**3GPP TSG-CT WG3 Meeting #142C3-253636**

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**Source: China Mobile, Ericsson, Huawei, Nokia**

**Title: Pseudo-CR on Naf\_VFLInference Service definition**

**Spec: 3GPP TS 29.530v0.1.0**

**Agenda item: 19.39**

**Document for: Approval**

**1. Introduction**

Introduce AF VFL Inference service.

**2. Reason for Change**

Align with 3GPP TS 23.288 clause 11.3 to introduce AF VFL Inference service.

**3. Conclusions**

API not completed defined.

**4. Proposal**

It is proposed to agree the following changes to 3GPP TS 29.530v0.1.0.

\* \* \* First Change \* \* \* \*

# 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".

[23288] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[29552] 3GPP TS 29.552: "5G System; Network Data Analytics signalling flows; Stage 3".

\* \* \* Next Change \* \* \* \*

## 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].

AI/ML Artificial Intelligence/Machine Learning

AF Application Function

GPSI Generic Public Subscription Identifier

NEF Network Exposure Function

NWDAF Network Data Analytics Function

REST Representational State Transfer

VFL Vertical Federated Learning

\* \* \* Next Change \* \* \* \*

## 5.1 Introduction

The AF offers to other NFs the following services:

- Naf\_VFLInference

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

Table 5.1-x: API Descriptions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Service Name | Clause | Description | OpenAPI Specification File | apiName | Annex |
| Naf\_VFLInference | 5.3 | AF VFL Inference | TS29530\_Naf\_ VFLInference.yaml | nnaf-vflinference | A.3 |

\* \* \* Next Change \* \* \* \*

## 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 [23288], 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;

- to 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 [23288]. The VFL signalling flows are defined in 3GPP TS 29.552 [29552].

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 Network Data Analytics Function (AF)

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

The Application Function (AF) allows NF service consumers to subscribe to and unsubscribe from one-time, periodic notification or 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 request AF VFL client(s) 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 to 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 instance which has subscribed to the event report service. | 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 [23288]).



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 request AF VFL client(s) 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 "AF VFL Inference Subscriptions", as shown in figure 5.3.2.2.2-1, step 1, to create a subscription for an "Individual AF 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 "notifCorreId" attribute; and

- a description of the subscribed analytics event(s) as the "vflInferAnaSubs" attribute.

and may include:

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

- the required conditions to apply VFL inference as the "vflInferReq" attribute;

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

If the AF created an "Individual AF 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 in the "immRep" attribute within the "ReportingInformation" structure in the "vflReportInfo" attribute sets to "true" during the event subscription, 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 [23288]).



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 AF VFL Inference Subscription" according to the information in the message body. The VflInferAnaSub 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 VflInferAnaSub 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 AF 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 VflInferAnaSub data type.

If the immediate reporting indication in the "immRep" attribute within the within the "ReportingInformation" structure in the "vflReportInfo" attribute sets to "true" during the event subscription update, 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 [23288]).



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 AF 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 VflInferAnaSubPatch 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 partial update an "Individual AF 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 VflInferAnaSub data type.

If the immediate reporting indication in the "immRep" attribute within the within the "ReportingInformation" structure in the "vflReportInfo" attribute sets to "true" during the event subscription, 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 [23288]).



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 [23288]).



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 "notifCorreId" attribute.

And may include:

- description of the notified event as "vflInferResults " attribute;

- cause for termination in the "termCauses" attribute if the AF wants to request the termination of events indicated by the "vflCorreIds" 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.

\* \* \* End of Changes \* \* \* \*