
notifCorreId	string	M	1	The value of Notification Correlation ID in the corresponding notification.	
notifUri	Uri	M	1	URI at which the NF service consumer requests to receive notifications.	
suppFeats	SupportedFeatures	C	0..1	List of Supported features used as described in clause 5.10.8. It shall be supplied by NF service consumer in the POST requests that request the creation of an Inference Subscriptions resource and shall be supplied by the AF in the reply of corresponding request.	
inferAnaSubs	map(InferAnaSub)	M	1..N	Identifies the inference subscription information for the subscribed analytics ID(s). The key of the map shall be set to the value of the "anaEvent" attribute in the InferAnaSub data structure.	
inferResults	array(InferResult)	O	1..N	Represents inference results. This attribute may be present only in the response message and if immediate reporting was requested via the "reportInfo" attribute.	
reportInfo	ReportingInformation	O	0..1	Reporting requirement information of the inference subscription. If omitted, the default values within the ReportingInformation data type apply.	

6.4.6.2.3 Type InferEventSubscPatch

Table 6.4.6.2.3-1: Definition of type InferEventSubscPatch

Attribute name	Data type	P	Cardinality	Description	Applicability
notifUri	Uri	O	0..1	URI at which the NF service consumer requests to receive notifications.	
notifCorreId	string	O	0..1	The value of Notification Correlation ID in the corresponding notification.	
inferAnaSubs	map(InferAnaSub)	O	1..N	Contains the updated subscribed inference events. The key of the map shall be set to the value of the "anaEvent" attribute in the InferAnaSub data structure.	
reportInfo	ReportingInformation	O	0..1	Reporting requirement information of the inference subscription. If omitted, the default values within the ReportingInformation data type apply.	

6.4.6.2.4 Type InferAnaSub

Table 6.4.6.2.4-1: Definition of type InferAnaSub

Attribute name	Data type	P	Cardinality	Description	Applicability
anaEvent	NwdafEvent	M	1	Type of analytics for which inference is required.	
eventFilter	EventFilter	O	0..1	Inference filter information.	
exterGroupIds	array(ExternalGroupId)	C	1..N	Identifies the external group of UE(s) to which the inference applies. (NOTE 1) (NOTE 2)	
gpsis	array(Gpsi)	C	1..N	Each element identifies a GPSI of an UE to which the inference applies. (NOTE 1) (NOTE 2)	
intGroupIds	array(GroupId)	C	1..N	Each element represents an internal group identifier of the UEs to which the inference applies. (NOTE 1) (NOTE 2)	
supis	array(Supi)	C	1..N	Each element identifies a SUPI of an UE to which the inference applies. (NOTE 1) (NOTE 2)	
anaMeta	array(AnalyticsMetadata)	O	1..N	List of analytics metadata that are requested to be included in the response. Only "NUM_OF_SAMPLES", "DATA_WINDOW", "DATA_STAT_PROPS" and “DATA_SOURCES” values are applicable.	
dataStatProps	array(DatasetStatisticalProperty)	O	1..N	List of dataset statistical properties of the data to be used to perform inference.	
timeWindows	array(TimeWindow)	O	1..N	The time periods for inference.	
resTime	DateTime	O	0..1	Time when the local result is needed.	
NOTE 1: The "exterGroupIds" and "gpsis" attributes are not applicable for the AF services if the AF is a trusted AF. The "intGroupIds" and "supis" attributes of the data type are not applicable for the AF services if the AF is an untrusted AF. NOTE 2: Only one of "exterGroupIds", "gpsis", "intGroupIds", or "supis" attributes shall be provided.					

6.4.6.2.5 Type InferNotif

Table 6.4.6.2.5-1: Definition of type InferNotif

Attribute name	Data type	P	Cardinality	Description	Applicability
notifCorreId	string	M	1	The value of Notification Correlation ID in the corresponding notification.	
inferResults	array(InferResult)	M	1..N	Represents inference results.	

6.4.6.2.6 Type InferResult

Table 6.4.6.2.6-1: Definition of type InferResult

Attribute name	Data type	P	Cardinality	Description	Applicability
inferRes	EventNotification	C	0..1	Represents inference results. (NOTE)	
vflNotOnTimeInd	DelayEventNotif	C	0..1	Indicates that the AF is not able to provide the inference results within the maximum response time. (NOTE)	
termCause	VflTermCause	C	0..1	A cause for which the AF client will send no further notifications for this subscription to the event specified by "event" attribute. Its presence indicates that the AF requests the termination of the subscription to the event specified by "event" attribute. (NOTE)	
NOTE: One of the "inferRes", "termCause" or "vflNotOnTimeInd" attributes shall be provided. The "ML_MODEL_TRAIN_FAILURE" value within the "delayCause" attribute in the "vflNotOnTimeInd" attribute is not applicable. The attributes within the "vflNotOnTimeInd" attribute here apply for VFL.					

6.4.6.3 Simple data types and enumerations

6.4.6.3.1 Introduction

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

6.4.6.3.2 Simple data types

The simple data types defined in table 6.4.6.3.2-1 shall be supported.

Table 6.4.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.4.7 Error Handling

6.4.7.1 General

For the Naf_Inference API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.5.7.2-1 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 5.5.7.1-1 of 3GPP TS 29.500 [4].

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

6.4.7.2 Protocol Errors

No specific procedures for the Naf_Inference service are specified.

6.4.7.3 Application Errors

The application errors defined for the Naf_Inference service are listed in Table 6.4.7.3-1.

Table 6.4.7.3-1: Application errors

Application Error	HTTP status code	Description	Applicability
OVERLOAD	403 Forbidden	Indicates the AF is overloaded.	
UE_LEFT_AREA	403 Forbidden	Indicates the UE has moved out of the serving area.	
INFERENCE_REQS_NOT_MET	403 Forbidden	Indicates the inference requirements are not met.	
NOT_AVAILABLE_FOR_VFL_PROCESS	403 Forbidden	Indicates the AF is not available for inference process anymore.	
NOTE: Including a "ProblemDetails" data structure with the "cause" attribute in the HTTP response is optional unless explicitly mandated in the service operation clauses.			

6.4.8 Feature negotiation

The optional features in table 6.4.8-1 are defined for the Naf_Inference API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.4.8-1: Supported Features

Feature number	Feature Name	Description

6.4.9 Security

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

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

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

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

6.4.10 HTTP redirection

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

An SCP that reselects a different AF producer instance will return the NF Instance ID of the new AF producer instance in the 3gpp-Sbi-Producer-Id header, as specified in clause 6.40.3.4 of 3GPP TS 29.500 [4].

If an AF redirects a service request to a different AF using an HTTP 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new AF towards which the service request is redirected shall be indicated in the 3gpp-Sbi-Target-Nf-Id header of the HTTP 307 Temporary Redirect or 308 Permanent Redirect response as specified in clause 6.40.9.1 of 3GPP TS 29.500 [4].

Annex A (normative): OpenAPI specification

A.1 General

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

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

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

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

A.2 Naf_VFLTraining API

```
openapi: 3.0.0

info:
  title: Naf_VFLTraining Service API
  version: 1.0.0
  description: |
    AF VFL Training Service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 29.530 V19.0.0; 5G System; Application Function Artificial Intelligence/Machine Learning
    (AI/ML) Services.
  url: http://www.3gpp.org/ftp/Specs/archive/29_series/29.530/

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

security:
  - {}
  - oAuth2ClientCredentials:
    - naf-vfl-train

paths:
  /subscriptions:

    post:
      summary: Request the creation of a VFL Training Subscription.
      operationId: CreateVflTrainSubsc
      tags:
        - VFL Training Subscriptions (Collection)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/VflTrainingSubs'
      responses:
        '201':
          description: >
            Created. The VFL Training Subscription is successfully created and a representation of
```

```
        the created Individual VFL Training Subscription resource shall be returned.
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/VflTrainingSubs'
      headers:
        Location:
          description: >
            Contains the URI of the created Individual VFL Training Subscription resource.
          required: true
          schema:
            type: string
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '502':
      $ref: 'TS29571_CommonData.yaml#/components/responses/502'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  callbacks:
    myNotification:
      '{$request.body#/notifUri}':
        post:
          requestBody:
            required: true
            content:
              application/json:
                schema:
                  $ref: 'TS29520_Nnwdaf_VFLTraining.yaml#/components/schemas/VflTrainingNotify'
          responses:
            '204':
              description: >
                No Content. The VFL Training Notification is successfully received
                and acknowledged.
            '307':
              $ref: 'TS29571_CommonData.yaml#/components/responses/307'
            '308':
              $ref: 'TS29571_CommonData.yaml#/components/responses/308'
            '400':
              $ref: 'TS29571_CommonData.yaml#/components/responses/400'
            '401':
              $ref: 'TS29571_CommonData.yaml#/components/responses/401'
            '403':
              $ref: 'TS29571_CommonData.yaml#/components/responses/403'
            '404':
              $ref: 'TS29571_CommonData.yaml#/components/responses/404'
            '411':
              $ref: 'TS29571_CommonData.yaml#/components/responses/411'
            '413':
              $ref: 'TS29571_CommonData.yaml#/components/responses/413'
            '415':
              $ref: 'TS29571_CommonData.yaml#/components/responses/415'
            '429':
              $ref: 'TS29571_CommonData.yaml#/components/responses/429'
            '500':
              $ref: 'TS29571_CommonData.yaml#/components/responses/500'
            '502':
              $ref: 'TS29571_CommonData.yaml#/components/responses/502'
            '503':
              $ref: 'TS29571_CommonData.yaml#/components/responses/503'
            default:
```

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

  /subscriptions/{subscriptionId}:
    parameters:
      - name: subscriptionId
        in: path
        description: >
          Represents the identifier of the Individual VFL Training Subscription
          resource.
        required: true
        schema:
          type: string

    get:
      summary: Retrieve an existing Individual VFL Training Subscription resource.
      operationId: GetIndVflTrainSubsc
      tags:
        - Individual VFL Training Subscription (Document)
      responses:
        '200':
          description: >
            OK. The requested Individual VFL Training Subscription resource is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/VflTrainingSubs'
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '406':
          $ref: 'TS29571_CommonData.yaml#/components/responses/406'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

    put:
      summary: Request the update of an existing Individual VFL Training Subscription resource.
      operationId: UpdateIndVflTrainSubsc
      tags:
        - Individual VFL Training Subscription (Document)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/VflTrainingSubs'
      responses:
        '200':
          description: >
            OK. The Individual VFL Training Subscription resource is successfully updated and a
            representation of the updated resource shall be returned in the response body.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/VflTrainingSubs'
        '204':
          description: >
            No Content. The Individual VFL Training Subscription resource is successfully updated
            and no content is returned in the response body.
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
```

```
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

    patch:
      summary: Request the modification of an existing Individual VFL Training Subscription
resource.
      operationId: ModifyIndVflTrainSubsc
      tags:
        - Individual VFL Training Subscription (Document)
      requestBody:
        required: true
        content:
          application/merge-patch+json:
            schema:
              $ref: '#/components/schemas/VflTrainingSubsPatch'
      responses:
        '200':
          description: >
            OK. The Individual VFL Training Subscription resource is successfully modified and a
            representation of the updated resource shall be returned in the response body.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/VflTrainingSubs'
        '204':
          description: >
            No Content. The Individual VFL Training Subscription resource is successfully modified
            and no content is returned in the response body.
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
```

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

    delete:
      summary: Request the deletion of an existing Individual VFL Training Subscription resource.
      operationId: DeleteIndVflTrainSubsc
      tags:
        - Individual VFL Training Subscription (Document)
      responses:
        '204':
          description: >
            No Content. The Individual VFL Training Subscription resource is successfully deleted.
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            naf-vfl-train: >
              Enables to access all the resources and custom operations of the Naf_VFLTraining API.


  schemas:

#
# STRUCTURED DATA TYPES
#

    VflTrainingSubs:
      description: >
        Represents a VFL Training Subscription.
      type: object
      properties:
        vflTrainSubs:
          type: array
          items:
            $ref: 'TS29520_Nnwdaf_VFLTraining.yaml#/components/schemas/VflTrainingSub'
          minItems: 1
        notifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        notifCorrId:
          type: string
        vflPreFlag:
          type: boolean
          description: >
            Indicates the subscription is for preparation of VFL, when it is included and set to
            "true". The default value is "false" if omitted.
        reportingReqs:
          $ref: 'TS29523_Npcf_EventExposure.yaml#/components/schemas/ReportingInformation'
        trainReports:
          type: array
          items:
            $ref: 'TS29520_Nnwdaf_VFLTraining.yaml#/components/schemas/VflTrainingNotify'
          minItems: 1
```

```
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      required:
        - vflTrainSubs

    VflTrainingSubsPatch:
      description: >
        Represents the requested modifications to a VFL Training Subscription.
      type: object
      properties:
        vflTrainSubs:
          type: array
          items:
            $ref: 'TS29520_Nnwdaf_VFLTraining.yaml#/components/schemas/VflTrainingSub'
          minItems: 1
        notifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        notifCorrId:
          type: string
        reportingReqs:
          $ref: 'TS29523_Npcf_EventExposure.yaml#/components/schemas/ReportingInformation'

# SIMPLE DATA TYPES
#

#
# ENUMERATIONS
#

# Data types describing alternative data types or combinations of data types:
#
```

A.3 Naf_VFLInference API

```
openapi: 3.0.0
info:
  title: Naf_VFLInference
  version: 1.0.1
  description: |
    Naf_VflInference API Service.
    © 2026, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 29.530 V19.1.0; 5G System; Application Function Artificial Intelligence/Machine
    Learning (AI/ML) Services
  url: https://www.3gpp.org/ftp/Specs/archive/29_series/29.530/

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

security:
  - {}
  - oAuth2ClientCredentials:
    - naf-vflinference

paths:
  /subscriptions:
    post:
      summary: Create a new Individual VFL Inference Subscription resource.
      operationId: CreateVFLInferenceSubcription
      tags:
        - Subscriptions (Collection)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/VflInferSub'
```

```
responses:
  '201':
    description: Create a new Individual VFL Inference Subscription resource.
    content:
      application/json:
        schema:
          $ref: '#/components/schemas/VflInferSub'
    headers:
      Location:
        description: >
          Contains the URI of the newly created resource, according to the
          structure
          {apiRoot}/naf-vflinference/v1/subscriptions/{subscriptionId}.
        required: true
        schema:
          type: string
  '400':
    $ref: 'TS29571_CommonData.yaml#/components/responses/400'
  '401':
    $ref: 'TS29571_CommonData.yaml#/components/responses/401'
  '403':
    $ref: 'TS29571_CommonData.yaml#/components/responses/403'
  '404':
    $ref: 'TS29571_CommonData.yaml#/components/responses/404'
  '411':
    $ref: 'TS29571_CommonData.yaml#/components/responses/411'
  '413':
    $ref: 'TS29571_CommonData.yaml#/components/responses/413'
  '415':
    $ref: 'TS29571_CommonData.yaml#/components/responses/415'
  '429':
    $ref: 'TS29571_CommonData.yaml#/components/responses/429'
  '500':
    $ref: 'TS29571_CommonData.yaml#/components/responses/500'
  '502':
    $ref: 'TS29571_CommonData.yaml#/components/responses/502'
  '503':
    $ref: 'TS29571_CommonData.yaml#/components/responses/503'
  default:
    $ref: 'TS29571_CommonData.yaml#/components/responses/default'
callbacks:
  myNotification:
    '{$request.body#/notifUri}':
      post:
        requestBody:
          required: true
          content:
            application/json:
              schema:
                $ref: 'TS29520_Nnwdaf_VFLInference.yaml#/components/schemas/VflInferNotif'
        responses:
          '204':
            description: No Content, Notification was succesfull
          '307':
            $ref: 'TS29571_CommonData.yaml#/components/responses/307'
          '308':
            $ref: 'TS29571_CommonData.yaml#/components/responses/308'
          '400':
            $ref: 'TS29571_CommonData.yaml#/components/responses/400'
          '401':
            $ref: 'TS29571_CommonData.yaml#/components/responses/401'
          '403':
            $ref: 'TS29571_CommonData.yaml#/components/responses/403'
          '404':
            $ref: 'TS29571_CommonData.yaml#/components/responses/404'
          '411':
            $ref: 'TS29571_CommonData.yaml#/components/responses/411'
          '413':
            $ref: 'TS29571_CommonData.yaml#/components/responses/413'
          '415':
            $ref: 'TS29571_CommonData.yaml#/components/responses/415'
          '429':
            $ref: 'TS29571_CommonData.yaml#/components/responses/429'
          '500':
            $ref: 'TS29571_CommonData.yaml#/components/responses/500'
          '502':
            $ref: 'TS29571_CommonData.yaml#/components/responses/502'
          '503':
```

```
                $ref: 'TS29571_CommonData.yaml#/components/responses/503'
              default:
                $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /subscriptions/{subscriptionId}:
    parameters:
      - name: subscriptionId
        in: path
        description: String identifying a subscription to the Naf_VFLInference Service.
        required: true
        schema:
          type: string

    get:
      summary: Retrieve an existing Individual VFL Inference Subscription resource.
      operationId: GetIndVFLTrainSubsc
      tags:
        - Individual VFL Inference Subscription (Document)
      responses:
        '200':
          description: >
            OK. The requested Individual VFL Inference Subscription resource is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/VflInferSub'
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '406':
          $ref: 'TS29571_CommonData.yaml#/components/responses/406'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

    put:
      summary: Update an existing Individual VFL Inference Subscription
      operationId: UpdateVFLInferenceSubcription
      tags:
        - Individual VFL Inference Subscription (Document)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/VflInferSub'
      responses:
        '200':
          description: >
            The Individual VFL Inference Subscription resource was modified
            successfully and a representation of that resource is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/VflInferSub'
        '204':
          description: >
            The Individual VFL Inference Subscription resource was modified successfully.
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
```

```
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  patch:
    summary: Partial update an existing Individual VFL Inference Subscription
    operationId: PartialUpdateVFLInferenceSubcription
    tags:
      - Individual VFL Inference Subscription (Document)
    requestBody:
      required: true
      content:
        application/merge-patch+json:
          schema:
            $ref: '#/components/schemas/VflInferSubPatch'
    responses:
      '200':
        description: >
          The Individual VFL Inference Subscription resource was partial modified successfully
          and a representation of that resource is returned.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/VflInferSub'
      '204':
        description: >
          The Individual VFL Inference Subscription resource was partial modified
          successfully.
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  delete:
```

```
      summary: Delete an existing Individual VFL Inference Subscription.
      operationId: DeleteVFLInferenceSubcription
      tags:
        - Individual VFL Inference Subscription (Document)
      responses:
        '204':
          description: >
            No Content. The Individual VFL Inference Subscription matching the
            subscriptionId was deleted.
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            naf-vflinference: Access to the Naf_VflInference API

  schemas:
    VflInferSub:
      description: Represents a VFL Inference subscription.
      type: object
      properties:
        notifCorrId:
          type: string
          description: >
            String identifying the Notification Correlation ID in the corresponding
            notification.
        notifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        reportingReqs:
          $ref: 'TS29523_Npcf_EventExposure.yaml#/components/schemas/ReportingInformation'
        suppFeats:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
        vflInferAnaSubs:
          type: array
          items:
            $ref: 'TS29520_Nnwdaf_VFLInference.yaml#/components/schemas/VflInferAnaSub'
          minItems: 1
          description: >
            Contains VFL inference subscription information for the subscribed analytics ID(s).
        vflInferResults:
          type: array
          items:
            $ref: 'TS29520_Nnwdaf_VFLInference.yaml#/components/schemas/VflInferResult'
          minItems: 1
          description: Represents intermediate VFL Inference result.
      required:
        - notifUri
        - notifCorrId
        - vflInferAnaSubs

    VflInferSubPatch:
      description: >
```

```
        Represents parameters to request the modification of a VFL Inference
        subscription.
      type: object
      properties:
        notifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        notifCorrId:
          type: string
          description: >
            String identifying the Notification Correlation ID in the corresponding
            notification.
        reportingReqs:
          $ref: 'TS29523_Npcf_EventExposure.yaml#/components/schemas/ReportingInformation'
        vflInferAnaSubs:
          type: array
          items:
            $ref: 'TS29520_Nnwdaf_VFLInference.yaml#/components/schemas/VflInferAnaSub'
          minItems: 1
          description: >
            Contains updated VFL inference subscription information for the subscribed
            analytics ID(s).

#
# ENUMERATIONS DATA TYPES
#
```

A.4 Naf_Training API

```
openapi: 3.0.0

info:
  title: Naf_Training Service API
  version: 1.0.1
  description: |
    AF Training Service.
    © 2026, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 29.530 V19.1.0; 5G System; Application Function Artificial Intelligence/Machine Learning
    (AI/ML) Services.
  url: http://www.3gpp.org/ftp/Specs/archive/29_series/29.530/

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

security:
  - {}
  - oAuth2ClientCredentials:
    - naf-train

paths:
  /subscriptions:

    post:
      summary: Request the creation of a Training Subscription.
      operationId: CreateTrainSubsc
      tags:
        - Training Subscriptions (Collection)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/TrainEventsSubsc'
      responses:
        '201':
          description: >
            Created. The Training Subscription is successfully created and a representation of
```

```
        the created Individual Training Subscription resource shall be returned.
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/TrainEventsSubsc'
      headers:
        Location:
          description: >
            Contains the URI of the created Individual Training Subscription resource.
          required: true
          schema:
            type: string
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '502':
      $ref: 'TS29571_CommonData.yaml#/components/responses/502'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  callbacks:
    TrainEventsNotif:
      '{$request.body#/notifUri}':
        post:
          requestBody:
            required: true
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/TrainEventsNotif'
          responses:
            '204':
              description: >
                No Content. The Training Notification is successfully received
                and acknowledged.
            '307':
              $ref: 'TS29571_CommonData.yaml#/components/responses/307'
            '308':
              $ref: 'TS29571_CommonData.yaml#/components/responses/308'
            '400':
              $ref: 'TS29571_CommonData.yaml#/components/responses/400'
            '401':
              $ref: 'TS29571_CommonData.yaml#/components/responses/401'
            '403':
              $ref: 'TS29571_CommonData.yaml#/components/responses/403'
            '404':
              $ref: 'TS29571_CommonData.yaml#/components/responses/404'
            '411':
              $ref: 'TS29571_CommonData.yaml#/components/responses/411'
            '413':
              $ref: 'TS29571_CommonData.yaml#/components/responses/413'
            '415':
              $ref: 'TS29571_CommonData.yaml#/components/responses/415'
            '429':
              $ref: 'TS29571_CommonData.yaml#/components/responses/429'
            '500':
              $ref: 'TS29571_CommonData.yaml#/components/responses/500'
            '502':
              $ref: 'TS29571_CommonData.yaml#/components/responses/502'
            '503':
              $ref: 'TS29571_CommonData.yaml#/components/responses/503'
            default:
```

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

  /subscriptions/{subscriptionId}:
    parameters:
      - name: subscriptionId
        in: path
        description: >
          Represents the identifier of the Individual Training Subscription
          resource.
        required: true
        schema:
          type: string

    get:
      summary: Retrieve an existing Individual Training Subscription resource.
      operationId: GetIndTrainSubsc
      tags:
        - Individual Training Subscription (Document)
      responses:
        '200':
          description: >
            OK. The requested Individual Training Subscription resource is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/TrainEventsSubsc'
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '406':
          $ref: 'TS29571_CommonData.yaml#/components/responses/406'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

    put:
      summary: Request the update of an existing Individual Training Subscription resource.
      operationId: UpdateIndTrainSubsc
      tags:
        - Individual Training Subscription (Document)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/TrainEventsSubsc'
      responses:
        '200':
          description: >
            OK. The Individual Training Subscription resource is successfully updated and a
            representation of the updated resource shall be returned in the response body.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/TrainEventsSubsc'
        '204':
          description: >
            No Content. The Individual Training Subscription resource is successfully updated
            and no content is returned in the response body.
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
```

```
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  patch:
    summary: Request the modification of an existing Individual Training Subscription resource.
    operationId: ModifyIndTrainSubsc
    tags:
      - Individual Training Subscription (Document)
    requestBody:
      required: true
      content:
        application/merge-patch+json:
          schema:
            $ref: '#/components/schemas/TrainEventsSubscPatch'
    responses:
      '200':
        description: >
          OK. The Individual Training Subscription resource is successfully modified and a
          representation of the updated resource shall be returned in the response body.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/TrainEventsSubsc'
      '204':
        description: >
          No Content. The Individual Training Subscription resource is successfully modified
          and no content is returned in the response body.
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
```

```
    delete:
      summary: Request the deletion of an existing Individual Training Subscription resource.
      operationId: DeleteIndTrainSubsc
      tags:
        - Individual Training Subscription (Document)
      responses:
        '204':
          description: >
            No Content. The Individual Training Subscription resource is successfully deleted.
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            naf-train: >
              Enables to access all the resources and custom operations of the Naf_Training API.

  schemas:

#
# STRUCTURED DATA TYPES
#

    TrainEventsSubsc:
      description: Represents a Training Subscription.
      type: object
      properties:
        trainEventSubs:
          type: object
          additionalProperties:
            $ref: '#/components/schemas/EventSubsc'
          minProperties: 1
          description: >
            Contains the subscribed training events. The key of the map shall be set to the
            value of the "event" attribute in the EventSubsc data structure.
        notifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        notifCorreId:
          type: string
        reportingReqs:
          $ref: 'TS29523_Npcf_EventExposure.yaml#/components/schemas/ReportingInformation'
        eventNotifs:
          type: array
          items:
            $ref: '#/components/schemas/EventNotif'
          minItems: 1
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      required:
        - trainEventSubs
        - notifUri
```

```
        - notifCorreId

    TrainEventsSubscPatch:
      description: Represents the requested modifications to a Training Subscription.
      type: object
      properties:
        trainEventSubs:
          type: object
          additionalProperties:
            $ref: '#/components/schemas/EventSubsc'
          minProperties: 1
          description: >
            Contains the updated subscribed training events. The key of the map shall be set to the
            value of the "event" attribute in the EventSubsc data structure.
        notifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        notifCorreId:
          type: string
        reportingReqs:
          $ref: 'TS29523_Npcf_EventExposure.yaml#/components/schemas/ReportingInformation'

    EventSubsc:
      description: Represents events training subscription.
      type: object
      properties:
        event:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NwdafEvent'
        useCaseCxt:
          type: string
        trainFilter:
          $ref: 'TS29520_Nnwdaf_AnalyticsInfo.yaml#/components/schemas/EventFilter'
        tgtUe:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/TargetUeInformation'
        exterGroupIds:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/ExternalGroupId'
          minItems: 1
        repRatio:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        targetPeriod:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
        inferInputData:
          $ref: 'TS29520_Nnwdaf_MLModelProvision.yaml#/components/schemas/InputDataInfo'
        timeModelNeeded:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        modelMonInfo:
          $ref: '#/components/schemas/MlModelMonitorInfo'
        accuLevel:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/Accuracy'
      required:
        - event

    MlModelMonitorInfo:
      description: Represents an event training subscription.
      type: object
      properties:
        modelMetric:
          $ref: 'TS29520_Nnwdaf_MLModelProvision.yaml#/components/schemas/MLModelMetric'
        accuThreshold:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        accuPeriod:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
        storedData:
          $ref:
'TS29520_Nnwdaf_MLModelProvision.yaml#/components/schemas/InferenceDataForModelTrain'

    TrainEventsNotif:
      description: Represents a events training notification.
      type: object
      properties:
        notifCorreId:
          type: string
        eventNotifs:
          type: array
          items:
            $ref: '#/components/schemas/EventNotif'
          minItems: 1
```

```
      required:
        - notifCorreId
        - eventNotifs

    EventNotif:
      description: Represents an event training report.
      type: object
      properties:
        event:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NwdafEvent'
        vflNotOnTimeInd:
          $ref: 'TS29520_Nnwdaf_MLModelTraining.yaml#/components/schemas/DelayEventNotif'
        trainingInd:
          type: boolean
          description: >
            Set to "true" to indicate that the ML model training is ongoing. Set to "false" to
            indicate that the ML model training is done. Default value is "false" if omitted.
        validityPeriod:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
        spatialValidity:
          $ref: 'TS29554_Npcf_BDTPolicyControl.yaml#/components/schemas/NetworkAreaInfo'
        repRatio:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        accMLModel:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        termCause:
          $ref: 'TS29520_Nnwdaf_VFLInference.yaml#/components/schemas/VflTermCause'
        vflCorrId:
          type: string
      required:
        - event

# SIMPLE DATA TYPES
#

#
# ENUMERATIONS
#

# Data types describing alternative data types or combinations of data types:
#
```

A.5 Naf_Inference API

```
openapi: 3.0.0

info:
  title: Naf_Inference
  version: 1.0.1
  description: |
    Naf_Inference API Service.
    © 2026, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
     3GPP TS 29.530 V19.1.0; 5G System; Application Function Artificial
     Intelligence/Machine Learning (AI/ML) Services.
  url: https://www.3gpp.org/ftp/Specs/archive/29_series/29.530/

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

security:
  - {}
  - oAuth2ClientCredentials:
    - naf-inference

paths:
  /subscriptions:
```

```
post:
  summary: Create a new Individual Inference Subscription resource.
  operationId: CreateInferenceSubcription
  tags:
    - Subscriptions (Collection)
  requestBody:
    required: true
    content:
      application/json:
        schema:
          $ref: '#/components/schemas/InferEventSubsc'
  responses:
    '201':
      description: Create a new Individual Inference Subscription resource.
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/InferEventSubsc'
      headers:
        Location:
          description: >
            Contains the URI of the newly created resource, according to the
            structure
            {apiRoot}/naf-inference/v1/subscriptions/{subscriptionId}.
          required: true
          schema:
            type: string
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '502':
      $ref: 'TS29571_CommonData.yaml#/components/responses/502'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  callbacks:
    myNotification:
      '{$request.body#/notifUri}':
        post:
          requestBody:
            required: true
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/InferNotif'
          responses:
            '204':
              description: No Content, Notification was successful
            '307':
              $ref: 'TS29571_CommonData.yaml#/components/responses/307'
            '308':
              $ref: 'TS29571_CommonData.yaml#/components/responses/308'
            '400':
              $ref: 'TS29571_CommonData.yaml#/components/responses/400'
            '401':
              $ref: 'TS29571_CommonData.yaml#/components/responses/401'
            '403':
              $ref: 'TS29571_CommonData.yaml#/components/responses/403'
            '404':
              $ref: 'TS29571_CommonData.yaml#/components/responses/404'
            '411':
```

```
                $ref: 'TS29571_CommonData.yaml#/components/responses/411'
              '413':
                $ref: 'TS29571_CommonData.yaml#/components/responses/413'
              '415':
                $ref: 'TS29571_CommonData.yaml#/components/responses/415'
              '429':
                $ref: 'TS29571_CommonData.yaml#/components/responses/429'
              '500':
                $ref: 'TS29571_CommonData.yaml#/components/responses/500'
              '502':
                $ref: 'TS29571_CommonData.yaml#/components/responses/502'
              '503':
                $ref: 'TS29571_CommonData.yaml#/components/responses/503'
              default:
                $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  /subscriptions/{subscriptionId}:

    put:
      summary: Update an existing Individual Inference Subscription
      operationId: UpdateInferenceSubcription
      tags:
        - Individual Inference Subscription (Document)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/InferEventSubsc'
      parameters:
        - name: subscriptionId
          in: path
          description: String identifying a subscription to the Naf_Inference Service.
          required: true
          schema:
            type: string
      responses:
        '200':
          description: >
            The Individual Inference Subscription resource was modified
            successfully and a representation of that resource is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/InferEventSubsc'
        '204':
          description: >
            The Individual Inference Subscription resource was modified
            successfully.
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '406':
          $ref: 'TS29571_CommonData.yaml#/components/responses/406'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

    patch:
      summary: Partial update an existing Individual Inference Subscription
      operationId: PartialUpdateInferenceSubcription
      tags:
```

```
      - Individual Inference Subscription (Document)
    requestBody:
      required: true
      content:
        application/merge-patch+json:
          schema:
            $ref: '#/components/schemas/InferEventSubscPatch'
    parameters:
      - name: subscriptionId
        in: path
        description: String identifying a subscription to the Naf_Inference Service.
        required: true
        schema:
          type: string
    responses:
      '200':
        description: >
          The Individual Inference Subscription resource was partial
          modified successfully and a representation of that resource is returned.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/InferEventSubsc'
      '204':
        description: >
          The Individual Inference Subscription resource was partial
          modified successfully.
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '406':
        $ref: 'TS29571_CommonData.yaml#/components/responses/406'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  delete:
    summary: Delete an existing Individual Inference Subscription.
    operationId: DeleteInferenceSubcription
    tags:
      - Individual Inference Subscription (Document)
    parameters:
      - name: subscriptionId
        in: path
        description: >
          String identifying a subscription to the Naf_Inference Service.
        required: true
        schema:
          type: string
    responses:
      '204':
        description: >
          No Content. The Individual Inference Subscription matching the
          subscriptionId was deleted.
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
```

```
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            naf-inference: Access to the Naf_Inference API

  schemas:
    InferEventSubsc:
      description: Represents an Inference subscription.
      type: object
      properties:
        notifCorreId:
          type: string
          description: >
            String identifying the Notification Correlation ID in the corresponding notification.
        notifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        suppFeats:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
        inferAnaSubs:
          type: object
          additionalProperties:
            $ref: '#/components/schemas/InferAnaSub'
          minItems: 1
          description: >
            Represents inference subscription per analytics Id. The key of the map shall
            be set to the value of the "anaEvent" attribute in the InferAnaSub data
            structure.
        inferResults:
          type: array
          items:
            $ref: '#/components/schemas/InferResult'
          minItems: 1
          description: Represents Inference result.
        reportInfo:
          $ref: 'TS29523_Npcf_EventExposure.yaml#/components/schemas/ReportingInformation'
      required:
        - notifUri
        - notifCorreId
        - inferAnaSubs

    InferNotif:
      description: Represents notifications on events that occurred.
      type: object
      properties:
        notifCorreId:
          type: string
          description: >
            String identifying the Notification Correlation ID in the corresponding notification.
        inferResults:
          type: array
          items:
            $ref: '#/components/schemas/InferResult'
          minItems: 1
          description: Represents inference results.
      required:
        - notifCorreId
        - inferResults
```

```
    InferEventSubscPatch:
      description: Represents parameters to request the modification of an Inference subscription.
      type: object
      properties:
        notifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        notifCorreId:
          type: string
          description: >
            String identifying the Notification Correlation ID in the corresponding notification.
        inferAnaSubs:
          type: object
          additionalProperties:
            $ref: '#/components/schemas/InferAnaSub'
          minItems: 1
          description: >
            Represents inference subscription per analytics Id. The key of the map shall
            be set to the value of the "anaEvent" attribute in the InferAnaSub data
            structure.
        reportInfo:
          $ref: 'TS29523_Npcf_EventExposure.yaml#/components/schemas/ReportingInformation'

    InferAnaSub:
      description: Represents a subscription to a single event.
      type: object
      properties:
        anaEvent:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/NwdafEvent'
        exterGroupIds:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/ExternalGroupId'
          minItems: 1
        gpsis:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
          minItems: 1
        intGroupIds:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
          minItems: 1
        supis:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
          minItems: 1
        eventFilter:
          $ref: 'TS29520_Nnwdaf_AnalyticsInfo.yaml#/components/schemas/EventFilter'
        anaMeta:
          type: array
          items:
            $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/AnalyticsMetadata'
          minItems: 1
        dataStatProps:
          type: array
          items:
            $ref:
'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/DatasetStatisticalProperty'
          minItems: 1
        timeWindows:
          type: array
          items:
            $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
          minItems: 1
        resTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      required:
        - anaEvent
      oneOf:
        - required: [exterGroupIds]
        - required: [gpsis]
        - required: [intGroupIds]
        - required: [supis]

    InferResult:
      description: Represents Inference result per target UE.
```

```
      type: object
      properties:
        inferRes:
          $ref: 'TS29520_Nnwdaf_EventsSubscription.yaml#/components/schemas/EventNotification'
        vflNotOnTimeInd:
          $ref: 'TS29520_Nnwdaf_MLModelTraining.yaml#/components/schemas/DelayEventNotif'
        termCause:
          $ref: 'TS29520_Nnwdaf_VFLInference.yaml#/components/schemas/VflTermCause'
      oneOf:
        - required: [inferRes]
        - required: [termCause]
        - required: [vflNotOnTimeInd]

#
# ENUMERATIONS DATA TYPES
#
```

Annex B (informative): Withdrawn API versions

B.1 General

This Annex lists withdrawn API versions of the APIs defined in the present specification. Clause 4.3.1.6 of 3GPP TS 29.501 [5] describes the withdrawal of API versions.

B.2 Naf_VFLTraining API

The API versions listed in table B.2-1 are withdrawn for the Naf_VFLTraining API.

Table B.2-1: Withdrawn API versions of the Naf_VFLTraining service

API version number	Remarks

B.3 Naf_VFLInference API

The API versions listed in table B.3-1 are withdrawn for the Naf_VFLInference API.

Table B.3-1: Withdrawn API versions of the Naf_VFLInference service

API version number	Remarks

B.4 Naf_Training API

The API versions listed in table B.4-1 are withdrawn for the Naf_Training API.

Table B.4-1: Withdrawn API versions of the Naf_Training service

API version number	Remarks

B.5 Naf_Inference API

The API versions listed in table B.5-1 are withdrawn for the Naf_Inference API.

Table B.5-1: Withdrawn API versions of the Naf_Inference service

API version number	Remarks

Annex C (normative): ABNF grammar for 3GPP SBI HTTP custom headers

C.1 General

This Annex contains a self-contained set of ABNF rules, comprising the re-used rules from IETF RFCs, and the rules defined by the 3GPP custom headers defined in this specification (see clause 6.x.y.z).

This grammar may be used as input to existing tools to help implementations to parse 3GPP custom headers.

Annex D (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2025-08	CT3#142	C3-253650				Inclusion of agreed pCRs C3-253362, C3-253363, C3-253544, C3-253546, C3-253547, C3-253548, C3-253549, C3-253550, C3-253551, C3-253552, C3-253636, C3-253637, C3-253638	0.1.0
2025-09	CT#109	CP-252068				Presentation to TSG CT for information	1.0.0
2025-10	CT#143	C3-254474				Inclusion of agreed pCRs C3-254367, C3-254127, C3-254556, C3-254384, C3-254369, C3-254269, C3-254386	1.1.0
2025-11	CT#144	C3-255656				Inclusion of agreed pCRs C3-255159, C3-255358, C3-255404, C3-255405, C3-255504, C3-255507, C3-255508, C3-255526, C3-255527, C3-255602, C3-255635, C3-255636, C3-255647, C3-255654	1.2.0
2025-12	CT#110	CP-253020				Presentation to TSG CT for approval	2.0.0
2025-12	CT#110	CP-253020				Approved by TSG CT	19.0.0
2026-01						Corrected yaml files coding: to be encoded as UTF-8 without BOM	19.0.1
2026-03	CT#111	CP-260066	0001	1	F	Correction on periodic reporting of ML model accuracy inforamtion	19.1.0
2026-03	CT#111	CP-260066	0003	1	F	Missing 403 Forbidden response code in Naf_Training API	19.1.0
2026-03	CT#111	CP-260066	0004	1	F	Missing 403 Forbidden response code in Naf_VFLInference API	19.1.0
2026-03	CT#111	CP-260066	0006	3	F	Corrections on the attribute name and HTTP status codes for Naf_Inference API	19.1.0
2026-03	CT#111	CP-260066	0007	1	F	Corrections on the resource name and consumer of Naf_VFLInference API	19.1.0
2026-03	CT#111	CP-260066	0008	1	F	Corrections on the status code and attribute presence of Naf_VFLTraining API	19.1.0
2026-03	CT#111	CP-260066	0009	1	F	Enhancements and corrections on the Naf_Training API	19.1.0
2026-03	CT#111	CP-260066	0010	1	F	VFL Inference Requirements corrections	19.1.0
2026-03	CT#111	CP-260081	0011	–	F	Update of info and externalDocs fields	19.1.0

History

Version	Date	Status
V19.0.1	February 2026	Publication
V19.1.0	March 2026	Publication